REPORT

REPORT ON
TRAINING OF TRAINERS
FOR
ALTERNATIVES
TO THE USE OF
METHYL BROMIDE
FOR SOIL FUMIGATION
IN
BRAZIL AND KENYA

REPORT ON
TRAINING OF TRAINERS
FOR
ALTERNATIVES
TO THE USE OF
METHYL BROMIDE
FOR SOIL FUMIGATION
IN
BRAZIL AND KENYA

Edited by
R. Labrada
and
L. Fornasari

Contacts:

Dr. Ricardo Labrada, Weed Officer
Plant Protection Service - Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla
00100 Rome, ITALY
Tel. +39-0657054079
Fax. +39-0657056347
E-mail: Ricardo.Labrada@FAO.org
Website: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/IPM/Weeds/Default.htm
Website: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/IPM/Web_Brom/Default.htm

Mr. Rajendra Shende, Chief
Energy and OzonAction Unit
Division of Technology, Industry and Economics
United Nations Environment Programme
Tour Mirabeau
39-43 quai André Citroen
75739 Paris Cedex 15, FRANCE
Tel. +33 1 44 37 1450
Fax. +33 1 44 37 1474
E-mail: ozonaction@unep.fr
Website: http://www.uneptie.org/ozonaction.html

This document is available on the FAO website at:
http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/agpp/IPM/Web_Brom/Default/htm and on the UNEP OzonAction website at: http://www.uneptie.org/ozonaction.html

CONTENTS

PREFACE

The phase out of Methyl Bromide (MeBr) is a priority for environment protection. This fumigant, widely used in agriculture, causes the destruction of the planet's protective layer of ozone in the stratosphere and harms also indirectly the environment and human health by increasing UVB radiation exposure and related health problems, including skin cancer, cataracts and suppression of the immune system.

Governments and international agencies have therefore decided to establish a programme for phasing out the use of MeBr, as agreed upon at the 1985 Vienna Convention and 1987 Montreal's Protocol. Since this fumigant is used in several high-income crops, the established phase out plan allows time to develop effective alternatives to replace MeBr. Also developing countries are keen to achieve MeBr phase out without delay, even before the deadline for Article 5 states.

The Integrated Pest Management (IPM) approach is the key to developing a comprehensive training programme for farmers on new alternatives. The basis of this approach is the training of extension workers and other agents who work closely with farmers. It should aim to make farmers aware of the need to discontinue the use of methyl bromide and to educate them in the application of newly developed alternatives.

Experience has shown that the majority of farmers are not persuaded to apply new innovative techniques following simple field demonstrations. This approach proved to be a waste of time and money in many areas where it is implemented. Therefore, the second step in the IPM approach should be the training of farmers by building on so-called "Farmer Field Schools" where farmers learn to apply, adapt and improve the new control technologies.

This report provides information on the Training of Trainers (TOT) conducted in Brazil and Kenya on alternatives to the use of this fumigant.

This training, which focuses on IPM principles, is in general based on three major steps:

- A preparatory workshop to identify already validated methyl bromide (MeBr) alternatives and major soil-borne pests
- The training of extension workers and other technical personnel on IPM and MeBr alternatives
- Farmer Field Schools

Agricultural researchers and extensionists could also use, as reference for TOT, the information contained in the Manual[1] and Global Report[2] in preparation by FAO (sponsored by UNEP).

These training activities, which are part of the Farmer Education and Training Programme[3] being carried out by FAO and sponsored by UNEP under the Montreal Protocol's Multilateral Fund, will also encourage the final validation of several promising alternatives to replace MeBr as soil fumigant. This will help developing countries to meet the MeBr phase-out requirements under the Montreal Protocol.

Ricardo Labrada FAO, Rome (I)
Luca Fornasari Montpellier (F)

---

(1) R. Braga, R. Labrada, L. Fornasari and N. Fratini. Manual for Training of Extension Workers and Farmers on Alternatives to Methyl Bromide for Soil Fumigation. FAO Plant Production and Protection Paper *(in press)*

(2) Labrada, R. and Fornasari, L. (Eds.) Global Report on Validated Alternatives to the Use of Methyl Bromide for Soil Fumigation. FAO Plant Production and Protection Paper (*in press*)

(3) Project Title: Farmer Training and Education Programmes for Methyl Bromide Alternatives in Latin America and Africa; Project Number IM / 2110-99-18 (EP/INT/903/UEP).

List of Acronyms

AL	State of Alagoas, Brazil
BA	State of Bahia, Brazil
CPACT	Agricultural Research Center for Temperate Climate of EMBRAPA
DTIE	Division of Technology, Industry and Economics of UNEP
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation)
EMATER	Empresa de Assistência Técnica e Extensão Rural
EPAGRI	Empresa de Pesquisa Agropecuária e Estenšao Rural de Santa Catarina S.A. (Brazil)
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
ICM	Integrated Crop Management
IGR	Increased Growth Response
INTA	Instituto Nacional de Tecnologia Agropecuaria (Argentina)
IPM	Integrated Pest Management
KFC	Kenyan Flower Council
LDPE	Low-Density Polyethylene (Film)
MBOTC	Methyl Bromide Technical Options Committee
MeBr	Methyl Bromide
MITC	Methyl Isothiocyanate
NPSSS	Negative Pressure Soil Steam Sterilization
PE	Polyethylene (Film)
TOT	Training of Trainers
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
VIF	Virtually Impermeable Film

BRAZIL

TRAINING OF TRAINERS IN THE STATES OF BAHIA AND ALAGOAS (BRAZIL) WITH THE PARTICIPATION OF ARGENTINA, CHILE AND COSTA RICA

1. Background

Methyl bromide (MeBr) is a soil fumigant largely used in Brazil for the control of soil-borne pests of vegetables and tobacco. It has been used for over thirty years and the consumption of this fumigant is particularly high in the southern part of the country for the cultivation of tobacco, where at present about 700 tons per year are used, involving over 150,000 families. For this reason, the national agricultural research agency EMBRAPA has started to work in the southern states of Brazil, such as Santa Catarina, Rio Grande do Sul and Parana, to replace methyl bromide with more environmentally-friendly practices. This project is conducted jointly with UNIDO. Although this programme is already achieving promising results in adapting new alternatives, there are other states in the country where there is a need to conduct similar activities, especially for training of traniners and farmers**.** This is the rationale for the present project conducted by FAO / UNEP for training of trainers on alternatives to methyl bromide. This fumigant is used in other states, such as Alagoas and Bahia, in northeastern Brazil. In that part of the country the consumption of MeBr is about 50 t / year, about 10,000 families using it for tobacco and horticultural crops.

At the small, or medium farming level, the most appropriate training method should be a participatory approach, where extension workers and farmers learn about new alternative methods to the use of MeBr and the principles and methods of Integrated Pest Management (IPM**).** Farmers normally do not accept top-down advice and for this reason a learning process would be the best option for them to understand the usefulness of new alternatives.

The application of IPM and the participatory approach enable farmers to adapt alternative methods to local needs and to understand the principles for an environmentally sound control of soil-borne pests. This process will include the development of training of trainers (TOT), or extension workers, on IPM and alternative methods for the control of soil-borne pests. Prior to this training, a national workshop was conducted to prepare the curriculum for TOT and farmers field school (FFS) and to identify already validated alternatives for the control of soil-borne pests in the country. This curriculum will served as guidance for training activities. After the TOT, farmers' field school activities will follow the same procedures used for TOT. Extension workers trained on IPM will be responsible for conducting FFSs.

Developing an IPM Programme
In order to develop a suitable programme of IPM, several steps are involved:

- Farmer involvement in the implementation and execution of the programme.
- Identification of appropriate strategies for the control of soil-borne pests, including new alternatives already validated in the country.
- Coordination of efforts among agricultural institutions and the private sector.

The process of IPM includes three steps:

a) A workshop to prepare the curriculum or the content of Training of Trainers (TOT) and Farmers Field Schools (FFS) with the participation of technical personnel (from government institutions and private sector) dealing with MeBr application.
b) Training of trainers (extension workers and plant protectionists) on IPM and MeBr alternatives.
c) Farmers Field Schools, where the producers will have the opportunity to devlop their own alternatives under the supervision of relevant extension worker and / or plan protectionist.

