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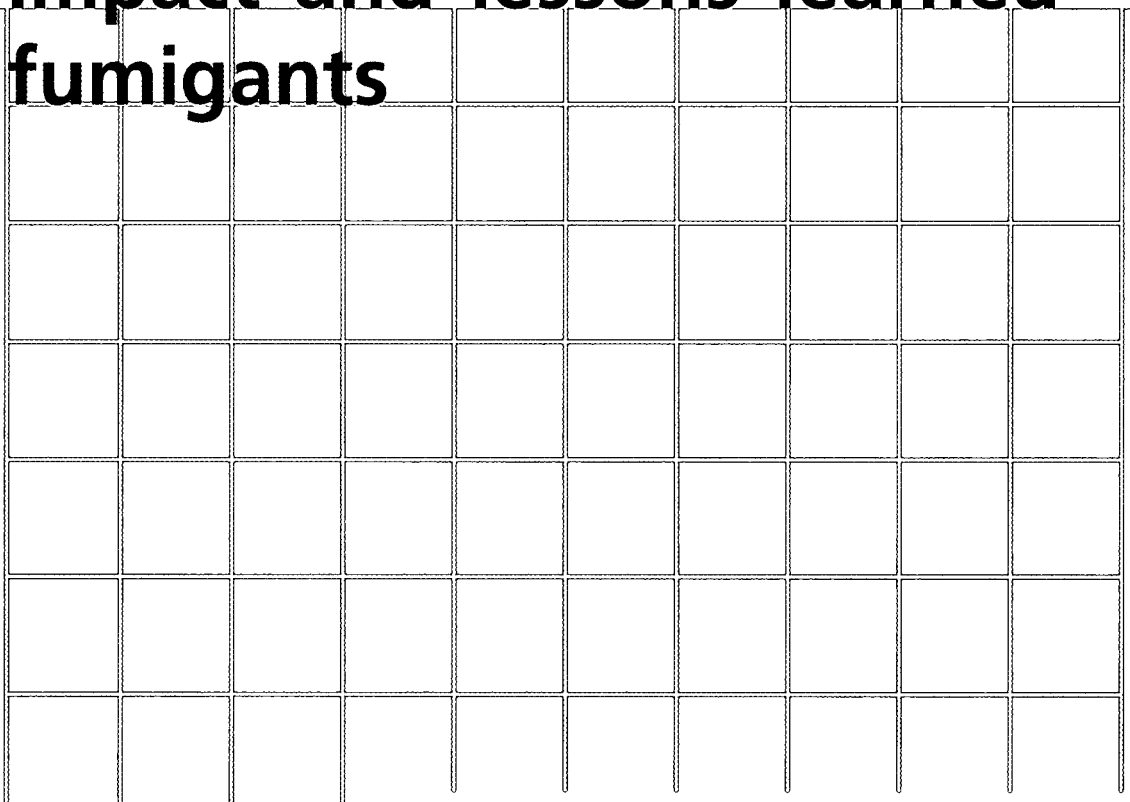
Ozone-friendly industrial development

Impact and lessons learned—fumigants



UNIDO in the Montreal Protocol—
technology transfer to developing countries

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

economy environment employment

Ozone-friendly Industrial development

UNIDO in the Montreal Protocol - technology transfer to developing countries

Impact and lessons learned—
Fumigants

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All tons are metric and all dollars are U.S. dollars.

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About this series

This booklet is one of a series of six designed for specialists interested in the effectiveness and efficiency of UNIDO's sectoral programmes for phasing out the use of ozone depleting substances (ODSs) by industry and agriculture. Covering refrigeration and alternative technologies for domestic appliances, refrigerant management plans, plastics foams, solvents (including process agents and aerosols) and fumigants, they focus on the complex interventions required to replace technologies, equipment and operating procedures in the main ODS-consuming sectors. Each sector calls for a different set of technical, economic and (in some cases) social solutions. Case study presentations show that the common benefit of adopting of ozone-friendly technologies is the opportunity to improve productivity, product design and quality and to move into new markets. The series documents not only the implementation of cost-effective projects, but also the many indirect benefits of UNIDO's work—such as technology transfer, employment generation, support for SMEs and institutional capacity building.

The series places UNIDO's efforts as an implementing agency for the Multilateral Fund (MLF) of the Montreal Protocol in the context of UNIDO's mission to support developing countries and countries in transition in their pursuit of sustainable industrial development. UNIDO interprets such development as the accomplishment of three things: (i) protecting the environment—with industry complying with environmental norms, efficiently utilizing non-renewable resources and conserving renewable resources; (ii) encouraging a competitive economy—with industry producing for export as well as domestic markets; and (iii) creating productive employment—with industry promoting long-term employment and increased prosperity.

Glossary

CFC	chlorofluorocarbon
ICF	ICF Consulting,Washington D.C.
INISAV	Instituto de Investigaciones de Sanidad Vegetal
MBTOC	Methyl Bromide Technical Options Committee
MLF	Multilateral Fund of the Montreal Protocol
ODS	ozone-depleting substance
ODP	ozone-depleting potential
UNEP	United Nations Environment Programme
USDA	United States Department of Agriculture
UV	ultraviolet

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FOREWORD

The year 2002 has seen a milestone in UNIDO"s contribution to preserving the stratospheric umbrella that protects life on earth from the sun's radiation - the ozone layer. Eleven years ago in October, the Organization became an implementing agency to the Montreal Protocol. It accepted, thereby, the challenge of helping cut back the use of ozone depleting substances (ODSs) that threaten the future of all life forms on our planet.

