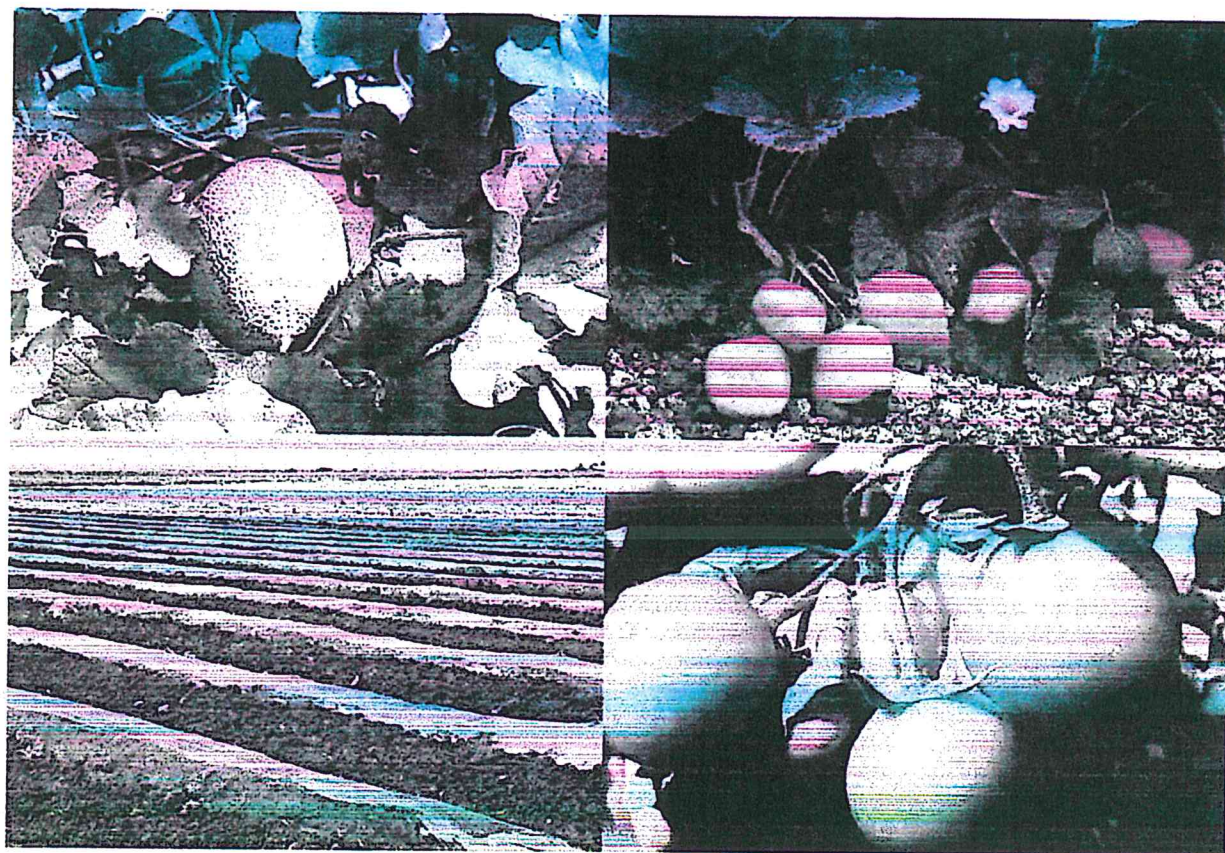




Universidad Autónoma de Sinaloa  
Facultad de Agronomía



## FINAL REPORT SECOND PART

**PROJECT:** "Alternatives to the use of methyl bromide in  
tomato, strawberry, tobacco, melon and flowers crops".  
Additional services related to Contract No. 99/075

**Culiacán, Sinaloa, Mexico. April, 2004**



## RESULTS:

### NEMATODES :

#### UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA

Site: Facultad de Agronomía, Culiacán, Sinaloa

Crop: Tomato saladette cv. Gala

Transplanting date: December 23th, 2002

Evaluation Parameter: Nodulation percent of roots per Meloidogyne/repetition

Evaluation date: April 29th, 2003

scale 1-6

TREATMENT	Repetition I						Repetition II					
	PLANTS						PLANTS					
	1	2	3	4	5	average	1	2	3	4	5	average
1.Control	40%	60%	80%	100%	60%	68.00%	60%	100%	100%	60%	80%	80.00%
2.Chloropicrin	40%	20%	0%	60%	20%	28.00%	20%	60%	80%	40%	0%	40.00%
3.Dichloropropen + chloropicrin	0%	40%	20%	0%	0%	12.00%	0%	20%	0%	0%	20%	8.00%
4.Methil Bromide 40	0%	20%	0%	0%	0%	4.00%	0%	0%	40%	0%	0%	8.00%
5.Cabbage + solarization	0%	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0%	0.00%
6.Metam sodium 25 + solarization	0%	0%	0%	0%	0%	0.00%	20%	0%	0%	0%	0%	4.00%
7.Cow manure + solarization	0%	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	20%	4.00%
8.Dazomet	0%	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0%	0.00%
9.Solarization	0%	0%	20%	0%	0%	4.00%	0%	0%	0%	0%	0%	0.00%
10.Metam sodium 50	40%	40%	20%	0%	20%	24.00%	0%	20%	40%	60%	0%	24.00%
11.Methyl Bromide 15	0%	0%	60%	0%	0%	12.00%	0%	20%	0%	40%	0%	12.00%
12.Maize + solarization	0%	20%	0%	0%	0%	4.00%	0%	0%	0%	0%	0%	0.00%
13.Hen manure + solarization	0%	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0%	0.00%
14.Dichloropropen	0%	0%	20%	0%	0%	4.00%	0%	0%	0%	0%	0%	0.00%

TREATMENT	Repetition III						Repetition IV					
	PLANTS						PLANTS					
	1	2	3	4	5	average	1	2	3	4	5	average
1.Control	80%	80%	100%	100%	100%	92.00%	80%	100%	100%	100%	100%	96.00%
2.Chloropicrin	20%	40%	60%	40%	60%	44.00%	0%	60%	60%	40%	60%	44.00%
3.Dichloropropen + chloropicrin	0%	0%	20%	0%	20%	8.00%	0%	20%	20%	0%	40%	16.00%
4.Methil Bromide 40	0%	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0%	0.00%
5.Cabbage + solarization	0%	20%	0%	0%	0%	4.00%	0%	0%	0%	40%	0%	8.00%
6.Metam sodium 25 + solarization	0%	0%	20%	0%	0%	4.00%	0%	0%	0%	0%	0%	0.00%
7.Cow manure + solarization	20%	0%	0%	0%	0%	4.00%	0%	0%	0%	0%	0%	0.00%
8.Dazomet	0%	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0%	0.00%
9.Solarization	0%	0%	0%	0%	0%	0.00%	0%	0%	20%	0%	0%	4.00%
10.Metam sodium 50	0%	20%	0%	40%	40%	20.00%	0%	0%	20%	0%	40%	12.00%
11.Methyl Bromide 15	0%	0%	0%	40%	20%	12.00%	0%	0%	0%	0%	20%	4.00%
12.Maize + solarization	20%	0%	0%	20%	20%	12.00%	0%	0%	40%	0%	0%	8.00%
13.Hen manure + solarization	0%	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0%	0.00%
14.Dichloropropen	20%	0%	0%	20%	0%	8.00%	0%	0%	40%	0%	0%	8.00%



# UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA

Site: Facultad de Agronomia, Culiacán, Sinaloa

Crop: Tomato saladette cv. Gala

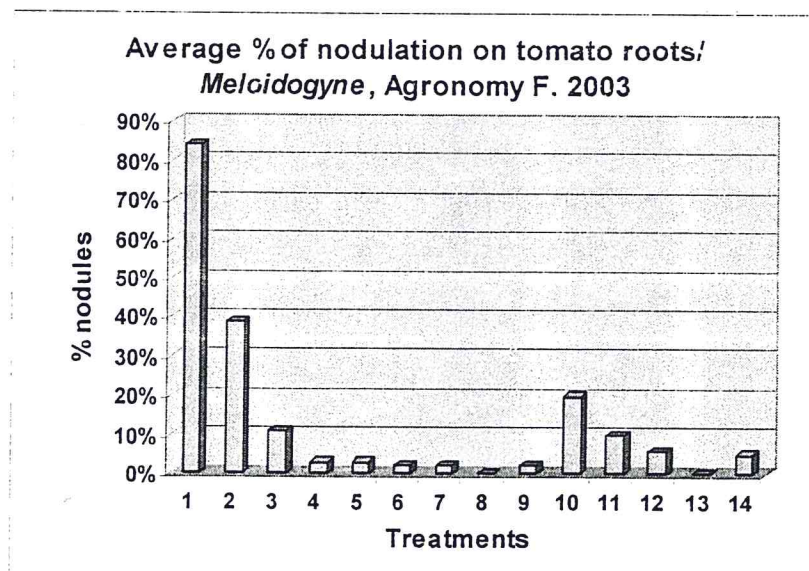
Transplanting date: December 23th, 2002

Evaluation Parameter: Nodulation percent of roots per *Meloidogyne*/repetition

Evaluation date: April 29th, 2003

Scale 1-6

Total average (%) of nodulation per <i>Meloidogyne</i> /repetition/treatment						
TREATMENT	R I	R II	R III	R IV	TOTAL	average
1.Control	68.00%	80.00%	92.00%	96.00%	336.00%	84.00%
2.Chloropicrin	28.00%	40.00%	44.00%	44.00%	156.00%	39.00%
3.Dichloropropen + chloropicrin	12.00%	8.00%	8.00%	16.00%	44.00%	11.00%
4.Methil Bromide 40	4.00%	8.00%	0.00%	0.00%	12.00%	3.00%
5.Cabbage + solarization	0.00%	0.00%	4.00%	8.00%	12.00%	3.00%
6.Metam sodium 25 + solarization	0.00%	4.00%	4.00%	0.00%	8.00%	2.00%
7.Cow manure + solarization	0.00%	4.00%	4.00%	0.00%	8.00%	2.00%
8.Dazomet	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
9.Solarization	4.00%	0.00%	0.00%	4.00%	8.00%	2.00%
10.Metam sodium 50	24.00%	24.00%	20.00%	12.00%	80.00%	20.00%
11.Methyl Bromide 15	12.00%	12.00%	12.00%	4.00%	40.00%	10.00%
12.Maize + solarization	4.00%	0.00%	12.00%	8.00%	24.00%	6.00%
13.Hen manure + solarization	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
14.Dichloropropen	4.00%	0.00%	8.00%	8.00%	20.00%	5.00%





## FUNGUS:

### UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA

Site: Facultad de Agronomía, Culiacán, Sinaloa

Crop: Tomato saladette cv. Gala

Transplanting date: December 23th, 2002

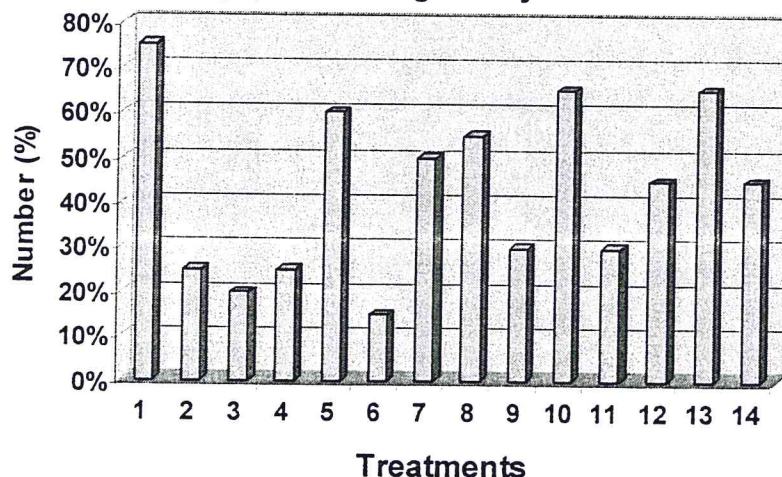
Evaluation parameter: Number and % of plants with root necrosis/*Fusarium oxysporum*/treatment

Evaluation date: April 29th, 2003

Number of plants/repetition: 33 = 132 plants/treatment

TREATMENT	REPETITION								PLANTS	%
	I		II		III		IV		TOTAL	AVERAGE
1.Control	26	80%	26	80%	20	60%	26	80%	98	75%
2.Chloropicrin	7	20%	0	0%	20	60%	7	20%	34	25%
3.Dichloropropen + chloropicrin	7	20%	7	20%	0	0%	13	40%	27	20%
4.Methil Bromide 40	13	40%	13	40%	7	20%	0	0%	33	25%
5.Cabbage + solarization	26	80%	20	60%	13	40%	20	60%	79	60%
6.Metam sodium 25 + solarization	0	0%	7	20%	13	40%	0	0%	20	15%
7.Cow manure + solarization	26	80%	20	60%	7	20%	13	40%	66	50%
8.Dazomet	26	80%	7	20%	26	80%	13	40%	72	55%
9.Solarization	7	20%	7	20%	13	40%	13	40%	40	30%
10.Metam sodium 50	20	60%	20	60%	20	60%	26	80%	86	65%
11.Methyi Bromide 15	13	40%	7	20%	7	20%	13	40%	40	30%
12.Maize + solarization	13	40%	20	60%	7	20%	20	60%	60	45%
13.Hen manure + solarization	26	80%	20	60%	20	60%	20	60%	86	65%
14.Dichloropropen	20	60%	13	40%	7	20%	20	60%	60	45%

% of tomato plants with root necrosis by *Fusarium oxysporum* F. Agronomy 2003





## YIELD:

### UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA

Site: Facultad de Agronomía, Culiacán, Sinaloa

Crop: Tomato saladette cv. Gala

Transplanting date: December 23th, 2002

Evaluation date: April 8th, 2003

#### TABLES OF TOTAL AVERAGE WEIGHT. PERCENTAGE OF FRUIT SIZES

(150g; 125g; 100g; Y -100g.) AND REMAIN/TREATMENT/CUT ON 40 M. LINEAR

TREATMENTS	AVERAGE	FRUIT SIZES/WEIGHT (Kg)				
	WEIGHT kg.	150gr	125gr	100gr	< 100gr	REMAIN
1.Control	6.375	0.00	0.59	1.80	2.16	1.83
2.Chloropicrin	7.025	0.10	0.26	2.01	2.34	2.06
3.Dichloropropen + chloropicrin	28.425	0.30	2.60	13.74	8.61	3.18
4.Methyl Bromide 40	9.625	0.18	0.83	3.35	3.55	1.73
5.Cabbage + solarization	8.725	0.13	0.56	2.74	3.63	1.68
6.Metam sodium 25 + solarization	14.200	0.25	1.06	6.25	4.25	2.39
7.Cow manure + solarization	18.175	0.00	0.69	7.98	6.04	3.48
8.Dazomet	9.900	0.00	0.64	2.68	3.08	3.51
9.Solarization	14.675	0.18	2.09	6.20	3.20	3.01
10.Metam sodium 50	14.425	0.43	2.18	5.95	3.16	2.71
11.Methyl Bromide 15	12.175	0.40	1.24	4.14	3.89	2.51
12.Maize + solarization	7.813	0.00	0.23	1.96	2.73	2.90
13.Hen manure + solarization	16.888	0.08	1.20	8.58	4.78	2.26
14.Dichloropropen	16.675	0.55	1.91	5.79	5.40	3.03

Evaluation date: April 14th, 2003

#### TABLES OF TOTAL AVERAGE WEIGHT. PERCENTAGE OF FRUIT SIZES

(150g; 125g; 100g; Y -100g.) AND REMAIN/TREATMENT/CUT ON 40 M. LINEAR

TREATMENTS	TOTAL	FRUIT SIZES/WEIGHT (Kg)				
	WEIGHT kg.	150gr	125gr	100gr	< 100gr	REMAIN
1.Control	3.525	0.075	0.225	0.425	1.550	1.250
2.Chloropicrin	4.975	0.100	0.400	1.138	1.850	1.488
3.Dichloropropen + chloropicrin	5.200	0.038	0.275	1.388	2.300	1.200
4.Methyl Bromide 40	4.050	0.163	0.225	1.025	1.438	1.200
5.Cabbage + solarization	4.550	0.075	0.275	0.963	1.975	1.263
6.Metam sodium 25 + solarization	7.125	0.163	0.563	1.488	3.675	1.238
7.Cow manure + solarization	6.275	0.163	0.238	1.200	3.525	1.150
8.Dazomet	4.150	0.113	0.250	0.838	1.425	1.525
9.Solarization	5.188	0.038	0.263	1.138	2.325	1.425
10.Metam sodium 50	3.988	0.113	0.200	0.650	1.838	1.188
11.Methyl Bromide 15	3.175	0.075	0.225	0.688	0.950	1.238
12.Maize + solarization	4.525	0.113	0.288	1.375	1.750	1.000
13.Hen manure + solarization	5.350	0.163	0.300	1.525	2.150	1.213
14.Dichloropropen	5.400	0.188	0.225	1.213	2.275	1.500



Evaluation date: April 17th, 2003

TABLES OF TOTAL AVERAGE WEIGHT. PERCENTAGE OF FRUIT SIZES  
(150g; 125g; 100g; Y -100g.) AND REMAIN/TREATMENT/CUT ON 40 M. LINEAR

TREATMENTS	TOTAL	FRUIT SIZES/WEIGHT (Kg)				
	WEIGHT kg.	150gr	125gr	100gr	< 100gr	REMAIN
1.Control	3.650	0.038	0.338	1.363	1.063	0.850
2.Chloropicrin	6.550	0.075	0.488	2.188	2.388	1.413
3.Dichloropropen + chloropicrin	5.475	0.000	0.050	0.788	2.750	1.888
4.Methil Bromide 40	5.350	0.113	0.275	1.338	2.113	1.513
5.Cabbage + solarization	3.175	0.038	0.150	0.825	1.350	0.813
6.Metam sodium 25 + solarization	6.200	0.000	0.300	1.688	3.013	1.200
7.Cow manure + solarization	5.400	0.000	0.150	0.988	2.988	1.275
8.Dazomet	4.763	0.000	0.175	0.975	1.925	1.688
9.Solarization	4.425	0.000	0.100	0.950	2.088	1.288
10.Metam sodium 50	6.625	0.038	0.075	1.400	3.338	1.775
11.Methyl Bromide 15	6.550	0.075	0.138	1.350	3.488	1.500
12.Maize + solarization	3.725	0.000	0.163	0.988	0.913	1.663
13.Hen manure + solarization	5.350	0.038	0.238	1.350	2.663	1.063
14.Dichloropropen	5.600	0.100	0.238	1.363	2.563	1.338

Evaluation date: April 20th, 2003

TABLES OF TOTAL AVERAGE WEIGHT. PERCENTAGE OF FRUIT SIZES  
(150g; 125g; 100g; Y -100g.) AND REMAIN/TREATMENT/CUT ON 40 M. LINEAR

TREATMENTS	TOTAL	FRUIT SIZES/WEIGHT (Kg)				
	WEIGHT kg.	150gr	125gr	100gr	< 100gr	REMAIN
1.Control	1.788	0.000	0.350	0.488	0.513	0.438
2.Chloropicrin	5.488	0.075	1.000	1.975	1.213	1.225
3.Dichloropropen + chloropicrin	9.338	0.000	0.988	3.813	1.775	2.763
4.Methil Bromide 40	11.538	0.000	1.563	3.113	2.513	4.350
5.Cabbage + solarization	8.550	0.000	0.600	2.038	1.325	4.588
6.Metam sodium 25 + solarization	17.950	0.000	3.550	7.588	3.688	3.125
7.Cow manure + solarization	14.113	0.000	1.200	4.088	3.000	4.575
8.Dazomet	6.188	0.000	0.513	1.238	0.613	3.825
9.Solarization	8.925	0.000	1.063	2.325	1.375	4.163
10.Metam sodium 50	7.713	0.000	0.775	2.525	2.263	2.150
11.Methyl Bromide 15	6.863	0.000	0.250	1.400	1.588	3.625
12.Maize + solarization	3.975	0.000	0.825	1.400	0.950	0.800
13.Hen manure + solarization	7.050	0.000	1.425	1.850	1.463	2.313
14.Dichloropropen	7.925	0.000	1.338	2.150	1.000	3.438



evaluation date: April 24th, 2003

**TABLES OF TOTAL AVERAGE WEIGHT. PERCENTAGE OF FRUIT SIZES**

**(150g; 125g; 100g; Y -100g.) AND REMAIN/TREATMENT/CUT ON 40 M. LINEAR**

TREATMENTS	TOTAL	FRUIT SIZES/WEIGHT (Kg)				
	WEIGHT kg.	150	125	100	Y - 100	REMAIN
1.Control	2.725	0.038	0.338	1.000	0.775	0.575
2.Chloropicrin	6.013	0.150	0.763	1.900	1.738	1.463
3.Dichloropropen + chloropicrin	7.400	0.000	0.425	2.038	2.563	2.625
4.Methil Bromide 40	8.438	0.113	0.788	2.200	2.575	3.013
5.Cabbage + solarization	5.863	0.038	0.338	1.425	1.575	2.488
6.Metam sodium 25 + solarization	12.075	0.000	1.500	4.075	4.175	2.325
7.Cow manure + solarization	9.750	0.000	0.538	2.225	3.750	3.238
8.Dazomet	5.475	0.000	0.313	1.125	1.313	2.725
9.Solarization	6.663	0.000	0.475	1.575	2.275	2.338
10.Metam sodium 50	7.163	0.038	0.413	1.950	2.800	1.963
11.Methyl Bromide 15	6.705	0.075	0.218	1.363	2.525	2.525
12.Maize + solarization	3.850	0.000	0.525	1.175	0.913	1.238
13.Hen manure + solarization	6.200	0.038	0.763	1.588	2.175	1.638
14.Dichloropropen	6.763	0.113	0.725	1.700	1.963	2.263

**UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA**

Site: Facultad de Agronomía, Culiacán, Sinaloa

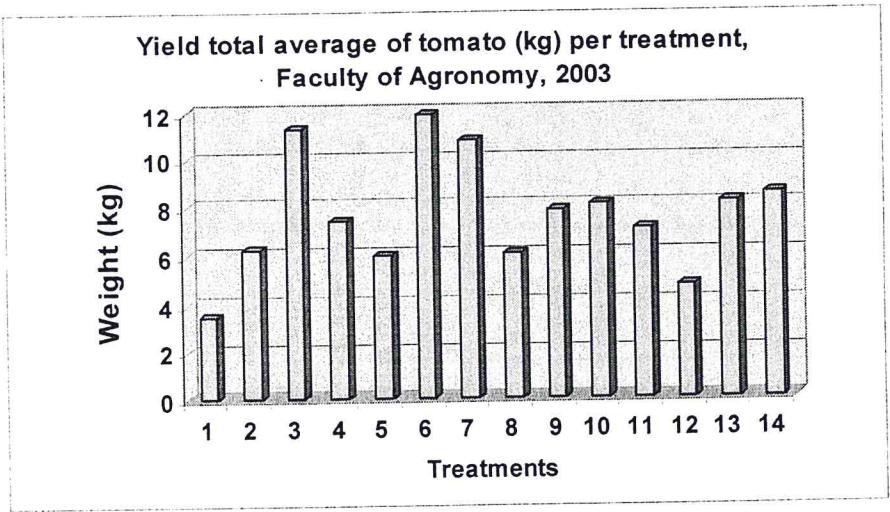
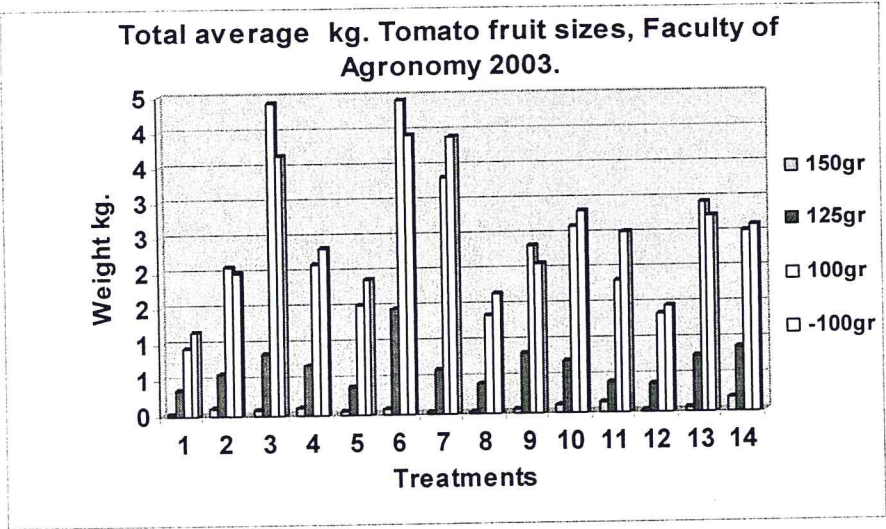
Cultivo: Tomate saladette cv. Gala

Transplanting date: September 23th, 2002

Evaluation parameter: Average of total yield (weight and fruit sizes) on 40 m linear /treatment

Evaluation date: April 8th to 24th, 2003 (5 cuts)

TREATMENT	Average	FRUIT AVERAGE SIZES				
	weight (KG)	150gr	125gr	100gr	Y - 100gr	REMAIN
1.Control	3.498	0.023	0.350	0.935	1.158	1.033
2.Chloropicrin	6.268	0.100	0.580	2.063	1.978	1.498
3.Dichloropropen + chloropicrin	11.298	0.068	0.863	4.385	3.648	2.335
4.Methil Bromide 40	7.443	0.090	0.678	2.105	2.333	2.238
5.Cabbage + solarization	6.010	0.048	0.378	1.523	1.865	2.198
6.Metam sodium 25 + solarization	11.885	0.083	1.455	4.433	3.935	1.980
7.Cow manure + solarization	10.823	0.033	0.595	3.320	3.900	2.725
8.Dazomet	6.100	0.023	0.395	1.345	1.658	2.680
9.Solarization	7.823	0.043	0.813	2.313	2.068	2.588
10.Metam sodium 50	8.130	0.115	0.725	2.605	2.820	1.865
11.Methyl Bromide 15	7.083	0.140	0.410	1.815	2.523	2.195
12.Maize + solarization	4.748	0.023	0.370	1.355	1.458	1.543
13.Hen manure + solarization	8.188	0.055	0.763	2.920	2.740	1.710
14.Dichloropropen	8.500	0.198	0.883	2.503	2.598	2.320



**FINAL CONCLUSION.** The treatments with greater production (export and national) were: dichloropropeno + Chloropicrin, and metam sodium + solarization. These are alternatives to the use of methyl bromide for the control of pathogens of the ground in tomato, nevertheless biofumigation could be a good treatment of control that could be adopted by lower producers.





**FINAL PROJECT REPORT:** Alternatives to the use of Methyl Bromide in the cultivation of **strawberry** (*Fragaria* spp.). This tasks were developed In Agricultural enterprise "Don Juanito", located in Colonia Vicente Guerrero, Valle de San Quintín, Baja California, Mexico. Universidad Autónoma de Sinaloa, Agronomy Faculty Responsible: MC. Francisco Javier Estrada Ramirez, Project Coordinator, and MC. Sostenes Montoya Angulo, Agronomist, in tests implementation. QFB. María de la Luz Acosta Pineda y MC. Carlos Morales Cazarez Colaboradores.

In this month, March 2004, we are reporting performed activities from 1999 to 2004.

## Introduction

During October, 1999, we started some tests in Baja California, Mexico, which consisted in the aplication of different treatments on soil, in order to analyze the control about soil microorganisms and in crops development, comparing Methyl bromide. We apply this substance in alluvial arenaceous land, with region characteristics (flora and fauna) half-dessert. Agricultural activities are based in the drip irrigation, using groundwater table.