2. Preparatory Workshop

Main Objectives

1. To identify available alternatives to methyl bromide already validated in Brazil that can be implemented in the states of Alagoas, Bahia and other parts of Brazil.
2. To identify national institutions, farmers' associations and the private sector to participate in the process of methyl bromide phase-out in this region of the country**.**
3. To develop the curriculum of the training of trainers, which will serve as the guide for conducting the foreseen training of trainers.

Workshop Content

1. Up-to-date information on methyl bromide alternatives validated in Brazil.
2. Explanations of IPM and the participatory training approach, experiences in other countries, major crops treated with meBr (as a soil fumigant) and target pests.
3. Planning of training of trainers (TOT), including identification of participants, site, date and length of this activity.

Participants

- Representatives and technicians from the state agricultural body EBDA
- Two specialists from EMBRAPA from southern states of the country actively working on the methyl bromide programme
- Two technicians from private enterprise producing tobacco in the region

- A national specialist on IPM and participatory approach
- An FAO technical officer
- Representatives of regional/local agricultural and environmental organizations
- UNEP representative
- Representative from the National Ozone Unit in Brazil

Outputs

1. Curriculum for training of trainers and farmers' field schools.
2. Increased awareness among technicians and trainers about the need to phase out methyl bromide and available alternatives.

Conclusions and recommendations

1. The workshop on Methyl Bromide alternatives took place in Cruz das Almas, Brazil, from 29 May to 1 June 2000. Twenty technicians from Alagoas and Bahia states attended the workshop, plus one tobacco grower from Bahia.

2. The objective of the workshop was to prepare the content of the future training of trainers. Therefore, three resource persons from EMBRAPA participated in the workshop: one specialist on IPM[(1)] who acted as the leader of the workshop and two others specialised in MeBr alternatives. The FAO technical officer[(2)] in charge of the project also participated as well as a specialist from the Ozone office in Brasilia.

(1) Luiz A. Salles
Brazilian Agricultural Research Corporation
Agricultural Research Center for Temperate Climate (EMBRAPA - CPACT) - Pelotas, Brazil

(2) Ricardo Labrada
Plant Protection Service
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla - Rome 00100, Italy

3. The Workshop met the expectations of all participants. In this event, simple and sustainable alternatives for replacement of methyl bromide (MeBr) were discussed as well as the IPM approach to be adopted.

4. Several alternatives were presented and the participants had the opportunity to discuss the feasibility of each of them under local conditions. It was also noted that MeBr consumption in this region is only five percent of that of the whole Brazil. Its main use is in tobacco and in vegetables.

5. The IPM specialist and the FAO technical officer also presented the IPM approach consisting of Training of Trainers and Farmers Field Schools; the participants discussed this subject at length.

6. All matters debated will undoubtedly contribute to better technical work on MeBr replacement. The workshop also gave the participants the opportunity to better understand the damage caused to the ozone layer by the use of the fumigant.

7. The main proposals of the workshop were:

- To conduct a TOT in mid-August 2000 in Cruz das Almas with the participation of 10 technicians, five from Alagoas state and the other five from Bahia.
- This TOT will be carried out in two phases, each lasting three days. The second phase will take place a month later. This arrangement is due to the necessity to carry out a demonstration of the best alternative chosen by the technicians.
- The preferred alternative is soil solarization. High temperatures in this Brazilian region seem to be adequate for successful implementation of soil solarization.
- The technicians discussed at length the possibility of other alternatives, such as float trays and biofumigation using organic manure. They finally concluded that the first option is not economically feasible and that the second may be implemented in areas where manure is well available.
- The TOT will be carried out in tomato seedbeds.
- The programme of the TOT also includes the description of the main soil-borne pests and their behaviour.

Curriculum for the Training of Trainers (TOT)

Objective

The overall objective is to prepare technical personnel to be trainers on technological alternatives for replacement of methyl bromide.

Expected results

Trainees are prepared to be trainers of technical personnel and producers involved in the tobacco and horticulture production with emphasis on the alternatives for replacement of methyl bromide.

Operational strategies

- To identify and select trainees who will be the future trainers
- To characterize and describe the biology, behavior, population dynamic and life cycle of main insect pests, pathogens and nematodes (leaf feeders, suckers, leaf miners, soil pests, bacterial bligth, alternaria, sclerotia, cercosporiose, virus) in seedbeds and field conditions
- To test and validate the most important control methods against pests, diseases, nematodes and weeds in tobacco seedlings in nursery and field
- To promote tobacco integrated pest management (IPM) in nursery and field

Technological alternatives to be tested and validated in this training of trainer program

- Solarization of conventional seedbed
- Solarization with sun-heat collector
- Biofumigation
- Fumigation with metam sodium

Strategy

- To promote and increase basic and applied knowledge about the above alternatives
- To promote and install pilot units in farmers for demonstrative purposes
- To promote the validation of those above alternatives
- To promote field visits and debates about the ongoing program

Methodology

- To promote a two-module training of trainer courses (TOT) for 10 extension agents from Bahia and Alagoas states
- To introduce and internalize the methodology of "Farmer's field schools"
- To promote technology diffusion and transference of results for public and private sector involved in tobacco production

3. Training of Trainers

Executive summary

The Training of Trainers was organized by the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme Division of Technology Industry and Economics (UNEP - DTIE) *OzonAction* Programme, hosted by the Government of the state of Bahia-Brazil and coordinated by – Brazilian Agricultural Research Corporation – EMBRAPA – Tropical Agroindustry and Bahia's State Agricultural Development Corporation – EBDA, from 13-15 September 2000.

The TOT was attended by selected extension agents from the states of Bahia and Alagoas – Brazil and three foreign representatives from Argentina, Chile and Costa Rica involved in the use of soil treatment for horticulture crops.

The overall objective of the second phase was to enforce ten selected people from the two states involved in the first phase and three foreign participants from Chile,

Argentina and Costa Rica to contribute with additional knowledge on methyl bromide phase out, field tests and validation of alternatives such as soil solarization.

The TOT was opened by Dr. Hermínio Maia Rocha, President of Bahia's State Agricultural Development Corporation. He stressed the importance of this event to Bahia's economy and environment and that methyl bromide should be replaced by other technological alternatives which are environmentally friendly, economically viable and socially acceptable.

Last May a preparatory workshop on alternatives to MeBr was held in Cruz das Almas – Bahia. The workshop involved 25 technical people from Extension Service-EMATER-AL and Bahia's State Agricultural Development Corporation-EBDA, University of Bahia, EMBRAPA – National Manihot and Fruit Crop Research Center, Horticulture crops Production Association and Non Governmental Organizations. The overall objective was to prepare technical people involved in the horticulture crop extension services on technological alternatives for the replacement of methyl bromide.

Before starting the TOT an assessment test was conducted in order to know the level of knowledge of all subjects related to methyl bromide phase out as well as on alternative technologies for replacement.

The assessment test was composed by ten questions that were asked at the beginning of the preparatory workshop. At that time, the overall average of methyl bromide general knowledge was 3.6, i.e., less than four questions were properly answered by all participants.

The overall average of methyl bromide knowledge before starting the TOT was 8.1, i.e., more than eighty percent of all questions about methyl bromide problems were properly answered by all participants. This was a useful indication of the effectiveness of the preparatory workshop.

The workshop consisted in a series of presentations, followed by discussions about the problems related to the use of methyl bromide in the states of Bahia and Alagoas-Brazil and Chile, Argentina and Mexico, potential alternatives for replacement (soil solarization on conventional seedbed, biofumigation and fumigation with metam sodium), demonstration of alternatives, field trip, training strategies, installation of pilot units for methyl bromide replacement and successful approaches for methyl bromide phase out.

Background

The preparatory workshop held in Cruz das Almas – Bahia (May 29 to June 1, 2000) involved 25 technical people from the Extension Service EMATER-AL and Bahia's State Agricultural Development Corporation-EBDA, University of Bahia, EMBRAPA

– National Manihot and Fruit Crop Research Center, Horticulture crops Production Association and Non Governmental Organizations.

The overall objective was to prepare technical people involved in the horticulture crop extension services on technological alternatives for the replacement of methyl bromide.