In that short interval since UNIDO became an implementing agency for the Montreal Protocol's Multilateral Fund, the Organization successfully eliminated an annual consumption of more than 24,500 tons of industrial chemicals that would otherwise have torn an even larger hole in the protective ozone shield. The allocation of 25 per cent of the Multilateral Fund's resources to UNIDO, increasing, as of 2003, thanks to the strong portfolio of projects, is unequivocal recognition of the Organization's track record in tackling the industrial challenges of today's world.

Working closely with the Fund's Secretariat and the United Nations Environment Programme, UNIDO applies its expertise in industry to transferring technology and know-how so that ODS consumption and its ozone depleting potential are reduced. Their impact has far exceeded the limited staff resources available within the Organization. A major success factor has been the establishment of an organizational branch dedicated to Montreal Protocol activities, which I created when transforming UNIDO in 1998.

Since then, UNIDO's role in combating ozone depletion has gone from strength to strength. But it has also taken on a new dimension, namely to help developing countries to benefit from globalization through increased trade. By enabling their industries to comply with environmental export requirements, UNIDO has opened up new markets for their industrial goods thus encouraging the growth of selected manufacturing sectors. The cooperation between UNIDO, the Multilateral Fund, other international agencies, donors and ODS technology recipients in pursuing the goals of the Montreal Protocol, demonstrates that collective multilateral efforts can indeed have a substantial impact on threats - environmental, economic and others - that face mankind.

Meanwhile the task of eliminating ODSs from industry is far from finished. To meet the challenges ahead, UNIDO is expanding its support for Montreal Protocol activities. In addition to individual projects to transfer ozone-friendly technologies, UNIDO will help developing countries plan their own phase-out programmes for ODSs. This summary booklet and its accompanying technical reports are an insight into one of the key value-added services that UNIDO offers its clients. They are also an industrial blueprint for protecting the ozone layer in the twenty-first century.

Carlos Magariños
Director-General

Fumigants

Methyl bromide is one of the world's top five most widely used pesticides. A rapid and effective pesticide gas (fumigant), it kills a wide range of pests in four primary use areas: soil fumigation, post harvest protection, and quarantine treatments. However, like CFCs and halons, methyl bromide is classified under the Montreal Protocol as a chemical that contributes to depletion of the earth's ozone layer. Studies show that it will be less expensive to eliminate methyl bromide and find alternatives than to finance the medical costs associated with the increase in skin cancer cases caused by increased exposure to ultraviolet (UV) rays. Increased UV radiation will also damage and destroy crops, and cause major weather changes.

The Montreal Protocol has signatures from over 120 countries banning methyl bromide. In industrialized countries, manufacture and importation of methyl bromide is being phased out as follows: 25 per cent reduction in 1999, 25 per cent in 2001, 20 per cent in 2003, and complete phase-out in 2005. In developing countries, consumption will be frozen in 2002 at 1995-98 average levels. They must complete a 20 per cent reduction in 2005 and phase out methyl bromide completely by 2015. Exemptions for both industrialized and developing countries include quarantine, critical uses and certain pre-shipment uses.

Early reductions in the use of methyl bromide will produce rapid improvements in the ozone layer, shortening the peak period of ozone depletion. This is because, unlike CFCs, methyl bromide inflicts its damage on the ozone layer rapidly. And, because of the synergistic reactions that occur between bromine and chlorine, early action on methyl bromide will also lessen the impact of other ozone-depleting substances already in the atmosphere.

Methyl bromide

The majority of methyl bromide is manufactured and used in industrialized countries, with developing countries consuming about 20 per cent of global production. Consumption is mainly for:

1. *Soil fumigation* —to control soil pests prior to planting high-value crops such as vegetables, fruits, tobacco, flowers and nursery plants. This is the major use of methyl bromide (67 per cent in 2002 according to the Methyl Bromide Technical Options Committee (MBTOC) 2002).
2. *Post harvest protection* — to control pests in stored grains and other dried products (24 per cent).
3. *Quarantine and pre-shipment treatments* —to control quarantine and storage pests in agricultural import/export commodities (9 per cent).

Methyl bromide is quick and effective at killing pests precisely because it is a toxic gas. However, if accidents occur, it can cause permanent injury to users—even death in extreme cases. Due to concerns about safety, water pollution and food residues, some governments have severely restricted its use.

Table 1 **Methyl bromide usage for soil fumigation (by country, 1996)**

Country	Methyl bromide consumption tons
United States	15,839
Japan	6,345
Italy	6,000
Israel	2,800
Spain	2,670
France	1,428
Brazil	1,260
Turkey	950
Mexico	900
Zimbabwe	765
Morocco	480
Other	8,461
Total pre-plant usage	**47,897**

Sources :•UNEP (1995); ICF (1997).

Available conversion technologies

There is no known single alternative fumigant, chemical or other technology that readily substitutes for methyl bromide in efficacy, low cost, ease of use, wide availability, worker- and environmental safety. On the contrary, research by the U.S. Department of Agriculture (USDA) indicates that, because specific crops have widely varying requirements, and because of variations in target pests, soil types and climate, multiple alternative control measures will be required to replace it. For pre-plant uses, measures include combinations of fungicides, herbicides, insecticides and other fumigants rather than non-chemical alternatives, including cultural changes in cropping systems, resistant crops, and biological control. For quarantine and export applications effective replacements include irradiation, heat, cold, and controlled atmosphere treatments.