The applied treatments were:

- 1) Control (no treatment);
- 2) Methyl Bromide 15 gr/m<sup>2</sup>, 80/20
- 3) Methyl Bromide 40 gr/m<sup>2</sup>, 80/20
- 4) Solarization (4 weeks)
- 5) Hen Manure, 5 kg and solarization (4 weeks)
- 6) Cow manure slightly done (5 kg) and solarization (4 weeks)
- 7) Fresh chinese broccoli (5 kg) and solarization (4 weeks)
- 8) Metham sodium (N, methyl sodium ditiocarbamate) and solarization (4 weeks)
- 9) Metham Sodium (50 ml/m<sup>2</sup>)
- 10) Chloropicrin (33 ml/m<sup>2</sup>)
- 11) Dazomet (tetrahydro-3,5 dimetil-2H-1,3,5-tiazidin-s tiona) (40 gr/m<sup>2</sup>)
- 12) 1,3-Dichloropropen (65%) + chloropicrin (35%) (27 ml/m<sup>2</sup>)
- 13) 1,3-Dichloropropen (11.2 ml/m<sup>2</sup>)
- 14) Compost (5 kg/m<sup>2</sup>)

## BODY OF THE REPORT

## Land preparation

The activities in cooperative farmer land started in last September, using machinery. It was carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the instalment underground pipeline. (We didn't stablish tests and applied Methyl bromide in all the land). Afterwards the beds were marked, arised and flattened. And finally we put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

## Experiment Design

The treatment designs were carried out in October 8th, 1999. First we marked the block margins using stakes, afterwards, we drew lines using lame in order to defin, the four blocks. In a piece of land with 56 beds; 50 M lenght, inside the enterprise commercial land. It was traced four blocks 10 m each; we selected 14 experimental plots with 4 beds, which we applied next randomized treatments.

1). Absolute control. In this experimental unit consist on 4 rows, 10 M. lenght, and we didn't realized any fungicide or organic matter application on the soil. The soil remained covered with plastic until the crop cycle finished.

2). Methyl Bromide 80/20 (15 gr/m<sup>2</sup>). In the soil in the 4 rows in this experimental unit it was injected 15 gr M<sup>2</sup> (80% methil bromide and 20% chloropicrin) M<sup>2</sup>. The application was carried out using a John Deere tractor. The soil will remain covered with plastic until the crop cycle finish.

3). Methyl Bromide 80/20 (40 gr/m<sup>2</sup>). It was applied 40 grs M<sup>2</sup> in the four rows (80% methyl bromide and 20% cholopicrin). The application was aproximattely 30 cm depth. The soil remained covered with plastic until the crop cycle finish.

4). Solarization. The four rows were padded or was covered with transparent plastic until the crop finish.

5). Hen manure was incorporated to the soil with the solarization. It was distributed on the soil, in that 10 mts. four rows 200 kgs hens manure, aproximattely 5 kgs per M<sup>2</sup>. It was incorpored by manual labour using hoes and the rows were covered with transparent plastic.

6). Cow Manure was incorporated to the soil with the solarization. It was distributed 200 kg. Cow manure, aproximattely 5 kg. Per M<sup>2</sup>. It was incorpored by manual labour using hoes, and the rows were covered with transparent plastic.

7). Green cabbage incorporated on the soil with the solarization. In order to apply this treatment, we chopped the cabbage in small pieces: then it was distributed 5



## Experiment Design

The treatment designs were carried out in September 28th, 2000. First we marked the block margins using stakes, afterwards, we drew lines using lame in order to define the four blocks. In a piece of land with 28 beds; 98 M length, inside the enterprise commercial land. It was traced four blocks 20 m each; we selected 7 experimental plots with 4 beds, which we applied next randomized treatments.

1). Chloropicrin. On this four furrows were applied 33ml/m<sup>2</sup> chloropicrin using the same equipment which we applied methyl-bromide. The furrows were covered in black/silver plastic during 22 days.

2). 1,3-dichloropropeno + chloropicrin. These furrows soil were treated using 27ml/m<sup>2</sup> mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product, using the same equipment used to apply the chloropicrin and the furrows were covered in black/silver plastic until the crop cycle finish.

3). Methyl Bromide 80/20 (40 gr/m<sup>2</sup>). It was applied 40 grs M<sup>2</sup> in the four rows (80% methyl bromide and 20% chloropicrin). The application was approximately 30 cm depth. The soil remained covered with plastic until the crop cycle finish.

4). Metham-sodium. In this four furrows it was applied 50 ml/m<sup>2</sup> metham sodium. After the application the furrows were covered in black/silver plastic.

5). Absolute control. In this experimental unit consist on 4 rows, 10 M. length, and we didn't realized any fungicide or organic matter application on the soil. The soil remained covered with plastic until the crop cycle finished.

6). Dazomet (tetrahydro-3,5 dimethyl-2H-1,3,5-tiadiazin-2 tione). On this furrows soil we distributed by manual labour 40 gr/m<sup>2</sup> dazomet: it was incorporated using hoes, after that, we applied water by sprinkler irrigation during 3 hrs. Finally, it was covered in black/silver plastic.

7). Methyl Bromide 80/20 (80% methyl bromide and 20% chloropicrin). The application was approximately 30 cm depth. The soil remained covered with plastic until the crop cycle finish. Commercial application.

Before the beds were covered with the organic treatments, dazomet and metham sodium were applied using sprinkling irrigation in order to damp the organics and descend the chemical products. The applications was carried out in damp soil.

## Planting

Planting was carried out with exported seedlings from California, United States, and it was carried out in November 11<sup>th</sup>, put in a seedling on the soil, through holes in plastic each 40 cm.

## WEEDS.

**Site:** Rancho "Don Juanito", col. Vicente Guerrero, San Quintín, B.C.

**Crop:** Strawberry.

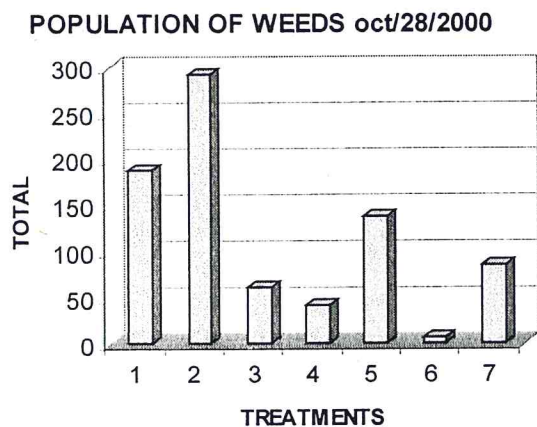
**Beginning of Experiment:** 29/sept/2000.

**Evaluation date:** 28/oct/2000.

**Evaluation parameter:** Population of Weeds.

**28/OCT./2000**

TREATMENTS	BLOCKS				
	I	II	III	IV	Total
1. Chloropicrin	43	20	82	43	188
2. Dichloro+Chloropicrin	41	207	31	15	294
3. Methyl bro. Sideline	1	8	29	23	61
4. Metam-sodium 50	8	10	7	17	42
5. Control	38	32	26	42	138
6. Dazomet	1	1	3	1	6
7. Methyl Bro. Commer.	16	24	29	17	86





**Site:** Rancho "Don Juanito", col. Vicente Guerrero, San Quintín, B.C.

**Crop:** Strawberry.

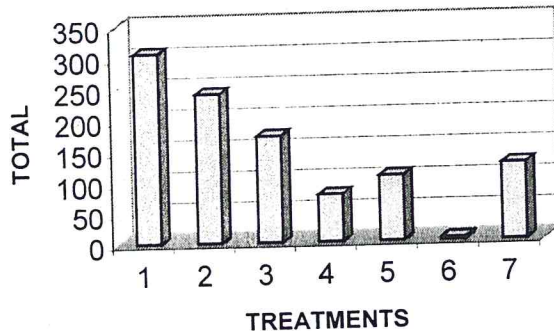
**Beginning of Experiment:** 29/sept/2000.

**Evaluation date:** 28/oct/2000.

**Evaluation parameter:** Population of Weeds.

09/nov./2000	BLOCKS				
TREATMENTS	I	II	III	IV	Total
1. Chloropicrin	68	54	97	87	306
2. Dichloro+Chloropicrin	79	108	41	13	241
3. Methyl bro. Sideline	38	46	44	44	172
4. Metam-sodium 50	20	20	17	20	77
5. Control	0	42	32	32	106
6. Dazomet	0	3	0	1	4
7. Methyl Bro. Commer.	24	20	29	50	123

**POPULATION OF WEEDS nov./09/2000**



## NEMATODES.

Site: Rancho Don Juanito, Col. Vicente Guerrero, B.C.S.

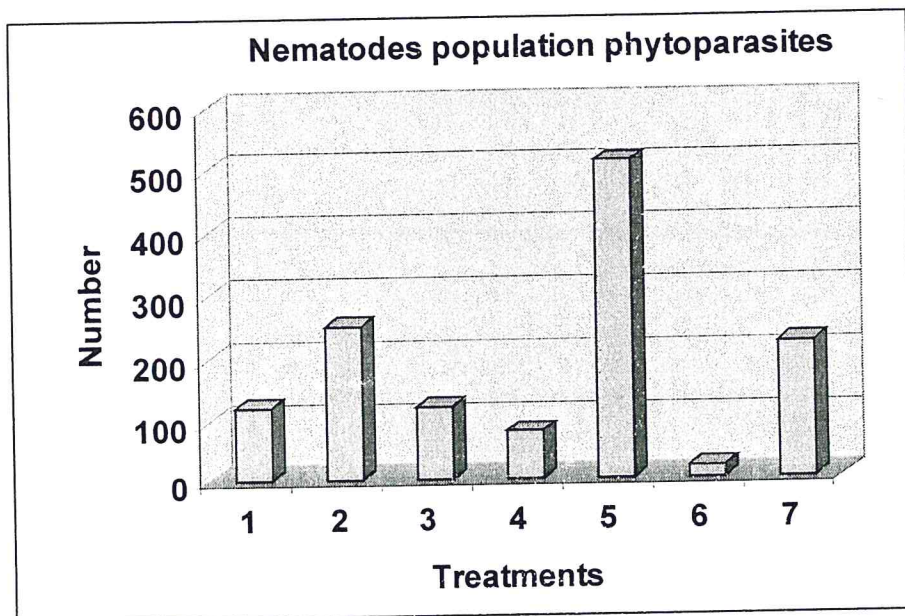
Crop: Strawberry

Measurement parameter: nematodes population

Planting: October 26th, 2000      evaluation: December, 2000

Phytoparasites Nematodes

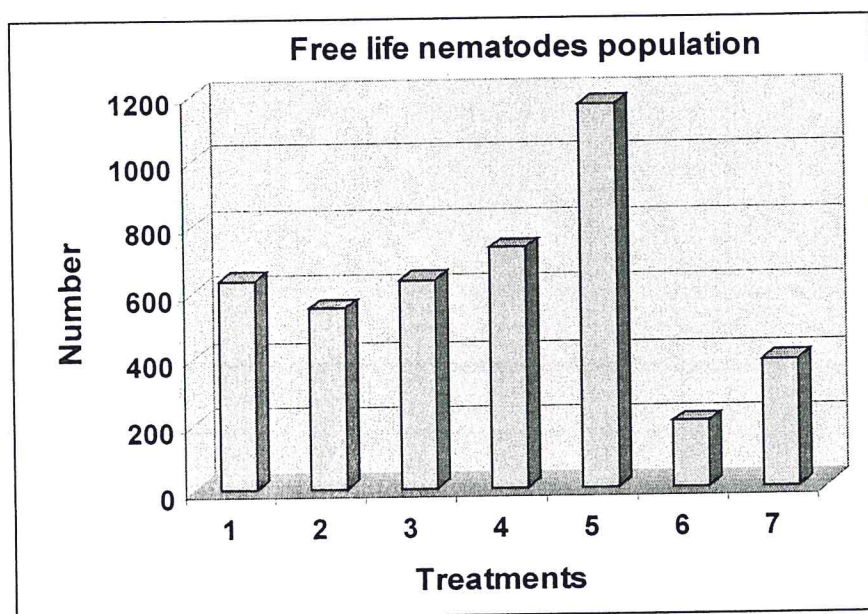
TREATMENT	BLOCK				AVERAGE
	I	II	III	IV	
1. Chloropicrin	180	60			120
2. Dichlorop.+Chloropic.	260	240			250
3. Methyl bromide	140	100			120
4. Metam sodium 50	80	80			80
5. Control	520	500			510
6. Dazomet	0	40			20
7. Methyl bromide C.	220	220			220





Free live nematodes

TREATMENT	BLOCK				AVERAGE
	I	II	III	IV	
1. Chloropicrin	1160	104			632
2. Dichlorop.+Chloropic.	100	1000			550
3. Methyl bromide	1140	124			632
4. Metam sodium 50	520	940			730
5. Control	1160	1180			1170
6. Dazomet	280	120			200
7. Methyl bromide C.	240	540			390



## YIELD.

### STATISTIC ANALYSIS OF STRAWBERRY OBTAINED RESULTS IN EXPERIMENT WHICH TOOK PLACE IN "DON JUANITO" CAMP, LA GARROCHA, SAN QUINTÍN BAJA CALIFORNIA, MÉXICO. CYCLE 2000-2001

**Crop:** Strawberry

Measurement parameter: Yield-total weight (**pounds**) of strawberry. Domestic and Export market.

#### FEBRUARY

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	17.05	15.55	14.95	11.65	59.20	14.80
2. Dichloroprop+chloropicrin	15.55	14.10	13.75	14.90	58.30	14.58
3. Methyl Bro on sideline	15.60	14.45	15.30	15.25	60.60	15.15
4. Metam sodium	14.90	13.80	14.90	14.15	57.75	14.44
5. Control	13.95	14.70	13.95	13.35	55.95	13.99
6. Dazomet	11.85	12.45	9.40	11.95	45.65	11.41
7. Methyl Bro-total	14.05	14.85	13.50	15.90	58.30	14.58

#### MARCH

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	30.05	33.10	30.10	23.15	116.40	29.10
2. Dichloroprop+chloropicrin	31.95	30.80	30.15	29.17	122.07	30.52
3. Methyl Bro on sideline	31.05	24.60	28.90	24.00	108.55	27.14
4. Metam sodium	27.35	29.10	33.20	30.80	120.45	30.11
5. Control	32.10	28.75	30.03	31.85	122.73	30.68
6. Dazomet	19.40	20.10	12.45	21.10	73.05	18.26
7. Methyl Bro-total	30.85	33.90	30.85	31.73	127.33	31.83

#### APRIL

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	39.71	49.05	43.65	36.39	168.80	42.20
2. Dichloroprop+chloropicrin	45.40	41.75	42.20	45.70	175.05	43.76
3. Methyl Bro on sideline	46.40	40.50	43.41	38.85	169.16	42.29
4. Metam sodium	42.80	45.15	47.20	45.80	180.95	45.24
5. Control	46.65	43.80	42.90	46.95	180.30	45.08
6. Dazomet	33.03	31.15	14.15	29.35	107.68	26.92
7. Methyl Bro-total	48.66	45.35	48.25	44.40	186.66	46.67



**SUM OF FEBRUARY, MARCH AND  
APRIL**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	86.81	97.70	88.70	71.19	344.40	86.10
2. Dichloroprop+chloropicrin	92.90	86.65	86.10	89.77	355.42	88.86
3. Methyl Bro on sideline	93.05	79.55	87.61	78.10	338.31	84.58
4. Metam sodium	85.05	88.05	95.30	90.75	359.15	89.79
5. Control	92.70	87.25	86.88	92.15	358.98	89.75
6. Dazomet	64.28	63.70	36.00	62.40	226.38	56.60
7. Methyl Bro-total	93.56	94.10	92.60	92.03	372.29	93.07

**ANALYSIS OF VARIANCE**

FV	GL	SC	CM	F	P F
Treatments	6	3712.28125	618.713562	10.2427	0.000
Repetitions	3	120.93750	40.312500	0.6739	0.582
Error	18	1076.78125	59.821182		
Total	27	4910.00000			

C.V. = 9.20%

**TABLE OF AVERAGES**

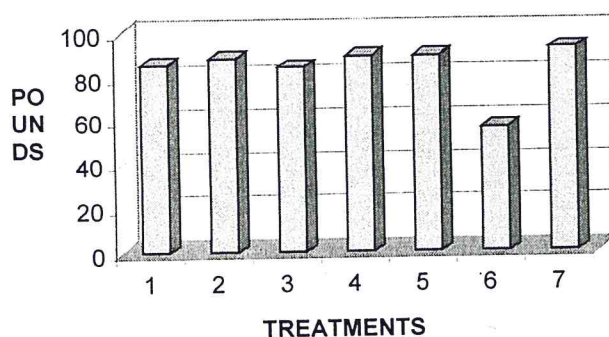
TREATMENTS	AVERAGE
7. Methyl Bromide-total	93.0725 A
4. Metam sodium	89.7875 A
5. Control	89.7450 A
2. Dichloropro+chloropicrin	88.8550 A
1. Chloropicrin	86.1000 A
3. Methil Bromide on sideline	84.5775 A
6. Dazomet	56.5950 B

Level of significance = 0.05

Tukey = 18.0599

Values of tables : q (0.05) = 4.67

WEIGHT OF STRAWBERRIES, S.Q.,  
2000-2001



YIELD OF STRAWBERRIES. DOMESTIC AND  
EXPORT MARKET, agricultural cycle 2000-2001.

**Crop:** Strawberry

**Measurement parameter:** Yield-total number of strawberries. Domestic and export market.

**FEBRUARY**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	138	137	140	103	518	129.50
2. Dichloroprop+chloropicrin	128	136	118	122	504	126.00
3. Methyl Bro on sideline	141	117	113	124	495	123.75
4. Metam sodium	155	130	142	117	544	136.00
5. Control	130	149	124	126	529	132.25
6. Dazomet	81	104	25	85	295	73.75
7. Methyl Bro-total	121	141	116	151	529	132.25

**MARCH**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	277.00	264.00	261.00	164.00	966	241.50
2. Dichloroprop+chloropicrin	282.00	265.00	296.00	225.00	1068	267.00
3. Methyl Bro on sideline	270.00	156.00	232.00	160.00	818	204.50
4. Metam sodium	252.00	257.00	307.00	277.00	1093	273.25
5. Control	308.00	264.00	280.00	304.00	1156	289.00
6. Dazomet	113.00	139.00	13.00	152.00	417	104.25
7. Methyl Bro-total	276.00	329.00	283.14	276.00	1164	291.04



**APRIL**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	714.00	780.00	705.00	557.00	2756	689.00
2. Dichloroprop+chloropicrin	745.00	687.00	743.00	741.00	2916	729.00
3. Methyl Bro on sideline	780.00	656.00	725.00	625.00	2786	696.50
4. Metam sodium	681.00	710.00	827.00	770.00	2988	747.00
5. Control	810.00	722.00	717.00	805.00	3054	763.50
6. Dazomet	474.00	433.00	45.00	386.00	1338	334.50
7. Methyl Bro-total	886.00	746.00	822.00	727.00	3181	795.25

**SUM OF FEBRUARY, MARCH AND  
APRIL**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	1129	1181	1106	824	4240	1060.00
2. Dichloroprop+chloropicrin	1155	1088	1157	1088	4488	1122.00
3. Methyl Bro on sideline	1191	929	1070	909	4099	1024.75
4. Metam sodium	1088	1097	1276	1164	4625	1156.25
5. Control	1248	1135	1121	1235	4739	1184.75
6. Dazomet	668	676	83	623	2050	512.50
7. Methyl Bro-total	1283	1216	1221	1154	4874	1218.54

**ANALYSIS OF VARIANCE**

FV	GL	SC	CM	F	P F
Treatments	6	1403330.000000	233888.328125	11.2277	0.000
Repetitions	3	52976.000000	17658.666016	0.8477	0.512
Error	18	374964.000000	20831.333984		
Total	27	1831270.000000			

C.V. = 13.89%

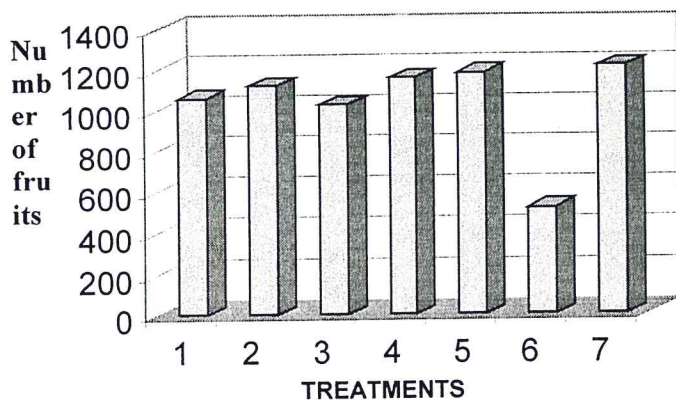
**TABLE OF AVERAGE**

TREATMENTS	AVERAGE
7. Methyl Bromide-total	1218.5000 A
5. Control	1184.7500 A
4. Metam-sodium	1154.2500 A
2. Dichloropro+chloropicrin	1118.0000 A
1. Chloropicrin	1060.0000 A
3. Methyl Bromide on sideline	1024.7500 A
6. Dazomet	512.5000 B

Level of significance = 0.05

Tukey = 337.0121 Values of tables : q (0.05) = 4.67.

## TOTAL OF STRAWBERRIES



**Crop:** Strawberry

Measurement parameter: Yield-Number of fruits-

**FIRST QUALITY. EXPORT**

### FEBRUARY

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	84	84	83	57	308	77.00
2. Dichloroprop+chloropicrin	80	59	56	77	272	68.00
3. Methyl Bro on sideline	93	83	79	81	336	84.00
4. Metam sodium	87	73	103	78	341	85.25
5. Control	69	88	70	63	290	72.50
6. Dazomet	35	53	4	35	127	31.75
7. Methyl Bro-total	81	90	55	102	328	82.00

### MARCH

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	170	185	169	102	626	156.50
2. Dichloroprop+chloropicrin	188	171	185	140	684	171.00
3. Methyl Bro on sideline	176	106	160	99	541	135.25
4. Metam sodium	149	177	222	172	720	180.00
5. Control	178	167	179	201	725	181.25
6. Dazomet	70	72	6	83	231	57.75
7. Methyl Bro-total	187	234	195	191	807	201.75



**APRIL**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	414	471	438	352	1,675	418.75
2. Dichloroprop+chloropicrin	433	410	439	451	1,733	433.25
3. Methyl Bro on sideline	439	372	414	389	1,614	403.50
4. Metam sodium	448	429	451	472	1,800	450.00
5. Control	520	425	458	472	1,875	468.75
6. Dazomet	253	256	28	242	779	194.75
7. Methyl Bro-total	523	472	462	396	1,853	463.25

**SUM OF FEBRUARY,  
MARCH AND APRIL**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	668	740	690	511	2609	652.25
2. Dichloroprop+chloropicrin	701	640	680	668	2689	672.25
3. Methyl Bro on sideline	708	561	653	569	2491	622.75
4. Metam sodium	684	679	776	722	2861	715.25
5. Control	767	680	707	736	2890	722.50
6. Dazomet	358	381	38	360	1137	284.25
7. Methyl Bro-total	791	796	712	689	2988	747.00

**ANÁLISIS OF VARIANCE**

FV	GL	SC	CM	F	P F
Treatments	6	605532.000000	100922.000000	14.0965	0.000
Repetitions	3	17624.000000	5874.666504	0.8206	0.502
Error	18	128869.000000	7159.388672		
Total	27	752025.000000			

C.V. = 13.41%

## TABLE OF RECORDS

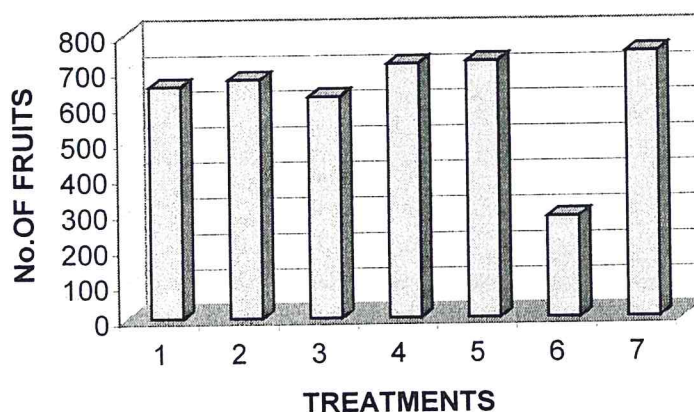
TREATMENTS	AVERAGE	
7. Methyl Bromide-total	747.0000	A
5. Control	722.5000	A
4. Metam-sodium	715.2500	A
2. Dichloropro+chloropicrin	672.2500	A
1. Chloropicrin	652.2500	A
3. Methyl Bromide on sideline	622.7500	A
6. Dazomet	284.2500	B

Level of significance = 0.05

Tukey = 197.5718

Values of tables :  $q(0.05) = 4.67$ .

## STRAWBERRIES FOR EXPORT



Crop: Strawberry

Measurement parameter: Yield-Number of fruits **SECOND QUALITY-DOMESTIC.**  
**FEBRUARY**

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	54	54	57	47	212	53.00
2. Dichloroprop+chloropicrin	50	77	62	45	234	58.50
3. Methyl Bro on sideline	50	37	34	43	164	41.00
4. Metam sodium	69	57	40	39	205	51.25
5. Control	61	61	54	63	239	59.75
6. Dazomet	46	52	21	50	169	42.25
7. Methyl Bro-total	40	53	61	52	206	51.50



### MARCH

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	107	79	92	62	340	85.00
2. Dichloroprop+chloropicrin	94	94	111	85	384	96.00
3. Methyl Bro on sideline	94	50	72	61	277	69.25
4. Metam sodium	103	80	85	105	373	93.25
5. Control	130	97	101	103	431	107.75
6. Dazomet	43	67	7	69	186	46.50
7. Methyl Bro-total	89	95	88	85	357	89.29

### APRIL

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	268	273	238	177	956	239.00
2. Dichloroprop+chloropicrin	303	292	297	273	1,165	291.25
3. Methyl Bro on sideline	349	259	316	248	1,172	293.00
4. Metam sodium	243	305	343	299	1,190	297.50
5. Control	281	280	286	330	1,177	294.25
6. Dazomet	215	193	51	143	602	150.50
7. Methyl Bro-total	347	268	265	308	1,188	297.00

### SUM OF FEBRUARY, MARCH AND APRIL

TREATMENTS	R1	R2	R3	R4	TOTAL	AVERAGE
1. Chloropicrin	429	406	387	286	1508	377.00
2. Dichloroprop+chloropicrin	447	463	470	403	1783	445.75
3. Methyl Bro on sideline	493	346	422	352	1613	403.25
4. Metam sodium	415	442	468	443	1768	442.00
5. Control	472	438	441	496	1847	461.75
6. Dazomet	304	312	79	262	957	239.25
7. Methyl Bro-total	476	416	414	445	1751	437.79

## ANALYSIS OF VARIANCE

FV	GL	SC	CM	F	P F
Treatments	6	141875.000000	23645.833984	7.2125	0.001
Repetitions	3	11853.500000	3951.166748	1.2052	0.336
Error	18	59012.500000	3278.472168		
Total	27	212741.000000			

C.V. = 14.28%

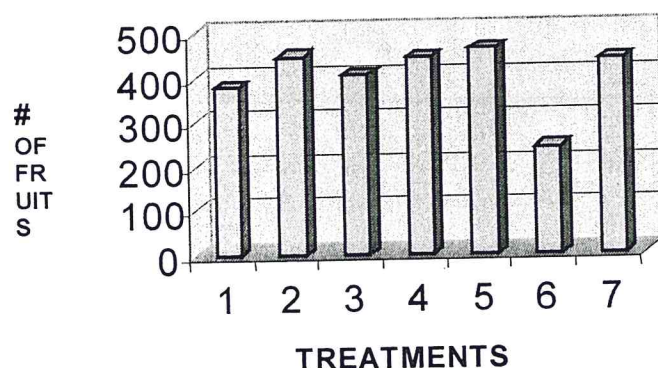
## TABLE OF RECORDS

TREATMENTS	AVERAGE
7. Methyl Bromide-total	461.7500 A
5. Control	445.7500 A
4. Metam-sodium	442.0000 A
2. Dichloropro+chloropicrin	437.7500 A
1. Chloropicrin	403.2500 A
3. Methyl Bromide on sideline	377.2500 A
6. Dazomet	239.2500 B

Level of significance = 0.05

Tukey = 133.6973 Values of tables : q (0.05) = 4.67.

## FRUITS OF SECOND QUALITY - DOMESTIC



TOTAL YIELD . SECOND QUALITY. DOMESTIC  
MARKET. CYCLE 2000-2001

**GENERAL CONCLUSION:** Based on obtained results in statistic analysis about number and weight of strawberries, domestic and export market which were harvested each treatment. We could observe that there is not significant differences among next treatments: 7 methyl bromide-total; 2 dichloroprop+chloropicrin; 5 control; 4 metam sodium; 1 chloropicrin; 3 Methyl Bromide on sideline. The worst treatment was 6; dazomet.





## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMÍA - UAS

### INTRODUCTION.

During September 2001, it was established the third test of project "Alternatives to the use of Methyl Bromide in the cultivation of **strawberry** (*Fragaria* spp.)" we started some tests in "Don Juanito" Ranch, San Quintin, Baja California, Mexico, which consisted in the application of different treatments on soil, in order to analyze the control about soil microorganisms and in crops development, comparing Methyl bromide. We apply this substance in alluvial arenaceous land, with region characteristics (flora and fauna) half-dessert. Agricultural activities are based in the drip irrigation, using groundwater table.

Treatments: Based on before obtained results during last season 2000-2001 we selected 5 (five) treatments.

The applied treatments were:

- 1) Chloropicrin (33 ml/m<sup>2</sup>)
- 2) 1,3-Dichloropropen (65%) + chloropicrin (35%) (27 ml/m<sup>2</sup>)
- 3) Methyl Bromide 40 gr/m<sup>2</sup>, 80/20
- 4) Metham Sodium (50 ml/m<sup>2</sup>)
- 5) Control (no treatment);

### BODY OF THE REPORT

#### Land preparation

The activities in cooperative farmer land started in last September, using machinery. It was carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the installment underground pipeline. (We didn't establish tests and applied Methyl bromide in all the land). Afterwards the beds were marked, arised and flattened.

And finally we put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

## Experiment Design

The treatment designs were carried out in September 20th, 2001. First we marked the block margins using stakes, afterwards, we drew lines using lame in order to define the four blocks. In a piece of land with 20 beds; 90 M length, inside the enterprise commercial land. It was traced four blocks 20 m each; we selected 5 experimental plots with 4 beds, which we applied next randomized treatments.

- 1). Chloropicrin. On this four furrows were applied  $33\text{ml/m}^2$  chloropicrin using the same equipment which we applied methyl-bromide. The furrows were covered in black/silver plastic during 22 days.
- 2). 1,3-dichloropropeno + chloropicrin. These furrows soil were treated using  $27\text{ml/m}^2$  mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product, using the same equipment used to apply the chloropicrin and the furrows were covered in black/silver plastic until the crop cycle finish.
- 3). Methyl Bromide 80/20 ( $40\text{ gr/m}^2$ ). It was applied  $40\text{ grs M}^2$  in the four rows (80% methyl bromide and 20% chloropicrin). The application was approximately 30 cm depth. The soil remained covered with plastic until the crop cycle finish.
- 4). Metham-sodium. In this four furrows it was applied  $50\text{ ml/m}^2$  metham sodium. After the application the furrows were covered in black/silver plastic.
- 5). Absolute control. In this experimental unit consist on 4 rows, 10 M. length, and we didn't realized any fungicide or organic matter application on the soil. The soil remained covered with plastic until the crop cycle finished.

## Planting

Planting was carried out with exported seedlings from California, United States, and it was carried out in October 22<sup>nd</sup>. 2001, put in a seedling on the soil, through holes in plastic each 40 cm.



## YIELD.

FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA  
SITE: Rancho "Don juanita" Col. Vicente Guerrero (campo la Garrocha), B.C.  
CROP: Strawberries  
PLANTING DATE: October 06th, 2001  
EVALUATION PARAMETER: Number of exportable strawberries/treatment  
on 4 m. lineals  
EVALUATION: January 02th, to May 31th,  
2002

### JANUARY

TREATMENTS	NUMBER OF STRAWBERRY (FIRST EXPORT)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	59	57	61	65	242
2. Dichloropropen+chloropicrin	46	51	53	68	218
3. Methyl Bromide 40	62	76	47	55	240
4. Metam sodium 50	51	59	47	70	227
5. Absolute control	58	59	59	46	222
6. Total Methyl Bromide	51	68	56	77	252

### FEBRUARY

TREATMENTS	NUMBER OF STRAWBERRY (FIRST EXPORT)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	111	89	123	86	409
2. Dichloropropen+chloropicrin	71	78	74	96	319
3. Methyl Bromide 40	47	50	62	41	200
4. Metam sodium 50	82	103	85	84	354
5. Absolute control	82	123	83	95	383
6. Total Methyl Bromide	92	79	85	113	369

MARCH

TREATMENTS	NUMBER OF STRAWBERRY (FIRST EXPORT)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	282	274	297	361	1214
2. Dichloropropen+chloropicrin	272	268	305	378	1223
3. Methyl Bromide 40	285	256	262	243	1046
4. Metam sodium 50	200	255	269	319	1043
5. Absolute control	262	263	264	240	1029
6. Total Methyl Bromide	339	272	309	281	1201

APRIL

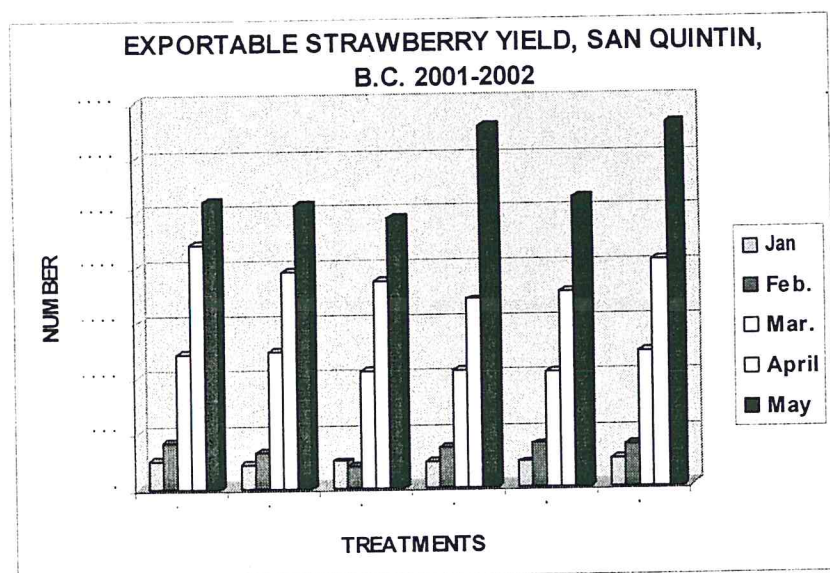
TREATMENTS	NUMBER OF STRAWBERRY (FIRST EXPORT)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	566	517	500	613	2196
2. Dichloropropen+chloropicrin	415	496	503	535	1949
3. Methyl Bromide 40	493	439	446	488	1866
4. Metam sodium 50	327	395	493	471	1686
5. Absolute control	426	449	464	410	1749
6. Total Methyl Bromide	568	518	434	526	2046

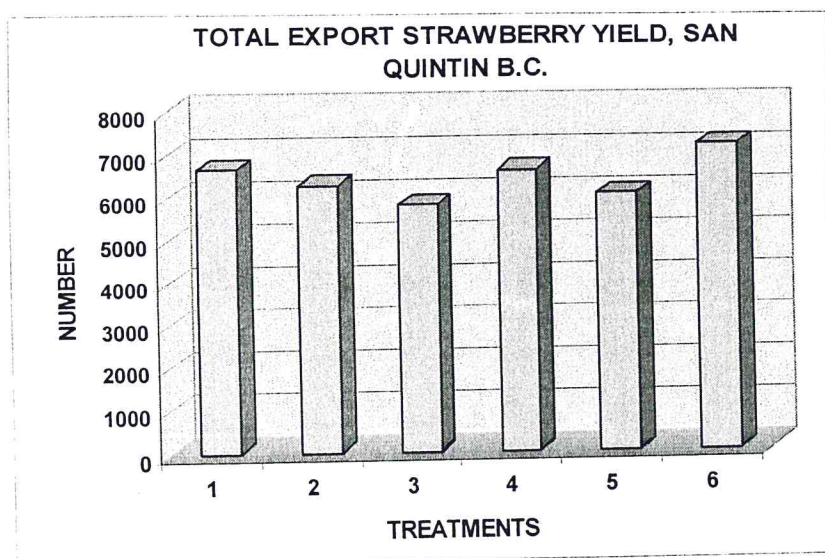
MAY

TREATMENTS	NUMBER OF STRAWBERRY (FIRST EXPORT)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	807	626	583	592	2608
2. Dichloropropen+chloropicrin	710	606	641	602	2559
3. Methyl Bromide 40	593	614	656	568	2431
4. Metam sodium 50	801	796	934	746	3277
5. Absolute control	778	497	693	655	2623
6. Total Methyl Bromide	869	736	937	742	3284



TREATMENTS	TOTAL OF EXPORTABLE STRAWBERRY PER TREATMENT ON 16 M. LINEAL						
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	TOTAL	AVERAGE
1. Chloropicrin	242	409	1214	2196	2608	6669	1334
2. Dichloropro+chloropicrin	218	319	1223	1949	2559	6268	1254
3. Methyl Bromide 40	240	200	1046	1866	2431	5783	1157
4. Metam sodium 50	227	354	1043	1686	3277	6587	1317
5. Absolute control	222	383	1029	1749	2623	6006	1201
6. Total Methyl Bromide	252	369	1201	2046	3284	7152	1430





**FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA**

SITE: Rancho "Don juanito" Col. Vicente Guerrero (campo la Garrocha), B.C.

CROP: Strawberries

PLANTING DATE: October 6th, 2001

EVALUATION PARAMETER: Number of domestic strawberries/treatment on 4 m. lineal

EVALUATION: January 2th, to May 31th, 2002

TREATMENTS	JANUARY NUMBER OF STRAWBERRY (DOMESTIC)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	10	13	13	3	39
2. Dichloropropen+chloropicrin	20	3	11	13	47
3. Methyl Bromide 40	8	13	9	7	37
4. Metam sodium 50	18	7	12	9	46
5. Absolute control	11	9	11	9	40
6. Total Methyl Bromide	19	4	19	4	46



FEBRUARY

TREATMENTS	NUMBER OF STRAWBERRY (DOMESTIC)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	15	32	23	30	100
2. Dichloropropen+chloropicrin	20	20	27	19	86
3. Methyl Bromide 40	25	30	13	7	75
4. Metam sodium 50	31	26	30	21	108
5. Absolute control	23	17	19	16	75
6. Total Methyl Bromide	18	18	33	26	95

MARCH

REATMENTS	NUMBER OF STRAWBERRY (DOMESTIC)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	90	126	106	95	417
2. Dichloropropen+chloropicrin	126	103	114	124	467
3. Methyl Bromide 40	110	93	104	94	401
4. Metam sodium 50	78	103	102	101	384
5. Absolute control	87	90	66	49	292
6. Total Methyl Bromide	89	106	64	104	363

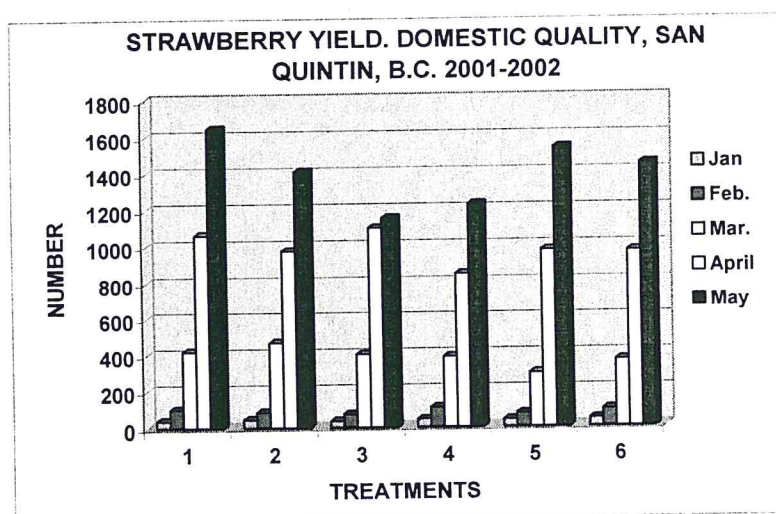
APRIL

TREATMENTS	NUMBER OF STRAWBERRY (DOMESTIC)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	226	240	285	311	1062
2. Dichloropropen+chloropicrin	163	231	267	312	973
3. Methyl Bromide 40	270	229	269	331	1099
4. Metam sodium 50	197	180	232	237	846
5. Absolute control	230	233	250	259	972
6. Total Methyl Bromide	234	278	208	248	968

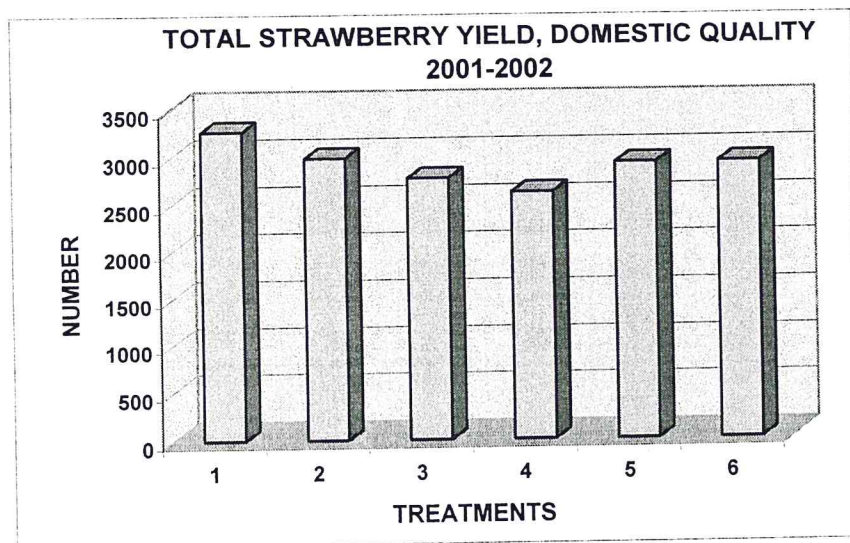
**MAY**

TREATMENTS	NUMBER OF STRAWBERRY (DOMESTIC)				
	R-I	R-II	R-III	R-IV	TOTAL
1. Chloropicrin	338	328	386	596	1648
2. Dichloropropen+chloropicrin	311	275	391	432	1409
3. Methyl Bromide 40	311	255	253	334	1153
4. Metam sodium 50	317	357	263	290	1227
5. Absolute control	316	426	407	387	1536
6. Total Methyl Bromide	362	298	429	358	1447

TREATMENTS	DOMESTIC STRAWBERRIES PER TREATMENT ON 16 M. LINEAL						
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	TOTAL	AVERAGE
1. Chloropicrin	39	100	417	1062	1648	3266	653
2. Dichloropro+chloropicrin	47	86	467	973	1409	2982	596
3. Methyl Bromide 40	37	75	401	1099	1153	2765	553
4. Metam sodium 50	46	108	384	846	1227	2611	522
5. Absolute control	40	75	292	972	1536	2915	583
6. Total Methyl Bromide	46	95	363	968	1447	2919	584







**Final Conclusion.** From the treatments proven in both places Chloropicrin and dichloropropen + Chloropicrin, turned out to be similar to the methyl Bromide, reason why they are an alternative to the use of methyl bromide for the control of pathogens of the ground in Mexico, nevertheless biofumigation could be a good treatment of control that could adopt the lower producers



## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMIA - UAS

**FINAL PROJECT REPORT.** Demonstration Project of Alternatives to the use of Methyl Bromide in the cultivation of **Strawberry**, (*Fragaria spp*). The development in Arandas, Jalisco Mexico. In this field have been working MC. Francisco Javier Estrada Ramirez, coordinator in this project. And MC. Sostenes Montoya Angulo, agronomist who is implementing the tests. QFB. María de la Luz Acosta Pineda y MC. Carlos Morales Cazarez Colaboradores.

In this month, March 2004, we are reporting performed activities from 1999 to 2004.

### INTRODUCTION.

Last June, 2001, in Arandas, Jalisco, Mexico, we started taking some tests. We apply different treatments in soil, in order to analyze the control about soil microorganisms and in crops development also, comparing Methyl bromide. We apply this substance in muddy type soil.

Treatments: We started the experiment in agricultural season 2001. we applied 9 (nine) treatments:

### TREATMENTS OR ALTERNATIVES:

- 1.- Control (no treatment).
- 2.- 15 gr/m<sup>2</sup> of methyl bromide (75/25 or 80/20).
- 3.- 40 gr/m<sup>2</sup> of methyl bromide (75/25 or 80/20).
- 4.- Five kg of pineapple compost, incorporated into the soil, plus four weeks of solarization
- 5- Five kg of fresh broccoli residue (or other cruciferous plant) incorporated into soil, plus four weeks of solarization.
- 6.- 25 ml/m<sup>2</sup> of metam-sodium ( N, methyl sodium ditiocarbamate) plus six weeks of solarization.
- 7.- 50 ml/m<sup>2</sup> of metam-sodium.
- 8.- 33 ml/m<sup>2</sup> of chloropicrin.
- 9.- 1,3-dichloropropene+chloropicrin,dose recommended by the manufacturer.



## BODY OF THE REPORT

### Land preparation.

The activities in cooperative farmer land started in last June, in Arandas, Jalisco, heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they made the installment underground pipeline. Afterwards the beds were marked, arised and flattened. The bed marks were marked 1.20 m between each one.

### Experiment Design

The treatment designs were carried out in June, 2001. In a piece of land with 54 beds, 30 m length, inside the enterprise commercial land. It was traced four blocks 10 m each; we selected 36 experimental plots with 3 beds, which we applied next randomized treatments:

- 1). **Absolute control.** In this experimental unit consist on 4 rows, 10 M. length, and we didn't realized any fungicide or organic matter application.
- 2). **Methyl Bromide 80/20.** In the four rows, It was injected 15 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin). The application was approximately 25-30 cm depth.
- 3). **Methyl Bromide 80/20.** In the four rows, It was injected 40 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin). The application was approximately 25-30 cm depth.
- 4). **Five kg of pineapple compost** incorporated into the soil, plus four weeks of solarization
- 5). **Broccoli** incorporated on the soil and solarization. In order to apply this treatment, we chopped the cabbage in small pieces: then it were distributed 5 kg per M<sup>2</sup>. It was incorporated by manual labour using hoes, after that, the rows were covered with transparent plastic.
- 6). **Metham-sodium.** In this four furrows it was applied 25 ml/m<sup>2</sup> metham sodium. The furrows were covered in black/silver plastic during 20 days.
- 7). **Metham-sodium.** In this four furrows it was applied 50 ml/m<sup>2</sup> metham sodium. The furrows were covered in black/silver plastic during 20 days.
- 8). **Chloropicrin.** On this four furrows were applied 33ml/m<sup>2</sup> chloropicrin using the same equipment which we applied methyl-bromide. The furrows were covered in black/silver plastic during 20 days.
- 9). **1,3-dichloropopren + chloropicrin.** These furrows soil were treated using 27ml/m<sup>2</sup> mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this

product using the same equipment used to apply the methyl-bromide, and the furrows were covered in black/silver plastic during 20 days.

The treatments were applied on damp soil.

Evaluations will be taking place in the central furrow in each experimental unit.

### Planting.

Strawberry plants were planed on no covered soil. Double furrow separated 35 cm each.

### Crop Management

Irrigation and fertilization will take place using drip irrigation, and they are controlled directly by farm technician. Same people took the records about the handworks like pruning, cutting, spinning, tied the plants, diseases control and foliage pests, etc.

## RESULTS:

### WEEDS

#### FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

PROJECT: ALTERNATIVES TO THE USE METHYL BROMIDE IN STRAWBERRIES

SITE: FRESAS ARANDAS, ARANDAS, JALISCO

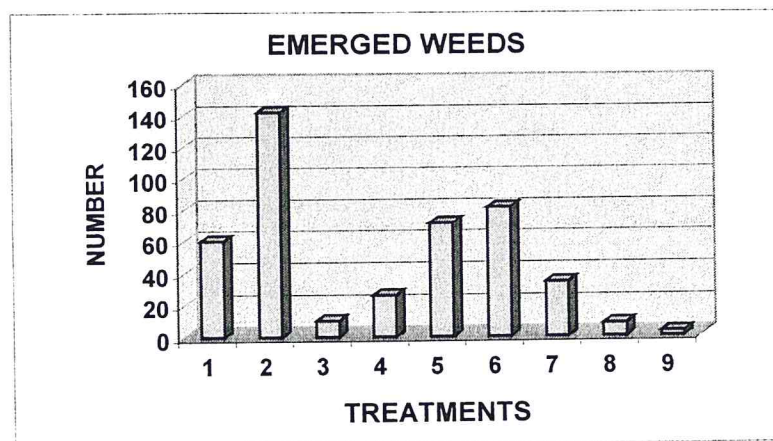
SITE: FRESAS ARANDAS, ARANDAS, JALISCO

Evaluation parameter: Emergence of weeds

Evaluation date: September 25th, 2001

TREATMENTS	NUMBER AND TYPE OF WEEDS							TOTAL
	Verdolaga	Zacate	Quelite	Enredadera	Coquillo	Oxalis	Meloncillo	
cabbage+solarization	5	6	5	0	43	0	1	60
Control	82	3	5	0	49	3	0	142
Methyl Bromide 40	1	0	0	0	5	2	2	10
Dichloro.+Chloropícrin	2	1	1	0	16	1	5	26
M. sodium+solarization	5	24	1	5	36	0	0	71
Pinneapple wastes	12	6	4	2	54	1	2	81
Metam sodium 50	7	14	4	0	3	1	5	34
Chloropicrin	0	1	0	0	7	0	0	8
Methyl Bromide 15	0	1	0	0	0	0	2	3





## YIELD:

### FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

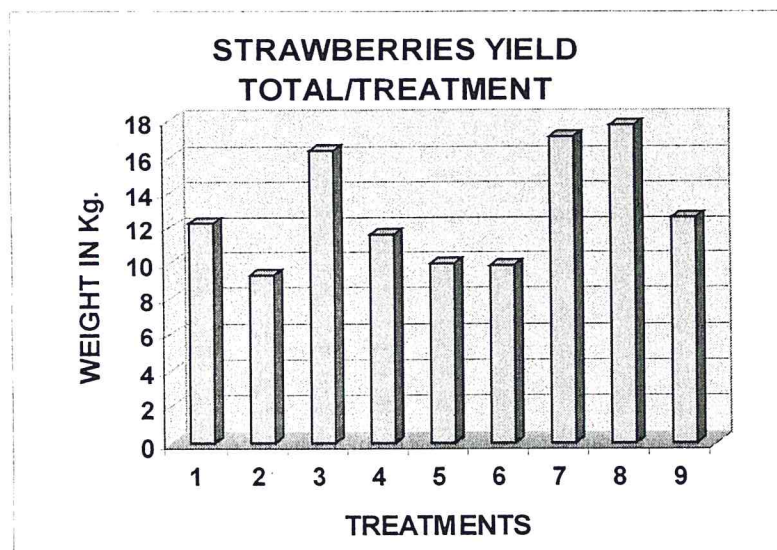
SITE: Strawberries Arandas S.A de C.V. Arandas, Jalisco.

Planting date: September 25th, 2001

Evaluation parameter: Yield of strawberries in Kgs, on 8 lineal meters/treatment

evaluation date: April 3rd, to June 22th, 2002

TREATMENTS	EVALUATION DATE									
	03-Abr	12-Abr	19-Abr	27-Abr	04-May	11-May	18-May	25-May	01-Jun	08-Jun
1.Cabbage+Solarization	3.1	1.6	0.9	0.7	0.9	1.3	0.6	0.8	0.9	1.4
2.Control	1.6	1.1	0.8	0.5	0.52	0.8	0.6	1.1	1.3	1
3.Methyl Bromide 40	3.3	2.3	0.9	0.8	1	1.5	1	1.6	2	2
4.Metam sodium+Solar.	3.7	1.6	0.75	0.6	0.5	0.9	0.7	1	0.9	0.9
5.Pinneapple+Solariz.	2.7	1.6	0.6	0.8	0.7	0.7	0.5	0.6	0.7	1
6.Metam sodium 50	2.2	1.4	0.6	0.6	0.7	0.8	0.4	0.7	1.2	1.2
7.Chloropicryn	3.1	2	1.2	0.8	1	1.6	1.1	2	2	2.3
8.Bromuro de metilo 15	3.3	2.1	1	0.5	1	1.5	1.4	2	2.7	2.3
9.Dichloro+Chlororop.	2.4	1.6	0.6	0.5	1	1.8	0.9	1	1.3	1.4



**FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA**

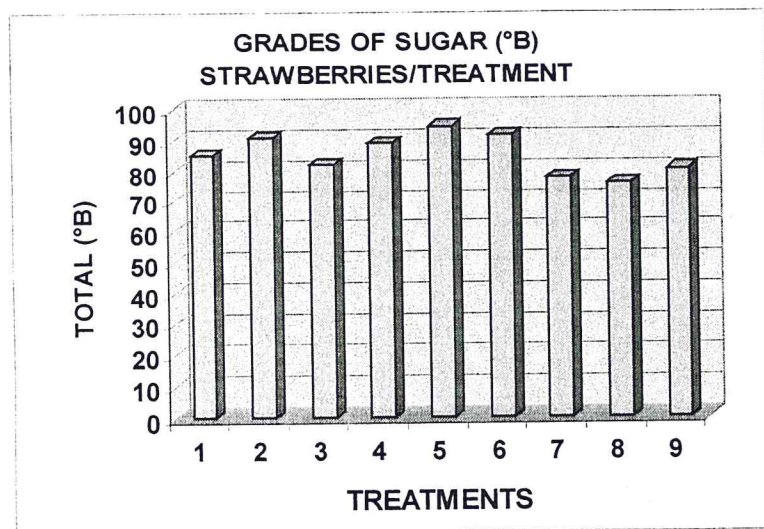
**SITE:** Strawberries Arandas S.A de C.V. Arandas, Jalisco.

**Planting date:** September 25th, 2001

**Evaluation parameter:** Evaluation in grades of sugar (°B) strawberries/treatment

**Evaluation date:** from april 3rd, to June 8th, 2002

TREATMENTS	EVALUATION DATE										TOTAL
	03-Abr	12-Abr	19-Abr	27-Abr	04-May	11-May	18-May	25-May	01-Jun	08-Jun	
1.Cabbage+Solarization	8	7.4	8	8.2	9.8	9	10.2	9	8.2	7.4	85.2
2.Control	8.4	8.3	10.8	8.4	9.8	9	10.2	9	8	9	90.9
3.Methyl Bromide 40	7.8	6.6	8.4	8.8	9.2	8	9	9.1	7.8	7.5	82.2
4.Metam sodium+Solar.	7.6	8.6	9.6	9.3	11	9	9	9.1	8.2	7.4	88.8
5.Pinneapple+Solariz.	8	8.4	10.4	9.7	10.6	9.8	10.4	10.4	8.2	8.6	94.5
6.Metam sodium 50	8	8.1	9.8	10.1	11.2	8.8	10.1	9	8	8.4	91.5
7.Chloropicryn	5.6	7.1	8	9	8.6	8.2	7.9	9.4	6.4	7.7	77.9
8.Bromuro de metilo 15	6.4	6	8.2	7.5	8.6	8.4	9	8.6	6.8	6.5	76
9.Dichloro+Chlororop.	7	7.4	8	8.6	9.6	8	9.2	7.4	7.7	7.6	80.5



**Final conclusion.** From the treatments proven Chloropicrin and dichloropropen + Chloropicrin, turned out to be similar to the methyl Bromide, reason why they are an alternative to the use of methyl bromide for the control of pathogens of the ground in Mexico, nevertheless biofumigation could be a good treatment of control that could adopt the lower producers





## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMIA - UAS

**FINAL PROJECT REPORT.** Demonstration Project of Alternatives to the use of Methyl Bromide in the cultivation of **Tobacco**, (*Nicotiana Tabacum*). The development in Santiago Ixcuintla, Nayarit, Mexico. In this field have been working MC. Francisco Javier Estrada Ramirez, coordinator in this project. And MC. Sostenes Montoya Angulo, agronomist who is implementing the tests. QFB. María de la Luz Acosta pineda y MC. Carlos Morales Cazarez, Colaboradores.

In this month, March 2004, we are reporting performed activities from 1999 to 2004.

### INTRODUCTION

Last August, 2001, in Santiago Ixcuintla, Nayarit, Mexico, we started taking some tests. Experiment was established chemistry substances. The bed were covered with transparent plastic in order to retain fumigant.

Treatments: We started the experiment in agricultural season 2001. we applied 6 (six) treatments:

### TREATMENTS OR ALTERNATIVES:

- 1.- Control (no treatment).
- 2.- 40 gr/m<sup>2</sup> of methyl bromide (75/25 or 80/20).
- 3.- 50 ml/m<sup>2</sup> of metam-sodium.
- 4.- 33 ml/m<sup>2</sup> of chloropicrin.
- 5.- 1,3-dichloropropene+chloropicrin,dose recommended by the manufacturer.
- 6.- 1,3-dichloropropene, dose recommended by the manufacturer (11.2 ml/m<sup>2</sup>).

