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PHASE-OUT OF METHYL BROMIDE FOR SOIL FUMIGATION IN PROTECTED HORTICULTURE AND CUT FLOWER PRODUCTION IN TURKEY

Republic of Turkey

Ministry of Agriculture and Rural Affairs

Batı Akdeniz Agricultural Research Institute

(Formerly, Citrus and Greenhouse Crops Research Institute)

Project number: MP/TUR/01/214

Phase I, Final Report

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PHASE-OUT OF METHYL BROMIDE FOR SOIL FUMIGATION IN PROTECTED HORTICULTURE AND CUT FLOWER PRODUCTION IN TURKEY

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Republic of Turkey, Ministry of Agriculture and Rural Affairs
Bati Akdeniz Agricultural Research Institute (BATEM)
(Formerly, Citrus and Greenhouse Crops Research Institute, CGCRI)

Phase I, Final Report

ABSTRACT

MeBr will be phased-out in Turkey by the year of 2008. To achieve this goal, Government of Turkey established a MeBr reduction calendar. In this frame, a project supported by UNIDO called "Phase-Out Of Methyl Bromide For Soil Fumigation In Protected Horticulture And Cut Flower Production In Turkey" has been in force since the beginning of 2003

In 2003, first year of the project, the following activities have been completed. A MeBr phase out action plan for 2003 was prepared and applied. In the frame of this plan, project personnel were determined and trained. Vegetable and cut flower growers were also informed about alternative methods of MeBr via mass media and meeting. Specification of equipment required for project implementation were prepared and some of the equipment (computers) purchased. Some of the growers (3678 persons) were interviewed, registered and trained with face-to-face meetings. In both vegetable and cut flower sectors 30% of growers (1028) give up using MeBr. Use of MeBr ratio by growers was 82.2% in cut flowers sector, however, 4.1% in vegetable sector. The most important reason for slow decrease in MeBr use in cut flower sector was that acceptance of MeBr alternative methods was not very high because of difficulty in stem application and high cost for heating energy.

Among the alternative methods, solarization (28.4%) alone or solarization + other methods (86%) was the most popular methods for the farmers due to their application easiness and low cost.

The aim of this project is to eliminate the use of 292.2 ODP tons of MeBr in protected vegetable and cut flower production and introduce alternative methods to growers and minimize the economic losses in the absence of the MeBr. In 2003 (from February to December), the MeBr usage as a soil disinfectant was 163.7 ODP tons and this amount of MeBr is lower than the amount which indicated in time schedule to phase out of MeBr use in Turkey. This results show that the growers has been using less MeBr as a soil disinfectant than previous years, and prefer alternative methods.

Turkey strictly applied the MeBr phase out program in Phase I of the project and followed the reduction calendar in 2003.

INTRODUCTION

Methyl bromide (MeBr) is widely used for soil fumigation, commodity and quarantine in the world. Even though MeBr is very effective to disinfect plant pests, nematodes, soil-borne pathogens and seeds of weeds, it is going to be globally phased out by year 2015, because of its damaging effect on ozone layer. In 1987, more than 160 countries including Turkey, signed an international treaty, better known as the Montreal Protocol, to globally phase out the use of substances that contribute to the depletion of the ozone layer. In this agreement, Turkey was going to phase out ozone layer depleting substances (ODS) by 2015. However, considering the seriousness of the adverse effects of the depletion of the ozone layer human health and environment. Turkey decided to ban the usage of MeBr by 2008 instead of 2015.

After this agreement, Turkey started to carry out two demonstration projects to determine the effective and economic alternative methods for soil disinfestations instead of MeBr. One of the projects named "Alternatives to the Use of Methyl Bromide as Soil Fumigant in Protected Horticulture and Ornamental Crops" was implemented in the West Mediterranean Region between 1998-2000 by CGCRI and supported by UNIDO. The other project titled "Introduction of Methyl Bromide Alternatives in Strawberry, Pepper and Eggplant in Turkey" was conducted on strawberry in Aydın Province and on vegetables in the East Mediterranean Region between 1999 and 2002. The World Bank supported this project.

In these two successful demonstration projects, alternative methods; solarization + low doses chemicals, solarization + bio-fumigation, soilless culture, steam pasteurization and some cultural applications, to MeBr were determined. At the end of these projects, the adoption of some MeBr alternatives was found economically feasible. Alternative soil pest

management methods used commercially for horticultural crops in modern and traditional farms were well documented. During the demonstration projects, Turkish growers were introduced with the alternatives such as solarization in combination with IPM, 1,3-dichloropropene, basamid, soilless culture, steam and biofumigation. As a result of the success and out comes from the demonstration projects, a demand by Turkish Government for completely phasing out of MeBr from the agricultural production, except quarantine usage, was raised up. In this context, a new MeBr phase out project called "Phase-Out Of Methyl Bromide For Soil Fumigation In Protected Horticulture And Cut Flower Production In Turkey" has come into force in 2003 by the support of UNIDO. Based on the new alternatives and the adoption of the already existing ones, Turkey arranged a time schedule to phase out methyl bromide usage in agricultural sectors including vegetable and cut flower sub-sectors (Table 1). According to this schedule, annual imports will be averagely reduced by 20% every year by the end of 2008.