In general, development and adoption of alternatives to methyl bromide requires four steps:

1. *Research* to identify, discover, develop, and evaluate technologies for their efficacy and cost-effectiveness. This is primarily a responsibility of state and university research organizations, although the private sector can play an important role in conducting and supporting such research.

2. *Registration and labelling.* Regulatory agencies are responsible for approving the registration of alternative chemical and biological control technologies in accordance with established authorities and protocols. The registrant is usually a corporate entity that owns or licenses a technology, funds it, and takes the risk in registering it.

3. *Commercialization and marketing.* Private-sector owners or registrants of new technologies must manufacture the product in large quantities and distribute and market it in order to make it available to growers and other users.

4. *Grower and user adoption.* These depend heavily on the technology's availability (marketing), efficacy, and cost-effectiveness. The potential, and ultimately the actual, market demand for an alternative technology by growers and other users is what drives steps 2 and 3.

Soil fumigation altematives

Chemical alternatives

Chemical alternatives include substances that are known not to affect the ozone layer, and have a similar activity to methyl bromide, e.g:

- **Dazomet** (dimethylformocarbothialdine) — a solid pre-plant fumigant material that produces methyl isothiocyanate gas in contact with moist soil. Dazomet controls or suppresses weeds, nematodes and symphylids, as well as a variety of soil-borne diseases caused by fungi such as *Fusarium spp* and such bacteria as *Agrobacteruum tumefaciens* and *Pseudomonas solanacearum.*
- **Metam Sodium** (methyldithiocarbamate) — a liquid pre-plant fumigant that in contact with the soil produces methyl isothiocyanate. Metam Sodium controls or suppresses weeds, nematodes and symphylids, as well as a variety of soil-borne diseases caused by fungi.
- **1,3-Dichloropropene** (1,3-dichloropropylene) + **Chloropicrin** (trichloronitromethane) —pre-plant soil fumigants that can be used together to combine the nematocidal properties of 1,3-D with the fungicidal properties of Chloropicrin. Known as Telone, it is a category I toxic chemical—as toxic as methyl bromide but not an ozone depletor. 1,3-D + Chloropicrin controls or suppresses nematodes, symphylids and wireworms. Its efficacy is not always confirmed for controlling soil-borne diseases caused by fungi, and it does not control weeds. Considering the dangers, its use must be kept under strict control.
- **Low-dose chemicals** in combination with an integrated pest management (IPM) programme and/or biofumigation and/or solarization. The application of an integrated pest management programme greatly reduces the doses and quantities of pesticides applied. The pesticide mix has to be adjusted according to the crop ecology and climate of the area. In particular, the use of fumigant nematocidal in

combination with biofumigation and/or solarization has been demonstrated to be very effective.

Non-chemical alternatives

- **Soil solarization** traps solar energy by covering the soil with a clear polyethylene or polyvinyl chloride UV-stabilized plastic sheet. It is used to control certain weed species, insects, mites, nematodes and a variety of soil-borne diseases caused by fungi.
- **Bio-fumigation** is the suppression of soil-borne pests and pathogens by combining the direct effect of toxic substances released in soil during organic matter decomposition, and long-term increase of soil temperature. Soil bio-fumigation controls certain weed species, nematodes and a variety of soil-borne diseases caused by fungi.
- **Grafting** is effective for soil-borne disease control and is particularly useful in crops for which no commercially acceptable resistant material is available. Grafting can be used to protect crops against vascular diseases caused by *Fusarium* spp. and *Verticillium* spp, nematodes like *Meloidogyne* spp, and viruses such as Melon Necrotic Spot Virus (MNSV) transmitted by a soil fungus *Olpidium bornovanus.*
- **Soil-less media** are used in nurseries, glasshouses and seedbeds. Sterilized synthetic or natural soil substitutes provide reliable support to prevent infestation by bacteria, fungi, nematodes and weeds. Organic media and some inert media are easily sterilized with steam and re-utilized.
- **Steam sterilization** (pasteurization) is more efficient and easier in terms of economic feasibility when raised or confined beds are used for production. Steam sterilizing the soil is costly but can be comparable to methyl bromide. It is probably the best option in the cut flower and strawberry sectors, because, combined with an IPM programme, it gives the best alternative pest control for a broad target spectrum.
- **Soil-less cultivation using floating trays** has been adopted with excellent results in the tobacco sector. It is obtained by sowing pelletized seeds in a tray with 200 or more cells. The tray (previously filled with substrate and sown) is left floating on a 5-10 cm deep solution of water and fertilizers. The pool is covered with a plastic micro tunnel or a greenhouse until the moment of transplanting. The advantages are:
    - No competition from weeds or plants that had emerged earlier.
    - Better root development, due to the ideal proportion of air and nutrients on the substrate.
    - Strong, healthy roots mean healthy and uniform plants.
    - Easier and more efficient transplanting: farmers do not spend time in sorting the better young plants from the rest, which greatly shortens the procedure of transplanting.
    - Better rate of acceptance in open fields: all the advantages mentioned above result in excellent acceptance in the open fields without any post-transplant plant stress.