The results and recomendations of the first phase were the election and posterior validation of appropriate alternatives for the replacement of methyl bromide in northeast Brazil such as Soil Solarization on Conventional Seedbed, Biofumigation and Fumigation with metam sodium.

Objective

The overall objective of the second phase was to enforce ten selected people from the two states involved in the first phase and three foreign participants from Chile, Argentina and Costa Rica to imput aditional knowledge on methy bromide phase out, field tests and validation of alternatives such as Soil Solarization, Biofumigation and Fumigation with metam sodium to replace methyl bromide.

Expected results

The TOT was planned to achieve the following results:

- greater awareness about methyl bromide environmental problems
- greater knowledge about methyl bromide policies at world level
- demonstration unit about technological alternatives to replace methyl bromide
- greater awareness about transference and diffusion of information about methyl bromide phase out
- Better information about methyl bromide alternatives that are already available

Methodology

Assessment test

Before starting the TOT an assessment test was applied in order to know the level of knowledge of all subjects related to methyl bromide phase out as well as on alternative technologies for its replacement.

The assessment test was composed by ten questions applied in the beginning of the preparatory workshop. At that time, the results showed that the overall average of methyl bromide general knowledge was 3.6, i.e., less than four questions were properly answered by each participant.

The results of the second assessment test showed that the overall average of methyl bromide knowledge before starting the TOT was 8.1, i.e., more than eighty percent of all questions about methyl bromide problems were adequately answered by each participant. This was a high indication of the effectiveness of the preparatory workshop.

Based on the good performance of the working group it was possible to establish a more accurate strategy plan for the three-day TOT.

The questions applied in the assessment test were as following:

1) What do you know about methyl bromide?
2) Do you consider methyl bromide a problem for the environment?
   Yes ( ) No ( )
   If yes, why?
3) What do you know about Montreal Protocol?
4) What is the amount of methyl bromide annually used in your state?
5) Is methyl bromide used in your state against ants or other insect pests?
6) What kind of pests (insect, disease, nematodes and weeds) are more important in horticulture crops in your state?
7) What kind of soil treatment is more used in your state for horticulture crops?
8) What is soil solarization?
9) What is biofumigation?
10) Have you ever applied metam sodium as a soil fumigant?

Lectures

Lectures to promote training of trainer courses (TOT) for 10 extension agents from Bahia and Alagoas – Brazil and three foreign participants, from Chile, Argentina and Costa Rica (Figure 01).

Separate lectures were given on each of the following topics to:

- introduce the methodology of Farmer Field Schools, with emphasis on the adoption of methyl bromide alternative technologies
- enforce knowledge of effects of methyl bromide on ozone layer, human health, agriculture, environment in general, wild life; Montreal Protocol; MIP with emphasis on methyl bromide alternative technologies
- promote technology diffusion and transference of results for public and private sectors involved in horticulture crop productions.
- introduce the general concept of IPM with emphasis on MB
- introduce alternatives for replacement of MB
- discuss bio-ecology and use of IPM concept for horticulture crop pests
- present the Montreal Protocol

Field trip

The purpose of the field trip was to set observations units in a producer area, for evaluation and validation of alternatives for replacement of methyl bromide (Figures 2-4).

The alternatives elected for evaluation and validation during the preparatory workshop were soil solarization (plastic coverage), bio-fumigation and fumigation with metam sodium. These three alternatives should allow the elimination of most soilborne diseases and weeds.

Two replicates for each alternative were installed (seedbed) with 12 meters long and 1,0m wide. The first step for each alternative consisted on the preparation of the nurseries

Soil Solarization is a process which requires more research and development on the type of film (plastic) used, the period of application, region, timing and type of soil, in order to adapt the process to Brazilian conditions. It is a method of soil disinfestation based on the use of solar energy mulching the soil manually, or mechanically, with a transparent plastic film and exposing it during the most intense solar radiation period.

In this demonstration unit a transparent plastic (0,25mm thick) was used to cover the soil. The treatment must be conducted for a period of 30 clear days. As the heat is dislocated by humidity, before covering the seedbed, the soil was irrigated until field capacity was reached. A thermometer was installed in the soil and observations were collected daily.

Seeding to the treated seedbed will take place after the thirty-day treating period.

Bio-fumigation consists in incorporating several soil amendments, such as organic matter, plus soil heater to enhance biological activities to suppress soilborne diseases and pest in general.

Bio-fumigation was accomplished by applying 7kg / m^2 of fresh cow manure. The manure was incorporated up to 20cm deep in the seedbed soil. After the distribution of manure, the seedbed was well irrigated and well covered with a black plastic film until the sowing date.

Fumigation with metam sodium is a method used in pre-planting with fungicide, nematicide and herbicide actions. It is a water soluble liquid, which after being applied in the soil, becomes a gas. After a certain period, the gas dissipates and the soil is ready for the planting.

The soil was revolved and wetted several times before applying metam sodium. The dosage used was based on a rate of 1,000 liters per hectare. Since the treated area was a nursery, metam sodium was applied with a watering pot shower and immediately covered with a black plastic.

Conclusions and recommendations

There is a need for national, or regional, support on methyl bromide replacement project; action plans of the project must be implemented by extension agents for each State in order to demonstrate validated alternatives;

Methodologies like Farmer Field Schools should be adapted and implemented, with emphasis on methyl bromide replacement technologies;

There is a need for UNEP to provide a program follow up (assistance) in the region by helping and supervising extension agents in the process of training small growers on methyl bromide replacement;

There is need for UNEP to enforce national agencies involved in the methyl bromide matters, in order to prepare and support future action plans;

The TOT fulfilled the requirements that were to prepare “training of trainers” on methyl bromide alternative technologies.

Figure 1. Participants attending TOT classes.

Fig. 2. Participants preparing nurseries

Fig. 3. General view of the pilot units covered with plastic film mulches

ANNEX 1. Programme of the TOT

Period:	13 to 15th September, 2000
Place:	Feira de Santana – BA – Brazil
Promotion:	UNEP/FAO
Coordination:	EMBARAPA – Tropical Agroindustry / EBDA
Participants:	Agronomists and technicians from private and public sectors involved in the production of crops which use methyl bromide as a soil fumigant

First day

8:00 – 8:30	Opening ceremony
8:30 – 9:00	Assessment test and Course Methodology Presentation
9:00 –10:00	Methyl bromide up to date
10:00 –10:15	Break
10:15 – 11:45	Up to date information on methyl bromide alternatives
11:45 – 12:15	Why to phase out methyl bromide
12:15 – 13:45	Lunch
13:45 – 14:30	Experiences in other countries
14:30 – 15:00	Video presentation and discussion
15:00 – 15:30	Montreal Protocol
15:30 – 16:15	Methyl bromide and MIP
16:15 – 16:30	Break
16:30 – 17:30	Target pests (insects, pathogens, weeds and nematodes)
17:30 – 18:00	General discussion on next day field trip

Second day

8:00 – 12:00	Field trip for installation of pilot units
12:00 – 14:00	Lunch
14:00 – 14:30	General discussion on field trip
14:30 – 16:15	General explanation on Integrated Pest Management Systems
16:15 – 17:15	"Farmer's field schools approach
17:15 – 18:00	Participatory training approach (round table)

Third day

8:00 – 8:30	General evaluation of previous day
8:30 – 9:30	Horticulture crop Insect Pest Management with emphasis on MB
9:30 – 10:00	Horticulture crop Disease Management with emphasis on MB
10:00 – 10:15	Break
10:15 – 10:30	Video presentation
10:30 – 11:30	Working group meeting
11:30 – 12:15	Working group presentation of proposals
12:15 – 14:00	Lunch
14:00 – 15:00	General Discussion and Review
15:00 – 16:00	Participant accomplishments for future actions

16:00 – 16:30 Discussion on third phase of TOT
16:30 – 17:00 Final conclusions and application of TOT evaluation

Distribution of material to the participants

Several UNEP materials about methyl bromide phase out
A set of materials and transparencies about IPM strategies with emphasis on MB replacement
A set of transparencies about horticulture pest management
A set of transparencies about horticulture disease management
A set of transparencies about methyl bromide replacement alternatives
A set of transparencies about “Farmer’s field schools
A set of transparencies about methyl bromide phase out
A set of transparencies about MB effect on human, agriculture and wild life