Table 1. Time Schedule to Phase out MeBr Use in Agricultural Sectors in Turkey

	Vegetable and Cut flower Sub-sectors			Total Methyl Bromide Consumption including Vegetable and Cut flower Sub-sectors*	
Year	Reduction	Consumption (ODP)	Consumption (Tons)	Consumption (ODP)	Consumption (Tons)
2000	0.0	292.2	487.6	342.6	571
2001	0.0	292.2	487.6	332.6	554.3
2002	29.3	263.6	439.3	293.4	489.0
2003	58.6	204.7	341.1	225.4	375.7
2004	58.6	146.1	243.5	167.4	279.0
2005	87.9	58.2	97.0	78.4	130.6
2006	58.6	00.0	00.0	20.4	34.0

MeBr consumption for quarantine, pre-shipment and laboratory use is not included

The objective of this project is to eliminate the use of 292.2 ODP tons of methyl bromide in vegetable and cut-flower sector by introducing new alternative methods without giving any or minimum to disturbance to farmers. So far, all obligations indicated in MeBr

phase out schedule were strictly implemented and will be continued to implement by the end of the project.

PROJECT PROGRESS

The MeBr phase out project of Turkey was successfully carried out in 2003 and will be continued by the year 2006. The MeBr phase out project has been implemented in these regions including following cities; Antalya, Mugla, Mersin, İzmir, Aydın, Adana and Isparta. A contact person has been designated in each city to provide easy and reliable connection and information exchange among the project personnel.

In Phase I of the project following activities were carried out:

Reorganization of Project Human Sources

The number of the technical personnel of the MeBr phase-out project was initially determined as 35. Then, the personnel number was increased to 67 due to necessities by additional agreement signed on 23 June 2003 among Dr. Suat Yılmaz, S. M. Si-Ahmed, and Dr Nihat Pakdil. Dr. Yılmaz was also appointed as project coordinator (Appendix 1). The project personnel were selected based on their knowledge, expertise ability to communicate effectively (Table 2).

Table 2. Personel Number According To Their Expert Field

Expert Field	Number
Plant pathologist	7
Nematologist	6
Entomologist	3
Plant Nutrition Scientist	4
Agronomist	15
Agro Economist	3
Greenhouse Construction Expert	1
Herbolog	1
Food Scientist	1
Chemical Expert	1
Extension staff	25
Total	**67**

As it is indicated in table 2, the project personnel were selected from different scientific disciplines in order to meet all possible grower demands. The project team contained IPM experts, plant pathologist, nematologist, plant nutrition experts etc.

Visits, Meetings and Trainings

A meeting was held on February 27, 2003 to introduce project personnel, increase communication and coordination among the participants in BATEM in Antalya. Second meeting was also held in Antalya in September 1-2, 2003 (Appendix 2). In this meeting, details of project personnel's job descriptions were defined and working groups were constituted. In the third meeting held in October 8, 2003, in BATEM, an action plan was prepared for field surveys and the project personnel working in Antalya region was trained. In this meeting, project coordinator gave information about progress of MeBr phase-out project. A comprehensive discussion took place among the participants on the developments of the MeBr phase-out project.

In the training section of this meeting (Appendix 3) following subjects (Table 3) were discussed and 38 personnel from Antalya and Isparta regions were trained. In meeting program, information about farmer interviews were discussed and an agricultural economist explained how to fill out the forms of interviews (Appendix 4).

Table 3. Subjects for Personnel Training In MeBr Phase out Project

Subjects	
Information on MeBr and phase-out project	
Information on soil-borne pathogens in vegetable growing areas	
Information on plant parasitic nematodes specifically *Meloidogyne* spp. in vegetable growing areas	
Alternative treatments against MeBr	Soilless culture
	Steam sterilization
	Soil solarization
	Soil solarization + biofumigation treatments
	Soil solarization + alternative chemical treatments
	Growing techniques for vegetables and ornamentals for IPM

Other than these meeting, two training meetings were organized in Adana and Mugla. In Adana meeting, 16 personnel from Adana and Mersin were trained in October 1, 2003 according to subjects as indicated in Table 3. Details of training program are shown in Appendix 5. 39 personnel from Mugla, Aydın and Izmır were trained in Mugla meeting (appendix 6), in October 6, 2003.