### BODY OF THE REPORT

#### Land preparation

The activities in cooperative farmer land started in last August, in Santiago Ixcuintla, machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in four beds,. Afterwards the beds were marked, arised and flattened. The bed marks were marked 1 m between each one.

## Experiment Design

The treatment designs were carried out in August, 2001. In a piece of land with 4 beds, 60 m length, inside the enterprise commercial land. It was traced four blocks 10 m each; we selected 24 experimental plots with 1 bed, which we applied next randomized treatments:

- 1). **Absolute control.** In this experimental unit consist on 4 rows, 10 M. length, and we didn't realized any fungicide or organic matter application.
- 2). **Methyl Bromide 80/20.** In the four rows, It was injected 40 grs  $M^2$  (80% methyl bromide and 20% chloropicrin). The application was approximately 25-30 cm depth.
- 3). **Metham-sodium.** In this four furrows it was applied 50 ml/ $m^2$  metham sodium. The furrows were covered in black/silver plastic during 20 days.
- 4). **Chloropicrin.** On this four furrows were applied 33ml/ $m^2$  chloropicrin using the same equipment which we applied methyl-bromide. The furrows were covered in black/silver plastic during 20 days.
- 5). **1,3-dichloropopren + chloropicrin.** These furrows soil were treated using 27ml/ $m^2$  mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product using the same equipment used to apply the methyl-bromide, and the furrows were covered in black/silver plastic during 20 days.
- 6). **1,3-dichloropropen.** These furrows soil were treated using 11.2 ml/ $m^2$  1,2-dichloropropen. This application was carried out using the equipment tractor thereafter. The furrows were covered in black/silver plastic during 20 days.

The treatments were applied on damp soil.

Evaluations will be taking place in 1  $M^2$  each repetition.

## Sowing.

Tobacco sowing were made directly on soil. Beds were covered using a plastic net.

## Crop Management

Irrigation will take place using sprinkling irrigation, and fertilization will be handwork. They are controlled directly by farm technicians. Same people took the records about the handworks like pruning, cutting, spinning, tied the plants, diseases control and foliage pests, etc.

## RESULTS:

### Vegetative growth.

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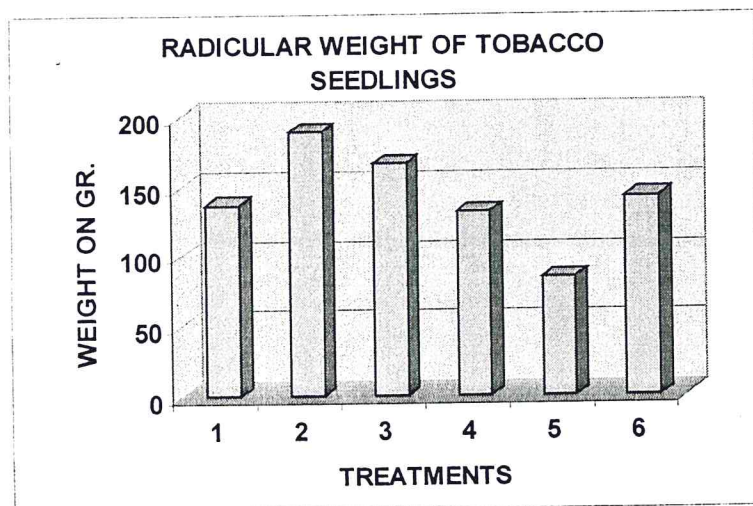
Enterprise: Tabacos del Pacifico Norte S.A de C.V.

Crop: Tabaco - Plantulas

Sowing date: 23/sept/01

Evaluation parameter: Radicular total weight on gr. of 10 useful plants/repetition

TREATMENTS	02-Nov-01				15-Nov-01				18-Nov-01				24-Nov-01				TOTAL
	REPETITION				REPETITION				REPETITION				REPETITION				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
1. Dichloropropene+Chloropicrin	4.8	4.8	5.6	6.6	6.5	7.7	8.4	4.3	7.5	17.8	10.0	9.8	9.0	15.0	9.0	10.0	136.8
2. Methyl Bromide 40	6.7	10	7.7	12	7.5	10.0	6.0	20.0	7.0	18.2	7.0	21.8	10.0	17.0	9.0	19.0	189.5
3. Dichloropropene	6.5	9.9	8.8	5.0	4.2	11.5	7.7	7.5	16.2	20.2	7.7	9.3	14.6	18.4	8.5	11.0	167.0
4. Metam-sodium 50	6.0	8.8	8.3	5.6	6.4	7.5	6.6	6.0	8.6	10.1	8.0	11.8	10.0	9.0	9.0	10.0	131.7
5. Control	0	2.5	5.9	0	4.5	5.0	4.0	3.0	5.2	7.5	10.0	8.3	3.0	8.0	9.6	7.8	84.3
6. Chloropicrin	8.8	3.9	8.4	8.7	9.8	7.6	8.7	10.0	9.8	7.6	8.7	10.0	10.0	8.4	10.8	11.7	142.9





**UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA**

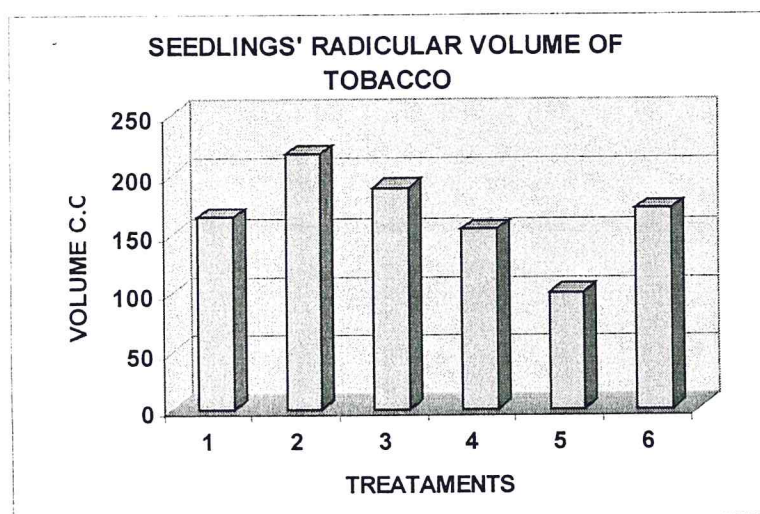
**ENTERPRISE:** Tabacos del Pacifico Norte S.A de C.V.

**Crop:** Tobacco - Seddlings

**Sowing date:** 23/sept/01

**Measurement parameter:** Total radicular volume of 10 useful plants/repetition, in cubic centimeter (c.c)

TREATMENTS	02-Nov-01				15-Nov-01				18-Nov-01				24-Nov-01				TOT.
	REPETITION				REPETITION				REPETITION				REPETITION				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
1. Dichloropropene+Chloropicrin	5.0	5.0	7.0	6.0	10.0	9.0	11.0	5.0	12.0	16.0	14.0	12.0	12.0	17.0	11.0	12.0	16.0
2. Methyl Bromide 40	5	10	9	14	7.0	12.0	7.0	23.0	10.0	22.0	8.0	25.0	12.0	20.0	10.0	23.0	22.0
3. Dichloropropene	8.0	11.0	10.0	5.0	5.0	13.0	8.0	7.0	17.0	24.0	5.9	10.0	17.0	23.0	11.0	14.0	18.0
4. Metam-sodium 50	7.0	9.0	9.0	7.0	8.0	9.0	8.0	8.0	9.0	10.0	10.0	14.0	13.0	10.0	11.0	12.0	15.0
5. Control	0	4	8	0	4.0	6.0	6.0	5.0	5.0	8.0	14.0	8.0	4.0	9.0	11.0	8.0	11.0
6. Chloropicrin	10.0	5.0	10.0	10.0	10.0	9.0	11.0	14.0	10.0	9.0	11.0	14.0	12.0	9.0	13.0	14.0	17.0



**UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA**

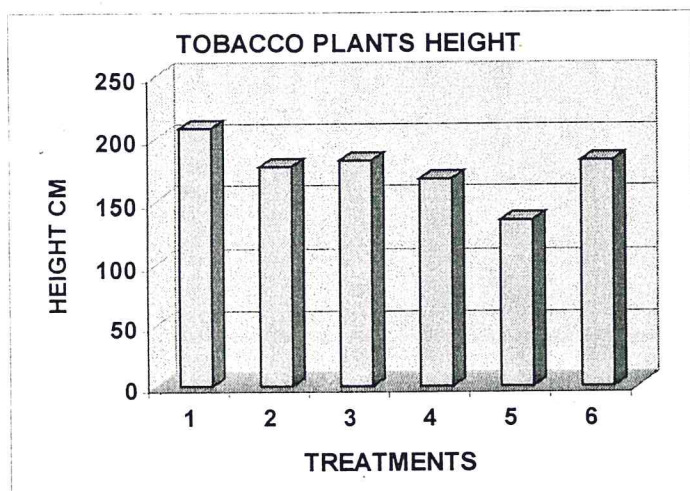
**Enterprise:** Tabacos del Pacifico Norte S.A de C.V.

**Crop:** Tobacco - Seedlings

**Sowing date:** Sept/23th/01

**Evaluation parameter:** Total averages (cm.) height of 10 useful plants/repetition

TREATMENTS	02-Nov-01				15-Nov-01				18-Nov-01				24-Nov-01				TOTAL
	REPETITION				REPETITION				REPETITION				REPETITION				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
1. Dichloropropen+Chloropicrin	11.9	2.0	12.3	8.9	15.0	13.7	12.3	14.2	17.4	14.9	14.3	13.4	15.6	15.1	14.3	12.9	207.9
2. Methyl Bromide 40	7.4	6.2	4.8	6.6	11.0	11.3	12.3	10.8	16.4	12.5	14.3	9.9	15.8	12.8	14.2	11.0	177.0
3. Dichloropropene	10.1	8.5	10.9	9.4	13.3	13.3	13.1	12.3	10.7	13.0	10.4	12.6	10.7	12.1	10.5	11.7	182.3
4. Metam Sodium 50	9.7	6.7	8.6	6.6	12.7	10.2	10.7	9.5	13.5	9.1	14.7	9.8	13.5	9.5	13.4	10.0	167.9
5. Control	0.4	3.2	4.7	0.0	7.7	8.8	7.1	5.7	13.9	17.1	13.2	11.7	3.6	14.8	12.0	10.9	134.5
6. Chloropicrin	7.1	4.5	5.2	13.1	11.4	12.5	13.0	15.2	11.4	12.5	13.0	15.2	9.2	11.4	12.7	14.2	181.3



## WEEDS.

### UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMÍA

ENTERPRISE: Tabacos del Pacifico Norte S.A de C.V

CROP: Tobacco

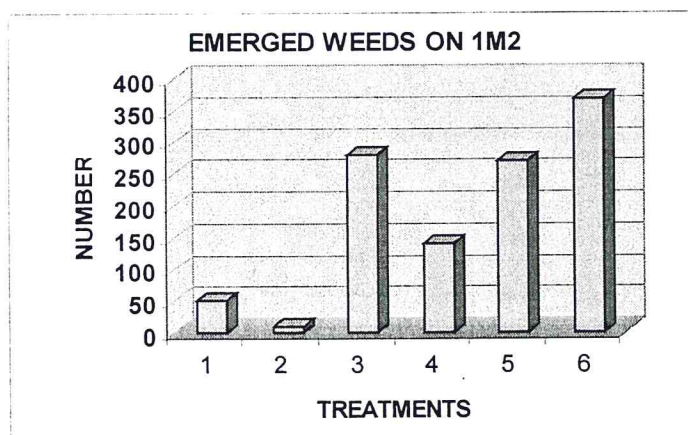
Site: Santiago Ixcluintla, Nayarit

Sowing date: Sept/23/01.

Measurement parameter: Total of emerged weeds on 1 m2/repetition

Evaluation date: 21/oct./01.

TREATMENTS	REPETITION				TOTAL	AVERAGE
	I	II	III	IV		
1. Dichloropropen+Chloropicrin	1	38	67	104	210	52.5
2. Methyl Bromide 40	3	5	12	25	45	11.2
3. Dichloropropene	207	277	225	405	1114	278.5
4. Metam Sodium 50	110	203	66	180	559	139.7
5. Control	236	231	339	272	1078	269.5
6. Chloropicrin	317	357	409	383	1466	366.5





## YIELD

UNIVERSIDAD AUTONOMA DE SINALOA - FACULTAD DE AGRONOMIA

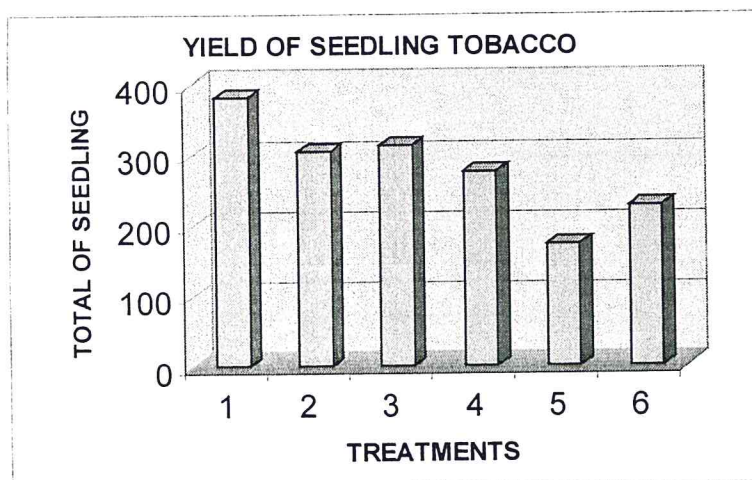
ENTERPRISE: Tabacos del Pacifico Norte S.A de C.V.

CROP: Tobacco - Seedlings

Sowing date: 23/sept/01

Evaluation parameter: Yield of useful plants on 50 cm<sup>2</sup>/repetition

	02-Nov-01				15-Nov-01				18-Nov-01				24-Nov-01				
TREATMENTS	REPETITION				REPETITION				REPETITION				REPETITION				TOTAL
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
1. Dichloropropene+Chloropicrin	27	4	29	18	38	25	26	27	28	18	27	30	25	20	18	22	38
2. Methyl Bromide 40	18	13	8	10	19	18	22	25	37	16	23	11	30	18	25	13	30
3. Dichloropropene	19	19	24	8	26	24	11	14	17	27	13	29	20	25	13	26	31
4. Metam-sodium 50	20	14	14	12	23	17	19	14	29	20	16	13	23	18	12	14	27
5. Control	1	6	11	0	9	13	8	6	5	26	18	23	3	18	12	16	17
6. Chloropicrin	13	6	9	29	21	14	11	15	21	14	11	15	15	11	13	11	22



**STATISTIC ANALYSIS OF USEFUL TOBACCO PLANTS HARVESTED PER TREATMENT, IN SANTIAGO IXCUINTLA NAYARIT.**

VARIABLE = Useful tobacco plants from 50 cm<sup>2</sup>

TREAT.	1	2	3	4
1. Dichlorop. + Chlorop.	118.0000	67.0000	100.0000	97.0000
2. Methyl Bro. 40	104.0000	65.0000	78.0000	59.0000
3. Dichloropropen	82.0000	95.0000	61.0000	77.0000
4. Metan-Sod. 50	95.0000	69.0000	61.0000	53.0000
5. Control	18.0000	63.0000	49.0000	45.0000
6. Chloropicrina	70.0000	45.0000	44.0000	70.0000

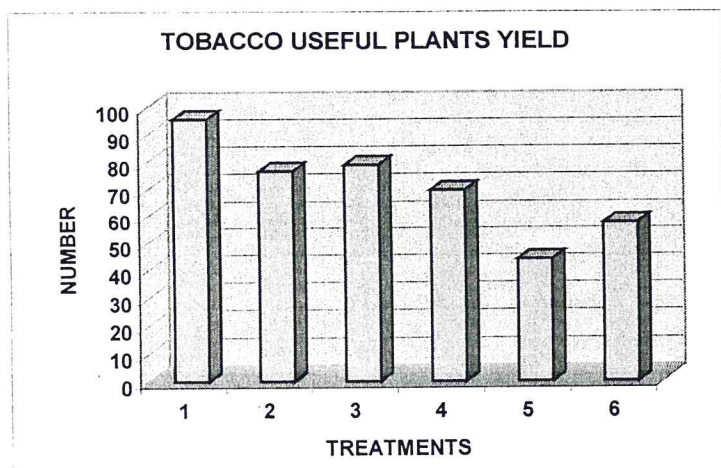
**ANALYSIS OF VARIANCE**

FV	GL	SC	CM	F	P>F
TREAT	5	25.687500	5.137500	3.9959	0.013
ERROR	18	23.142334	1.285685		
TOTAL	23	48.829834			

C.V. = 13.73 %

**TABLE OF AVERAGES**

TREAT.	AVERAGE
1	95.500000 A
3	78.750000 AB
2	76.500000 AB
4	69.500000 AB
6	57.250000 AB
5	43.750000 B



**FINAL CONCLUSION.** Obtained results were analyzed by Tukey method (  $P = .95$ ), whit next result. The best significative result was the application of Dichloropropene + Chloropicrin, with 95.5 useful plants on 50 cm<sup>2</sup> average. Next significance group was treatments dichloropropene, 78.75 useful plants average; Methyl Bromide 40, 76.5 useful plants; Metam-Sodium 50, 69.5 useful plants and Chloropicrin 57.25 useful plants. We didn't find significative differences. And all of them were meaningfully more efficient than control, with 43.75 useful plants average. Dichloropropene + Chloropicrin does not control the weed, which makes difficult the harvest of plants, whereas the use of floating trays (floating) gives superior results, but has not been tried because tests on great scale already exist that verify their effectiveness. At the moment, approximately 80% of tobacco plants take place in trays in Nayarit.





## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMIA - UAS

**FINAL PROJECT REPORT:** Alternatives to the use of Methyl Bromide in the cultivation of melon. (*Cucumis melo* L.). In Agricultural enterprise Agrodelicias de la Baja Sur, S.A. de C.V. located on Km 10, Todos Santos Road, New Ranch (La Campana), Ejido El Carrizal, La Paz, Baja California Sur, Mexico. Universidad Autónoma de Sinaloa, Agronomy Faculty Responsible: MC. Francisco Javier Estrada Ramirez, Project Coordinator, and MC. Sostenes Montoya Angulo, Agronomist, in the tests implementation, QFB. María de la Luz Acosta Pineda and Carlos Morales Cazarez, Colaboradores.

In this month, March 2004, we are reporting performed activities from 1999 to 2004.

### INTRODUCTION

During August, 1999, it was established the test of project "Alternatives to the use of Methyl Bromide in the cultivation of **melon**. (*Cucumis melo* L.). we started some tests in Ranch "La Campana", La Paz, Baja California, Sur, Mexico, which consisted in the application of different treatments on soil, in order to analyze the control about soil microorganisms and in crops development, comparing Methyl bromide. We apply this substance in alluvial arenaceous land, with region characteristics (flora and fauna) half-desert. Agricultural activities are based in drip irrigation, using groundwater table in "La Campana" Ranch, this activity is carried out in seven wells which are strategically distributed. The tests site is at ranch south, in an arenaceous land, which has acid PH. We applied agricultural lime in order to obtain the appropriate PH, to the melon seed (PH 6.5). In this land it hadn't taken place any seed three years ago, and the last cultivation in this land was tomatoe.

The applied treatments were:

- 1) Control (no treatment);
- 2) Methyl Bromide 15 gr/m<sup>2</sup>, 80/20
- 3) Methyl Bromide 40 gr/m<sup>2</sup>, 80/20
- 4) Solarization (4 weeks)
- 5) Hen Manure, 5 kg and solarization (4 weeks)
- 6) Cow manure slightly done (5 kg) and solarization (4 weeks)
- 7) Fresh chinese broccoli buried (5 kg) and solarization (4 weeks)
- 8) Metham sodium (N, methyl sodium ditiocarbamate) and solarization (4 weeks)
- 9) Metham Sodium (50 ml/m<sup>2</sup>)
- 10) Chloropicrin (33 ml/m<sup>2</sup>)
- 11) Dazomet (tetrahydro-3,5 dimetil-2H-1,3,5-tiazidin-s tiona) (40 gr/m<sup>2</sup>)
- 12) 1,3-Dichloropropen (65%) + chloropicrin (35%) (27 ml/m<sup>2</sup>)

13) 1,3-Dichloropropen ( $11.2 \text{ ml/m}^2$ )

## **BODY OF THE REPORT**

### **Land preparation**

The activities in cooperative farmer land started in last July, when "Agrodelicias de la Baja Sur" enterprise heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the instalment underground pipeline. Afterwards the beds were marked, arised and flattened. And finally they put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

### **Experiment Design**

The treatment designs were carried out in August 25th, 1999. First we marked the block margins using stakes, afterwards, we drew lines using lame in order to defin the blocks. In a piece of land with 56 beds; 50 M lenght, inside the enterprise commercial land. It was traced four blocks 10 m each; we selected 13 experimental plots with 4 beds, which we applied next randomized treatments:

- 1). Absolute control. In this experimental unit consist on 4 rows, 10 M. lenght, and we didn't realized any fungicide or organic matter application on the soil. The soil remained covered with plastic.
- 2). Methyl Bromide 80/20 ( $15 \text{ gr/m}^2$ ). In the soil, in the 4 rows in this experimental unit it was injected  $15 \text{ gr M}^2$  (80% methyl bromide and 20% chloropicrin)  $\text{M}^2$ . The application was through irrigation pipeline. Actually the soil remained covered with plastic.
- 3). Methyl Bromide 80/20. In the four rows, It was applied  $40 \text{ grs M}^2$  (80% methyl bromide and 20% chloropicrin). Actually the soil remained covered with plastic.
- 4). Solarization. The four rows were padded or was covered with transparent plastic.
- 5). Hen manure was incorporated to the soil and solarization. It was distributed on the soil, in that 10 mts. four rows 200 kgs hens manure, aproximattely 5 kgs per  $\text{M}^2$ . It was incorpored by manual labour using hoes and the rows were covered with transparent plastic.
- 6). Cow Manure was incorporated to the soil with the solarization. It was distributed 200 kg. Cow manure, aproximattely 5 kg. Per  $\text{M}^2$ . It was incorpored by manual labour using hoes, and the rows were covered with transparent plastic.
- 7). Green cabbage incorporated on the soil and solarization. In order to apply this treatment, we chopped the cabbage in small pieces: then it were distributed 5 kg



per  $M^2$ . It was incorporated by manual labour using hoes, after that, the rows were covered with transparent plastic.

8). Metham-sodium (N, methyl ditiocarbamate sodium) with solarization. This product was Sprinkled using a garden watering can. It was applied approximately 25  $ml/m^2$  metham sodium. After the application, the rows were covered with transparent plastic.

9). Metham-sodium. In this four furrows it was applied. We sprinkled this product using a garden watering can; approximately 50  $ml/m^2$  metham sodium. After the application, the furrows were covered in black/silver plastic.

10). Chloropicrin. On this four furrows were applied 33 $ml/m^2$  chloropicrin using a little drip application equipment. The furrows were covered in black/silver plastic.

11). Dazomet( tetrahydro-3,5 dimethyl-2H-1,3,5-tiadizin-2 tione). On this furrows soil we distributed by manual labour 40  $gr/m^2$  dazomet: it was incorporated using hoes, after that, we applied water by sprinkler irrigation during 3 hrs. Finally, the furrows were covered in black/silver plastic.

12). 1,3-dichloropropeno + chloropicrin. These furrows soil were treated using 27  $ml/m^2$  mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product using the same equipment that we used to apply the chloropicrin and the furrows are covered in black/silver plastic nowadays.

13). 1,3-dichloropropeno. These furrows soil were treated using 11.2  $ml/m^2$  1,3-dichloropropeno. This application was carried out using the equipment thereinbefore. The furrows are covered in black/silver plastic nowadays.

The treatments were applied in damp soil.

Evaluations are taking place in the two central furrows in each experimental unit. We attached a label in 10 plants (five each row or 10 cm central bed) which were randomized, in order to take size measures.

### **Seeding**

The seeding was carried out in September 22th, putting a seed on the ground through little holes in plastic each 45 cm.

## **RESULTS**

### **Germination Percentage**

Six days after carry out the seeding. It was estimated the germinated seed percentage in all the treatments. We counted the two furrows or central beds holes in plastic of the experimental units; afterwards, it was counted the emerged



seedlings and using this records, it was calculated the germination percentage, which is displayed in tables thereafter:

**Crop:** Melon

**Site:** Rancho La Campana, La Paz, B.C.S.

**Parameter:** Germination percentage

**Seeding date:** September 22th, 1999

**Date:** September 28<sup>th</sup>, 1999

**Media per blocks table. germination percentage in melon seeds.**

TREATMENT	BLOCK				MEDIA
	I	II	III	IV	
Control	96	89.29	94.34	96.08	93.93
Cabbage	78.57	880.89	92.16	89.09	87.18
Telone C35	92.45	93.75	87.27	90.57	91.01
Methyl bromide 40	89.09	94.12	94.23	96.37	93.45
Telone II	87.03	88.68	90	85.45	87.79
Chloropicrin	94.12	88.89	98.04	9107	93.03
Metham sodium 25	79.59	94.23	94.64	96	91.12
Methyl bromide 15	98.15	90.91	85.71	88	90.69
Solarization	94.44	70.37	83.02	88.68	84.13
Metham sodium 50	88.68	78.18	84.9	84	83.94
Hen manure	49.02	47.17	33.33	54.72	46.06
Dazomet	52.83	66.67	77.36	87.5	71.09
Cow manure	78.43	62	58.82	52.73	63

**Root disease incidence.-** We are carrying out plant observations in order to detect symptoms like yellow leaves, no development, withering or dead, however, nowadays we haven't detected any abnormality.

**Nematodes Population.** Seven weeks after central furrows transplanting, in each experimental unit, near plant roots, 0-30 cm depth. We took five soil subsampling, in order to obtain one kg. Sampling. Immediately after that, the soil samplers were procesed using sieves 60 and 325 mesh per Inch<sup>2</sup>.

We put into a 1,000 ml graduate test tube 400 ml of water, we stirred each soil sample perfectly homogenized. We stirred hard and we put out in a small cask containing 4 liters of water. Afterwards the soil was dissolved in water, allowed to stand for 20 seconds and this water with the soil was passed through a 60 mesh sieves and this soil with water was put into a second small cask. Subsequently it was stirred again allowing to stand for 20 seconds, then it was passed through a 325 sieve mesh. The soil retained in this sieve mesh was taken using a teaspoon and it was passed into a 100 ml flask and it was taken to the Faculty of Agronomy Pthytopatology lab in order to carry out nematodes extraction. In lab the soil from the flasks was put on a piece of toilet paper which was on a wire mesh, which was

on a plastic funnel. In the funnel extreme it was put a flexible plastic hose which was stopped up using a pincer; the funnel was filled up of water until this touch the sieved soil. After 24 hours, from the bottom extreme hose, we pick up a 10 ml. Sample; it was gauged again using clean water, and after 24 hours again it was taken another water sample with nematodes. This activity was repeated in all 52 samples.

Using a biological microscope we observed the nematodes and we counted which we found in 1 ml. Aliquots. Afterwards we calculed the founded populations in 20 ml of water which we obtained using the sieve funnel method. These samples correspond to the soil 200 ml populations.