ANNEX 2. List of Participants

ARGENTINA

Cristina BIAGGI
INTA-EEA Famaillá (Agronomist)
Tucumãn - Argentina

BRAZIL

Claudio Luiz L. AZEVEDO
EBDA (Agronomist)
R. Sérgio Cardoso, 65
Conc. Jacuipe

Carlos A. M. BORGES
ADAB-FEIRA (Agronomist)
Casa da Agricultura - Feraiba / BA

Raimundo BRAGA
EMBRAPA-CNPAT (Agronomist)
(Coordinator & TOT trainer)
Av. Dr[a] Sara Mesquita, 2270
Pici 60511-110 Fortaleza / CE

Jorge Luis T. DOS SANTOS
EMATER-AL (Agronomist)
R. Antonio Oliveira Melo, 743
Arapiraca / AL

Humberto V. DOS SANTOS
EMATER-AL (Agronomist)
R. Ana Nery, 137
Eldorado - Arapiraca / AL

Maria Clarice FERRAZ
EBDA (Agronomist)
Av. Adhemarde Barros, 967
Ondina - Salvador / BA

Júlio Cézar MACEDO
EBDA (Agronomist)
Av. Dr. Raul Alves de Souza, 335
Sento Sé / BA

Yuri BITTENCOURT NEVES
ADAB (Student/Agronomy)
Casa da Agricoltura - Feira

Severino O. NUNES
EMATER-AL (Agronomist)
R. Gov. Luiz Cavalcante - Coite do Noia

José Mario C. OLIVEIRA
EBDA (Agronomist)
BA 504, km 25 (Faz. Porteiras)
Irará – BA

Renalvo ROSA
EMATER-AL (Agronomist)
R. Gov. Divaldo Suruguay,36
Girau do Ponciano / AL

Rommel G. VILELA
EMATER-AL (Agronomist)
Rod. al101 Norte
Jacarecica - Maceió / AL

CHILE

Roberto MIR
SAG (Agronomist)
Av. Buknes, 140 Piso 3
Santiago - Chile

COSTA RICA

Lilliana CHAVES
Consultant (Agronomist)

San Isidro, Apdo 07-8000
San José – Costa Rica

KENYA

TRAINING OF TRAINERS IN KENYA

1. Background

Kenya is one of the developing countries with high use of Methyl bromide (MeBr) as a soil fumigant. In Kenya MeBr is mainly used for the control of soil-borne pests in cut flowers and strawberry. The level of consumption of MeBr is relatively high in the country and work has been initiated to replace the fumigant by other control measures in the near future. In this context, the main work carried out by UNIDO consisted of demonstration on new feasible control alternatives. However, there is a need to reach the farmers using MeBr in order to train them in new alternatives.

At the small or medium farming level, the most appropriate training method is a participatory approach, where extension workers and farmers learn about new alternatives and the principles and methods of Integrated Pest Management (IPM**).** Farmers normally do not accept top-down advice and for this reason a learning process would be the best option for them to understand the usefulness of new alternatives.

Application of IPM and the participatory approach enable farmers to adapt new alternatives and to understand the principles for an environmentally sound control of soil-borne pests. This process will include the development of training of trainers (TOT) and Farmers Field Schools (FFS). TOT is a training activity for Extension Workers on IPM, where they will also be informed on new alternatives for the control of soil-borne pests. Prior to this training, a one - day national workshop will be conducted to prepare the curriculum for TOT and FFS, and to identify already validated alternatives for the control of soil-borne pests in the country. This curriculum will serve as guidance for training activities. Once TOT is completed, farmers' field school activities will follow the same procedures used for TOT. Extension workers trained on IPM will be responsible for conducting FFSs.

FFS will be carried out in a large plot, where farmers will attend it regularly. In this area they will work on their own in the development of adapted alternatives in strawberry. This first pilot activity will serve as a basis for future FFS in Kenya on the same subject.

Several factors are important to develop a successful IPM programme:

- Farmer involvement in the implementation and execution of the programme.
- Identification of appropriate strategies for the control of soil-borne pests, including new alternatives already validated in the country.
- Coordination of efforts among agricultural institutions and the private sector.

The process of IPM may include the following steps, which were followed in this project:

1. A workshop to prepare the curriculum of Training of Trainers (TOT) and Farmers Field Schools (FFS) with the participation of technical personnel (from government institutions and private sector) dealing with MeBr application;
2. Training of trainers (extension workers and plant protectionists) on IPM and MeBr alternatives; and
3. Farmers Field Schools, where the producers will have the opportunity to develop their own alternatives under the supervision of relevant extension worker and / or plan protectionist.

2. Preparatory Workshop

KARI, National Potato Research Centre, was be the national counterpart institution for the planned workshop and TOT.

Main Objectives

- To identify available alternatives to methyl bromide already validated in Kenya Brazil that can be implemented for the control of soil-borne pests in areas of cut flowers and strawberry.
- To identify national institutions and farmers' associations to participate in the process of methyl bromide phase-out in this region of the country**.**
- To develop the curriculum of the training of trainers and farmers' field schools, which will serve as the guide for conducting the foreseenTOT and FFS.

Workshop Content

- Up-to-date information on methyl bromide alternatives validated in Kenya. .
- Explanations of IPM and the participatory training approach, experiences in other countries, major crops treated with MeBr (as a soil fumigant) and target pests.
- Planning of training of trainers (TOT), including identification of participants, site, date and length of this activity.

Participants (max. 12)

- Representatives and technicians from KARI.
- Specialists from extension service in Kenya.
- Technicians from cooperative or enterprises applying meBr in farmers' areas.
- A national consultant on IPM and participatory approach
- Two FAO technical officers
- FAO international consultant on MeBr alternatives

- Representatives of regional / local agricultural and environmental organizations
- UNEP representative
- Representative from the National Ozone Unit in Kenya.
- Two participants from Uganda and one from Tanzania.

Outputs
- Curriculum for Training of Trainers and Farmer Field Schools.
- Increased awareness among technicians and trainers about the need to phase out methyl bromide and available alternatives.

3. Training of Trainers

Executive Summary

Kenya is a developing country with high use of Methyl bromide (MeBr) as a soil fumigant to control soil-borne pests in cut flowers and strawberry. The level of MeBr consumption is relatively high in the country and work has been initiated to replace the fumigant by other control measures in the near future. In this context, the main work carried out by UNIDO consisted of demonstration on new feasible control alternatives. However, the information has not reached the majority of medium and large-scale farmers, the main users.

In order to sensitize and train the MeBr users in new alternatives and so facilitate complete phase out of the chemical as a soil fumigant, appropriate training approach is needed. To this effect, FAO/UNEP in close collaboration with Kenya Agricultural Research Institute (KARI) organized and implemented a training of trainers'course (TOT) on MeBr phase out in Kenya on 27th November to 2nd December 2000.

Prior to the TOT course, a two-day national workshop was organized and conducted on 27th and 28th November 2000 to prepare the curriculum for the TOT and FFS, and to identify locally validated alternatives for the control of soil-borne pests in Kenya. The curriculum will serve as guidance for future training activities in the phase out of methyl bromide.

The workshop participants included FAO, UNEP, UNIDO, Kenya Ozone Secretariat, KARI, Ministry of Agriculture extension department, NGOs, cut flower and strawberry farmers and two senior officers from Uganda Ministry of Agriculture, Livestock and Fisheries.

The workshop identified the major soil borne pathogens in cut flowers and strawberries and locally validated alternatives to methyl bromide that can be used by large and medium scale growers. The outputs from the workshop were used in the TOT course to sensitize the trainees and also impart new technology and information on locally validated MeBr alternatives for the control of soil borne pests.

The TOT course on methyl bromide phase-out took place on 28th November to 2nd December 2000. 22 trainees participated in the course. The participants were mainly extension workers, plant protection research-farmer-linkage personnel in KARI and the two senior officers from Uganda Ministry of Agriculture, Livestock and Fisheries. The TOT participants discussed how to plan, organize and implement FFS for medium scale cut flower growers in Kenya.