A technical study tour with participation of project coordinator and two farmers was done to SIS company in Sicily, Italy from 27 to 31 October 2003. In this study tour, MeBr, chloropicrin, telone and other application techniques were observed in the field. Chloropicrin + Telone combination was very effective to control soil-borne pathogens and nematodes, which could be better alternative to MeBr and applicable in Turkey too. Another good thing was that the machines developed by SIS Company for Chloropicrin + Telone application was very effective and could be very useful machine.

A meeting was held in "Ozone Department" of Ministry of Environment in October 24th, 2003 with the participation of technical personnel from BATEM, project policy coordinator from Protection and Control Directorate of Ministry of Agricultural and Rural Affairs, and department head from Ministry of Environment. In this meeting, necessity of keeping good relations between both Ministries was agreed. Strict control on MeBr imports to prevent illegal entrance was decided. It was agreed on that all related sides should obey all regulatory rules and helped MeBr Phase out project of Turkey and finished it on time.

Another meeting was held in November 13th, 2003 in Antalya with the participation of the representatives from Ministry of Agriculture, BATEM, Foundation of Turkish Technology Improvement, and cities in project. In this meeting, details of project action plan and financial programs were discussed.

Registration of Growers and Face-to- face Informatory Activities

In this project, methodologies of introducing MeBr alternatives through training of the farmers in face- to- face communication and using mass media have been utilized. In order to achieve this goal media activities (appendix 7) and farmer meetings (appendix 8) were organized.

The public relations team has organized periodical interviews and conferences on TV and Radio programs and will continue with similar activities such as; educational programs, radio talks and TV interviews.

To give more information about the MeBr phase-out project to producers and to the public, preparation of the leaflets were prepared on the following subjects:

-General information about solarization and methyl bromide, alternative applications to MeBr, nematods, soil-born pathogens, weeds, soil-less culture, steam pasteurization and bio-safety. Experts were assigned for leaflet design and other preparations.

Preparation of the brochures have also been started and experts assigned for the following subjects:

-IPM applications and their importance

-Protected vegetables, strawberry, ornamentals production

-Tobacco production

Total of 3678 growers (MeBr Phase out Project CD of Turkey) were visited and interviewed in 5 cities (Antalya, Mersin, Muğla, Isparta and İzmir) in 2003. Visit to growers will extensively be continued in 7 cities in 2004 and other years.

Growers were mainly visited by random sampling methods in all cities except İzmir. In this city growers using MeBr deliberately were visited. According to interview results, total number of 3678 growers from Antalya, Isparta, Mersin, Muğla and İzmir were 2456, 159, 330, 596 and 13, respectively (Table 4).

Interview results show that 6.7% were using MeBr in total 3678 growers. However, 4.1% of vegetable growers in 3554 and 82.2% of cut flowers growers in 124 were using MeBr in their greenhouse as soil fumigant. Even though the number of interviewed farmers has not been completed, the ratio of growers using MeBr in vegetable sector is 4.1%, which is parallel to our estimation (3-5%) given in Progress Report I. The ratio of MeBr using growers in all 5 cities Antalya, Isparta, Mersin, Muğla and İzmir were 7.2%, 1.2%, 9.4%, 0.8% and 76.4%, respectively. Vegetable production is done in all cities; however, cut flower production is mainly done in Antalya, Isparta and İzmir.

Table 4. Number of Growers Using MeBr in Vegetable and Cut-Flower Sectors in 5 Cities, in Turkey

CITIES	Number of Growers			Number of Growers Using MeBr			Ratios (%)		
	Vegetable (V1)	Cut Flower (CF1)	Total (T1)	Vegetable (V2)	Cut Flower (CF2)	Total (T2)	V2/V1	CF2/CF1	(T2)/(T1)
Antalya	2456	98	**2554**	103	82	**185**	4,19	83,67	**7,24**
Isparta	159	5	**164**	0	2	**2**	0,00	40,00	**1,22**
Mersin	330	0	**330**	31	0	**31**	9,39	-	**9,39**
Muğla	596	0	**596**	5	0	**5**	0,84	-	**0,83**
İzmir	13	21	**34**	8	18	**26**	61,54	85,71	**76,47**
Total	**3554**	**124**	**3678**	**147**	**102**	**249**	**4,14**	**82,26**	**6,77**

Vegetable and cut flower production areas and MeBr used areas were shown in Table 5. MeBr used areas in cut flower sector (1700 da) was more than areas in vegetable sector (728 da). MeBr was used in 15.8% of total vegetable and cut flower production areas (15318 da). Most of the MeBr used production areas was in Antalya (1893 da). It was followed by Mersin (261.5 da), İzmir (144 da) and Isparta (122 da). Since the MeBr is used in primarily in cut flower sector in Antalya, our focus will be on cut flower growers in Antalya and other cities in future.