The records obtained are displayed in next tables:

**Crop:** Melon

**Site:** Rancho La Campana, La Paz, B.C.S.

**Parameter:** Nematode populations

**Fecha de siembra:** September 22th, 1999

**Fecha:** November 15-20<sup>th</sup>, 1999

Block I	NEMATODES					Total
TREATMENT	Aphelenc	Longidorus	Tylechus	Dorilaimi	V. Libre	Phytoparasites
Control	0	0	20	0	160	20
Cabbage	0	0	0	0	2860	0
Telone C35	0	0	0	0	580	0
Methyl bromide 40	0	0	0	0	460	0
Telone II	0	0	0	0	120	0
Chloropicrin	0	0	0	0	360	0
Metham sodium 25	0	20	0	0	980	20
Methyl bromide 15	0	0	0	0	780	0
Solarization	0	0	0	0	160	0
Metham sodium 50	0	0	0	0	380	0
Hen manure	20	0	0	0	2840	20
Dazomet	0	0	0	0	1.6	0
Cow manure	0	40	0	0	720	40

Block II	NEMATODES					Total
TREATMENT	Aphelenc	Longidorus	Tylechus	Dorilaimi	V. Libre	Phytoparasites
Control	0	0	0	0	100	0
Cabbage		40	0	0	2220	40
Telone C35	0	0	0	0	560	0
Methyl bromide 40		40	0	0	760	40
Telone II	0	0	0	0	140	0
Chloropicrin	0	0	0	0	380	0
Metham sodium 25		20	0	0	980	20
Methyl bromide 15	0	0	0	0	880	0
Solarization	0	0	0	0	320	0
Metham sodium 50	0	0	0	0	200	0
Hen manure	40	0	0	0	3480	40
Dazomet	0	20	0	0	440	20
Cow manure	0	60	0	0	2220	60

Block III	NEMATODES					Total
TREATMENT	Aphelenc	Longidorus	Tylechus	Meloidog	V. Libre	Phytoparasites
Control	0	0	0	0	160	0
Cabbage	0	0	0	0	660	0
Telone C35	0	0	0	0	560	0
Methyl bromide 40	0	20	0	0	1120	20
Telone II	0	20	0	0	60	20
Chloropicrin	0	20	0	0	340	20
Metham sodium 25	0	0	0	0	140	0
Methyl bromide 15	0	0	0	0	120	0
Solarization	0	40	0	0	160	40
Metham sodium 50	0	40	0	0	440	40
Hen manure	20	0	0	0	2640	20
Dazomet	0	0	0	0	600	0
Cow manure	20	0	0	80	1860	100



Block IV	NEMATODES					Total
TREATMENT	Aphelenc	Longidorus	Tylench	Meloidog	V. Libre	Phytoparasites
Control	0	60	0	0	1400	60
Cabbage	0	0	20	0	900	20
Telone C35	0	0	0	0	580	0
Methyl bromide 40	0	0	0	0	45	0
Telone II	0	0	0	0	660	0
Chloropicrin	0	0	0	0	700	0
Metham sodium 25	0	40	0	0	420	40
Methyl bromide 15	0	0	0	0	240	0
Solarization	0	0	0	0	360	0
Metham sodium 50	0	0	0	0	120	0
Hen manure	20	20	0	20	2460	60
Dazomet	20	0	20	0	120	40
Cow manure	20	0	20	40	560	80

\*Aphelenc = *Aphelenchus*

Longidorus = *Longidorus*

Tylenchor = *Tylechorhynchus*

Tylechus = *Tylenchus*

Dorilaimi = *Dorilaimides* Group

Trophurus = *Trophurus*

V. Libre = Life free Nematodes (no estiletto).



## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMIA - UAS

### INTRODUCTION.

During August, 2001, it was established the third test of project "Alternatives to the use of Methyl Bromide in the cultivation of **melon**. (*Cucumis melo* L.). we started some tests in Ranch "La Campana", La Paz, Baja California, Sur, Mexico, which consisted in the application of different treatments on soil, in order to analyze the control about soil microorganisms and in crops development, comparing Methyl bromide. We apply this substance in alluvial arenaceous land, with region characteristics (flora and fauna) half-dessert. Agricultural activities are based in drip irrigation, using groundwater table in "La Campana" Ranch, this activity is carried out in seven wills which are strategically distributed. The tests site is at ranch south, in an arenaceous land, which has acid PH. We applied agricultural lime in order to obtain the appropriate PH, to the melon seed (PH 6.5). In this land it hadn't taken place any seed three years ago, and the last cultivation in this land was tomato.

Treatments: Based on obtained results during before experiment from agricultural period 2000-2001 we selected 6 (six) treatments:

The applied treatments were:

- 1) Control (no treatment);
- 2) Metham Sodium (50 ml/m<sup>2</sup>)
- 3) Methyl Bromide 40 gr/m<sup>2</sup>, 80/20
- 4) 1,3-Dichloropropen (11.2 ml/m<sup>2</sup>)
- 5) 1,3-Dichloropropen (65%) + chloropicrin (35%) (27 ml/m<sup>2</sup>)
- 6) Chloropicrin (33 ml/m<sup>2</sup>)

### BODY OF REPORT

#### Land preparation

The activities in cooperative farmer land started in last August, when "Agrodelicias de la Baja Sur" enterprise heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the installment underground pipeline. Afterwards the beds were marked, arised and flattened. And finally they put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

## Experiment Design

The treatment designs were carried out in August, 2001. First we marked the block margins using stakes, afterwards, we drew lines using lame in order to define the blocks. In a piece of land with 18 beds; 50 M length, inside the enterprise commercial land. It was traced four blocks 20 m each; we selected 24 experimental plots with 3 beds, which we applied next randomized treatments:

- 1). Absolute control. In this experimental unit consist on 4 rows, 10 M. length, and we didn't realized any fungicide or organic matter application on the soil. The soil remained covered with plastic.
- 2). 1,3-dichloropopren + chloropicrin. These furrows soil were treated using 27 ml/m<sup>2</sup> mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product using the same equipment that we used to apply the chloropicrin and the furrows are covered in black/silver plastic nowadays.
- 3). Methyl Bromide 80/20. In the four rows, It was applied 40 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin). Actually the soil remained covered with plastic.
- 4). Chloropicrin. On this four furrows were applied 33ml/m<sup>2</sup> chloropicrin using a little drip application equipment. The furrows were covered in black/silver plastic.
- 5). Metham-sodium. In this four furrows it was applied. We sprinkled this product using a garden watering can; approximately 50 ml/m<sup>2</sup> metham sodium. After the application, the furrows were covered in black/silver plastic.
- 6). 1,3-dichloropropen. These furrows soil were treated using 11.2 ml/m<sup>2</sup> 1,3-dichloropropen. This application was carried out using the equipment therein before. The furrows are covered in black/silver plastic nowadays.

The treatments were applied in damp soil.

Evaluations are taking place in the central furrow in each experimental unit.

## Seeding

The seeding was carried out in September 1<sup>st</sup>, putting a seed on the ground through little holes in plastic each 45 cm.



## RESULTS

### Germination Percentage

Six days after carry out the seeding. It was estimated the germinated seed percentage in all the treatments. We counted one furrow on central beds holes in plastic of the experimental units; afterwards, it was counted the emerged seedlings and using this records, it was calculated the germination percentage, which is displayed in tables thereafter:

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Site: Rancho La Campana, La Paz, B.C.S.

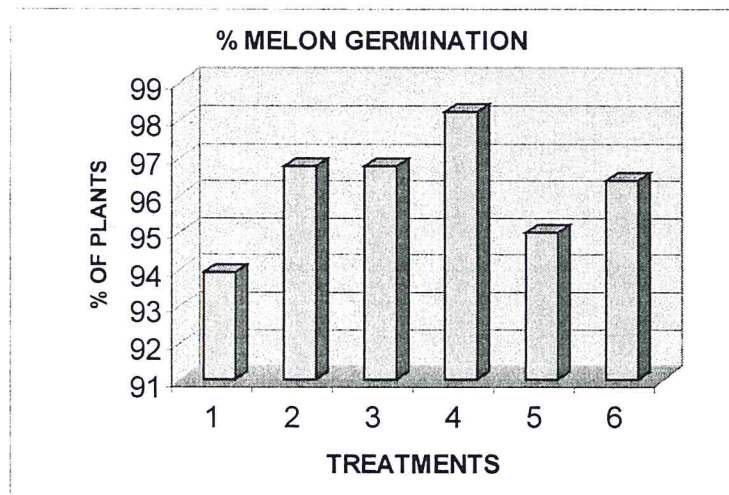
Crop: Melon

Measurement parameter: Germination's percentage of 70 seeds on 25 lineal m evaluated

Sowing date: December 1st, 2001

Evaluation date: September 7th, 2001

TREATMENT	No. OF MELON EMERGED PLANTS/REPETITION					
	R-I	R-II	R-III	R-IV	TOTAL	%GER.
1. Dichloropropen	67.00	66.00	66.00	64.00	263.00	93.93
2. Chloropicrin	69.00	68.00	66.00	68.00	271.00	96.78
3. Methyl Bromide 40	70.00	68.00	67.00	66.00	271.00	96.78
4. Metam-sodium 50	69.00	69.00	69.00	68.00	275.00	98.21
5. Control	66.00	65.00	67.00	68.00	266.00	95
6. Dichloropropen+Chloropicrin	66.00	67.00	68.00	69.00	270.00	96.42



## WEEDS POPULATION:

We counted number and species of weeds found in 1 m<sup>2</sup> per repetition each treatment.

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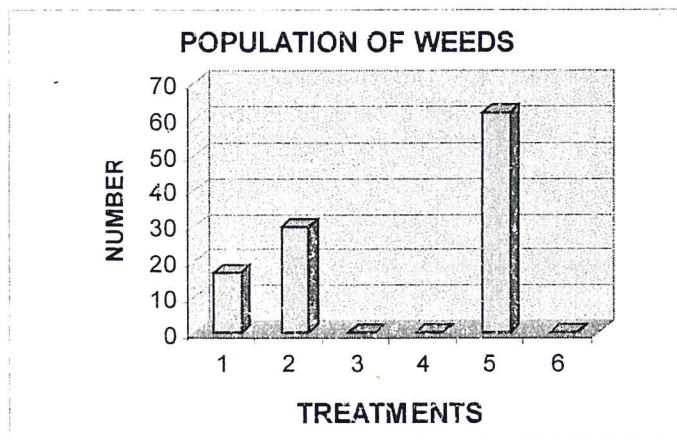
Site: Rancho La Campana, La Paz, B.C.S. Crop: Melon

Measurement parameter: kind and number of weeds on 1 m<sup>2</sup> evaluated

Sowing date: September 1st, 2001

Evaluation date: September 9th, 2001

TREATMENT	NUMBER AND KIND OF WEEDS					TOTAL
	CARDO	ZACATEZ	QUELITES	TOLUACHE	CHUAL	
1. Dichloropropene	0	0	10	2	5	17
2. Chloropicrin	21	7	1	1	0	30
3. Methyl Bromide 40	0	0	0	0	0	0
4. Metam-sodium 50	0	0	0	0	0	0
5. Control	0	0	42	5	15	62
6. Dichloropropen+Chloropicrin	0	0	0	0	0	0



**Root disease incidence.-** We are carrying out plant observations in order to detect symptoms like yellow leaves, no development, withering or dead, however, nowadays we haven't detected any abnormality.

**Nematodes Population.** Seven weeks after central furrows transplanting, in each experimental unit, near plant roots, 0-30 cm depth. We took five soil sub sampling, in order to obtain one kg. Sampling. Immediately after that, the soil samplers were processed using sieves 60 and 325 mesh per Inch<sup>2</sup>. We didn't find nematodes phytoparasites.

We put into a 1,000 ml graduate test tube 400 ml of water, we stirred each soil sample perfectly homogenized. We stirred hard and we put out in a small cask containing 4 liters of water. Afterwards the soil was dissolved in water, allowed to stand for 20 seconds and this water with the soil was passed through a 60 mesh sieves and this soil with water was put into a second small cask. Subsequently it was stirred again allowing to stand for 20 seconds, then it was passed through a 325 sieve mesh. The soil retained in this sieve mesh was taken using a teaspoon and it was passed into a 100 ml flask and it was taken to the Faculty of Agronomy Phytopatology lab in order to carry out nematodes extraction. In lab the soil from the flasks was put on a piece of toilet paper which was on a wire mesh, which was on a plastic funnel. In the funnel extreme it was put a flexible plastic hose which was stopped up using a pincer; the funnel was filled up of water until this touch the sieved soil. After 24 hours, from the bottom extreme hose, we pick up a 10 ml. Sample; it was gauged again using clean water, and after 24 hours again it was taken another water sample with nematodes. This activity was repeated in all 52 samples.

Using a biological microscope we observed the nematodes and we counted which we found in 1 ml. Aliquots. Afterwards we calculated the founded populations in 20 ml of water which we obtained using the sieve funnel method. These samples correspond to the soil 200 ml populations.

**PRODUCTION OF FUITS:** Yield evaluation took place in November 2001, on 1 central bed 20 lineal meters each repetition per treatment. Fruit were classified sizes and commercial categories 6,9,12,15,18, and 23 and remains. In order to compare results per treatment, we separated exportation fruits per repetition and remain fruits, and we considered total average production per categories and we recorded separately in order to observe differences among treatments. The results are showed on next tables.



# **FACULTAD DE AGRONOMÍA - UNIVERSIDAD AUTONOMA DE SINALOA**

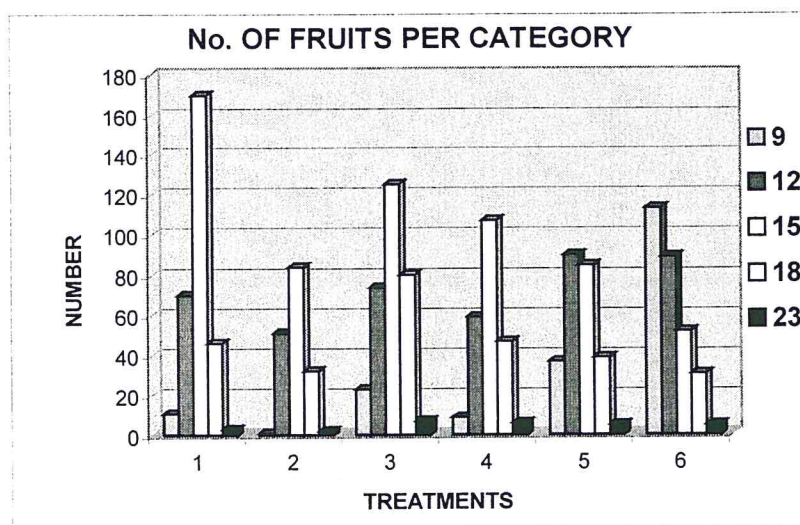
**Site:** Rancho La Campana, La Paz, B.C.S.

**Croo:** Melon

**Measurement parameter:** Yield on 20 lineal m evaluated/repetition

**Sowing date:** September 1st, 2001      **Evaluation date:** Nov 10th, 2001

TREATMENT	# OF FRUITS PER CATEGORY				
	9	12	15	18	23
1. Dichloropropen	11.00	70.00	170.00	46.00	3.00
2. Chloropicrin	1.00	51.00	84.00	32.00	2.00
3. Methyl Bromide 40	23.00	74.00	125.00	80.00	7.00
4. Metam-sodium 50	9.00	59.00	107.00	47.00	6.00
5. Control	37.00	90.00	85.00	39.00	5.00
6. Dichloropropen+Chloropicrin	113.00	89.00	52.00	31.00	5.00



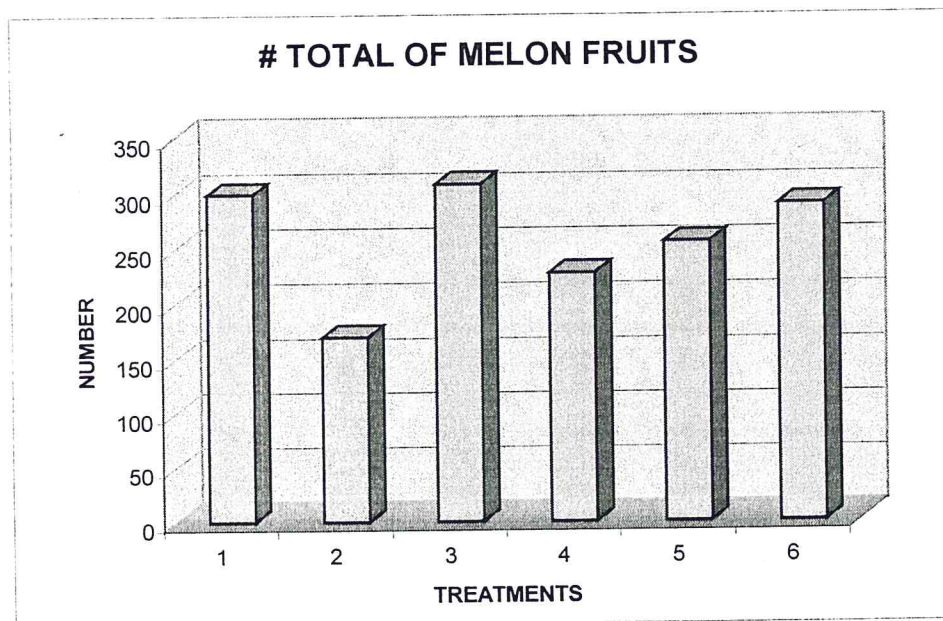
**FACULTAD DE AGRONOMÍA - UNIVERSIDAD AUTONOMA DE SINALOA**

**Site:** La Campana Ranch, La Paz, B.C.S.      **Crop:** Melon

**Measurement parameter:** Production on 20 m evaluated lineal/repetition

**Sowing date:** September 1st, 2001      **Evaluation date:** November 10th, 2001

TREATMENT	# MELON FRUITS				TOTAL
	R-I	R-II	R-III	R-IV	
1. Dichloropropene	76	70	80	74	300
2. Chloropicrin	40	43	36	51	170
3. Methyl Bromide 40	88	57	99	65	309
4. Metam-sodium 50	59	60	55	54	228
5. Control	64	58	69	65	256
6. Dichloropropen+Chloropicrin	77	69	69	75	290



**STATISTIC ANALYSIS OF RESULTS OBTAINED IN MELON CROP. LA CAMPANA RANCH. SOWING ON SEPTEMBER 1st, and HARVESTED on November 10th., 2001.**

Table 1. Treatments and Number of melons per sizes.

TREATMENTS	SIZES	Rep 1	Rep 2	Rep 3	Rep 4
1. Dichloropropene	9	3	2	2	4
	12	17	15	21	17
	15	46	45	44	35
	18	10	8	13	15
	23	0	0	0	3
2. Chloropicrin	9	0	1	0	0
	12	13	12	10	16
	15	17	23	21	23
	18	10	6	5	11
	23	0	1	0	1
3. Methyl Bromide 40	9	12	2	6	3
	12	20	17	23	14
	15	27	22	42	34
	18	25	14	27	14
	23	4	2	1	0
4. Metam – Sodium 50	9	5	3	0	1
	12	17	16	12	14
	15	21	27	30	29
	18	16	12	10	9
	23	0	2	3	1
5. Control	9	7	6	10	14
	12	25	17	28	20
	15	20	22	22	21
	18	12	13	7	7
	23	0	0	2	3
6. Dichloropropene + Chloropicrin	9	29	28	30	26
	12	21	23	20	25
	15	16	10	12	14
	18	8	8	5	10
	23	3	0	2	0



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	15	46	45	44	35
	18	10	8	13	15
	23	0	0	0	3
2. Chloropicrin	9	0	1	0	0
	12	13	12	10	16
	15	17	23	21	23
	18	10	6	5	11
	23	0	1	0	1
3. Methyl Bromide 40	9	12	2	6	3
	12	20	17	23	14
	15	27	22	42	34
	18	25	14	27	14
	23	4	2	1	0
4. Metam – Sodium 50	9	5	3	0	1
	12	17	16	12	14
	15	21	27	30	29
	18	16	12	10	9
	23	0	2	3	1
5. Control	9	7	6	10	14
	12	25	17	28	20
	15	20	22	22	21
	18	12	13	7	7
	23	0	0	2	3
6. Dichloropropene + Chloropicrin	9	29	28	30	26
	12	21	23	20	25
	15	16	10	12	14
	18	8	8	5	10
	23	3	0	2	0

#### Average 5. COMPARISON OF TREATMENT'S AVERAGE

TREATMENT	AVERAGE
3	15.4500 A
1	15.0000 A
6	14.5000 A
5	12.8000 AB
4	11.4000 BC
2	8.5000 C

LEVEL OF SIGNIFICANCE = 0.05

TUKEY = 3.0776

VALUES OF TABLES:

$$q(0.05) = 4.13 \quad q(0.01) = 4.94$$

#### Table 6. COMPARISON OF SIZES' AVERAGES

SIZES	AVERAGE
3. 9	25.9583 A
2. 12	18.0417 B
4. 15	11.4583 C
1. 18	8.0833 D
5. 23	1.1667 E

LEVEL OF SIGNIFICANCE = 0.05

TUKEY = 2.6871

VALUES OF TABLES:

$$q(0.05) = 3.95 \quad q(0.01) = 4.77$$

#### Average 5. COMPARISON OF TREATMENT'S AVERAGE

TREATMENT	AVERAGE
3	15.4500 A
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LEVEL OF SIGNIFICANCE = 0.05

TUKEY = 2.6871

VALUES OF TABLES:

$$q(0.05) = 3.95 \quad q(0.01) = 4.77$$



Table 7. COMPARISON OF TREATMENT'S AVERAGE AND MELON'S SIZES

TREATMENTS	Size 9	Size 12	Size 15	Size 18	Size 23	AVERAGE
1. Dichloropropene	2.74 BC	17.50 AB	42.50 A	11.50 B	0.75 A	15.00
2. Chloropicrin	0.25 C	12.75 B	21.00 C	8.00 B	0.50 A	8.50
3. Methyl Bromide 40	5.75 BC	18.50 AB	31.25 B	20.00 A	1.75 A	15.45
4. Metan – Sodium 50	2.25 C	14.75 B	26.75 BC	11.75 B	1.50 A	11.40
5. Control	9.25 B	22.50 A	21.25 C	9.75 B	1.25 A	12.80
6. Dichloropropen + Chloropicrin	28.25 A	22.25 A	13.00 D	7.75 B	1.25 A	14.50
AVERAGE	8.08	18.04	25.96	11.46	1.17	

Value of Tukey = 6.5821

$q_{(0.05)} = 3.95$

$q_{(0.01)} = 4.77$

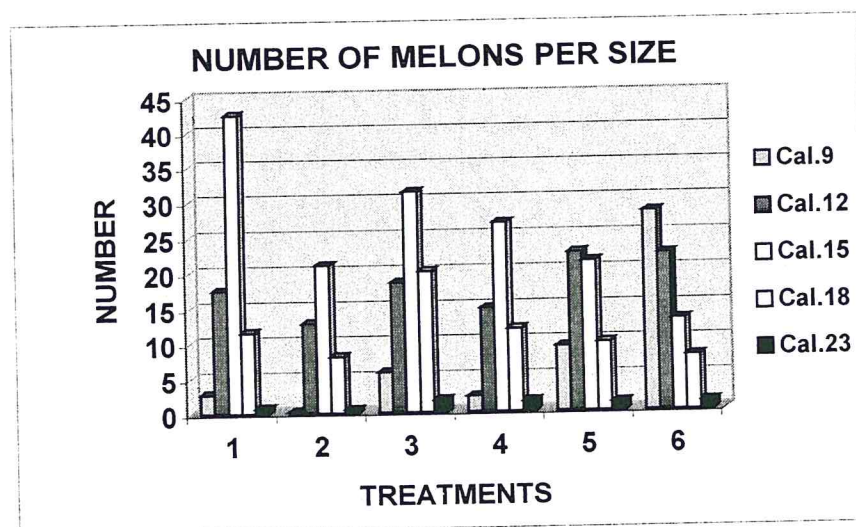


Table 8. VARIABLE: Number of melons per treatment (Sum of all sizes)

TREATMENTS	REPETITIONS			
	1	2	3	4
1. Dichloropropene	76.0000	70.0000	80.0000	74.0000
2. Chloropicrin	40.0000	43.0000	36.0000	51.0000
3. Methyl Bromide 40	88.0000	57.0000	99.0000	65.0000
4. Metan – Sodium 50	59.0000	60.0000	55.0000	54.0000
5. Control	64.0000	58.0000	69.0000	65.0000
6. Dichlorop + Chlorop	77.0000	69.0000	69.0000	75.0000

Table 9. ANALYSIS OF VARIANCE OF TREATMENTS (Sum of all sizes)

FV	GL	SC	CM	F	P>F
TREATMENTS	5	3508.210938	701.642212	8.8545 **	0.001
REPETITIONS	3	272.125000	90.708336	1.1447	0.364
ERROR	15	1188.625000	79.241669		
TOTAL	23	4968.960938			

C.V. = 13.76%

Table 10. AVERAGE (Sum of all sizes)

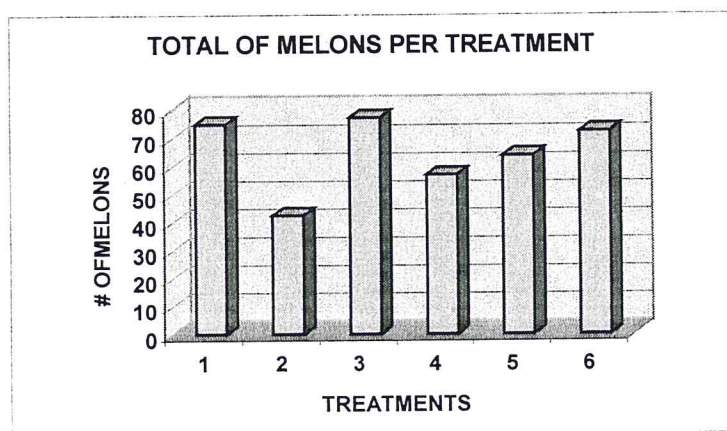
TREATMENT	AVERAGE
1	75.000000
2	42.500000
3	77.250000
4	57.000000
5	64.000000
6	72.500000

Table 11. COMPARISON OF AVERAGE (Sum of all sizes)

TREATMENT	AVERAGE
3	77.2500 A
1	75.0000 A
6	72.5000 A
5	64.0000 A
4	57.0000 AB
2	42.5000 B

LEVEL OF SIGNIFICANCE = 0.05

TUKEY = 20.4741: VALUES OF TABLES (0.05), (0.01) = 4.60, 5.80



### INTERPRETATION OF RESULTS:

Analysis of variance resulted highly significant effects for treatments, categories or sizes and treatments-sizes.

**Comparison of treatment' averages.** It was made three groups of significance. First place of significance in treatments was 3, Methyl Bromide 40, 1; Dichloropropene and 6; Dichloropropene + Chloropicrina, with 15.45, 15.00 and 14.50 melons respectively. Second place are treatments 5; Control and 4; Metam Sodium 50, with 12.80 and 11.40 melons respectively. Last place was treatment 2; Chloropicrin, with 8.50 melons average.



**Comparison of sizes' average.** All sizes were statistically different. Size 15 was on first place with 25.96 melons average; then it was size 12 with 18.04 melons average; third place was size 18 with 11.46 melons average. Size 9 average was 8.08 melons. Fourth place. The most low average was of 1.17 melons, and was size 23.

#### **FINAL CONCLUSIONS.**

In general, and according to the results obtained in melon tests, chemical treatments that in some experiments showed greater total production and per calibers they were: Dichloropropen + chloropicrin and Methyl bromide.



## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMIA - UAS

**FINAL PROJECT REPORT:** Alternatives to the use of Methyl Bromide in the cultivation of **melon**. (*Cucumis melo* L.). In "Las Carmelitas, Ranch", Colima, Colima, Mexico. Universidad Autónoma de Sinaloa, Agronomy Faculty Responsible: MC. Francisco Javier Estrada Ramirez, Project Coordinator, and MC. Sostenes Montoya Angulo, Agronomist, in the tests implementation. QFB. María de la Luz Acosta Pineda y MC. Carlos Morales Cazarez, Colaboradores.

In this month, March 2004, we are reporting performed activities from 1999 to 2004.

### INTRODUCTION

During June, 2001, we started some tests in Colima, Colima, Mexico, which consisted in the application of different treatments on soil, in order to analyze the control about soil microorganisms and in crops development, comparing Methyl bromide. We apply this substance in alluvial land. Agricultural activities are based in drip irrigation.

Treatments: we selected 9 (nine) treatments:

The applied treatments were:

- 1) Control (no treatment);
- 2) Metham Sodium (50 ml/m<sup>2</sup>)
- 3) Methyl Bromide 40 gr/m<sup>2</sup>, 80/20
- 4) Methyl Bromide 15 gr/m<sup>2</sup>, 80/20
- 5) Metham Sodium (25 ml/m<sup>2</sup>) + solarization
- 6) 5 kg/m<sup>2</sup> Corn remain plants + Nitrogen fertilizer (1 kg/M<sup>2</sup>) + solarization
- 7) 5 kg/M<sup>2</sup> Melon remain plants + 1 kg/M<sup>2</sup> bovine cattle manure + solarization
- 8) 1,3-Dichloropropen (65%) + chloropicrin (35%) (27 ml/m<sup>2</sup>)
- 9) Chloropicrin (33 ml/m<sup>2</sup>)

### BODY OF REPORT

#### Land preparation

The activities in cooperative farmer land started in last June, when "Las Carmelitas, ranch" heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the installment underground pipeline. Afterwards the beds were

marked, arised and flattened. And finally they put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

### Experiment Design

The treatment designs were carried out in June, 2001. First we marked the block margins using stakes, afterwards, we drew lines using lame in order to define the blocks. In a piece of land with 27 beds; 50 M length, inside the enterprise commercial land. It was traced four blocks 10 m each; we selected 36 experimental plots with 3 beds, which we applied next randomized treatments:

1). Absolute control. In this experimental unit consist on 4 rows, 10 M. length, and we didn't realized any fungicide or organic matter application on the soil. The soil remained covered with plastic.