Background

Kenya is one of the developing countries with high use of Methyl bromide (MeBr) as a soil fumigant. MeBr is mainly used for the control of soil-borne pests in cut flowers and strawberry. The level of consumption of MeBr is relatively high in the country and work has been initiated to replace the fumigant by other control measures in the near future. In this context, the main work carried out by UNIDO consisted of demonstration on new feasible control alternatives. However, there is a need to reach the medium and large scale farmers using MeBr in order to train them in new alternatives and so facilitate complete phase out of the chemical as a soil fumigant.

At the small or medium farming level, the most appropriate training method is a participatory approach, where extension workers and farmers are instructed in new alternatives, and are also educated in the principles and methods of integrated pest management (IPM). The target farmers will not accept top-down advice, and for this reason, a learning process would be the best option for them to understand the usefulness of the new alternatives.

Application of IPM and the participatory approach enable farmers to adapt new alternatives and to understand the principles for an ecology-based control of soil-borne pests. This process will include the development of training of trainers (TOT) and farmer field schools (FFS). TOT is a training activity for extension workers on IPM, where they will also be informed on new alternatives to methyl bromide for the control of soil-borne pests.

Prior to the TOT course, a two-day national workshop was organized and conducted to prepare the curriculum for the TOT and FFS, and to identify locally validated alternatives for the control of soil-borne pests in Kenya. This curriculum will serve as guidance for future training activities.

This first pilot activity will serve as a basis for future TOT and FFS in Kenya on the phase out of methyl bromide as a soil fumigant.

Organization
The training activity to facilitate the phase out of methyl bromide in Kenya as a soil fumigant was organized by FAO and UNEP and hosted by Kenya Agricultural Research Institute (KARI). KARI, National Potato Research Center, was the national counterpart institution for the preparatory workshop and TOT.

Participants for the workshop were drawn from KARI (national horticulture research department), FAO, UNEP, the Kenya Ozone Secretariat, UNIDO, Kenya Ministry of Agriculture extension department, Uganda Ministry of Agriculture, Livestock, and Fisheries, cut flower and strawberry farmer representatives, HCDA, local NGOs, and independent consultants (Annex 2).

The TOT drew participants from the ministry of agriculture extension services as well as independent extension agents involved in the cut flower and strawberry production. In addition, farmers and KARI research-farmer linkage personnel working with cut flower and strawberry growers including two participants from Uganda Ministry of Agriculture, Livestock, and Fisheries, participated in the TOT (Annex 3).

The preparatory workshop
This workshop took place on 27th and 28th November 2000 at KARI National Agricultural Research Laboratories, Kabete. The objectives of the workshop were:

- To identify available alternatives to methyl bromide already validated in Kenya that can be implemented for the control of soil-borne pests in areas of cut flowers and strawberry in Kenya and possibly Uganda.
- To identify national institutions and farmer associations to participate in the process of methyl bromide phase-out in Kenya and East Africa**.**
- To develop the curriculum of the training of trainers (TOT) and farmer field schools (FFS), which will serve as the guide for conducting future TOT and FFS.

Output of the preparatory workshop
To achieve the above objectives, the workshop made a critical review of the results of the UNIDO demonstration project on carnations at SULMAC Naivasha and information presented at the workshop by cut flower and strawberry growers. The results are summarized in Tables 1, 2 and 3.

Table 1. Major soil borne pests of cut flowers in Kenya

CROP	MAJOR SOILBORNE PEST
Carnations	• *Fusarium oxysporum* f *dianthi* and *F. roseum* f *cerealis* • *Rhizoctonia solani*
Roses	• Root knot nematodes • Crown gall (*Agrobacteria tumefaciens)*
Eustoma (Lisianthus)	• *Pythium* spp • *Rhizoctonia solani* • *Fusarium oxysporium*
Calla lilies	• *Pythium* spp • *Fusarium oxysporium* • *Rhizoctonia solani*
Statice	• Root rot and crown rot
Eryngium	• *Fusarium* wilt
Asters	• *Fusarium conglutinans* var *callistephi* • *Phytophthora cryptogen* • *Colesporium solidaginis* root rot
Aconitum	• *Verticilium* wilt
Molucella	• *Pythium* spp • *Rhizoctonia solani* • *Fusarium oxysporium* • *Cercospora*

Table 2. MeBr alternatives validated in Kenya for the control of major soil borne pests

- Use of clean planting material
- Chemical alternatives
  1. MITC generating pesticides. These include metam sodium and dazomet.
  2. Other pesticides e.g. fenamiphos
- Biofumigants
  The Mexican marigold, also known as *Tagetes*, was the only plant which has been used successfully in the control of root knot nematode in roses by a Kenyan farmer.
- Botanical pesticides
  Neem based products either e.c. and / or cake formulations have been used for the control of root knot nematodes by some farmers.
- Soilless culture, or hydroponics
  This has been used successfully in the production of greenhouse plants, particularly roses, calla lilies, *Anthurium* and a few other cut flowers. In such growing conditions, there has been effective control of all major soilborne pests.

  Farmers are using various materials including coconut husks, cocospeat, pumice and murram. All these substrates, except for cocospeat, which is imported from Asia, are available locally.
- A combination of MITC and *Trichoderma* formulations
  1. Metam sodium half dosage plus *Trichoderma*
  2. Dazomet half dosage plus *Trichoderma*

Table 3. Major soil borne pests of strawberries and validated methyl bromide alternatives, Limuru-Kiambu

PESTS	METHYL BROMIDE ALTERNATIVES
• Phytophthora crown rot (*Pyhtophthora spp)* • Verticillium wilt (*Verticillium dahliae)*	• Mulching film 20 micron • Metam sodium as soil drench before planting • Use of resistant varieties e.g. Chandria • Use raised beds and drip irrigation • Plant in non infected soils • Locate berry fields in well drained soils

There was also an increase in the general awareness about the hazards of methyl bromide and the need to phase it out, and available alternatives for soilborne pests, among the participants and the general public. This was partly due to good coverage by more than three of the local dailies and TV (Annex 2).

Uganda
The current use and status of the phase out of MeBr in Uganda were also discussed. In Uganda MeBr is not a registered agricultural chemical. However, it is used only in cut flower production. To date, there are 22 cut flower farms, all growing roses for the export market where MeBr is used to control nematodes, *Fusarium* and bacterial wilt as well as weeds, including sedges.

Training of trainers (TOT)
The TOT was held at Wida Highway Motel Limuru from 29th November to 2nd December 2000. Its main objectives were:

- To impart methods for regular assessment of soil-borne pests.
- To inform and discuss the available alternatives to MeBr already validated in Kenya (the output from the preparatory workshop discussed above) that can be implemented for soil-borne pest control in areas of cut flowers and strawberry.

Output of the Training of Trainers:

- 22 extension workers and plant personnel working with farmers were trained on IPM methods and locally validated MeBr alternatives.
- The participants discussed planning, organisation and implementation of FFS for medium scale cut flower growers in Kenya.

Planning FFS

1. Organise and execute a meeting with FPEAK to inform and discuss modalities to invite the owners of cut flower farms in target area
2. Invite the farm owners to a sensitisation meeting under the auspices of FPEAK
3. The trainer, FPEAK and farm owners hold a preliminary awareness meeting. At this first meeting, the group should be able to plan for the date of the 1st FFS, MeBr potential alternative options for inclusion in the FFS, the FFS site and the actual number of farmers who will participate in the FFS.
4. The trainer should invite the technical managers or farm owners for a follow-up meeting to further plan the FFS.
5. The Trainer must arrange a visit to the FFS site before the date of the 1st FFS

Organisation of FFS
This has to be done in collaboration with the FFS members bearing in mind that the Trainer is just a facilitator to the group.

1. Sensitise participants on MeBr problems and need to phase out
2. Sensitise participants on IPM
3. Identify soil borne pests
4. Discuss potential validated MeBr alternatives and select options for validation in the FFS
5. Plan for source of FFS inputs (labour, agro-chemicals, planting material), recording procedure and keeping
6. Organise election of group leadership
7. Set timetable for work schedule and frequency of FFS meetings

To remember when organising and implementing FFS

- Avoid too many unnecessary meetings with farmers
- Facilitators should have good knowledge about the problem in the area and be equipped with viable alternatives to offer to the farmers
- Plan for simple experiments (validation demonstration plots) that can be easily carried out by farmers.
- Avoid large farmer groups (12-15 is ideal for good learning)
- Active participation in the FFS by the trainer and farmers is essential on each FFS
- For validation, select a farm site with real problems (hot spots)

Evaluation

- Course quality and contents
  All the participants commended the course and indicated that it would be beneficial for other extension workers. This is because it was structured to create awareness and also impart new knowledge on the participants.