Table 5. Distribution of MeBr Used Areas (da) According to Cities

CITIES	Growing Areas (da)			MeBr Used Growing Areas (da)			Ratios (%)		
	Vegetable (V1)	Cut Flower (CF1)	Total (T1)	Vegetable (V2)	Cut Flower (CF2)	Total (T2)	V2/V1	CF2/CF1	(T2)/(T1)
Antalya	9762,2	1814,2	**11576**	415,6	1477,6	**1893,2**	4,2	81,4	**16,3**
Isparta	114,5	251,0	**365,5**	0	122	**122**	0,0	48,6	**33,3**
Mersin	1985,3	0	**1985,4**	261,5	0	**261,5**	13,8	-	**13,1**
Muğla	1216,4	0	**1216,4**	7,7	0	**7,7**	0,6	-	**0,6**
İzmir	56,2	117,7	**173,9**	43,2	100,7	**143,9**	76,8	85,5	**82,7**
Total	**13134,7**	**2182,9**	**15318**	**728**	**1700,3**	**2428,4**	**5,5**	**77,8**	**15,8**

Table 6. Distribution of MeBr Used Areas (da) According to Crops

Crops	Antalya (da)	Isparta (da)	Mugla (da)	Izmir (da)	Mersin (da)	TOTAL (da)	Areas of Species / Total Areas (%)
Tomato	94,5	0	5,7	0	6	**106,2**	4,4
Pepper	41,5	0	0	0	100	**141,5**	5,8
Cucumber	257,2	0	0	0	39	**296,2**	12,2
Egg-Plant	21,4	0	0	0	0,5	**21,9**	0,9
Strawberry	1,0	0	2,0	43,2	116	**162,2**	6,7
Carnation	1154,3	122	0	90,7	0	**1367,5**	56,3
Gerbera	298,8	0	0	0	0	**308,8**	12,7
Solidago	4,0	0	0	0	0	**4,0**	0,2
Gypsophylla	8,6	0	0	0	0	**8,6**	0,3
Lisianthus	6,9	0	0	0	0	**6,9**	0,3
Rose	5,0	0	0	0	0	**5,0**	0,2
TOTAL	1893,2	122	7,7	143,9	261,5	**2428,4**	100

MeBr usage according to crops in 5 cities is shown in Table 6. More than half of MeBr (56.3%9) was used in carnation greenhouses (1367 da) in entire vegetables and cut

flowers greenhouses (2428 da). It was followed by gerbera (308 da), cucumber (296 da), strawberry (162 da), pepper (141 da) and tomato (106 da). MeBr is used in all vegetable and cut flower species in Antalya; however, in İzmir and Mersin in strawberry, and in Isparta in carnation.

In the frame of this project, face to face training of growers and increase in the price of MeBr resulted in a decrease in MeBr consumption in 2003. In this training programs MeBr alternatives were explained to growers in details. Usage of alternative methods to MeBr by growers was shown in Table 7. Vast majority of the growers (84% in 3426) were used solarization alone or in combination with other methods. Most of the growers (48.6%) preferred to use solarization + chemicals because of their effectiveness and application easiness. The least preferred method (0.4%) was the steam sterilization because of its application difficulties and high cost for heating energy.

Table 7. Use of Alternative Methods by Growers Instead of MeBr

Alternative Methods	Number of Growers	(%)
Solarization	972	28,4
Solarization+Biofumigation	243	7,1
Solarization+Chemicals	1668	48,7
Chemicals	201	5,9
Steam Sterilization	14	0,4
Others	297	8,7
Unanswered	31	0,9
Total	3426	100

So far, total of 3678 growers with 15318 da greenhouses was visited and registered. In these areas, total of 72 ODP tons of MeBr, one third of total MeBr consumption allowed to use for Turkey in 2003, was used. While 30% of growers (1028) had used MeBr in past, they gave up using MeBr in 2003. The most important reason for giving up MeBr usage was the dramatic increase in MeBr prices due to reducing MeBr import. Some of the growers (9.4%) stated that they gave up MeBr usage because of their harmful effect to environment and living organisms (Data shown in MeBr Phase out Project CD of Turkey).

Some interesting results were also obtained from this interview. 86% of growers interviewed in the project districts are older than, and 14% of them are younger than 30 years old (Data shown in MeBr Phase out Project CD of Turkey). Their education level in elementary, secondary school and University are 70%, 22% and 4%, respectively. 60% of

growers have more than ten years experience in their carriers. Most of the vegetable and cut flower production is done in plastic houses. Majority of growers (88%) have their own greenhouses however, some (4%) are tenants, and some (5%) sharecropper.