Due to excellent results in terms of plant quality and cost, tobacco producers around the world have adopted soil-less floating tray cultivation, permitting fast phase-out of methyl bromide in the tobacco sector. Cuba has already phased out 100 per cent of methyl bromide used for tobacco seeds bed sterilization.

- **Biological control** using agents such as *Trichoderma harzianum* to control the growth of fungi and nematodes. The technique also prevents acute pathologies by avoiding a biological vacuum. However, biological control must be applied in combination with other techniques. Wide-scale application of the technology is still to come.

UNIDO in the methyl bromide sector

In many Article 5 countries, demonstration projects have to be mounted in order to select the most suitable alternatives—taking into account climatic conditions, crops and the mode of operation. Conducted by local experts (with some guidance from international experts) and with the involvement of farmers, research institutes and government authorities, they are a significant first step in the transfer of know-how—introducing the farmers themselves to practical demonstrations of the applicability of various alternatives. UNIDO has been the driving force in gaining funding for them, explaining to the MLF Executive Committee that it was the only way to convince farmers from Article 5 countries to switch to non ODS technologies. In addition, based on data collected in the field, UNIDO significantly assisted the Executive Committee in establishing guidelines for the methyl bromide sector. As a result, the majority of Article 5 countries have now agreed to a total phase-out of methyl bromide—well ahead of the official schedule (2015).

UNIDO contributes by bringing together all stakeholders, opening the door for gradual but advanced phase-out of methyl bromide in Article 5 countries, in fifteen of which its phase-out projects have been approved. In 2003 the Organization will submit additional projects for three countries and prepare national phase-out plans for China and Mexico—the largest consumers of methyl bromide among Article 5 countries.

Between 1997 and 2002 demonstration projects were conducted in 22 countries (see table 2). Table 3 shows the alternative technologies subsequently selected in the five main agricultural sectors in 15 of them. They will phase out a total of 1,144.7 ODP tons of methyl bromide (table 4) at a funding cost of $16.8 million. The total funding for UNIDO fumigant projects, including the demonstration projects (table 5), amounts to $24.7 million.

Table 2 Crops and funding for UNIDO demonstration projects in 22 countries

Country	Funding ($ millions)	Crops tested			
Argentina	0.462	Horticultural	Strawberry	Flowers	
Botswana	0.146	Horticultural			
Brazil	0.365	Tobacco			
Cameroon	0.160	Tobacco			
China	0.429	Horticultural	Strawberry	Tobacco	Ginseng
Columbia	0.123	Banana			
Croatia	0.260	Horticultural	Tobacco		
Dominican Republic	0.324	Tobacco	Flowers		
Guatemala	0.382	Horticultural	Strawberry	Flowers	
Indonesia	0.332	Commodity			
Jordan	0.385	Horticultural	Strawberry		
Kenya	0.329	Horticultural	Flowers		
The FYR of Macedonia	0.259	Horticultural	Tobacco		
Mexico	0.790	Horticultural	Strawberry	Tobacco	
Morocco	0.479	Horticultural	Strawberry		
Syria	0.476	Horticultural			
Thailand	0.280	Horticultural			
Tunisia	0.290	Horticultural			
Turkey	0.305	Horticultural	Flowers		
Uruguay	0.299	Horticultural	Strawberry	Flowers	
Vietnam	0.411	Horticultural			
Zimbabwe	0.353	Tobacco			
Total	**9.021**				

Source: UNIDO Methyl Bromide Unit

Table 3 **Methyl bromide alternatives selected by UNIDO by sector**

•

Country	Sector				
	Strawberry	**Vegetables**	**Tobacco**	**Cut flowers**	**Post-harvest**
Argentina	Steam	Metam		Steam	
Brazil			Floating		
Croatia			Floating		
Cuba			Floating		
Iran					Phosphine
Lebanon	Steam				
FYR Macedonia		Solarization	Floating		
Morocco	Steam	Solarization Metam			
Romania					
Senegal					Phosphine
Syria					Phosphine
Turkey		Solarization Biofumigation		Steam	
Uganda				Steam	
Uruguay		Solarization Biofumigation			
Zimbabwe				Steam	

Source: UNIDO Methyl Bromide Unit

Table 4 Ongoing UNIDO methyl bromide phase-out projects in 15 countries

Country	ODP phased out (tons)	Total fund approved ($ millions)
Argentina	331.0	3,184
Brazil	84.4	2,321
Croatia	16.2	0,477
Cuba	48.0	1,673
Dominican Rep.	141.0	0,923
Egypt	186.0	2,751
Guatemala	468.0	3.257
Honduras	213.0	1,977
Iran	12.4	0,260
Lebanon	16.0	0,772
FYR Macedonia	27.2	1,075
Morocco	155.0	2,190
Morocco	109.8	0,400
Morocco**	61.2	0,674
Romania*	93.6	0,415
Senegal	1.0	0,060
Syria	5.0	0,300
Turkey	29.2	1,000
Uganda	12.0	0,229
Uruguay	24.0	0,469
Zimbabwe	132.0	0,904
Total	**2,166.0**	**25,311**

* Funded by Italy.
** Funded by France.
Source: UNIDO Methyl Bromide Unit

Table 5 Funding approved for UNIDO fumigant projects (by type)

Project	Funding ($ millions)
Demonstration	9,021
Phase-out	25,311
Total	**34,332**

Source: UNIDO Methyl Bromide Unit

The leading role of UNIDO in the fumigants sector is evident in the 59.6 per cent of the total amount approved for this sector by the Multilateral Fund (table 6).