- Useful subjects/topics
  Various topics were mentioned and these are shown below:

TOPIC	PERCENT SCORE
IPM	21.6
Environmental effects of MeBr	21.6
Biofumigation	8.1
Hydroponics	8.1
Soil borne pathogens & MeBr alternatives	21.6
FFS	13.5
Field trips	5.4

- Suggestions for improvement
  Three subjects were suggested as shown below:

TOPIC	PERCENT SCORE
Organize for more specialized resource persons to cover special topics	9.1
Organize for more field trips and case studies to enhance learning	72.7
More group work	18.2

Fig. 1. Preparatory workshop on Methyl Bromide phase out (Nairobi)

Fig. 2. Visit to areas of strawberry production, TOT

Fig. 3. Visit to areas for production of ornamentals, TOT

Fig. 4. Strawberry production with mulching

Fig. 5. Soilless production of roses (Nairobi)

Fig. 6. Soilless production of roses (Nairobi)

ANNEX 1.

Programmes for Preparatory Workshop and Training of Trainers

A. Preparatory Workshop, NARL-Kabete

Monday, 27th November

8:30 - 9:00 Registration of participants
9:00 Dr. Jackson Kabira to invite Dr. R. Kiome to officially open the workshop
9:10 Dr. R. Kiome, Director KARI opens the workshop
9:20 Dr. David Okioga, Kenya Ozone unit representative
9:30 Ms Corinna Gilfillan, UNEP representative
9:40 Dr. Ricardo Labrada FAO representative, for giving the introduction of the objective of the workshop
10:00 Coffee Break

Session I: Chairperson-Dr. Grace Ohayo-Mitoko
10:30 Introduction of participants
11:00 Need for Methyl Bromide phase out: **Dr. David Okioga**, Kenya Ozone Secretariat
11:30 Principles of IPM and the need of this approach for MeBr phase out: **Dr Nyambo**.
11:50 Discussion
13:00 Lunch

Session II: Chairperson- Dr. R. Labrada
14:00 Main MeBr alternatives: **Dr. Mohamed Ammati**.
14:20 Major soil-borne pest problems in strawberry in Kenya: **Mr. Francis Wambugu**, KARI, National Horticulture Research Centre Thika
14:40 Major soil-borne pest problems in cut flowers in Kenya: **Mr. Jack Juma**
15:15 Coffee break
15:30 Discussion

Tuesday, 28th November

Session I: Chairperson- Dr. Jackson Kabira
8:30 Suitable Alternatives in process of validation in Kenya by UNIDO: **Jack Juma**
9:00 Alternatives for soil-borne pest control in strawberries in Kenya (1 farm)
9:30 Alternatives for soil-borne pest control in cut flowers in Kenya (2 farms)

10:00 KARI contribution to alternatives for soil-borne pest control in cut flowers on the Coast: **Mr. E. Kilonzo**, KARI Matuga
10:15 Coffee break
10:45 Discussion on the alternatives and analysis of their feasibility for use in Kenya: **Dr. M. Ammati.**
13:00 Lunch

Session II: Chairperson: Dr. Brigitte Nyambo
14:00 Discussion on the alternatives and analysis of their feasibility for use in Kenya continued: **Dr. M. Ammati**
15:30 Coffee break
16:00 Discussion of TOT & FFS programme in the phase out of methyl bromide in Kenya: **Dr. Ricardo Labrada**

B. Training of trainers in MeBr Alternatives (TOT)

Wednesday, 29th November
9:00 Introduction of participants
9:30 Need for MeBr phase out: **Dr. Grace Ohayo-Mitoko**
10:30 Coffee break
11:00 Discussion: major soil-borne pest problems in cut flowers and strawberry in Kenya: **Dr. M. Ammati.**
12:30 Lunch
13:30 IPM/FFS/TOT in the phase out of MeBr: **Dr Ricardo Labrada**
14:30 Summary of major soil borne pest problems and control options in cut flowers by area: **Dr M. Ammati**
16:00 Plenary
19:30 Dinner
20:00 Video show

Thursday, 30th November

8:00 Special issues / topics:
1. Soilless media: **Nyambo**
2. MITC: **Ammati**
3. Biofumigation: **Grace Mitoko**
4. Solarisation: **Labrada**

9:30 Summary of major soil borne pest problems and control options in strawberry: **Strawberry farmer**
10.30 Coffee break

11:00 How to plan, organise and implement a farmer field school for cut flower and strawberry farmers in Kenya: group work: **B. Nyambo**
12:00 Plenary: **B. Nyambo**
13:00 Lunch
14:00 Selection of options for soil borne control in cut flowers and strawberry: group work: **B. Nyambo**
15:30 Coffee break
17:00 Plenary: **B. Nyambo**
19:30 Dinner

Friday, 1st December

8:30 Visit to Sian Roses (flower farm): **Mary Anne Gachukia**
13:00 Lunch
14:00 Visit to Hatabor Rainbow Blooms Ltd (strawberry farm): **B. Nyambo & Mary Anne Gachukia**
19:30 Dinner
20:00 Video show

Saturday, 2nd December

8:30 Analysis of field visits and implications to the phase out of MeBr: **M. Ammati**
Summarising soil-pest problems in cut flowers and strawberry and possible control options: **M. Ammati**
10:00 Plenary: Summarising potentially feasible MeBr alternatives for Kenya and future FFS activities: **R. Labrada**
10:30 Coffee break
11:00 Summarising potentially feasible MeBr alternatives (cont...)
11:45 Conclusions and recommendations for future FFS in Kenya: **R. Labrada**
12:30 Presentation of certificate and closing: **Dr. J. Kabira**

ANNEX 2.

List of participants to the preparatory workshop

KARI

Ms. Mary Anne Gachukia
Research Officer (Flowers)
KARI, National Potato Research Centre
P. O. Box 338 Limuru

Dr. Jackson Kabira
Centre Director
KARI, National Potato Research Centre
P. O. Box 338 Limuru

Mr.Edwardo Kilonzo Joseph
Research Officer (Flowers)
KARI, Matuga Agricultural Research Centre
P. O. Box 4
MATUGA KWALE

Mr. Peter M. Kinyae
KARI, National Potato Research Centre
P. O. Box 338 Limuru

Dr. Romanus M. Kiome
Director, KARI
P. O. Box 57811, Nairobi

Mr. Charles Lung'aho
KARI, National Potato Research Centre
P. O. Box 338 Limuru

Dr. R. S. Malik
Horticulture Advisor
ADSP/USAID/KARI
P. O. Box 58137 Nairobi

Mr. Chris M. Ngatia
Research Officer (Post Harvest Grain Storage)
KARI-NARL
P. O. Box 14733
Nairobi

Ms. Nancy Ng'ng'a
KARI, National Potato Research Centre
P. O. Box 338 Limuru

Mrs. Mary Wabule
Assistant Director, Horticulture Division
KARI
P. O. Box 57811, Nairobi

Mr. Francis Wambugu
Research officer (Starwberry)
KARI National Horticulture Research Centre
P. O. box 220 Thika

National Ozone Unit

Dr. David M. Okioga
Coordinator, Kenya Ozone Office
Ministry of Environmental Conservation Secretariat
P. O. Box 67839, Nairobi