Another interesting result from this interview was that growers (76%) used MeBr to control all harmful organisms (nematodes, causal agents of diseases and seed of weeds) in soil. However, some growers (19.4%) used MeBr only for nematodes and some (1.6%) for only weed control. Other than soil fumigation small amount of MeBr was also used for fumigating manure and controlling weeds around green houses. Among the interviewed farmers, 38% of them expressed that MeBr was harmful to human health. 23.9% of them told that MeBr contaminated soil and killed microorganisms. The rate of the growers who knew MeBr's harmful effect to ozone layer was 5.9%. Apart from these, the rate of the growers hearing that MeBr usage will be phased out for soil fumigation was 38.6%.

Purchasing of Equipment

Existence of enough tools and equipment and their effective usage have crucial role on the success of project. As mentioned in project contract, establishing a computer center for data collection and evaluation was one of the important subjects, which was achieved at the end of 2003 by purchasing and distributing 68 computers. Technical specifications for educational equipment (color photocopy machine, projection machine, digital and video cameras) and analytical equipment (phase-contrast research microscope, binocular, microscope, laminar flow, sensitive balance), chemicals (1-3 dichloropropene, dazomet), biofumigation materials (caw and chicken manure) and plastic were prepared by the project personnel and sent to UNIDO for starting bidding process.

All other equipment specifications are ready on hand in project team and they will be sent to UNIDO when they are needed.

CONCLUSION

Phasing out 204.7 ODP tons of MeBr usage in vegetable and cut flower sub-sectors, as soil fumigant in Turkey will be the most important aim. So far, Turkey has tried to do best for the success of the project and will continue to phase out MeBr by the end of 2008 by gradually decreasing MeBr consumption every year (20% averagely). In 2003, 163.7 ODP tons of MeBr was imported. When 53.7 ODP tons of stock MeBr from last year added to this

number (163.7 ODP tons) it ends up 217.4 ODP tons of MeBr, which is less than 225.4 tons total MeBr consumption allowed to use in 2003 (Table 1). This goal was achieved in 2003.
Achieving MeBr consumption goals in 2003 indicated in time schedule to phase out MeBr use in soil fumigation to agricultural sectors (Table 1) in Turkey was results of applying two successful demonstration projects and starting a new MeBr phase out project. In these projects farmers and technical person was trained. The public attention was attracted on MeBr use and damaging effect of MeBr on ozone layer and environment using mass media. New MeBr alternatives were determined, and have been gradually introduced and accepted by the growers. Specifically using half doses of MeBr had strong effect on the reduction of MeBr use. Strict control and trace of MeBr use by Ministry of Agriculture had also significant effect on this reduction.

While applying the project, special concern will be shown to the farmers who are going to be affected by the phasing out of MeBr. Implementing MeBr alternatives in project areas may minimize possible economic losses of farmers. All project steps have been planned and were applied in the direction of this target.

Initial interview results provided very valuable information about project progress. Use of MeBr in vegetable sector was around 4.1%, which is as expected. However, use of MeBr in cut flower sector is still 82.2%. The most important reason for slow decrease in MeBr use in cut flower sector was that acceptance of MeBr alternative methods was not very high because of difficulty in steam application and high cost for heating energy. Solarization, Solarization + other methods could not be used in this sector due to inappropriateness of season. Some other effective and cheap methods need to be thought for this sector. Chloropicrin + telone application could be very good alternative for this sector. To transfer this technology to Turkey, some demonstration studies need to be done in the near future.
As expected, there was a dramatic reduction in MeBr use in vegetable sector. One reason for this was that limitation of MeBr imports by Ministry of Agriculture resulted in the shortage of MeBr in market. As a result of this, MeBr prices increased and growers could not afford to buy MeBr for soil fumigation in vegetable sector. Another reason was that alternatives introduced by our project personnel were accepted by vegetable growers. 30% of growers (1028) gave up using MeBr and started to use alternatives methods in this year. Among the alternative methods, solarization (28.4%) alone or solarization + other methods (86%) was the

most popular methods for the farmers due to their application easiness and low cost. Climatic conditions in project area are also very favorable to apply solarization. Therefore, solarization based methods will be the most attractive methods in the future for all vegetable growers.

In conclusion, the goals of the project were achieved and phase I of the project was successfully completed. Second phase of the project is intensively continuing in 2004.

APPENDIX 1

Additional Contract

Subject: Phase out of Methyl bromide in protected tomato, cucumber and carnation crops

A meeting among Dr. Suat YILMAZ, Director of Citrus and Greenhouse Crop Research Institute, in the presence of Dr. Adnan ÖZÇELİK and Mr Ahmet DEVİREN. With Mr. S. M. Si Ahmed Head of Methyl bromide unit-UNIDO took place in Antalya on 23 June 2003. A close consultation with the Ministry of Agriculture Directorate General for Plant Protection was ensured during the whole meeting.

After exchange of views and clarification provided on both sides it was agreed on the following.

Dr. Suat YILMAZ is appointed as project coordinator.