Table 6 UNIDO share of MLF-funded fumigant investment projects*

Item	*UNIDO*	*Multilateral Fund*
ODP phased out (tons)	2,010.6	2,774.5
Funds approved ($ millions)	31.86	51.04
Cost effectiveness, $/kg of methyl bromide phased out	15.85	18.4
Funds for UNIDO fumigant projects (demo plus phase-out) as compared to the total funds approved for fumigant sector for all implementing agencies		62.4%

* Approved until April 2003
Source: 39th MLF Executive Committee.

Scope and approach of conversion projects

Economic implications

The assistance provided through the projects implemented by UNIDO not only help developing countries to comply with the schedule agreed under the Montreal Protocol. They also:

- Help growers and companies adopt and adjust technologies, making them more competitive.
- Enable producers of tobacco seedlings to meet the strict requirements of tobacco multinationals.
- Allow (through the alternatives introduced and the technical assistance provided) growers and enterprises to gain access to European and North American markets by complying with their very strict standard in terms of quality and environmental constraints.
- Encourage European and North American producers, who need to eliminate the use of methyl bromide in their own countries earlier (2005) than the developing countries (2015), to accept imports from other countries that also find alternatives to using methyl bromide.
- Cut down dependence on pesticide imports—the case with most of the alternative technologies selected.

In summary, the international market requires high quality food produced according to strict safety measures. For many years, the concept of quality of many vegetable products was colour, flavour, size, weight and homogeneity. Now, in order to fulfil the strict quality requirements, the products should also be:

- Without chemical residues
- Environmentally friendly
- Health and safety oriented.

Because of the above, there exist many certification systems to control such requirements.

Environmental implications

Methyl bromide phase-out is not only an agreed schedule under the Montreal Protocol for protecting the ozone layer. It has many other implications:

- Most of the alternative technologies are more environmentally friendly regarding soil, water and crop pollution compared to methyl bromide;
- In the case of biofumigation and solarization, methyl bromide is replaced with materials available locally at very low price (chicken or cow manure, agro-processing residuals etc.);
- Alternative technology implementation brings better working place safety and healthier conditions for the workers;
- Non-chemical alternatives such as solarization, biofumigation and grafting are essential for integrated pest management or organic production plan.

At the beginning, elimination of methyl bromide was seen as a threat to the survival of many farmers and companies. Conscious that any wrong decision on the alternative selected may put them out of the business, UNIDO, as the lead agency in the methyl bromide replacement sector took the view that methyl bromide phase-out is not only a matter of protecting the ozone layer. It is also a major opportunity for thousands of farmers to adopt and adjust technologies, making them more competitive in the international market place.

Case studies

Phasing out methyl bromide from peanut seed storage: Novasen (Senegal)

Sector: fumigants
Company: Novasen Ltd, Senegal
Project no.: MP/SEN/98/110
Project title: Phasing out methyl bromide in the peanut seed storage

Background

Peanut production covers 42 per cent of the cultivated land in Senegal and provides income for more than one million people. The sector continues to suffer from a shrinking market. At the same time production continues to fall due to soil depletion.

In 1996 total national consumption of methyl bromide was 1,200 kg, all of it used by Novasen as a fumigant for 8,500 tons of peanuts intended for seed, of which the company produces some 13,000 tons. Production is mainly in the Kaolack region (8,000 tons), Casamance (2,000 tons) and Louga (1,000 tons). Thirteen main collection points serve nine permanent storage sites each with bulk silos of about 700 tons capacity. Novasen ensures quality of seed supplies to its growers.

Alternative technology selection

Methyl bromide was replaced with an equally effective fumigant, phosphine, applied in tablet form. The tablets release gas over 6-24 hours and require dosage rates of five tablets per ton.

Services provided

Equipment provided includes the following: gas proof sheets, phosphine gas measurement meters, safety equipment and special seed storage. Training covers the following: principles of the phosphine fumigation, safety precautions, correct handling and storage of fumigation sheets, and Integrated Commodity Management (ICM).

Impact

In addition to the elimination of Senegal's use of methyl bromide, which was the main objective, the project also improved safety measures. The company now is applying phosphine to control pest in combination with Integrated Commodity Management, which implies low doses of the phosphine, good handling of the fumigation sheets. Novasen staff has learned all aspects of safety precautions, including use of proper gas masks, gas (phosphine) concentration meters.

The company continues to provide its growers with peanut seeds meeting high international standards.

Project cost effectiveness is $99/ kg of ODP phased out.

Phasing out methyl bromide from tobacco seedlings: Brazil

Sector: fumigants
Company: farmers
Project no.: MP/BRA/00/018
Project title: Phasing out methyl bromide in the tobacco seedlings

Background

In July, the Executive Committee of the Multilateral Fund approved funding for the $2.34 million project as a national incentive and (on an exceptional basis) to implement phase-out of at least 20 per cent of the methyl bromide currently used in Brazil's tobacco sector.