Other national participants

Mr. Andrew Byamugisha

Senior Agricultural Inspector
MAALF
P. O. Box 102 Entebbe
Uganda

Mr. Jack Juma
P. O. Box 6
SULMAC Post Office
Naivasha

Emily Kaiga
Nation TV & Radio
P. O. Box 49010 Nairobi

Mr. Gilbert Kibata
Head, Plant Protection
NARL
P. O. Box 14773, Nairobi

James Maganga
Nation TV & Radio
P. O. Box 49010 Nairobi

Martha Mdingi
East African Standard
P. O. Box Nairobi

Dr. Grace Ohayo-Mitoko
Health & Environmental Watch
P. O. Box 25287, Nairobi

Mr. John K. Muhuhu
Suera Flowers,
P. O. Box 2019 Nyahururu

Mr. Michael Ouma
The 'Topic' Magazine
P. O. Box 45837, Nairobi

Mary Nzioka
East African Standard
P. O. Box Nairobi

Participants from Uganda
Mr Andrew Byamugisha
SAI/Crop Protection
Ministry of Agriculture, Animal,
Industry & Fisheries, P. O. Box 102
Entebbe, Uganda

Mrs Daisy Eresu
SAI/Crop Protection
P. O. Box 102 Entebbe, Uganda

FAO
Dr. Augusta Abate
FAO Kenya

Dr. Mohammed Ammati
Resource person
Institut Agronomique et Veterinaire
Hassan II, BP 6202 Rabat-Institut
Morocco

Dr. Ricardo Labrada
FAO Plant Protection Services
Via delle Terme di Caracalla
00100 Rome Italy

Dr. Brigitte Nyambo
Consultant
Integrated Crop Management
Practitioner
P. O. Box 90 Village Market-Nairobi

UNEP
Ms Corinna Gilfillan
UNEP TIE OzoneAction Programme
Paris France

Mr. Michael Graber
UNEP Ozone Secretariat
P. O. Bo 30552 Gigiri, Nairobi

ANNEX 3.

List of participants to TOT

KENYA

Eduardo KILONZO
KARI Research-farmer linkage
KARI Matuga, P. O. Box 4, Matuga-Kwale

Justus WACHIRA
KARI Research-farmer linkage
KARI Njabini Potato Research sub Centre
P. O. box 185, South Kinang'op

Z. M. KINYUA
KARI research-farmer linkage
KARI-NARL
P. O. Box 14733, Nairobi

Stephen MURIA
Farmer-farmer linkage
Kinag'op Flower Growers Association
P. O. Box 55 South Kinang'op

Stanley WAGURA
Horticulture extension officer
Ministry of Agriculture,
P. o. Box 137 South Kinang'op

A. N. KOIMBORI
Horticulture extension officer
DCO Murang'a
P. O. Box 68 Murang'a

Alice NAKHUMICHA
KARI Research-farmer linkage
NHRC Thika,
P. O. Box 220 Thika

Nancy M. MUTHOKA
KARI Research-farmer linkage
NHRC Thika,
P. O. Box 220 Thika

Mary Mumbi NDUNG'U
Horticulture extension officer
Ministry of Agriculture
Kikuyu Extension Office

John Karanja KAHORO
Farmer-farmer linkage
P. O. Box 80,
Mukeu via Naivasha

Triza W. MUNGAI
Horticulture extension officer
Ministry of Agriculture
Kikuyu Extension Office
P. O. Box 63 KIKUYU

Francisi WAMBUGU
KARI Research-farmer linkage
(Strawberries)
NHRC Thika,
P. O. Box 220 Thika

William M. NGARUIVA
KARI Research-farmer Linkage
NPRC, P. O. Box 338 Limuru

J. M. NDUNG'U
Horticulture extension officer
Maragua District Horticultural Officer
P. O. Box 152 Kigumo
Mary Anne Gachukia

Mary Anne GACHUKIA

KARI Research-farmer linkage (Flowers)
NPRC, P. O. Box 338 Limuru

Peter KINYAE
KARI Research-farmer linkage (Socio economics)
NPRC, P. O. Box 338 Limuru

Peter RUKWARO
Farmer
Field manager, RainBow Hatabor, P. O. Bo 40470 Nairobi

Juma ODONGO
Horticulture extension officer
Divisional Agricultural Office, P. O. Box 72 Naromoru-Nyeri

Rose MUTISO
Horticulture extension officer
Ministry of Agriculture,
P. O. Box 199 Limuru

Corinna GILFILLAN
Resource person
UNEP-TIE

Mohammed AMMATI
Resource person
FAO/ITU Hassan II Morocco

Ricardo LABRADA
Resource person
FAO Plant Protection Service Rome

Brigitte NYAMBO
Resource person
Consultant, ICMP, Nairobi

Grace Ohayo MITOKO
Resource person
HEWA

Jack JUMA
Resource person
Consultant

Jackson KABIRA
Centre Director
KARI NPRC Tigoni

UGANDA

Andrew BYAMUGISHA
SAI/Crop Protection
Ministry of Agriculture, Animal, Industry & Fisheries
P. O. Box 102 Entebbe

Daisy ERESU
SAI / Crop Protection
Ministry of Agriculture, Animal, Industry & Fisheries
P. O. Box 102 Entebbe

APPENDIX 1.

About the FAO – Plant Production and Protection Division (AGP) & Plant Protection Service (AGPP)

The Food and Agriculture Organization of the United Nations was founded in 1945 with a mandate to raise levels of nutrition and standards of living, to improve agricultural productivity and to better the condition of rural populations.

Today, FAO is one of the largest specialized agencies in the United Nations system and the lead agency for agriculture, forestry, fisheries and rural development. An intergovernmental organization, FAO has 180 member countries plus one member organization, the European Community.

Since its inception, FAO has worked to alleviate poverty and hunger by promoting agricultural development, improved nutrition and the pursuit of food security - defined as the access of all people at all times to the food they need for an active and healthy life.

Food production has increased at an unprecedented rate since FAO was founded in 1945, outpacing the doubling of the world's population over the same period. Since the early 1960s, the proportion of hungry people in the developing world has been reduced from more than 50 percent to less than 20 percent. Despite these gains, however, more than 790 million people in the developing world - more than the total population of North America and Western Europe combined - still go hungry.

A specific priority of the Organization is encouraging sustainable agriculture and rural development, a long-term strategy for increasing food production and food security while conserving and managing natural resources. The aim is to meet the needs of both present and future generations by promoting development that does not degrade the environment and is technically appropriate, economically viable and socially acceptable.

FAO is composed of eight departments: Administration and Finance, Agriculture, Economic and Social, Fisheries, Forestry, General Affairs and Information, Sustainable Development and Technical Cooperation.

Plant Production and Protection Division

The Plant Production and Protection Division **(**AGP), one of the six Divisions of the Department of Agriculture, addresses the development of sustainable agricultural systems to improve crop and grassland productivity, to create conditions for enhanced food security and general eonomic development and to conserve the environment through the development of agriculture's biological resources.

AGP's activities include the provision of regional and global fora for common action among countries and programmes on the conservation of plant genetic resources for food and agriculture (PGRFA), crop improvement and seed production development, and environmentally sound management of pests including Integrated Pest Management (IPM).

Major outputs cover seed security, a rolling Global Plan of Action for the conservation and sustainable use of PGRFA, biosecurity in relation to the spread of plant pests and weeds including International Standards for Phytosanitary measures, reduction of risks of pesticide use to the human health and the environment and ecological approaches to achieve sustainable intensification of crop and grassland production and diversification opportunities.

The AGP Division includes:

1. The Office of the Director (AGPD);

2. The Crop and Grassland Service (AGPC), which provides technical advice to FAO Members on increasing sustainable crop and grassland production through plant improvement, application of plant biotechnology techniques, development of integrated production systems and rational grassland management.

3. The Plant Protection Service (AGPP), which promotes effective plant protection, safe to human health and the environment, so as to avoid or reduce crop losses caused by plant pests, during growth, in transit and in storage. It aims at reducing emergency situations caused by transboundary pests; and

4. The Seed and Plant Genetic Resources Service (AGPS), which provides technical advice to FAO Members on seed programmes and policies, including seed and planting material improvement, production and processing, storage, testing, quality control and certification, and seed security. It assists and advises on effective conservation and sustainable utilization of plant genetic resources for food and agriculture (PGRFA) and promotes the implementation of the Global Plan of Action on PGRFA by all stakeholders.