1. Training component :

- The personnel will be increased in order to properly address the needs of the protect.
- For the pupose of an adequate and complete data base it was agrred that a computer center will be established. To this effect fifty (50) office computers and 15 potable ones will be required.
- The training programme will include all Methyl bromide users in the soil fumigation thoughout the country (in this respect the strawberry and mushroom subsections will also be included).

The first progress report will be made available to UNIDO by December 2003.

The total budget for this component is US$800.000

2- Equipment component

The needs for equipment for the alternatives selected are as fallows

1	Analytical equipment	US$ 50.000
2	Chemicals and bio-fumigation material	US$ 150.000
3	Computer equipment	US$ 80.000
4	Dazomet equipment	US$ 180.000
5	Telone equipment	US$ 200.000
6	Soil thermometers	US$ 10.000
7	EC and pH meters	US$ 15.000
8	Fetilizer injection	US$ 100.000
9	Hard Plastic	US$ 120.000
10	İrrigation pipe	US$ 140.000
11	Filters	US$ 27.500
12	Fittings	US$ 110.000
13	Plastic for Solarization	US$ 250.000
14	Safety Kits	US$ 36.000
15	Steam Pasteurization equipment (Positive Pressure)	US$ 850.000
16	Educational Equipment	US$ 60.000
	TOTAL	US$ 2.378.500

In addition to that it was agreed that US$150.000 will be dedicated to workshops, national and international expertise and US$70.000 as contingency funds.

For-2003 (Phase I), the following equipment will be purchased.

1	Steam equipment	US$ 425.000
2	Computers	US$ 80.000
3	Dazomet equipment	US$ 50.000
4	1.3 F equipment	US$ 0.000
5	Soil Thermometers	US$ 2.500
6	EC and pH meters	US$ 4.500
7	Safety Kits	US$ 15.000
8	Fertilizer Injection	US$ 25.000
9	Chemicals and Bio-fumigation material	US$ 45.000
10	Analytical equipment	US$ 45.000
11	Educational equipment	US$ 40.000
	TOTAL	US$ 782.000

Signed

Dr. Suat YILMAZ
Director
Citrus and Greenhouse Crop
Research Institute
Project Coordinator

Signed

S. Signed M. Si Ahmed
Head
Methyl Bromide Unit
Montreal Protocol Branch
UNIDO

Signed

Dr. Nihat PAKDİL
General of Protection and Control Directorate
Ministry of Agriculture

APPENDIX 2

Responsibilities of the Project Personnel

Location : Citrus and Greenhouse Crops Research Institute-Antalya
Date : September 01-02, 2003

The meeting took place in Citrus and Greenhouse Crops Research Institute in 01-02-2003. A total of 46 personnel has been attended to the meeting from Citrus and Greenhouse Crops Research Institute, Protection and Control Center of Ministry of Agriculture, Agricultural Protection Research Institute of Adana, University of Adnan Menderes, Extension Services of Ministry of Agriculture of Antalya, Mersin, Mugla, Izmir and Isparta.

The meeting has been led by Dr.Hulusi Utebay and completed as the following program.

- The agenda has been presented by Dr. Suat Yılmaz and discussed thoroughly among the attendees.
- After the discussion and consultation, the responsibilities and duties of the personnel have been determined as below:

The responsibilities and duties of the project coordinator

- Management of the project, preparation of project program and action plan.
- Guide the project staff and determine their responsibilities, provide the essentials for the project and arrange the organization.
- Provide the project materials and distribute the materials in a suitable way.
- Prepare the intermediary (progress) and final reports.
- Provide the connection with Ministry of Agriculture, Protection and Control Center of Ministry of Agriculture, Ministry of Forest and Environment, Development and Technology Foundation of Turkey, Universities, Private Sector and UNIDO.

The responsibilities and duties of the administrator

- Cooperation among the project personnel and preparing the work program.
- Provide technique information and attend the press conferences.
- Help to prepare the project reports
- Provide the coordination among the technique personnel and organize the administrative matters
- Arrange of the workshops, meetings, etc.

- Evaluate the project data
- Keep the data records and up-date them
- Assist the coordinator

The responsibilities and duties of the Extension Experts

- Education of the project personnel
- Inform the press about the project and emphasize the importance of the project for human health and environment.
- Presentation in workshops and meetings
- Preparing brochure, periodic and books
- Information about the operating the equipment, tools and using the chemicals
- Assist the coordinator

The responsibilities and duties of the trainers

- Registration of the farmers
- Information about the operating the equipment, tools and use of chemicals
- Training of the farmers
- Arrangement of the demonstrations
- Explanation to local press officers after consulting with administrators
- Assist the coordinator

The responsibilities and duties of the extension staff

- Registration of farmers
- Offer the information to farmers by face to face
- Arrangement of the demonstrations
- Assist the coordinator

The project action plan has been discussed in the meeting and the project will be executed in a two separate region. Dr. Seral YUCEL was appointed as the responsible person of Region II. Dr. Yucel is a contact person who will gather and transfer all information, data and correspondence of Adana and Mersin.