Brazil is the world's fourth largest tobacco producer and tobacco seedbeds account for 95 per cent of national methyl bromide consumption. The yearly harvest fluctuates around 500,000 tons and a significant part is exported. The main areas involved are the southern and the northeastern part of the country. In the south, the States of Rio Grande do Sul, Santa Catarina and Paraná represent 90 per cent of total national production, while Bahia and Alagoas located in the northeast provide the remaining 10 per cent. There are some 209,000 producers working a total cultivated area of approximately 310,000 hectares. The entire sector is based on an Integrated Production System featuring strong planning by the enterprises at the beginning of the growing season.

Alternative technology selection

Confirming the results obtained in a UNIDO demonstration project, Brazilian producers selected the soil-less floating tray system in micro tunnels as the most appropriate for organizational and technical reasons. From an environmental standpoint, due to the smaller surface used, a reduction in pesticide application has been recorded. It is also acknowledged that plants produced with the floating tray system are more homogeneous, less sensitive to transplant stress and are more easily transported. The results achieved in terms of quality and quantity of plants, encouraged farmers to undertake the conversion process.

Services provided

Equipment and supplies provided through the project included: microtunnels, expanded polystyrene tray, black polyethylene film, substrates, seeders, manual clipping devices. In addition, training was offered in: preparation of a micro-pool, erection of micro-tunnels, handling and cleaning the seeder, sowing with the seeder and compacting the substrate.

Impact

Besides the elimination of the 20 per cent (84.4 tons) of ODP ahead of schedule, the project trained some 140,000 farmers on the new technology. The farmers acquired modern techniques and met higher standard of quality required by the tobacco multinationals, thus integrating them into agro-industrial processing. A significant reduction of the land dedicated to tobacco seedlings was released for other activities and consequently increased incomes.

Project cost-effectiveness was $28/ kg of ODP phased out.

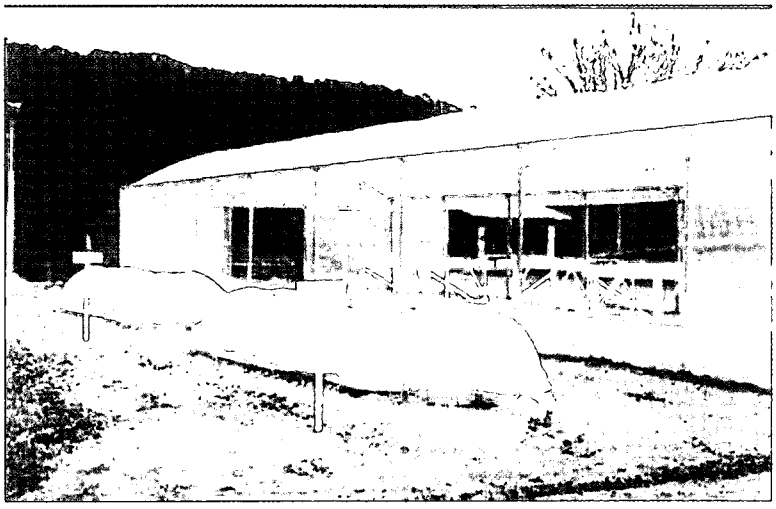

Fig.1: Brazilian tobacco farmers use soil-less tray system in micro-tunnels to eliminate methyl bromide

Phasing out methyl bromide from strawberry production: Morocco

Sector: fumigants
Company: Association marocaine des producteurs de fraises
Project no.: MP/MOR/00/164
Project name: Phasing out methyl bromide in the production of strawberries

Background

In Morocco, where the strawberry crop is highly intensified and in the year 2000 covered an area of 2,430 hectares, production is mainly directed towards exports, either as a fresh or frozen product. Some 370 farmers, who cultivate areas ranging from 1 to 100 ha or more, are grouped mainly through the "Association marocaine des producteurs de fraises" (AMPF).

After Morocco ratified the Copenhagen amendment, the country needed urgent assistance from the Multilateral Fund to help it comply with the phase-out schedule set for Article 5 countries. In addition, as a large exporter of strawberries to the European Union, Morocco needed to produce strawberries without resort to methyl bromide treatment—since the EU countries themselves are committed to a total phase-out of methyl bromide by 2005.

In 1998, UNIDO in cooperation with the Ministry of Agriculture and Environment and with "Institut agronomique et vétérinaire Hassan II", conducted a demonstration project in order to test different alternatives to methyl bromide. The results showed the following alternatives as best suited to Morocco's needs and conditions:

- Negative pressure soil steam pasteurization
- Solarization in combination with 1,3 dichloropropene or Metam sodium
- Bio-fumigation.

In November 2000, the Government submitted a phase-out project through UNIDO, proposing these alternatives for the elimination of 259 metric tones (155 ODP tones) of methyl bromide in the production of strawberries. The $2.2 project funding was divided into five tranches consisting of yearly partial phase-out according to an agreement signed between the Government and the Executive Committee. Partial phase-out of 25 tons ODP was achieved in 2001.

Alternative technology selection

After a careful review of the alternatives tested in the UNIDO demonstration project implemented in cooperation with "Institut national agronomique et vétérinaire Hassan II"and the "Assocation marocaine des producteurs de fraises", the following were selected:

- Negative pressure soil steam pasteurization for early production of strawberries in order to avoid reinfestation. Steam pasteurization was found to be most effective and using negative pressure made the treatment effective at greater depths, particularly in sandy soils.
- Solarization in combination with 1,3 D dichloropropene or Metam sodium for strawberries to be planted during the summer season. Soil solarization combined with low-doses of chemicals is well proven during summer months.