2). 1,3-dichloropopren + chloropicrin. These furrows soil were treated using 27 ml/m<sup>2</sup> mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product using the same equipment that we used to apply the chloropicrin and the furrows are covered in black/silver plastic nowadays.

3). Methyl Bromide 80/20. In the four rows, It was applied 40 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin). Actually the soil remained covered with plastic.

4). Methyl Bromide 80/20. In the four rows, It was applied 15 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin). Actually the soil remained covered with plastic.

5). Chloropicrin. On this four furrows were applied 33ml/m<sup>2</sup> chloropicrin using a little drip application equipment. The furrows were covered in black/silver plastic.

6). Metham-sodium. In this four furrows it was applied. We sprinkled this product using a garden watering can; approximately 50 ml/m<sup>2</sup> metham sodium. After the application, the furrows were covered in black/silver plastic.

7). Metham-sodium. In this four furrows it was applied. We sprinkled this product using a garden watering can; approximately 25 ml/m<sup>2</sup> metham sodium. After the application, plus solarization.

8). 5 kg/m<sup>2</sup> Corn remain plants + Nitrogen fertilizer (1 kg/M<sup>2</sup>) + solarization

9). 5 kg/M<sup>2</sup> Melon remain plants + 1 kg/M<sup>2</sup> bovine cattle manure + solarization

The treatments were applied in damp soil. Evaluations are taking place in the central furrow in each experimental unit.

### Planting

Planting was carried out in November. Plants were sowing 30 cm. Separated among each.



## **RESULTS.**

### **MELON EXPERIMENT RESULTS IN COLIMA**

Yield results weren't significant, because we just took a representative sampling each treatment. Farm Engineer just observed yield on 5 lineal meters per treatment, which isn't reliable. In order to reinforce results explanation on February 23<sup>rd</sup>, 2002, we took place an visual analysis. We can appreciate behavior that different treatments developed in the farm. We took photographs which we can observe the crops when harvested. We observed an infection by *Fusarium oxysporum* f.sp. *meloni*, with next results and conclusions.

**PHOTOGRAPH 1. CONTROL.** It displayed 100% dead plants. Notice that in order to fill the empty space it was sowed cucumbers.

**PHOTOGRAPH 2. METAM – SODIUM 50.** It behaved same way than control. It displayed 100% dead plants, and cucumbers were sowed.

**PHOTOGRAPH 3. METHYL BROMIDE 40.** It was conserved 100% of plants, which showed more vigor and yield than the rest of treatments.

**PHOTOGRAPH 4. METHYL BROMIDE 15.** You can observe that plants' vigor is minor than Methyl Bromide 40. It showed diseased or dry plants, but with acceptable yield.

**PHOTOGRAPH 5. METAM – SODIUM 25 + SOLARIZATION.** Noticed that 100% of plants are dead, which remained until yield, and most of fruits didn't ripen.

**PHOTOGRAPH 6. CORN STUBBLE + SOLARIZATION.** It showed similar results than control. All plants died and produced melons weren't harvested.

**PHOTOGRAPH 7. MELON STUBBLE + SOLARIZATION.** This treatment was similar than metam-sodium + solarization. Most of the plants remained until yield, but finally they died and fruits didn't ripen.

**PHOTOGRAPH 8. DICHLOROPROPEN + CHLOROPICRIN.** Its behavior was similar than Methyl Bromide 15. It didn't show differences in plants vigor and yield. It showed diseased or dried plants same proportion.

**PHOTOGRAPH 9. CHLOROPICRIN.** We could observe more quantity of dead plants. This treatment was lower than Methyl Bromide 15 and dichloropropene + chloropicrin, but it's better than the other treatments. Methyl Bromide 40 was the best.



**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION  
FACULTAD DE AGRONOMIA - UAS**

## **INTRODUCTION.**

During November, 2002, it was established the second test of project "Alternatives to the use of Methyl Bromide in the cultivation of **melon**. (*Cucumis melo* L.). we started some tests in "Las Carmelitas, Ranch", Colima, Colima, Mexico, which consisted in the application of different treatments on soil, in order to analyze the control about soil microorganisms and crops development, comparing Methyl bromide. We apply this substance in alluvial land. Agricultural activities are based on drip irrigation.

Treatments: Based on before obtained results during last season 2000-2001 we selected 4 (four) treatments.

The applied treatments were:

- 1) Control (no treatment);
- 2) Methyl Bromide 40 gr/m<sup>2</sup>, 80/20
- 3) 1,3-Dichloropropen (65%) + chloropicrin (35%) (27 ml/m<sup>2</sup>)
- 4) Chloropicrin (33 ml/m<sup>2</sup>)

## **BODY OF REPORT**

### **Land preparation**

The activities in cooperative farmer land started in last November, when "Las Carmelitas, ranch" heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the installment underground pipeline. Afterwards the beds were marked, arised and flattened. And finally they put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

### **Experiment Design**

The treatment designs were carried out in November, 2002. First we marked the block margins using stakes, afterwards, we drew lines using lame in order to define the blocks. In a piece of land with 12 beds; 100 M length, inside the enterprise commercial land. It was traced four blocks 10 m each; we selected 36 experimental plots with 3 beds, which we applied next randomized treatments:



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2). **1,3-dichloropopren + chloropicrin.** These furrows soil were treated using 27 ml/m<sup>2</sup> mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product using the same equipment that we used to apply the chloropicrin and the furrows are covered in black/silver plastic nowadays.

3). **Methyl Bromide 80/20.** In the four rows, It was applied 40 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin). Actually the soil remained covered with plastic.

4). **Chloropicrin.** On this four furrows were applied 33ml/m<sup>2</sup> chloropicrin using a little drip application equipment. The furrows were covered in black/silver plastic.

The treatments were applied in damp soil.

Evaluations are taking place in the central furrow in each experimental unit.

## Planting

Planting was carried out in December. Plants were sowing 30 cm. Separated among each.

## YIELD RESULTS

### FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

Site: El Bajio ranch, Colima, Colima

Crop: Melon cv. Pacstart

Evaluation parameter: Yield on 20 m. lineal/repetition/treatment

Planting date: December 7th, 2002

Evaluation date: February 10th, 2003

#### METHYL BROMIDE 40

REPETITION	NUMBER OF FRUITS/CATEGORY/REPETITION						TOTAL	REMAIN
	6	9	12	15	18	23		
I	0	8	13	16	13	5	55	5
II	1	10	18	8	18	3	58	2
III	1	12	17	21	19	3	73	1
IV	0	8	23	13	19	3	66	2
Total	2	38.00	71.00	58.00	69.00	14.00		10.00
Average	0.50	9.50	17.75	14.50	17.25	3.50		2.50



**CHLOROPICRIN**

REPETITION	NUMBER OF FRUITS/CATEGORY/REPETITION						TOTAL	REMAIN
	6	9	12	15	18	23		
I	0	9	15	16	19	3	62	2
II	1	12	21	15	13	7	69	4
III	2	15	25	10	25	7	84	1
IV	0	7	20	16	22	4	69	2
Total	3	43.00	81.00	57.00	79.00	21.00		9.00
Average	0.75	10.75	20.25	14.25	19.75	5.25		2.25

**DICHLOROPROPEN + CHLOROPICRIN**

REPETITION	NUMBER OF FRUITS/CATEGORY/REPETITION						TOTAL	REMAIN
	6	9	12	15	18	23		
I	0	5	15	14	18	10	62	3
II	1	13	17	17	17	9	74	1
III	0	12	20	27	25	3	87	1
IV	0	6	16	20	24	2	68	2
Total	1	36.00	68.00	78.00	84.00	24.00		7.00
Average	0.25	9.00	17.00	19.50	21.00	6.00		1.75

**BIOTROL**

REPETITION	NUMBER OF FRUITS/CATEGORY/REPETITION						TOTAL	REMAIN
	6	9	12	15	18	23		
I	2	10	13	14	15	5	59	6
II	1	15	17	13	10	2	58	2
III	0	11	27	17	9	3	67	2
IV	1	15	21	17	10	3	67	2
Total	4	51.00	78.00	61.00	44.00	13.00		12.00
Average	1.00	12.75	19.50	15.25	11.00	3.25		3.00

**CONTROL**

REPETITION	NUMBER OF FRUITS/CATEGORY/REPETITION						TOTAL	REMAIN
	6	9	12	15	18	23		
I	0	5	9	15	24	9	62	0
II	0	16	13	19	37	3	88	1
III	1	8	17	17	30	2	75	1
IV	0	16	13	10	18	6	63	2
Total	1	45.00	52.00	61.00	109.00	20.00		4.00
Average	0.25	11.25	13.00	15.25	27.25	5.00		1.00

# **FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA**

Site: El Bajio ranch, Colima, Colima

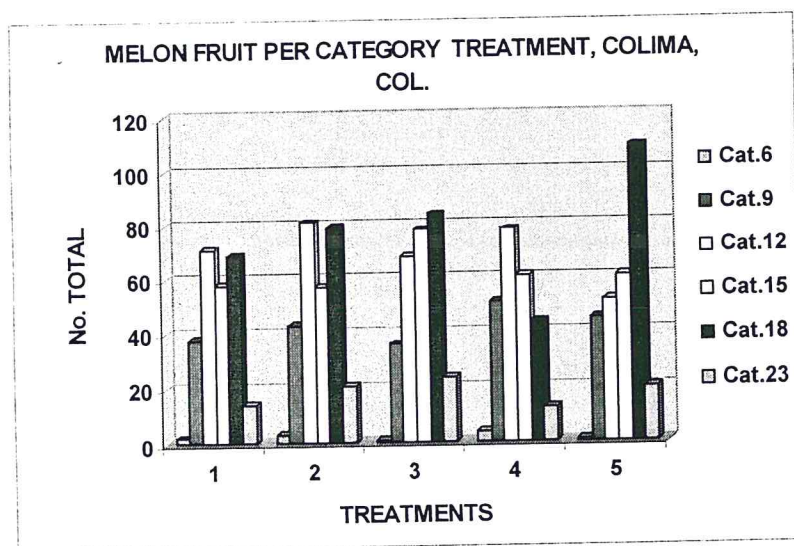
Crop: Melon cv. Pacstart

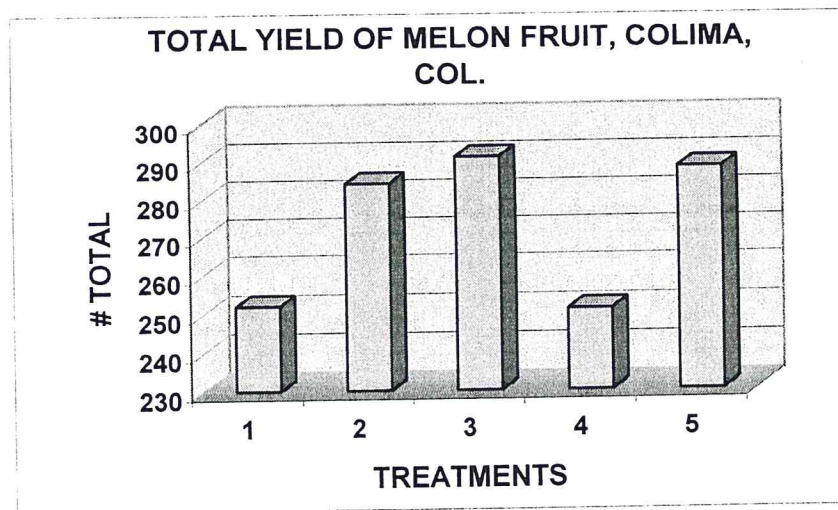
Evaluation parameter: Yield on 80 m. lineal/treatment

Planting date: December 7th, 2002

Evaluation parameter: February 10th, 2003

TREATMENTS	NUMBER OF FRUITS/CATEGORY/TREATMENT						TOTAL
	6	9	12	15	18	23	
1. Methyl Bromide 40	2	38	71	58	69	14	252
2. Chloropicrin	3	43	81	57	79	21	284
3. Dichloropropen+Chloropicrin	1	36	68	78	84	24	291
4. Biotrol	4	51	78	61	44	13	251
5. Control	1	45	52	61	109	20	288





**FINAL CONCLUSION.** In general, and according to the results obtained in melon tests, chemical treatments that in some experiments showed greater total production and per calibers they were: Dichloropropen + chloropicrin and single chloropicrin, but they are deficient when *Fusarium oxysporum f. sp meloni* or Virus of the Sifting of the melon (MNSV), are present, reason why is not justified as alternative in the melon culture.





## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMIA - UAS

**FINAL PROJECT REPORT.** Demonstration Project of Alternatives to the use of Methyl Bromide in the cultivation of Flowers (*Lilium Casablanca*). The development in Villaguerrero, estado de México. In this field have been working MC. Francisco Javier Estrada Ramirez, coordinator in this project. And MC. Sostenes Montoya Angulo, agronomist who is implementing the tests. QFB. María de la Luz Acosta Pineda y MC. Carlos Morales Cazarez Colaboradores.

In this month, March 2004, we are reporting performed activities from 1999 to 2004.

### INTRODUCTION

Last September, 2002, in Villaguerrero, Mexico, we started taking some tests. We apply different treatments in soil, in order to analyze the control about soil microorganisms and in crops development also, comparing Methyl bromide. We apply this substance in muddy type soil.

Treatments: we applied 10 (ten) treatments:

1. Dichloropropen + chloropicrin 16 ml/m<sup>2</sup>.
2. Control
3. Methyl bromide 75/25, 40 gr/m<sup>2</sup>
4. Methyl Bromide 75/25, 20 gr/m<sup>2</sup>
5. Metam-sodium 50 ml/m<sup>2</sup>
6. Chloropicrin 33ml/m<sup>2</sup>
7. Five kg of chicken manure incorporated into soil, plus four weeks of solarization.
8. Five kg of fresh broccoli residue (or other cruciferous plant) incorporated into soil, plus four weeks of solarization.
9. 25 ml/m<sup>2</sup> of metam-sodium ( N, methyl sodium ditiocarbamate) plus six weeks of solarization.
10. Five kg of lilium and gervera incorporated into soil, plus four weeks of Solarization

### BODY OF THE REPORT

## **Land preparation**

The activities in cooperative farmer land started in last September, when "Villaguerrero" heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil seven beds, after that, they made the installment underground pipeline. Afterwards the beds were marked, arised and flattened. The bed marks were marked 1 m between each one.

## **Experiment Design**

The treatment designs were carried out in September, 2002. In a piece of land with 5 beds, 50 m length, inside the enterprise commercial land. It was traced four blocks 10 m each; we selected 40 experimental plots with 1 beds, which we applied next randomized treatments:

- 1). 1,3-dichloropopren + chloropicrin. These furrows soil were treated using 27ml/m<sup>2</sup> mixture 1,3-dichloropropeno (65%) chloropicrin (35%). We applied this product using the same equipment used to apply the methyl-bromide, and the furrows were covered in black/silver plastic during 20 days.
- 2). Absolute control. In this experimental unit consist on 4 rows, 10 M. length, and we didn't realized any fungicide or organic matter application.
- 3). Methyl Bromide 80/20. In the four rows, It was injected 40 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin).The application was approximately 25-30 cm depth.
- 4). Methyl Bromide 80/20. In the four rows, It was injected 20 grs M<sup>2</sup> (80% methyl bromide and 20% chloropicrin).The application was approximately 25-30 cm depth.
- 5). Metham-sodium. In this four furrows it was applied 50 ml/m<sup>2</sup> metham sodium. The furrows were covered in black/silver plastic during 20 days.
- 6). Chloropicrin. On this four furrows were applied 33ml/m<sup>2</sup> chloropicrin using the same equipment which we applied methyl-bromide. The furrows were covered in black/silver plastic during 20 days.

The treatments were applied on damp soil.

Evaluations are going to take place in the 5 M<sup>2</sup> each repetition.

## **Planting.**

Flower plants will be direct sowing on soil. Four rows 10 cm separated.



## Crop Management

Irrigation and fertilization will take place using drip irrigation, and they will be controlled directly by enterprise field manager. Same people will take the records about the handworks like pruning, cutting, spinning, tied the plants, diseases control and foliage pests, etc.

## YIELD RESULTS:

### FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

SITE: Cosmoflor S.A de C.V. Villa Guerrero Edo. de México

PLANTING DATE: October 17th, 2002

CROP: Flower; Lilium casablanca

Evaluation parameter: Plants high cm.

EVALUATION DATE: January 18th, 2003

EVALUATION DATE: January 18th, 2003																							
TREATMENTS	Heigh on Cm. 10 Lilium plants per repetition/treatment																						
	REPETITION I										AVERAG	REPETITION II										AVERAG	
1. Control	86	81	83	94	85	92	87	81	80	88	85.7	87	85	93	82	88	84	82	84	90	84	85.9	
2. Methil Bromide 20	95	83	82	78	78	79	83	83	81	77	81.9	83	91	90	89	84	92	85	89	85	83	87.1	
3. Methil Bromide 40	93	95	102	93	90	95	95	92	94	93	94.2	90	80	85	97	94	95	91	90	97	97	91.6	
4. Dichlor+Chloropicrin	90	101	97	93	100	96	98	97	95	94	96.1	101	100	101	94	103	95	102	90	95	95	97.6	
5. Chloropicrin	89	101	94	94	90	103	95	95	98	93	95.2	98	97	94	98	96	85	91	93	99	89	94	
6. Metam sodium 50	87	87	80	80	86	78	85	83	85	85	83.6	95	86	86	88	94	88	94	87	89	84	89.1	
7. Metam sodium 25+sol.	90	85	98	86	92	90	94	92	97	98	92.2	87	90	89	84	96	95	94	85	91	102	91.3	
8. Cabbage+solarization	81	79	78	89	85	80	82	87	88	89	83.8	87	90	90	92	89	95	98	105	97	100	94.3	
9. Hen manure+solarization	92	85	84	97	96	96	88	86	84	77	88.5	85	83	88	82	85	92	86	92	86	88	86.7	
10. Lilium and Gerbera+sol.	81	90	85	85	85	88	85	78	85	90	85.2	93	95	93	90	89	92	90	85	75	86	88.8	

TREATMENTS	Heigh on Cm. 10 Lilium plants per repetition/treatment																					
	REPETITION III										AVERAG	REPETITION IV										AVERAG
1. Control	97	92	86	92	85	90	80	83	84	78	86.7	84	85	92	78	87	74	82	89	72	84	82.7
2. Methil Bromide 20	83	83	85	95	88	97	82	94	97	96	90	87	90	95	92	86	91	95	91	80	87	89.4
3. Methil Bromide 40	90	92	91	96	95	90	98	81	86	91	91	90	83	85	91	90	90	88	82	92	75	86.6
4. Dichlor+Chloropicrin	93	94	95	99	97	92	97	98	83	96	94.4	94	93	84	86	80	91	85	87	90	87	87.7
5. Chloropicrin	92	90	99	92	90	97	95	93	87	84	91.9	99	90	87	95	87	95	94	88	84	90	90.9
6. Metam sodium 50	93	90	91	90	80	83	88	95	85	90	88.5	97	91	90	90	88	93	90	88	92	93	91.2
7. Metam sodium 25+sol.	101	95	90	96	81	80	100	100	93	91	92.7	98	98	85	94	104	90	89	102	93	94	94.7
8. Cabbage+solarization	106	94	99	100	95	94	97	90	89	91	95.5	90	93	81	92	97	101	99	92	86	96	92.7
9. Hen manure+solarization	95	85	83	82	80	80	97	95	88	83	86.8	88	82	83	82	80	87	75	92	75	81	82.5
10. Lilium and Gerbera+sol.	84	82	92	94	82	90	85	85	88	87	86.9	82	89	76	80	89	87	91	89	90	95	86.8



# **FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA**

**SITE:** Cosmoflor S.A de C.V. Villa Guerrero Edo. de México

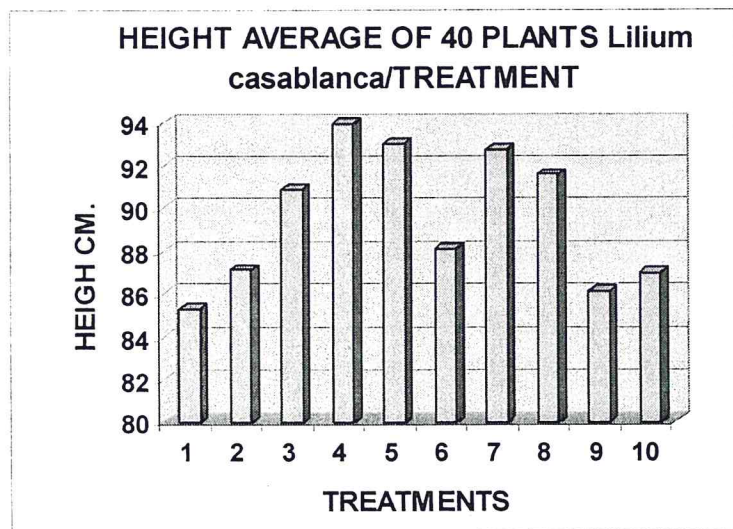
**PLANTING DATE:** October 17th, 2002

**CROP:** Flower Lilium casablanca var.

Evaluation parameter: Height on cm. of 10 plants/repetition/treatment

**EVALUATION DATE:** January 18th, 2003

TREATMENTS	HEIGHT AVERAGE/REPETITION/TREATMENT					
	I	II	III	IV	TOTAL	AVERAGE
1. Control	85.7	85.9	86.7	82.7	341	85.25
2. Methil Bromide 20	81.9	87.1	90	89.4	348.4	87.1
3. Methil Bromide 40	94.2	91.6	91	86.6	363.4	90.85
4. Dichlor+Chloropicrin	96.1	97.6	94.4	87.7	375.8	93.95
5. Chloropicrin	95.2	94	91.9	90.9	372	93
6. Metam sodium 50	83.6	89.1	88.5	91.2	352.4	88.1
7. Metam sodium 25+sol.	92.2	91.3	92.7	94.7	370.9	92.725
8. Cabbage+solarization	83.8	94.3	95.5	92.7	366.3	91.575
9. Hen manure+solarization	88.5	86.7	86.8	82.5	344.5	86.125
10. Lilium and Gerbera+sol.	85.2	88.8	86.9	86.8	347.7	86.925



# FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

SITE: Cosmoflor S.A de C.V. Villa Guerrero Edo. de México

PLANTING DATE: October 17th, 2002

CROP: Flower var.Lilium casablanca

Evaluation parameter: Lenght on cm. 10 flower bud/repetition

EVALUATION: February 21th, 2003

EVALUATION: February 21<sup>st</sup>, 2005

TREATMENTS	Lenght on cm. 10 flower bud/repetition/treatment											TOTAL	AVERAGE
	REPETITION I												
1. Control	11.6	9.5	10.4	9.6	10.4	10.3	10.4	10	9.8	10.8	102.8	10.28	
2. Methil Bromide 20	10	9.7	10.4	10.7	10.4	9.7	10.3	10.5	10.5	12.5	104.7	10.47	
3. Methil Bromide 40	11.9	11.4	10.8	10.5	10	10	10.2	10.6	10.1	11.3	106.8	10.68	
4. Dichlor+Chloropicrin	11.2	10.9	10.1	11.1	10.3	12.3	11	11.2	10.9	10.9	109.9	10.99	
5. Chloropicrin	11.3	10.7	11.4	11.2	11.3	11	11.7	10.9	11.7	11.9	113.1	11.31	
6. Metam sodium 50	11.9	9.5	10	10.5	10	10.5	10.2	9.1	10.6	9.5	101.8	10.18	
7. Metam sodium 25+sol.	11.1	10.3	10.5	10.8	11	12.2	10	10	10	11.5	107.4	10.74	
8. Cabbage+solarization	9.1	9.3	10.5	10.3	10.7	9.7	10.1	11	11.3	10.3	102.3	10.23	
9. Hen manure+solarization	10.4	10.2	10.3	10.9	9.2	10.1	10	9.9	10.5	9.3	100.8	10.08	
10.Lilium and Gerbera+sol.	10.9	10.2	10.1	9.9	9.7	10.3	10.4	10.1	10.5	9.7	101.8	10.18	

TREATMENTS	Lenght on cm. 10 flower bud/repetition/treatment											
	REPETICIÓN II										TOTAL	AVERAGE
1. Control	9.6	8.3	10.1	10.4	10	9.5	9.4	9.9	10.8	10.3	98.3	9.83
2. Methil Bromide 20	9.6	10.7	10.7	11.2	8.6	8.1	10.4	11.2	11.4	11.5	103.4	10.34
3. Methil Bromide 40	10.1	9.1	10.2	10.4	9.8	11.5	10	10.5	9.8	11.3	102.7	10.27
4. Dichlor+Chloropicrin	11.2	12.3	10.9	10.1	10.6	10.7	10.6	10.9	12	11.2	110.5	11.05
5. Chloropicrin	9.7	11.7	9.8	9.8	10	11.6	9.2	10.6	10	10.4	102.8	10.28
6. Metam sodium 50	9.2	9.4	10.1	10.3	11.3	10.2	10.8	10.5	10.3	11	103.1	10.31
7. Metam sodium 25+sol.	8.9	10	9.8	10.7	10.8	10.8	10	10.1	10.2	10.7	102	10.2
8. Cabbage+solarization	10.2	8.8	10.2	11.4	10	10.4	10.2	10.4	10	10.5	102.1	10.21
9. Hen manure+solarization	10.4	9.8	10.8	8.7	9.8	10.1	10.6	10.2	10.1	11	101.5	10.15
10.Lilium and Gerbera+sol.	8.2	9.9	10.1	10.6	9.2	9.8	10	10.5	10.5	9.8	98.6	9.86

TREATMENTS	Lenght on cm. 10 flower bud/repetition/treatment											
	REPETICIÓN III										TOTAL	AVERAGE
1. Control	9.2	10.2	10.8	10.5	10.3	10.8	10.3	10.1	10.5	10.5	103.2	10.32
2. Methil Bromide 20	11	10	9.5	9.7	9.9	9.6	10.6	10.5	9.9	11.1	101.8	10.18
3. Methil Bromide 40	10.5	10.6	10.9	10.6	10.3	10.5	11	9.5	8.6	10.2	102.7	10.27
4. Dichlor+Chloropicrin	10.1	10.7	11.8	10.3	9.8	9.5	10.7	11.5	11.2	11.3	106.9	10.69
5. Chloropicrin	11.8	8.7	12	11.2	9.8	9.5	10.7	11.5	11.2	11.3	107.7	10.77
6. Metam sodium 50	11.1	10.8	9.6	10.8	9.4	9.4	10.6	10.1	10.2	10.3	102.3	10.23
7. Metam sodium 25+sol.	9.8	10.5	12.1	9.4	10.3	10.2	10.6	11	9.8	11.5	105.2	10.52
8. Cabbage+solarization	10.1	10.5	10.6	9.5	9.2	10.2	10.5	9.9	10.4	11	101.9	10.19
9. Hen manure+solarization	9.2	11	10.2	10.1	9.9	10.5	10	10.7	10.7	9.9	102.2	10.22
10.Lilium and Gerbera+sol.	9.7	9.9	8.3	9.9	11.1	9.1	10.2	10.5	10.2	10.5	99.4	9.94



TREATMENTS	Lenght on cm. 10 flower bud/repetition/treatment											
	REPETICIÓN IV										TOTAL	AVERAGE
1. Control	10.2	10.2	10	11.3	8.9	10	9.4	9.3	9.5	11	99.8	9.98
2. Methil Bromide 20	10.4	10	10.9	9.6	11.3	10.2	9.7	11.5	10.9	10.7	105.2	10.52
3. Methil Bromide 40	11.2	10.1	11.5	10.8	10.9	9	9.1	9.6	10.3	10.7	103.2	10.32
4. Dichlor+Chloropicrin	10.1	11	10.1	10.6	10.1	9.9	10.6	9.3	9.1	10.7	101.5	10.15
5. Chloropicrin	10.6	9.2	8.8	9.3	8.6	9.2	10.5	9.5	11.2	10.7	97.6	9.76
6. Metam sodium 50	11.1	11.4	10.6	10	9.5	10.9	10.1	8.4	10.8	10.8	103.6	10.36
7. Metam sodium 25+sol.	10.2	9.8	9.5	10.9	11	10.5	9.9	10.4	10.8	9.8	102.8	10.28
8. Cabbage+solarization	9	9.4	10.3	10.5	11	10	10.6	9.5	9.9	10.7	100.9	10.09
9. Hen manure+solarization	10.1	10.9	11	9	9.3	10.1	9.8	9.9	9.9	10.6	100.6	10.06
10.Lilium and Gerbera+sol.	10.5	9.9	10.6	9.2	10.3	9.9	9.6	10	9.2	11.2	100.4	10.04

# FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

SITE: Cosmoflor S.A de C.V. Villa Guerrero Edo. de México

PLANTING DATE: October 17th, 2002

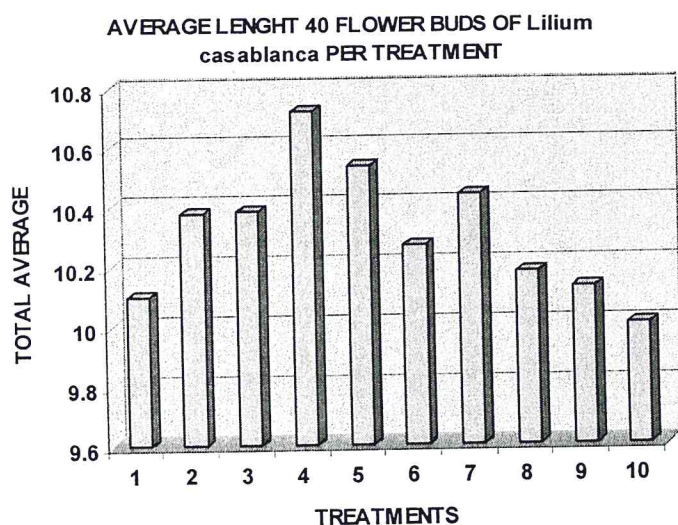
Evaluation parameter: Lenght on cm. 10 flower  
bottom/repetition

EVALUATION: February 21th, 2003

CROP: Flower var.Lilium casablanca

TREATMENTS	LENGHT AVERAGE AT BUD/REPETITION					
	I	II	III	IV	TOTAL	AVERAGE
1. Control	10.28	9.83	10.32	9.98	40.41	10.1025
2. Methil Bromide 20	10.47	10.34	10.18	10.52	41.51	10.3775
3. Methil Bromide 40	10.68	10.27	10.27	10.32	41.54	10.385
4. Dichlor+Chloropicrin	10.99	11.05	10.69	10.15	42.88	10.72
5. Chloropicrin	11.31	10.28	10.77	9.76	42.12	10.53
6. Metam sodium 50	10.18	10.31	10.23	10.36	41.08	10.27
7. Metam sodium 25+sol.	10.74	10.2	10.52	10.28	41.74	10.435
8. Cabbage+solarization	10.23	10.21	10.19	10.09	40.72	10.18
9. Hen manure+solarization	10.08	10.15	10.22	10.06	40.51	10.1275
10.Lilium and Gerbera+sol.	10.18	9.86	9.94	10.04	40.02	10.005





# **FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA**

**SITE:** Cosmoflor S.A de C.V. Villa Guerrero Edo. de México

**PLANTING DATE:** October 17th, 2002

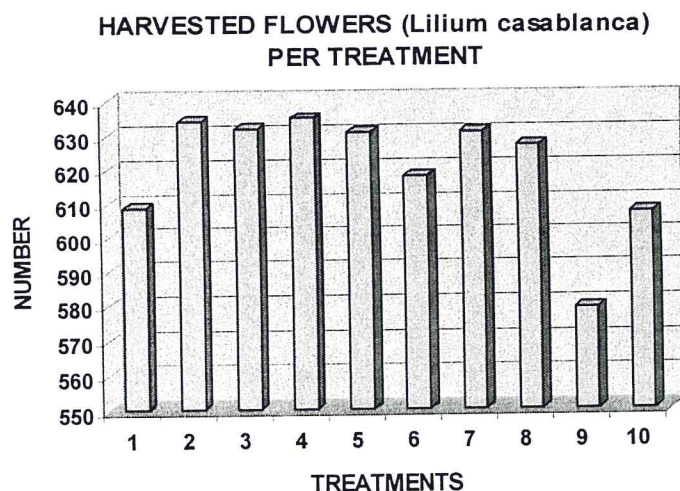
**CROP:** Flower var. Lilium casablanca

Evaluation parameter: Number of useful plants on 4 m lineal/repetition

**EVALUATION DATE:** February 21th, 2003

40 bulbs/m. lineal=160 Bulbs.

TREATMENTS	NUMBER OF HARVESTED PLANTS/REPETITION					
	I	II	III	IV	TOTAL	AVERAGE
1. Control	156	154	150	149	609	152.25
2. Methil Bromide 20	159	158	159	158	634	158.5
3. Methil Bromide 40	156	159	157	160	632	158
4. Dichlor+Chloropicrin	158	160	159	158	635	158.75
5. Chloropicrin	158	158	158	157	631	157.75
6. Metam sodium 50	155	156	152	155	618	154.5
7. Metam sodium 25+sol.	157	158	159	157	631	157.75
8. Cabbage+solarization	155	159	158	155	627	156.75
9. Hen manure+solarization	148	149	137	145	579	144.75
10. Lilium and Gerbera+sol.	144	151	159	153	607	151.75



**Final conclusion.** With based on the yield average of flowers, taking as parameter the number of harvested plants and the length of evaluated floral buds, in Graphs it can be observed the behavior of treatments, where Dichloropropen+chloropicrin, Chloropicrin, Metam sodium+solarization and methyl Bromide are over the rest of the treatments. The flower production is very complicated since a great diversity of species is cultivated, therefore are affected by a range of pathogens of the ground that sometimes are difficult to control. In order to take care of the phytosanitary problems of the ground, we have to give continuity to the test flowers by means of the implementation of a treatment with steam by means of a boiler, since we considered that he is control method more appropriated and mainly respectful with the environment.



**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION  
FACULTAD DE AGRONOMIA - UAS**

**TITLE:** Use of *Cucurbita maximaXmoschata* y *Cucumis melo* materials grafting-holder resistant to viruses of sieving (MNSV) as alternative to the use of Methyl Bromide in melon crop. (*Cucumis melo* L.).

**RESEARCHERS:** Dr. Julio César Tello Marquina  
Dr. Eduardo Jesús Fernández Rodríguez  
Universidad de Almería, España.

M.C. Francisco Javier Estrada Ramírez  
M.C. Sostenes Montoya Angulo  
MC. Carlos Morales Cazarez  
QFB. María de la Luz Acosta Pineda  
Universidad Autónoma de Sinaloa, México.

**RESEARCH SITE:** Experiment plots will be in "Las Carmelitas", Ranch, Jiquilpan, Colima, México.(a 26 Km. De Colima).

**CROP, VARIETY AND YIELD TO HARVEST:** Melon (*Cucumis melo* L.), any variety that farmer prefers. Variety Pacstart and the harvest will be fruits.

### **INTRODUCCIÓN.**

On November, 2001 in Colima, Colima, Mexico, it started the experiment of melon grafting. They used different materials grafting holder of pumpkin (*Cucurbita maximaXmoschata*) and melon, with genetic resistance to virus of sieving mosaic of melon (MNSV) and soil pathogens like *Fusarium oxysporum*, *Rhizoctonia* and nematodes. This technique of grafting was used as alternative to the use of Methyl Bromide, which is used by farmers on soil fumigations in order to control pathogens and weeds in some crops.



**TREATMENTS.** During agricultural cycle 2001-2002 it was applied 7 treatments, which were organized next way:

### **GRAFTING HOLDER MATERIAL TO USE**

We will use two different groups as grafting holder material:

**Group A:** Hybrid of *Cucurbita maximaXmoschata*:

<b>Crop:</b>	<b>Enterprise:</b>
RS841	(Royal Sluis),
PATRÓN F1	(Tezier ibérica)
ULISES	(Ramiro Arnedo)

**Group B:** Crops of *Cucumis melo* with genetic resistance to mosaic virus of sieved (MNSV).

<b>Crop:</b>	<b>Enterprise:</b>
CLX 2705	(Seed Clause)
PRIMAL	(S&G NOVARTIS-ROGERS)

**It was used two controls.**

1. Sowing ( to sow with normal cavity)
2. Repicado (to insert the cavity in other grafting)

### **BODY OF REPORT.**

**Land preparation.-** The activities in cooperative farmer land started in last June, when "Las Carmelitas, ranch" heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the installment underground pipeline. Afterwards the beds were marked, arisen and flattened. And finally they put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

### **MATERIALS AND METHODES OF GRAFTING.**

In order to carry out grafting, we sowed grafting holder material and commercial melon in trays of 200 cavities. Seeds of *Cucumis melo* that is resistance to sieved virus will be sowed same date than cantaloupe melon. Any seed the farmer choose. *Cucurbita maximaXmoschata* seeds (pumpkin) will be sowed five days after. We want both plants melon and pumpkin have same developed at the date to make grafting. At this time plants will have first two leaves. Which is the optima developed in order to carry out grafting process. The technique used is approximation. This process took place on November 17<sup>th</sup>, 2001.

After plants have been grafted, they put them in trays of bigger cavity (7x7 cm) and lately they were maintained on high relative humidity under for 72 hours under a taking root chamber In order to be sure that de grafting take root. Then plants were maintained under a shadow-mesh 60 % during 15 or 17 days. Three days before plants were taken to the farm, we cut off the root from grafting in order to check out their taken root.

### EXPERIMENTAL DESIGN.

Implementation of treatments on land was took carried out on December 8, 2001. We used the blocks design completely randomized, with repetitions. We used 7 treatments; 5 grafting-holder materials and 2 controls, which sum 28 plots or experimental units (u.e.), each experimental units were formed from 4 furrows, 4.5 m length with 30 plants/plot, and evaluations were carried out on two central furrows. All this tasks on a surface of 1000 m<sup>2</sup>.

### PLANTING.

Plants of grafting melon were planted on beds covered with black plastic, separated 1.80 m and among plants 60 cm. A control without grafting was planted from 30 cm separated. Farmer make this tasks during normal sowings.

### Crop Management

Irrigation and fertilization took place using drip irrigation, and they are controlled directly by enterprise field manager. Same people took the records about the handworks like pruning, cutting, spinning, tied the plants, diseases control and foliage pests, etc.

### RESULTS

#### DISEASED.

#### FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

**Site:** Rancho Las Carmelitas, Colima, Colima

**Planting date:** December 8th, 2001

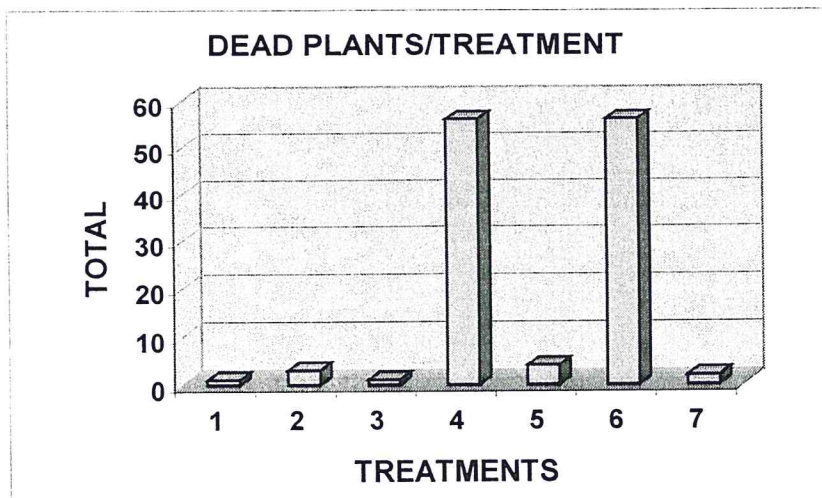
**Plants per repetition:** 14

**Crop:** Melon

**Evaluation parameter:** Dead plants on two central furrows

**Evaluation date:** January 3rd, 2002

TREATMENT	REPETITIONS				TOTAL
	I	II	III	IV	
1. Ulises	1	0	0	0	1
2. Primal	1	0	0	2	3
3. Patron	0	0	0	1	1
4. Control 1	14	14	14	14	56
5. RS841	2	1	0	1	4
6. Control 2	14	14	14	14	56
7. CLX 2705	1	0	1	0	2



## FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

**Site:** Rancho Las Carmelitas, Colima, Colima

**Crop:** Melon

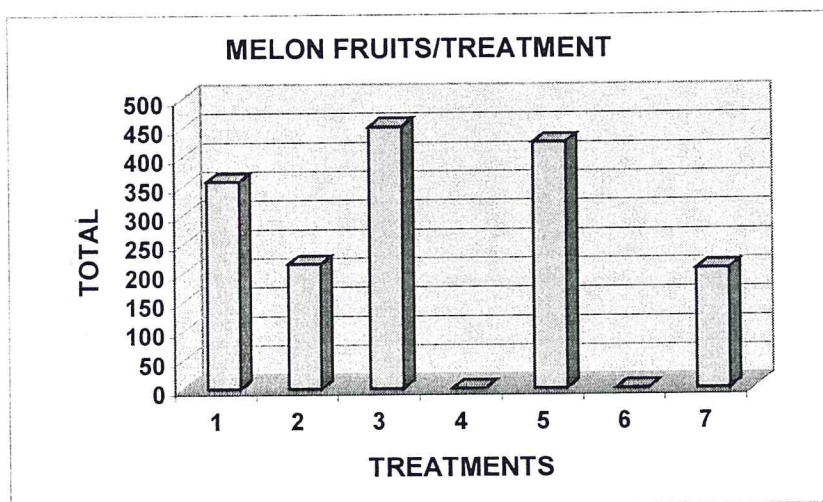
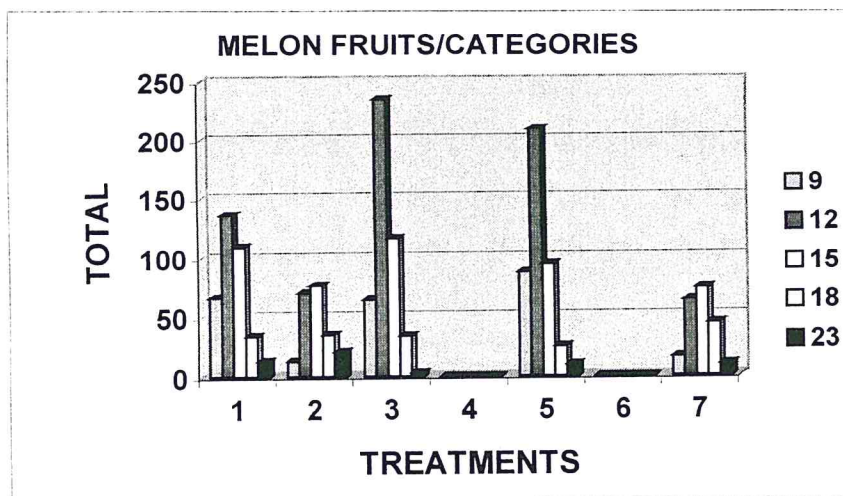
**Planting date:** December 8th, 2001

**evaluation parameter:** Total yield of fruits per treatment

**Evaluation date:** from February 6th, to March 6th, 2002

TREATMENT	SIZES OR CATEGORIES					TOTAL	REMAIN
	9	12	15	18	23		
1. Ulises	66	136	109	34	13	358	8
2. Primal	13	70	76	35	21	215	4
3. Patron	64	235	116	34	3	452	0
4. Control 1	0	0	0	0	0	0	0
5. RS841	87	209	94	25	10	425	3
6. Control 2	0	0	0	0	0	0	0
7. CLX 2705	16	63	73	44	10	206	1





**CONCLUSION.** The results show a greater commercial production in all the grafted melon plants on those of melon not grafted (control), which had zero production, this is because 30 days after transplant all the plants of the control died by attack of *Fusarium oxysporum f. sp. meloni*. Graft holders Patron and RS841 were superior as much in total production as in sizes, followed by Ulises and very underneath are Primal and CLX2705 (graft holder melons). The test was made on ground infested by *Fusarium*.



## UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FACULTAD DE AGRONOMIA - UAS

### INTRODUCCIÓN.

On October, 2002, in "El bajo", Ranch Colima, Colima, Mexico, it started the experiment of melon grafting. They used different materials grafting holder of pumpkin (*Cucurbita maximaXmoschata*) with genetic resistance to virus of sieving mosaic of melon (MNSV) and soil pathogens like *Fusarium oxysporum*, *Rhizoctonia* and nematodes. This technique of grafting was used as alternative to the use of Methyl Bromide, which is used by farmers on soil fumigations in order to control pathogens and weeds in some crops.

**TREATMENTS.** During agricultural cycle 2002-2003 it was applied 5 treatments, which were organized next way:

- 1.- Grafting. (30 cm among plants)
- 2.- Grafting (60 cm among plants )
- 3.- Grafting (90 cm among plants)
- 4.- Grafting (1.20 m among plants)
- 5.- Control (30 cm among plants)

### GRAFTING HOLDER MATERIAL TO USE

#### Grafting holder material:

Hybrid RS841 of *Cucurbita maximaXmoschata*:

**CROP, VARIETY AND YIELD TO HARVEST:** Melon (*Cucumis melo* L.), any variety that farmer prefers. Variety Pacstart and the harvest will be fruits.

### BODY OF REPORT.

**Land preparation.-** The activities in cooperative farmer land started in last September, when "El Bajío, ranch" heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the installment underground pipeline. Afterwards the beds were marked, arisen and flattened. And finally they put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

## **MATERIALS AND METHODES OF GRAFTING.**

In order to carry out grafting, we sowed grafting holder material and commercial melon in trays of 200 cavities. Any seed the farmer choose. *Cucurbita maxima* X *moschata* seeds (pumpkin) sowed five days after. We want both plants melon and pumpkin have same developed at the date to make grafting. At this time plants will have first two leaves. Which is the optima developed in order to carry out grafting process. The technique used is approximation. This process took place on October, 2002.

After plants have been grafted, they put them in trays of bigger cavity (7x7 cm) and lately they were maintained on high relative humidity under for 72 hours under a taking root chamber In order to be sure that de grafting take root. Then plants were maintained under a shadow-mesh 60 % during 15 or 17 days. Three days before plants were taken to the farm, we cut off the root from grafting in order to check out their taken root.

## **EXPERIMENTAL DESIG:**

Implementation of treatments on land was took carried out on November 22, 2002. We used the blocks design completely randomized, with repetitions. We used 5 treatments; 4 grafting-holder materials and 1 control, which sum 20 plots or experimental units (u.e.), each experimental units were formed from 4 furrows, 10 m length and evaluations were carried out on two central furrows. All this tasks on a surface of 1800 m<sup>2</sup>.

## **PLANTING.**

Plants of grafting melon were planted on beds covered with black plastic, separated 1.80 m and we will use planting density thereinbefore. Farmer make this tasks during normal sowings.

## **Crop Management**

Irrigation and fertilization took place using drip irrigation, and they are controlled directly by enterprise field manager. Same people took the records about the handworks like pruning, cutting, spinning, tied the plants, diseases control and foliage pests, etc.



## YIELD RESULTS:

### FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

**Site:** El Bajío Ranch, Colima, Colima.

**Crop:** Grafting of melon

**Graft holder material:** Gourd RS 841

**Measurement parameter:** Yield on 80 m lineal/treatment

**Planting date:** November 22th, 2002

**Evaluation date:** January 24th, to February 3th, 2003 (5 cuttings)

January 24th, 2003

TREATMENT	NUMBER OF FRUITS/CATEGORY/TREATMENT					
	6	9	12	15	18	23
Distance/plants						
RS 841 - 0.30 m	0	0	0	2	6	2
RS 841 - 0.60 m	0	0	1	6	5	2
RS 841 - 0.90 m	0	0	1	6	2	0
RS 841 - 1.20 m	0	0	0	3	0	0
Control - 0.30 m	0	0	0	0	1	0

January 27th, 2003

TREATMENT	NUMBER OF FRUITS/CATEGORY/TREATMENT					
	6	9	12	15	18	23
Distance/plants						
RS 841 - 0.30 m	0	0	0	1	3	1
RS 841 - 0.60 m	0	0	1	6	9	0
RS 841 - 0.90 m	0	0	3	3	4	0
RS 841 - 1.20 m	0	0	2	3	2	0
Control - 0.30 m	0	2	1	0	5	0

January 29th, 2003

TREATMENT	NUMBER OF FRUITS/CATEGORY/TREATMENT					
	6	9	12	15	18	23
Distance/plants						
RS 841 - 0.30 m	0	0	0	4	9	2
RS 841 - 0.60 m	0	0	2	6	7	0
RS 841 - 0.90 m	0	0	3	8	5	0
RS 841 - 1.20 m	0	1	0	2	3	0
Control - 0.30 m	0	2	3	8	11	3

January 31th, 2003

TREATMENT	NUMBER OF FRUITS/CATEGORY/TREATMENT					
Distance/plants	6	9	12	15	18	23
RS 841 - 0.30 m	0	0	2	3	17	3
RS 841 - 0.60 m	0	0	1	2	7	5
RS 841 - 0.90 m	0	1	9	7	8	0
RS 841 - 1.20 m	0	0	0	3	3	0
Control - 0.30 m	1	10	17	22	37	5

February 3th, 2003

TREATMENT	NUMBER OF FRUITS/CATEGORY/TREATMENT					
Distance/plants	6	9	12	15	18	23
RS 841 - 0.30 m	0	74	114	101	24	9
RS 841 - 0.60 m	2	54	82	49	12	11
RS 841 - 0.90 m	5	85	101	48	13	0
RS 841 - 1.20 m	1	74	101	47	3	0
Control - 0.30 m	0	30	29	29	47	12

## FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA

Site: El Bajio ranch, Colima, Colima.

Crop: Grafting of melon

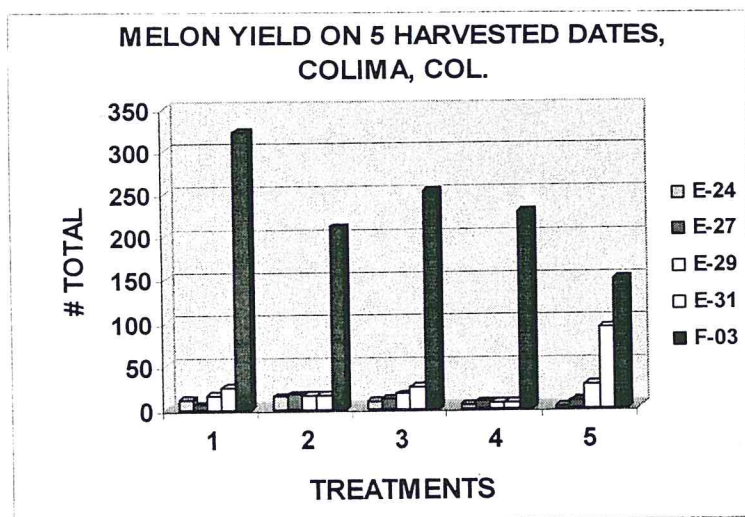
Graft older material: Gourd RS 841

Measurement parameter: Yield on 80 m lineal/treatment

Planting date: November 22th, 2002

Evaluation parameter: January 24th, to February 3th, 2003 (5cuttings)

TREATMENTS	NUMBER OF FRUITS/HARVESTED DATE/TREATMENT				
Distance/plants	24/01/03	27/01/03	29/01/03	31/01/03	03/02/03
1. RS 841 - 0.30 m	10	5	15	25	322
2. RS 841 - 0.60 m	14	16	15	15	210
3. RS 841 - 0.90 m	9	10	16	25	252
4. RS 841 - 1.20 m	3	7	6	6	226
Control - 0.30 m	1	8	27	92	147



# **FACULTAD DE AGRONOMIA - UNIVERSIDAD AUTONOMA DE SINALOA**

Site: El Bajio ranch, Colima, Colima.

Site: El Bajio ranch, Colima, Colima.

Graft holder material:Gourd RS 841

Measurement parameter: Yield on 80 m lineal/treatment

Planting date: November 22th, 2002

Evaluation parameter: January 24th, to February 3th, 2003 (5cuttings)

TREATMENTS	NUMBER OF FRUITS/CATEGORY/TREATMENT						TOTAL
	6	9	12	15	18	23	
Distance/plants							
RS 841 - 0.30 m	0	74	116	111	59	17	377
RS 841 - 0.60 m	2	54	87	69	40	18	270
RS 841 - 0.90 m	5	86	117	72	32	0	312
RS 841 - 1.20 m	1	75	103	58	11	0	248
Control - 0.30 m	1	44	50	59	101	20	275





**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION  
FACULTAD DE AGRONOMIA - UAS**

**TITLE:** Use of *Cucurbita maximaXmoschata* y *Cucumis melo* materials grafting-holder resistant to viruses of sieving (MNSV) as alternative to the use of Methyl Bromide in melon crop. (*Cucumis melo* L.).

**RESEARCHERS:**

Dr. Julio César Tello Marquina  
Dr. Eduardo Jesús Fernández Rodríguez  
Universidad de Almería, España.

MC. Francisco Javier Estrada Ramírez  
MC. Sostenes Montoya Angulo  
MC. Carlos Morales Cazarez  
QFB. María de la Luz Acosta Pineda  
Universidad Autónoma de Sinaloa, México.

**RESEARCH SITE:** Experiment plots will be Rancho "La Campana", ubicado a 45 km. De La Paz, Todos Santos Road, La Paz, Baja California, Sur.

**CROP, VARIETY AND YIELD TO HARVEST:** Melon (*Cucumis melo* L.), any variety that farmer prefers. Variety Pacstart and the harvest will be fruits.

**INTRODUCTION.**

On August, 2002 in Colima, Colima, Mexico, it started the experiment of melon grafting. They used different materials grafting holder of pumpkin (*Cucurbita maximaXmoschata*) with genetic resistance to virus of sieving mosaic of melon (MNSV) and soil pathogens like *Fusarium oxysporum*, *Rhizoctonia* and nematodes. This technique of grafting was used as alternative to the use of Methyl Bromide, which is used by farmers on soil fumigations in order to control pathogens and weeds in some crops.

**TREATMENTS.** During agricultural cycle 2002-2003 it was applied 5 treatments each grafting holder material, which were organized next way:

- 1.- Grafting. (30 cm among plants)
- 2.- Grafting (60 cm among plants )
- 3.- Grafting (90 cm among plants)
- 4.- Grafting (1.20 m among plants)
- 5.- Control (30 cm among plants)

## GRAFTING HOLDER MATERIAL TO USE

### Grafting holder material:

Hybrid RS841 of *Cucurbita maximaXmoschata*:

Hybrid Patron of *Cucurbita maximaXmoschata*

## BODY OF REPORT.

**Land preparation.-** The activities in cooperative farmer land started in last October, when Agronomia Faculty's heavy machinery carried out double subsoil in land. They opened the soil 50 cm depth. Then they raked the soil in three rows, after that, they carried out the installment underground pipeline. Afterwards the beds were marked, arisen and flattened. And finally they put the padded with black-silver plastic (silver side up). The bed marks were marked 1.80 m between each one.

## MATERIALS AND METHODES OF GRAFTING.

In order to carry out grafting, we sowed grafting holder material and commercial melon in trays of 200 cavities. Any seed the farmer choose. *Cucurbita maximaXmoschata* seeds (pumpkin) sowed five days after. We want both plants melon and pumpkin have same developed at the date to make grafting. At this time plants will have first two leaves. Which is the optima developed in order to carry out grafting process. The technique used is approximation. This process took place on August, 2002.

After plants have been grafted, they put them in trays of bigger cavity (7x7 cm) and lately they were maintained on high relative humidity under for 72 hours under a taking root chamber In order to be sure that de grafting take root. Then plants were maintained under a shadow-mesh 60 % during 15 or 17 days. Three days before plants were taken to the farm, we cut off the root from grafting in order to check out their taken root.

**EXPERIMENTAL DESIG:** Implementation of treatments on land was took carried out on August 29, 2002. We used the blocks design completely randomized, with repetitions. We used 5 treatments; 3 repetitions each, 4 grafting-holder materials and 1 control, which sum 30 plots or experimental units (u.e.), each experimental units were formed from 1 furrow, 15 m length and evaluations were carried out on furrow. All this tasks on a surface of 1000 m<sup>2</sup>.

## PLANTING.

Plants of grafting melon were planted on beds covered with black plastic, separated 1.80 m and we will use planting density thereinbefore. Farmer make this tasks during normal sowings.