Region I (Antalya, Muğla, Aydın, İzmir and Isparta)

Region II (Adana and Mersin)

In each city in the regions a person will be responsible as written below;

City	Person	Institute of the Person
Antalya	Bedrullah Erçin	Extension Services of MARA
Mugla	Türkay Öztürk	Extension Services of MARA
Aydin	Dr.Seher Benlioğlu	Ad. Men. Un. Agriculture Faculty
Izmir	Ömer Maden	Extension Services of MARA
Isparta	Yaşar Avcı	Extension Services of MARA
Adana	Nimet Avci	Extension Services of MARA
Mersin	Ayşe Sakarya	Extension Services of MARA

APPENDIX 3

MeBr Phase Out Project Training Program

Citrus and Greenhouse Crops Research Institute, ANTALYA

October 08, 2003

Subject	Trainer	Institution
General information about MeBr and phase-out project	Dr. Adnan ÖZÇELİK	Citrus and Greenhouse Crops Research Institute, Antalya
General information about soilless culture	Cevdet F. ÖZKAN	Citrus and Greenhouse Crops Research Institute, Antalya
General information about Soil-borne patogens in vegetable growing areas	Dr. Abdullah ÜNLÜ	Citrus and Greenhouse Crops Research Institute, Antalya
General information about Plant parasitic nematodes especially *Meloidogyne* spp. in vegetable growing areas	Zübeyir DEVRAN	Citrus and Greenhouse Crops Research Institute, Antalya
Soil Solarization and Steam sterilization treatments	Aytekin AKTAŞ	Citrus and Greenhouse Crops Research Institute, Antalya
Soil Solarization plus biofumigation treatments	Mehmet KEÇECİ	Citrus and Greenhouse Crops Research Institute, Antalya
Soil Solarization plus alternative chemical treatments	Ali ÖZTOP	Citrus and Greenhouse Crops Research Institute, Antalya
General information about questionnaire and its forms	Betül SAYIN	Citrus and Greenhouse Crops Research Institute, Antalya

APPENDIX 4

Date:...../...../.....
Form Number:
Name of the Reporter:

QUESTIONNAIRE FORM FOR THE USE OF METIL BROMIDE (MeBr) IN AGRICULTURAL PRODUCTION

Village:	Town:
City:	Farmer Name and Surname:

1-Age of farmer:

(1) 18-30 (2) 30-40 (3) 41-50 (4) 51-60 (5) 60+-

2- Education level of farmer

(1) Can not read-write (2) Can read-write (3) Elementary School (4) Middle school
(5) High school (6) Training collage (7) University

3- How long have you been in grenhouse sector?

(1) 0-5 (2) 6-10 (3) 11-20 (4) 21-30 (5) 31+-

	Greenhouse type (1) Glass (2) Plastic (*) (3) Low tunnel	**Greenhouse area** (da)	**Crop** (1) Tomato (2) Pepper (3) Cucumber (4) Eggplant (5) Squash (6) Melon (7) Strawberry (8) Carnation (9) Gerbera (10) Others	**Growing seasons** (1) Spring (2) Fall (3)Single crop	**Property type** (1) Owner (2) Leasing (3) Partnership
1					
2					
3					
4					
5					
6					

(*): High plastic tunnel included

4- Do you apply MeBr in agricultural production?

(1) Yes (2) No

IF YES, PLEASE GO TO QUESTION NINE

5- Did you apply MeBr before?

(1) Yes (2) No

6- Why don't you apply MeBr or why did you give up?

(1) Because it is expensive
(2) Harmfull for environment and health
(3) There are alternative methods
(4) All of them

7- Which pesticide or methods do you prefer as an alternative to MeBr?

(1) Solarization
(2) Solarization + biofumigation
(3) Solarization + chemicals
(4) Chemicals
(5) Steam sterilization
(6) Soiless culture
(7) Others

8- Did you have any sufficient result from alternative applications?

(1) Yes (2) No

9- How long have you been using MeBr?

MeBr Applied Product	**Area (da)**	**Aim of application** (1) Soilborne pathogens and nematodes (2) Control of weeds (3) Both	**Application dose** (1) 30 (2) 50 kg/da (3) 60 kg/da (4) 75 kg/da (5) 100 kg/da (6) Other	**Aplication periods** (1) Every year (2) Every 2 years (3) Having problem	Information source about applications of MeBr (1) Pesticide store (2) Agricultural organization (3) University (4) Neigboor or friends

10- Do you have any information about alternative methods and chemicals to MeBr applications?