- Bio-fumigation—selected by some farmers for controlling certain varieties of nematodes, weeds and fungi.

Services provided

- Supply of steam generator equipment as well as negative pressure equipment (mainly tubing), injection and safety equipment.
- Training in the use of boilers, injection equipment and the safe use of chemicals - largely not implemented in Morocco when using methyl bromide. The Government contributed the services of the "Institut agronomique et vétérinaire Hassan II" as the institution for ensuring training, delivery of equipment, compliance with the phase-out schedule, and any additional costs borne by farmers.

Impact

- Through this and other approved projects (e.g. phase-out in the bananas, cut flowers and tomatoes), Morocco will be able to comply with the freeze obligation of 2002, and the reduction target of 2005. Already a partial phase-out of 25 ODP tons has been reported. Further phase-out was expected for the other two projects as well as this project in 2002.
- Eliminating methyl bromide in the production of strawberries by 2005 will allow exporters to comply with the EU regulations that disallow methyl bromide as of 2005.
- The alternative technology will allow the most up-to-date techniques, particularly negative pressure steam pasteurization and bio fumigation, which are considered environmentally friendly technologies.
- Solarization with low-doses of chemicals will considerably reduce the massive use of methyl bromide, which, apart from its ever increasing cost, has always been a safety concern among Moroccan farmers. Low-doses of chemicals coupled with safety equipment, it is hoped, will remove that concern.

The cost-effectiveness threshold was not yet established but usually ranges between $10 and $14/kg ODP phased out.

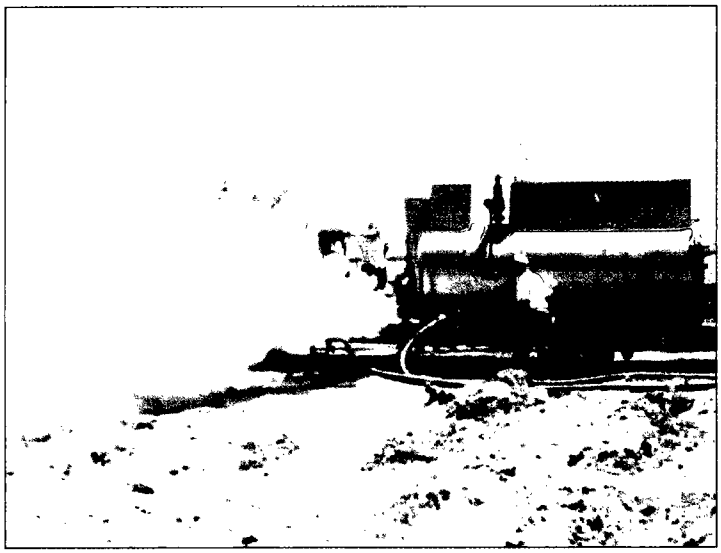

Fig. 2: UNIDO demonstrates alternative approaches to phasing methyl bromide out of Moroccan strawberry production

Phasing out methyl bromide from tobacco production: Cuba

Sector: Fumigants
Company: Instituto de Investigaciones de Sanidad Vegetal (INISAV)
Project no.: MP/CUB/98/088
Project title: Phasing out methyl bromide in the tobacco sector

Background

Tobacco production in Cuba is of great importance because of its quality and Cuban tobacco's reputation as one of the world finest. The area dedicated to tobacco seedbeds is estimated at 3,450 hectares. Reflecting shortages of chemicals and other inputs to treat soil-borne diseases (fungi nematodes and weeds), Cuba already introduced alternative environment-friendly technologies such as tilling, and more importantly, biological control.

To produce high quality tobacco (Tajado and Vega fina) to zero default standards, the Ministry of Agriculture tested the floating tray technology and found it highly efficient. The trials were conducted without the financial assistance of the Multilateral Fund, therefore no demonstration project was necessary to introduce the technology.

In 1998, Cuba submitted a project through UNIDO for total phase-out of methyl bromide from Cuba's production of tobacco seedlings. The $1.7 million project, which was the first ever approved by the Executive Committee of the Multilateral Fund, aimed to eliminate 80 tons (or 48 tons ODP) of methyl bromide in the tobacco sector. Its completion enables Cuba to produce high quality tobacco meeting zero default standards and thus eligible as the external cigar layer in finished products for export.

Alternative technology selection

The alternatives to methyl bromide previously tested by the Ministry of Agriculture, were as follows:

- Trycoderma Harzianum combined with low doses of chemicals in the framework of integrated pest management,
- Floating tray system.

The first was not found entirely satisfactory, since it did not meet the zero default standard. In addition shortage of chemicals did not allow the selection of this alternative. In contrast, the floating tray system relied on a substrate produced locally and the resulting tobacco did fully comply with the zero default standard. It was therefore selected and UNIDO was requested to prepare a phase-out project in order to generalize it as an alternative technology.

Services provided

- Supply of equipment such as large plastic tunnels (greenhouses), trays, seeders, lawn-mowers, a conductivity meter and a water analysis kit, small plastic micro-tunnels.

- Training for the erection of micro-tunnels and large greenhouses, handling and cleaning seeder and mowers of trays, monitoring water conductivity and pruning seedlings.