## Crop Management

Irrigation and fertilization took place using drip irrigation, and they are controlled directly by enterprise field manager. Same people took the records about the handworks like pruning, cutting, spinning, tied the plants, diseases control and foliage pests, etc.

## YIELD RESULTS:

**FACULTAD DE AGRONOMÍA UNIVERSIDAD AUTONOMA DE SINALOA**  
**Site:** La Campana, Ranch, La Paz, B.C.S.  
**Crop:** Grafting of melon  
**Measurement parameter:** Yield on 15m lineal evaluated/repetition  
**Planting date:** September 14th, 2002  
**Evaluation:** November 22nd, 2002

Grafting holder (Patron) 40 cm/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	38	22	11	7	0
II	42	28	7	1	1
III	36	23	21	6	0
Total	116.00	73.00	39.00	14.00	1.00
Average	38.67	24.33	13.00	4.67	0.33

Grafting holder (Patron) 60 cm/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	33	27	24	1	0
II	44	10	4	0	0
III	45	24	0	0	0
Total	122.00	61.00	28.00	1.00	0.00
Average	40.67	20.33	9.33	0.33	0.00

GRAFTING HOLDER (Patron) 80 cm/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	41	15	7	2	0
II	39	20	7	0	0
III	49	13	1	1	0
Total	129.00	48.00	15.00	3.00	0.00
Average	43.00	16.00	5.00	1.00	0.00



GRAFTING HOLDER (Patron) 1.0 m/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	21	17	7	0	0
II	42	2	4	0	0
III	35	4	3	1	0
Total	98.00	23.00	14.00	1.00	0.00
Average	32.67	7.67	4.67	0.33	0.00

GRAFTING HOLDER (RS-841) 40 cm/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	32	17	19	3	0
II	42	20	5	3	0
III	34	26	19	2	0
Total	108.00	63.00	43.00	8.00	0.00
Average	36.00	21.00	14.33	2.67	0.00

GRAFTING HOLDER (RS-841) 60 cm/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	37	17	9	2	0
II	44	13	2	1	0
III	42	12	5	1	0
Total	123.00	42.00	16.00	4.00	0.00
Average	41.00	14.00	5.33	1.33	0.00

GRAFTING HOLDER (RS-841) 80 cm/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	28	27	2	0	0
II	34	26	4	0	0
III	46	17	1	0	0
Total	108.00	70.00	7.00	0.00	0.00
Average	36.00	23.33	2.33	0.00	0.00

GRAFTING HOLDER (RS-841) 1.0 m/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	23	13	6	0	0
II	49	12	0	0	0
III	34	10	3	0	0
Total	106.00	35.00	9.00	0.00	0.00
Average	35.33	11.67	3.00	0.00	0.00

CONTROL 40 cm/plants					
REPETITION	NUMBER OF FRUITS PER CATEGORY				
	9	12	15	18	23
I	7	30	30	3	0
II	6	35	29	10	0
III	4	33	31	11	0
Total	17.00	98.00	90.00	24.00	0.00
Average	5.67	32.67	30.00	8.00	0.00

**FACULTAD DE AGRONOMÍA UNIVERSIDAD AUTONOMA DE SINALOA**

Site: La Campana, Ranch, La Paz, B.C.S.

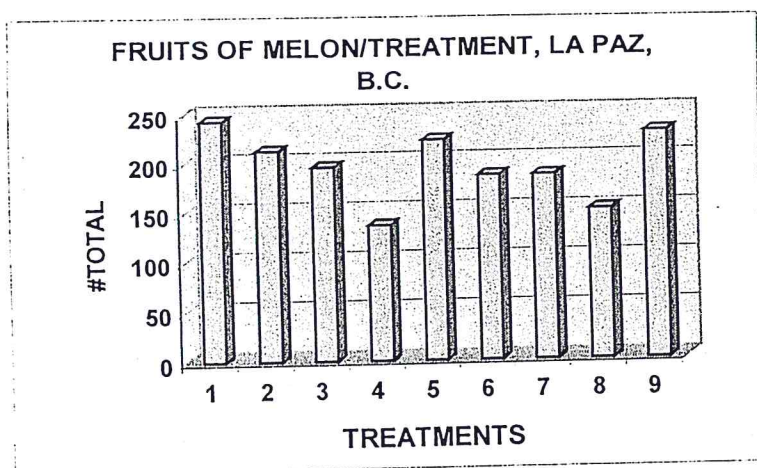
Crop: Grafting of melon

Measurement parameter: Yield on 15m lineal evaluated/repetition

Planting date: September 14th, 2002

Evaluation: November 22nd, 2002

TREATMENTS	NUMBER OF FRUITS/TREATMENT			
	R-I	R-II	R-III	TOTAL
1. Patron 40 cm	78	79	86	243
2. Patron 60 cm	85	58	69	212
3. Patron 80 cm	65	66	64	195
4. Patron 100 cm	45	48	43	136
5. RS-841 40 cm	71	70	81	222
6. RS-841 60 cm	65	60	60	185
7. RS-841 80 cm	57	64	64	185
8. RS-841 100 cm	42	61	47	150
9. Control 40 cm	70	80	79	229



**FACULTAD DE AGRONOMÍA UNIVERSIDAD AUTONOMA DE SINALOA**

Site: La Campana, Ranch, La Paz, B.C.S.

Crop: Grafting of melon

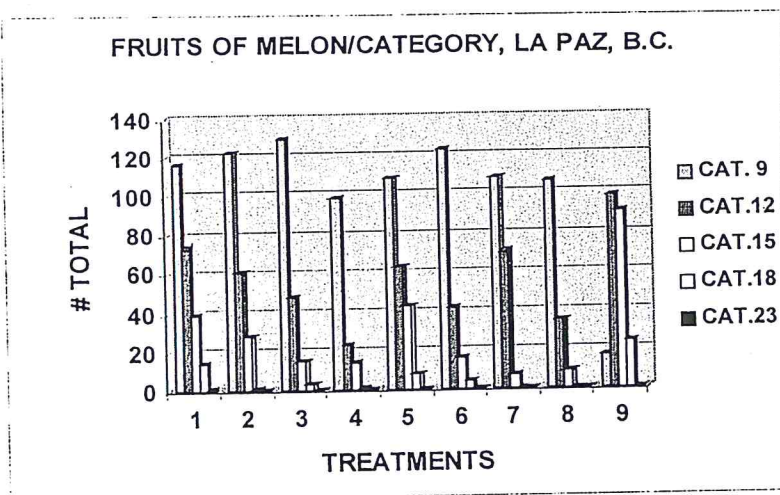
Measurement parameter: Yield on 15m lineal evaluated/repetition

Planting date: September 14th, 2002

Evaluation: November 22nd, 2002

TREATMENTS	NUMBER OF FRUITS/TREATMENT/CATEGORY				
	9	12	15	18	23
1. Patron 40 cm	116.00	73.00	39.00	14.00	1.00
2. Patron 60 cm	122.00	61.00	28.00	1.00	0.00
3. Patron 80 cm	129.00	48.00	15.00	3.00	0.00
4. Patron 100 cm	98.00	23.00	14.00	1.00	0.00
5. RS-841 40 cm	108.00	63.00	43.00	8.00	0.00
6. RS-841 60 cm	123.00	42.00	16.00	4.00	0.00
7. RS-841 80 cm	108.00	70.00	7.00	0.00	0.00
8. RS-841 100 cm	106.00	35.00	9.00	0.00	0.00
9. Control 40 cm	17.00	98.00	90.00	24.00	0.00





**Final conclusion.** The melon grafts on graft holder materials of pumpkin, also turn out to be a no chemical more appropriate alternative since it does not contaminate and it offers total resistance to the *Fusarium fungus oxysporum f. sp. meloni*, like *Olpidium radicale* that transmit the Virus of the Sifting of the melon (MNSV), which cannot be fought by any fumigant of ground, including methyl bromide, besides the use of grafts elevates the production of quality of melon. This makes of the melon grafts a profitable and mainly respectful alternative with the environment to the use of methyl bromide. The production results show the same tendency that the test of Colima.



## ANNEX

### ECONOMIC ASSESSMENT OF THE TECHNOLOGIES USED IN THE CULTIVATION OF TOMATO, MELON, STRAWBERRY AND MELON: METHYL BROMIDE, METAM-SODIUM AND DICHLOROPROPEN + CHLOROPICRIN AND MELON GRAFTING.

#### 1. Introduction

Methyl Bromide is an ozone depleting substance used as a fumigant in horticulture and is controlled under the Montreal Protocol Agreement, the international ozone protection treaty.

Use of MBr bromide in developing countries will be reduced by 20% in 2005 and phased out in 2015. For this reason it is necessary to identify alternative treatments for particular crops to substitute the use of methyl bromide as a fumigant in horticulture.

Methyl bromide in agriculture is used mainly to control some soil pathogens that attack horticultural crops such as tomato, chili bell, melon and some berries.

#### 2. Objective

The objective of this report is to prepare a cost comparative analysis of the results obtained with the best tested alternatives to Methyl Bromide in tomato, strawberry and melon crops.

The alternatives considered for this analysis were methyl bromide, metam-sodium and dichloropropeno combined with chloropicrin.

#### 3. Methodology.

As a first step, the economic information was collected including costs of: labor, land preparation, planting, tillage, treatments, fertilizers, other inputs, then the harvest activities required were listed, according to the agrochemical used.

Second, the average costs of crops in the different areas were considered. Finally the inputs were expressed in hectares and the costs in Mexican pesos.

##### 3.1. Inputs Identification

The basic materials used in open-field for tomato crops are: plastics, hoses, fumigants, fuel and labor. Additional costs are: the environmental handling of residual plastics, that include transport and recycling costs.

##### 3.2. Process

The harvest process is as follows:

Soil preparation for embedding; plastic covering; hoses fumigant and irrigation system installation; plastic removal and handling.

### 3.3. Environmental costs.

This cost includes plastic removal and packaging, as well as its transportation and transformation (whether recycled or incinerated).

## 4. Process description.

### 4.1. Embedding and 1.80 mts. rows.

This activity is carried out with a tractor, with a yield of 5 hectares per day.

#### Costs

Tractor driver	\$135.00 per day
Fuel	\$180.00 per day

The cost per hectare is included in the attached figures and were considered just the hectares worked per day.

The fuel cost is \$ 5.14 pesos per litre (without government subsidy)  
Per labor day (8 hrs) are needed around 30-35 litres depending on the kind of tractor.

The commercial price without subsidy was considered due to that the government subsidy for fuel is just temporary and changes every time, please see the subsidies for different months:

December 2003:	\$2.30 pesos per litre
January 2004:	\$2.17 pesos per litre
February 2004:	\$2.02 pesos per litre
March 2004:	\$2.00 pesos per litre
April 2004:	\$1.91 pesos por litro.

The subsidy is decreasing every month meanwhile the fuel cost is increasing 1 cent per month.

### 4.2. Plastic covering

For this activity is required a tractor, a tractor driver and 3 workers (assistants)

#### Costs

Fields can be harvested only 4 hectares per day.

Tractor driver	\$135.00 pesos
Fuel	\$120.00 pesos
Workers:	\$90 per labor day x 3 = 270.00 pesos
Plastic:	4.6 roll per hectare are required (each roll measures 1,200 mts.), since each roll costs \$1,500 pesos, the total amount is 6,944.44 pesos.
Hose:	550 mts are required per hectare and 100 mts cost \$120 pesos, total cost \$6,600.00 per hectare.



Fumigant application: \$8,800.00 per ha (400 lbs are required per hectare),  
1 lb costs USD\$2.00 ( \$1.00 = USD\$11.00)

#### 4.3 Plastic removal.

For Metam-sodium and solarization plastic removal needs to be done twice.

##### Costs

Four workers are needed to remove 14 rows of plastic per hectare. Their salary is \$90 pesos per worker per day, which makes a total of \$360 pesos per hectare.

A tractor can tow plastic 5 to 7 hectares per day, depending on the location of the plastic deposit area. It should be considered whether plastic is to be recycled or incinerated.

Tractor driver	\$135.00
Fuel	\$125.00

#### 4.4. Environmental manage of plastics.

Once the rolls and bales are gathered in a storage center, they will be transported to a recycling or incineration center.

Bale formation is carried out by one worker.	\$90.00 per hectare
Bale material includes a metal strip	\$35.00 per hectare
Transportation \$2.50 per kg., for 575 kgs.:	\$1,437.50 per hectare*
Recycling cost \$3.50 per kg. for 575 kgs.:	\$2,012.50 per hectare*

These costs could be considered very expensive but it should be considered that the recycling centers are so far from the land and also that the incineration centers need a special authorization/permission (which is expensive).

#### 4.5. Bedding re-sizing.

The bed borders are re-sized 15 to 20 has. per day, using a tractor.

Tractor driver	\$135.00
Fuel	\$150.00
Total of 18 to 20 pesos per hectare	

#### 4.6. Plastic covering for padded

The same activities described in point 4.2 are required, just the plastic cost changes, this costs 1,000 pesos per roll (1.20m each roll), a total of 4.6 rolls per hectare are needed. Total cost 4,600 pesos per hectare.

#### 4.7. Plastic Perforation.

If plastic is not perforated, the cost will have to include the salaries of four workers per hectare.

90.00 pesos per 4 worker= total 360.00 pesos per hectare.

#### **5. Fumigant application dose and cost per hectare.**

Methyl bromide: 400 lbs/ha (1lb=2 dollars).  
 $400 \times 2 \times 11 = 8,800.00$  pesos / hectare.

Metam-sodium: 150 lts/ha (17.00 pesos per lt)  
 $17 \times 150 = 2,250.00$  pesos / hectare.

Dichloropropen + Chloropicrin: 150 lts/ha (7.5 dollars per lt )  
 $150 \times 7.5 \times 11 = 12,375.00$  pesos per hectare.

#### **6. Melon grafting plants per hectare.**

10,000 plants per hectare

Cost per plant \$ 2.40 pesos (this cost was given by grafting producers in Jalisco and Colima – the only places in Mexico where melon in grafting is cultivated ). The agricultor buys the seeds and gives them to a grafting producer.

The cost for seeds pumpkin and melon grafting per hectare is: \$ 2,750.00 pesos.

#### **7. Table, summary of costs per crop. (see attached excel files).**

7.1. CULTIVATION OF TOMATO CARRIED OUT IN OPEN FIELD WITH TREATMENT OF METHYL BROMIDE									
ACTIVITIES	COST PER HECTARE - APPLICATION IN BEDS					PADDED OF CROPS	COST ENVIRONMENTAL	TOTAL	
	FUEL DIESEL	TRACTOR DRIVER	PEONS	HOSE GOTE	FUMIGANT M. BROMIDE				
FLOOR PREPARATION	\$ 245.00	\$ 180.00						\$ 425.00	
LEVELLING	\$ 75.00	\$ 60.00						\$ 135.00	
FORMATION OF BEDS	\$ 36.00	\$ 27.00						\$ 63.00	
PLACEMENT OF ADDED AND HOSE GOTE	\$ 36.00	\$ 34.00	\$ 68.00	\$ 6,600.00	\$ 8,800.00	\$ 4,600.00		\$ 20,138.00	
PERFORATION OF PLASTIC			\$ 360.00					\$ 360.00	
REMOVAL OF PLASTIC	\$ 25.00	\$ 27.00	\$ 360.00					\$ 412.00	
FORMATION OF BALE							\$ 90.00	\$ 90.00	
EQUIPMENT AND MATERIALS							\$ 35.00	\$ 35.00	
TRANSPORT							\$ 1,437.50	\$ 1,437.50	
RECYCLING							\$ 2,012.50	\$ 2,012.50	
TOTAL	\$ 417.00	\$ 328.00	\$ 788.00	\$ 6,600.00	\$ 8,800.00	\$ 4,600.00	\$ 3,575.00	\$ 25,108.00	
									<b>DOLLARS \$ 2,282.54</b>



7.2. CULTIVATION OF TOMATO CARRIED OUT IN OPEN FIELD WITH TREATMENT OF METAM - SODIO + SOLARIZACION									
				COST PER HECTARE - APPLICATION IN BEDS					
ACTIVITIES	FUEL DIESEL	TRACTOR DRIVER	PEONS	PLASTIC FOR SOLARIZATION	HOSE GOTEO	IRRIGATION	FUMIGANT M.SODIO	PADDED OF CROPS	COST ENVIRONMENT
FLOOR PREPARATION	\$ 245.00	\$ 180.00							\$ 425.00
LEVELLING	\$ 75.00	\$ 60.00							\$ 135.00
FORMATION OF BEDS	\$ 36.00	\$ 27.00							\$ 63.00
PLASTIC/SOLARIZATON AND HOSE GOTEO	\$ 36.00	\$ 34.00	\$ 68.00	\$ 6,944.44	\$ 6,600.00	\$ 300.00	\$ 2,250.00		\$ 16,232.44
REMOVAL OF PLASTIC	\$ 25.00	\$ 27.00	\$ 360.00						\$ 412.00
BEDDING RE-SIZING	\$ 9.00	\$ 10.00							\$ 19.00
COVERING PLASTIC FOR CROPS	\$ 36.00	\$ 34.00	\$ 68.00					\$ 4,600.00	\$ 4,738.00
PERFORATION OF PLASTIC			\$ 360.00						\$ 360.00
REMOVAL OF PLASTIC	\$ 25.00	\$ 27.00	\$ 360.00						\$ 412.00
FORMATION OF BALE								\$ 180.00	\$ 180.00
EQUIPMENT AND MATERIALS									\$ 70.00
TRANSPORT									\$ 2,875.00
RECYCLING									\$ 4,025.00
TOTAL	\$ 487.00	\$ 399.00	\$ 1,216.00	\$ 6,944.44	\$ 6,600.00	\$ 300.00	\$ 2,250.00	\$ 4,600.00	\$ 29,946.44
									DOLLARS. \$ 2,722.40

7.3. CULTIVATION OF TOMATO CARRIED OUT IN OPEN FIELD WITH TREATMENT OF DICHLOROPROPENO + CLOROPICRINA									
ACTIVITIES	COST PER HECTARE - APPLICATION IN BEDS					PADDED OF CROPS	COST		TOTAL
	FUEL DIESEL	TRACTOR DRIVER	PEONS	HOSE GOTEQ	FUMIGANT M. BROMIDE		ENVIRONMENTAL		
FLOOR PREPARATION	\$ 245.00	\$ 180.00							\$ 425.00
LEVELLING	\$ 75.00	\$ 60.00							\$ 135.00
IRRIGATION	\$ 36.00	\$ 27.00							\$ 63.00
PLACEMENT OF ADDED AND HOSE GOTEQ	\$ 36.00	\$ 34.00	\$ 68.00	\$ 6,600.00	\$ 12,375.00	\$ 4,600.00			\$ 23,713.00
PERFORATION OF PLASTIC			\$ 360.00						\$ 360.00
REMOVAL PLASTIC	\$ 25.00	\$ 27.00	\$ 360.00						\$ 412.00
FORMATION OF BALE							\$ 90.00		\$ 90.00
EQUIPMENT AND MATERIAL							\$ 35.00		\$ 35.00
TRANSPORT							\$ 1,437.50		\$ 1,437.50
RECYCLING							\$ 2,012.50		\$ 2,012.50
TOTAL	\$ 417.00	\$ 328.00	\$ 788.00	\$ 6,600.00	\$ 12,375.00	\$ 4,600.00	\$ 3,575.00		\$ 28,683.00
									<b>DOLLARS. \$ 2,607.54</b>

7.4 CULTIVATION OF STRAWBERRY CARRIED OUT IN OPEN FIELD WITH TREATMENT OF METHYL BROMIDE									
ACTIVITIES	COST PER HECTARE - APPLICATION TOTAL							PADDED OF CROPS	TOTAL
	FUEL DIESEL	TRACTOR DRIVER	PEONS	PLASTIC FOR FUMIGANT	HOSE GOTEQ	FUMIGANT M. BROMIDE	COST ENVIRONMENTAL		
FLOOR PREPARATION	\$ 245.00	\$ 180.00							\$ 425.00
LEVELLING	\$ 75.00	\$ 60.00							\$ 135.00
IRRIGATION			\$ 360.00						\$ 360.00
PLACEMENT PLASTIC FOR BROMIDE	\$ 75.00	\$ 45.00	\$ 90.00	\$ 8,662.50		\$ 15,400.00			\$ 24,272.50
REMOVAL PLASTIC FOR BROMIDE	\$ 75.00	\$ 45.00	\$ 360.00						\$ 480.00
FORMATION OF BALE	\$ 50.00	\$ 35.00							\$ 85.00
PLACEMENT OF ADDED AND HOSE GOTEQ	\$ 75.00	\$ 45.00	\$ 480.00		\$ 6,600.00			\$ 4,600.00	\$ 11,800.00
PERFORATION OF PLASTIC			\$ 360.00						\$ 360.00
REMOVAL PLASTIC	\$ 75.00	\$ 45.00	\$ 360.00						
FORMATION OF BALE							\$ 180.00		\$ 180.00
EQUIPMENT AND MATERIAL							\$ 70.00		\$ 70.00
TRANSPORT							\$ 2,875.00		\$ 2,875.00
RECYCLING							\$ 4,025.00		\$ 4,025.00
TOTAL	\$ 670.00	\$ 455.00	\$ 2,010.00	\$ 8,662.50	\$ 6,600.00	\$ 15,400.00	\$ 7,150.00	\$ 4,600.00	\$ 45,067.50
									<b>DOLLARS. \$ 4,097.04</b>



7.5 CULTIVATION OF STRAWBERRY CARRIED OUT IN OPEN FIELD WITH TREATMENT OF DICLOROPROPENO + CLOROPICRINA									
ACTIVITIES	FUEL DIESEL	COST PER HECTARE - APPLICATION TOTAL					PADDED OF CROPS	COST ENVIRONMENTAL	TOTAL
		TRACTOR DRIVER	PEONS	PLASTIC FOR FUMIGANT	HOSE GOTEO	FUMIGANT C 35			
FLOOR PREPARATION	\$ 245.00	\$ 180.00							\$ 425.00
IRRIGATION			\$ 360.00						\$ 360.00
PLACE AND REMOVAL LINE OF IRRIGATION			\$ 480.00						\$ 480.00
LEVELLING	\$ 75.00	\$ 60.00							\$ 135.00
PLACEMENT PLASTIC FOR APPLICATION	\$ 75.00	\$ 45.00	\$ 480.00	\$ 8,662.50		\$ 12,375.00			\$ 21,637.50
REMOVAL PLASTIC	\$ 75.00	\$ 45.00	\$ 360.00						\$ 480.00
FORMATION OF BALE	\$ 50.00	\$ 35.00							\$ 85.00
PLACEMENT OF ADDED AND HOSE GOTEO	\$ 75.00	\$ 45.00	\$ 480.00		\$ 6,600.00		\$ 4,600.00		\$ 11,800.00
PERFORATION OF PLASTIC			\$ 360.00						\$ 360.00
REMOVAL PLASTIC	\$ 75.00	\$ 45.00	\$ 360.00					\$ 180.00	\$ 480.00
FORMATION OF BALE								\$ 70.00	\$ 70.00
EQUIPMENT AND MATERIAL								\$ 2,875.00	\$ 2,875.00
TRANSPORT								\$ 4,025.00	\$ 4,025.00
RECYCLING								\$ 7,150.00	\$ 43,392.50
TOTAL	\$ 670.00	\$ 455.00	\$ 2,880.00	\$ 8,662.50	\$ 6,600.00	\$ 12,375.00	\$ 4,600.00	\$	\$ 3,944.77

7.6 CULTIVATION OF MELON CARRIED OUT IN OPEN FIELD WITH TREATMENT OF METHYL BROMIDE									
ACTIVITIES	COST PER HECTARE - APPLICATION IN BEDS						PADDED OF CROPS	COST ENVIRONMENTAL	TOTAL
	FUEL DIESEL	TRACTOR DRIVER	PEONS	HOSE GOTEQ	FUMIGANT M. BROMIDE				
FLOOR PREPARATION	\$ 245.00	\$ 180.00							\$ 425.00
LEVELLING	\$ 75.00	\$ 60.00							\$ 135.00
FORMATION OF BEDS	\$ 36.00	\$ 27.00							\$ 63.00
PLACEMENT OF ADDED AND HOSE GOTEQ	\$ 36.00	\$ 34.00	\$ 68.00	\$ 6,600.00	\$ 8,800.00	\$ 4,600.00			\$ 20,138.00
PERFORATION OF PLASTIC			\$ 360.00						\$ 360.00
REMOVAL PLASTIC	\$ 25.00	\$ 27.00	\$ 360.00						\$ 412.00
FORMATION OF BALE							\$ 90.00	\$ 90.00	\$ 90.00
EQUIPMENT AND MATERIALS							\$ 35.00	\$ 35.00	\$ 35.00
TRANSPORT							\$ 1,437.50	\$ 1,437.50	\$ 1,437.50
RECYCLING							\$ 2,012.50	\$ 2,012.50	\$ 2,012.50
TOTAL	\$ 417.00	\$ 328.00	\$ 788.00	\$ 6,600.00	\$ 8,800.00	\$ 4,600.00	\$ 3,575.00	\$ 25,108.00	\$ 25,108.00
									<b>DOLLARS. \$ 2,282.54</b>

7.7. CULTIVATION OF MELON CARRIED OUT IN OPEN FIELD WITH TREATMENT OF DICHLOROPROPENO + CLOROPICRINA									
ACTIVITIES	COST PER HECTARE - APPLICATION IN BEDS				PADDED OF CROPS	COST		TOTAL	
	FUEL DIESEL	TRACTOR DRIVER	PEONS	HOSE GOTEQ	FUMIGANT C - 35	ENVIRONMENTAL			
FLOOR PREPARATION	\$ 245.00	\$ 180.00						\$ 425.00	
LEVELLING	\$ 75.00	\$ 60.00						\$ 135.00	
FORMATION OF BEDS	\$ 50.00	\$ 35.00						\$ 85.00	
PLACEMENT OF ADDED AND HOSE GOTEQ	\$ 75.00	\$ 45.00	\$ 90.00	\$ 6,600.00	\$ 12,375.00	\$ 4,600.00		\$ 23,785.00	
IRRIGATION			\$ 120.00					\$ 120.00	
PERFORATION OF PLASTIC			\$ 360.00					\$ 360.00	
REMOVAL OF PLASTIC	\$ 75.00	\$ 45.00	\$ 360.00					\$ 480.00	
FORMATION OF BALE							\$ 90.00	\$ 90.00	
EQUIPMENT AND MATERIALS							\$ 35.00	\$ 35.00	
TRANSPORT							\$ 1,437.50	\$ 1,437.50	
RECYCLING							\$ 2,012.50	\$ 2,012.50	
TOTAL	\$ 520.00	\$ 365.00	\$ 930.00	\$ 6,600.00	\$ 12,375.00	\$ 4,600.00	\$	\$ 28,965.00	
								<b>DOLLARS. \$ 2,633.18</b>	



7.8. CULTIVATION OF MELON CARRIED OUT IN OPEN FIELD WITH GRAFTING ON PUMPKIN									
ACTIVITIES	FUEL DIESEL	COST PER HECTARE					PADDED OF CROPS	COST ENVIRONMENTAL	TOTAL
		TRACTOR DRIVER	PEONS	HOSE GOTEO	SEDDS (MELON AND PUMPKIN)	10,000 PLANT GRAFTING			
FLOOR PREPARATION	\$ 245.00	\$ 180.00							\$ 425.00
LEVELLING	\$ 75.00	\$ 60.00							\$ 135.00
FORMATION OF BEDS	\$ 50.00	\$ 35.00							\$ 85.00
PLACEMENT OF ADDED AND HOSE GOTEO	\$ 75.00	\$ 45.00	\$ 90.00	\$ 6,600.00			\$ 4,600.00		\$ 11,410.00
IRRIGATION			\$ 120.00						\$ 120.00
PERFORATION OF PLASTIC			\$ 360.00						\$ 360.00
FORMATION OF PLANT					\$ 2,750.00	\$ 24,000.00			\$ 26,750.00
REMOVAL OF PLASTIC	\$ 75.00	\$ 45.00	\$ 360.00					\$ 90.00	\$ 480.00
FORMATION OF BALE								\$ 35.00	\$ 90.00
EQUIPMENT AND MATERIALS								\$ 1,437.50	\$ 35.00
TRANSPORT								\$ 2,012.50	\$ 1,437.50
RECYCLING								\$ 3,575.00	\$ 2,012.50
TOTAL	\$ 520.00	\$ 365.00	\$ 930.00	\$ 6,600.00	\$ 2,750.00	\$ 24,000.00	\$ 4,600.00	\$	\$ 43,340.00
DOLLARS. \$									3,940.00