(1) Yes (2) No

11- Do you have any information about the effect of MeBr to environment and human health?

(1) Harmfull for human health
(2) Soil contamination
(3) Kill the effective microorganisms in the soil
(4) Destroy ozone layer
(5) Leave residues on crops

(6) I have no idea.

12- Did you hear that MeBr applicatinos in Turkey will be phase-out?

(1) Yes (2) No

If yes, where did you hear that?

(1) Pesticide store (2) Agricultural organization personnel
(3) University (4) Neighbor or friends
(5) Media

APPENDIX 5

MeBr Phase Out Project Training Program

Plant Protection Institute, ADANA

October 01, 2003

Subject	Trainer	Institution
MeBr usage areas and usage problems General information on plant parasitic nematodes and root-knot nematodes (*Meloidogyne* spp.) in vegetable culture	Prof. Dr. Halil ELEKÇİOĞLU	University of Çukurova, Faculty of Agriculture, Department of Plant Protection, Adana
Soil Solarization plus alternative chemical treatments and Soil Solarization plus biofumigation treatments General information about soilborne plant pathogen in vegetable and strawberry	Dr. Seral YÜCEL	Plant Protection Institute, Adana
General information about soilless culture	Cevdet F. ÖZKAN	Citrus and Greenhouse Crops Research Institute, Antalya
Soil Solarization and Steam sterilization treatments	Aytekin AKTAŞ	Citrus and Greenhouse Crops Research Institute, Antalya

APPENDIX 6

MeBr Phase Out Project Training Program

Extension Service of Ministry of Agriculture, MUĞLA

October 06,2003

Subject	Trainer	Institution
General information about MeBr and phase-out project	Dr. Adnan ÖZÇELİK	Citrus and Greenhouse Crops Research Institute, Antalya
General information about soil less culture	Cevdet F. ÖZKAN	Citrus and Greenhouse Crops Research Institute, Antalya
General information about Soil-borne pathogens in vegetable growing areas	Münevver GÖÇMEN	Citrus and Greenhouse Crops Research Institute, Antalya
General information about Plant parasitic nematodes especially *Meloidogyne* spp. in vegetable growing areas	Zübeyir DEVRAN	Citrus and Greenhouse Crops Research Institute, Antalya
Soil Solarization and Steam sterilization treatments	Aytekin AKTAŞ	Citrus and Greenhouse Crops Research Institute, Antalya
Soil Solarization plus biofumigation treatments	Mehmet KEÇECİ	Citrus and Greenhouse Crops Research Institute, Antalya
Soil Solarization plus alternative chemical treatments	Dr. Abdullah ÜNLÜ	Citrus and Greenhouse Crops Research Institute, Antalya
Alternative treatments of MeBr in strawberry growing areas	Assoc. Prof. Dr. Seher BENLİOĞLU	University of Adnan Menderes, Faculty of Agriculture, Deparment of Plant Protection, Aydın

APPENDIX 7.

Media Activity (February 17- December 31)

Date	Type and place of Media	Subject	Personnel
March 26, 2003	Written and Visual Media Player	Effects of MeBr, its phase out calendar and alternative treatments	Ahmet DEVİREN
March 28, 2003	TRT-1 Radio (Live)	Effects of MeBr, its phase out calendar and alternative treatments	Ahmet DEVİREN
July 7, 2003	VIP TV (Antalya)	Effects of MeBr and project works	Ahmet DEVİREN
July 17, 2003	ART TV (Antalya, Live)	Effects of MeBr and project works	Ahmet DEVİREN

APPENDIX 8

Activities for Informing Growers and Society

Date	Meeting Place	Subject	Personnel	Number of participants
March 22, 2003	Growtech Agriculture Fair, Antalya	Effects of MeBr, its phase out calendar and alternative treatments	Dr. Adnan ÖZÇELİK	60
March 24, 2003	A meeting held by Trade Exchange for Chemical Retailers in Kumluca	MeBr and its alternatives	Dr. Adnan ÖZÇELİK	30
June 6, 2003	Kale	MeBr and its alternatives	Dr. Adnan ÖZÇELİK	250-300 growers
June 12, 2003	Kumluca	MeBr and its alternatives	Dr. Adnan ÖZÇELİK	80 growers
June 25,2003	Silifke/Mersin	Alternatives methods to MeBr in strawberry,	Dr.Seral YUCEL	40 growers
July 6, 2003	Aksu	MeBr and its alternatives	Ahmet DEVİREN	60 growers
July 11, 2003	Adanalioglu/ Mersin	Demonstration trial for growers	Adana Working Group	growers
October 8,2003,	Extention services of Min. Agriculture, Adana	Alternatives methods to MeBr in vegetable and strawberry,	Dr. Seral YUCEl,	26 extention