Through the services of INISAV the Government of Cuba contributed the construction work for the installation of the greenhouses, the technical staff for erection and commissioning of the greenhouses, and the internal transportation costs for the equipment purchased.

Impact

The most important impact was the phase-out of 80 tons of methyl bromide, thus allowing Cuba to fully comply with the phase-out schedule agreed for Article 5 countries. Indeed Cuba, which had a baseline consumption of more than 100 tons, was requested to freeze its consumption at its baseline level by 2002 and to reduce its consumption to 20 per cent by 2005. Through the project Cuba will fully comply.

The second impact is the introduction of a completely environment-friendly technology, safe and up to date. The technology not only ensures an excellent export opportunity, since it allows an environment friendly product complying with the zero default standards, but allows the use of a local substrate and discontinues the import of a substance costing $160,000 annually.

In summary, the project:

- Reduces Cuba's methyl bromide consumption from 100 tons (baseline consumption) to 20 tons, which is well beyond both the freeze target of 2002 and the reduction target of 2005.
- Reduces (through the use of the floating tray system) imports of 80 tons of methyl bromide annually (with a cost of $2/kg).
- Use of local substrate instead of imported chemicals.
- Enables compliance with a zero default standard.

The cost-effectiveness threshold has not been established, but usually lies between $25 and $35/kg ODP phased out.

Fig. 3: Floating tray system for tobacco seedlings enables Cuba to comply with methyl bromide phase-out schedule.

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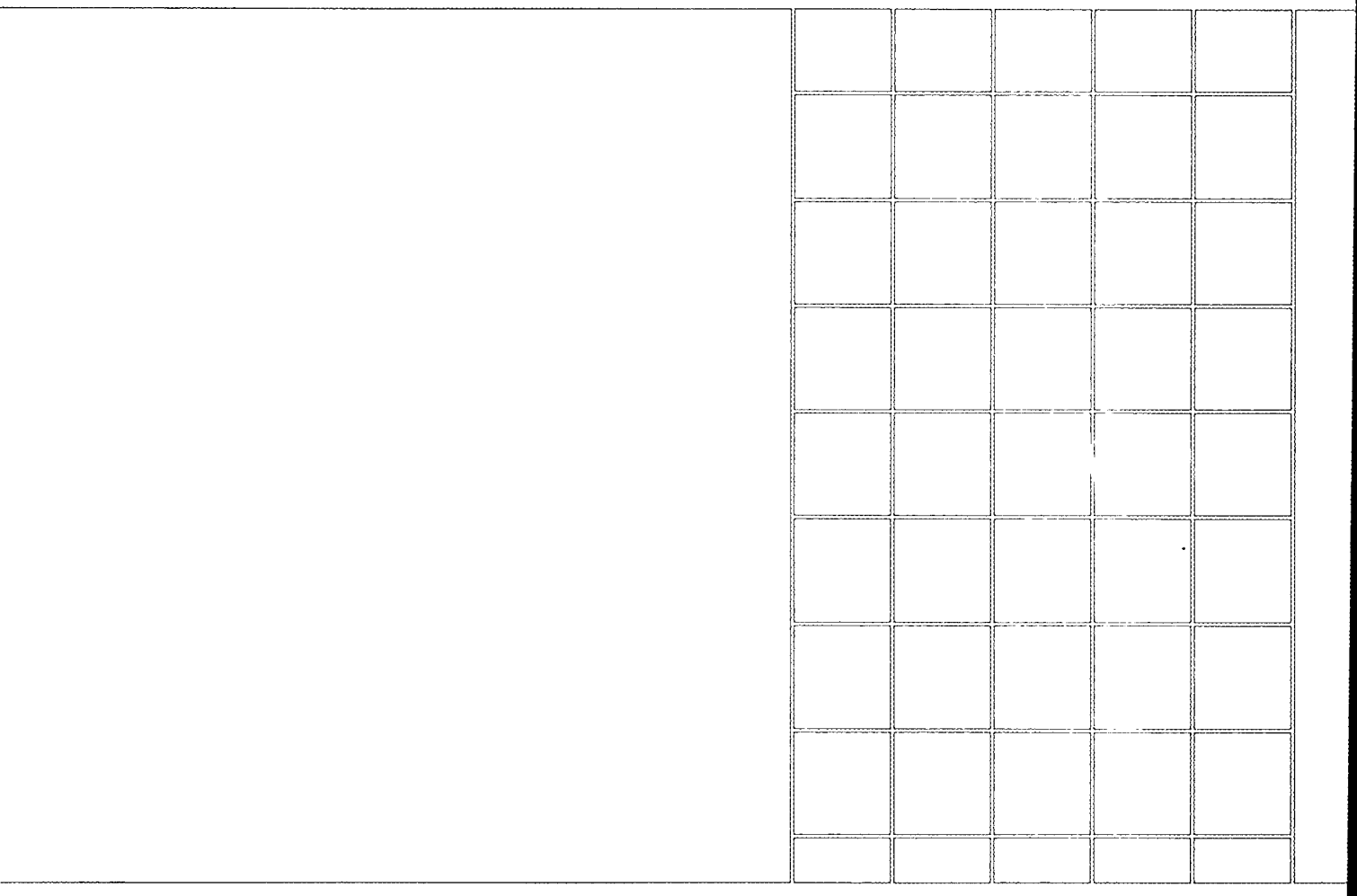

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