Plant Protection Service

The Plant Protection Service (AGPP) of FAO addresses international aspects of plant protection and closely cooperates with regional and national plant protection organizations and programmes. The programme addresses plant quarantine in the Secretariat to the International Plant Protection Convention, setting standards, exchanging information and fostering cooperation. Concerning pesticide management, the programme promotes the implementation of the International Code of Conduct on the Distribution and Use of Pesticides; it implements with UNEP the PIC procedure on banned and severely restricted pesticides and, with WHO, makes recommendations for maximum residue levels.

On Pest Management, the Service supports the establishment of Integrated Pest Management Programmes. including the application of Biological Control and weed management.

The Plant Protection programme provides regular updates on the desert locust situation through the Desert Locust Information Service. A forum for countries to discuss and take action on locust management is provided through the Desert Locust Control Committee and several Sub-regional Commissions. The programme also technically supports and coordinates migratory pest control operations, where so required.

Through the EMPRES programme, the Service assists in early warning, early reaction and research on pests of a transboundary nature. Initial emphasis is on migratory pests, in particular the strengthening and support of the Desert Locust Management System. A cooperative programme has been developed in the Central Region and is being extended to West Africa.

Plant Protection Officers in the regions provide regional, sub-regional and national dimensions to the Programme.

Plant Protection posts exist in the Regional Offices in Africa (Ghana), Asia and the Pacific (Thailand), Latin America (Chile), and the Near East (Cairo), and in the sub-regional office in Tunis, Barbados and Western Samoa. A Locust Officer is posted in Algeria.

The Integrated Pest Management (IPM) programme identifies problems and implements rational plant protection strategies that are economically viable and take into account human health and the environment. This programme deals with the implementation of IPM projects from institutional to farmer level.

FAO's experience has shown that:

- IPM is about people: to succeed it has to be a farmer driven process;
- IPM increases the sustainability of farming systems. It improves ecological sustainability, as it relies primarily on environmentally-benign processes including the use of pest resistant varieties, the actions of natural enemies and cultural control. It improves social stability because it is institutionalized at the level of the farming community and local government. Finally, IPM programmes are economically sustainable as they reduce farmers' dependence on procured inputs.
- IPM addresses far more than purely pest management. It offers an entry point to improve the farming system as a whole.
- The farmers' field school concept can be used to address other farming situations and extension problems.

Ozone Depleting Substances and Methyl Bromide

FAO is not an implementing agency of the Montreal Protocol, but since 1998 it started some work on methyl bromide phase out, conducting joint activities with UNEP on alternatives to the use of Methyl Bromide in agriculture.

The major goal of the work that FAO is carrying out with UNEP is to conduct a comprehensive training on methyl bromide alternatives, which also focuses on the use of IPM principles.

This training is in general based on three major steps:

- A preparatory workshop to identify already validated methyl bromide (MeBr) alternatives and major soil-borne pests
- The training of extension workers and other technical personnel on IPM and MeBr alternatives
- Farmers' Field Schools

FAO / UNEP activities also include the preparation of manuals and reports on methyl bromide alternatives.

For more information about the Plant Protection Service services please contact:

N. A. Van der Graaff
Chief, Plant Protection Service
Plant Production and Protection Division
FAO
Viale delle Terme di Caracalla
00100 Rome, Italy
E-mail: Niek.VanDerGraaff@fao.org
Tel. +39-0657053441
Fax. +39-0657056347
Internet: www.fao.org

APPENDIX 2.

About the UNEP Division of Technology, Industry and Economics

The mission of the UNEP Division of Technology, Industry and Economics is to help decision-makers in government, local authorities, and industry develop and adopt policies and practices that:

- are cleaner and safer;
- make efficient use of natural resources;
- ensure adequate management of chemicals;
- incorporate environmental costs;
- reduce pollution and risks for humans and the environment.

The UNEP Division of Technology, Industry and Economics (UNEP DTIE), with its head office in Paris, is composed of one centre and four units:

- The International Environmental Technology Centre (Osaka), which promotes the adoption and use of environmentally sound technologies with a focus on the environmental management of cities and freshwater basins, in developing countries and countries in transition.

- Production and Consumption (Paris), which fosters the development of cleaner and safer production and consumption patterns that lead to increased efficiency in the use of natural resources and reductions in pollution.

- Chemicals (Geneva), which promotes sustainable development by catalysing global actions and building national capacities for the sound management of chemicals and the improvement of chemical safety world-wide, with a priority on Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC, jointly with FAO).

- Energy and OzonAction (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition, and promotes good management practices and use of energy, with a focus on atmospheric impacts. The UNEP/RISØ Collaborating Centre on Energy and Environment supports the work of the Unit.

- Economics and Trade (Geneva), which promotes the use and application of assessment and incentive tools for environmental policy and helps improve the understanding of linkages between trade and environment and the role of financial institutions in promoting sustainable development.

UNEP DTIE activities focus on raising awareness, improving the transfer of information, building capacity, fostering technology cooperation, partnerships and transfer, improving understanding of environmental impacts of trade issues, promoting integration of environmental considerations into economic policies, and catalysing global chemical safety.

UNEP DTIE OzonAction Programme

Nations around the world are taking concrete actions to reduce and eliminate production and consumption of CFCs, halons, carbon tetrachloride, methyl chloroform, methyl bromide and HCFCs. When released into the atmosphere these substances damage the stratospheric ozone layer — a shield that protects life on Earth from the dangerous effects of solar ultraviolet radiation. Nearly every country in the world — currently 172 countries -- has committed itself under the Montreal Protocol to phase out the use and production of ODS. Recognizing that developing countries require special technical and financial assistance in order to meet their commitments under the Montreal Protocol, the Parties established the Multilateral Fund and requested UNEP, along with UNDP, UNIDO and the World Bank, to provide the necessary support. In addition, UNEP supports ozone protection activities in Countries with Economies in Transition (CEITs) as an implementing agency of the Global Environment Facility (GEF).

Since 1991, the UNEP DTIE OzonAction Programme has strengthened the capacity of governments (particularly National Ozone Units or "NOUs") and industry in developing countries to make informed decisions about technology choices and to develop the policies required to implement the Montreal Protocol. By delivering the following services to developing countries, tailored to their individual needs, the OzonAction Programme has helped promote cost-effective phase-out activities at the national and regional levels:

Information Exchange
Provides information tools and services to encourage and enable decision makers to make informed decisions on policies and investments required to phase out ODS. Since 1991, the Programme has developed and disseminated to NOUs over 100 individual publications, videos, and databases that include public awareness materials, a quarterly newsletter, a web site, sector-specific technical publications for identifying and selecting alternative technologies and guidelines to help governments establish policies and regulations.

Training
Builds the capacity of policy makers, customs officials and local industry to implement national ODS phase-out activities. The Programme promotes the involvement of local experts from industry and academia in training workshops and brings together local stakeholders with experts from the global ozone protection community. UNEP conducts training at the regional level and also supports national training activities (including providing training manuals and other materials).

Networking
Provides a regular forum for officers in NOUs to meet to exchange experiences, develop skills, and share knowledge and ideas with counterparts from both developing and developed countries. Networking helps ensure that NOUs have the information, skills and contacts required for managing national ODS phase-out activities successfully. UNEP currently operates 8 regional/sub-regional Networks involving 109 developing and 8 developed countries, which have resulted in member countries taking early steps to implement the Montreal Protocol.

Refrigerant Management Plans (RMPs)
Provide countries with an integrated, cost-effective strategy for ODS phase-out in the refrigeration and air conditioning sectors. RMPs have to assist developing countries (especially those that consume low volumes of ODS) to overcome the numerous obstacles to phase out ODS in the critical refrigeration sector. UNEP DTIE is currently providing specific expertise, information and guidance to support the development of RMPs in 60 countries.

Country Programmes and Institutional Strengthening
Support the development and implementation of national ODS phase-out strategies especially for low-volume ODS-consuming countries. The Programme is currently assisting 90 countries to develop their Country Programmes and 76 countries to implement their Institutional-Strengthening projects.

For more information about these services please contact:

Mr. Rajendra Shende, Chief, Energy and OzonAction Unit
UNEP Division of Technology, Industry and Economics
OzonAction Programme
39-43, quai André Citroën
75739 Paris Cedex 15 France
Email: ozonaction@unep.fr
Tel: +33 1 44 37 14 50
Fax: +33 1 44 37 14 74
www.uneptie.org/ozonaction.html