PROJECT COVER SHEET – NON-MULTI-YEAR INVESTMENT PROJECTS

COUNTRY: Mexico

PROJECT TITLE	BILATERAL/IMPLEMENTING AGENCY
National Phase out of MB –Terminal Project	UNIDO (Lead Agency) ITALY/SPAIN/CANADA

NATIONAL CO-ORDINATING AGENCY: Ministry of the Environment (SEMARNAT)

LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT

A: ARTICLE-7 DATA (ODP TONNES, 2007, AS OF [JANUARY 2008]**)**

Annex E, MB	895 ODP tonnes		

B: COUNTRY PROGRAMME SECTORAL DATA (ODP TONNES, 200[X], **AS OF** [DATE]**)**

ODS Name	Subsector/quantity	Subsector/quantity	Subsector/quantity	Subsector/quantity.

CFC consumption remaining eligible for funding (ODP tonnes)	

CURRENT YEAR BUSINESS PLAN: Total funding US $: total phase-out 10.2 ODP tonnes.

ODS USE AT ENTERPRISE	895	ODP tonnes
ODS TO BE PHASED OUT:	895	ODP tonnes
ODS TO BE PHASED IN		ODP tonnes
PROJECT DURATION:	72	Months
PROJECT COSTS:		
Incremental Capital Cost	US $	12,564,763
Contingency (10%)	US $	1,256,476
Incremental Operating Cost	US $	-4,598,860
Total Project Cost	US $	9,222,379
LOCAL OWNERSHIP:	100%	
EXPORT COMPONENT:	N/A	
REQUESTED GRANT:	US $	9,222,379
COST- EFFECTIVENESS:	US $/kg	10.3
IMPLEMENTING AGENCY SUPPORT COST: (Various)	US $	967,643
TOTAL COST OF PROJECT TO MLF:	US $	10,190,022
STATUS OF COUNTERPART FUNDING:	N/A	
FIRST TRANCHE (2008)	US$ 3,000,000 (ITALY 2,000,000)	
IMPLEMENTING AGENCY SUPPORT COST (7.5%&13%)	US$ 75,000 (ITALY 260,000)	
PROJECT MONITORING MILESTONES INCLUDED:	Yes	

PROJECT SUMMARY: The project aims at phasing out 895 ODP tonnes of methyl bromide used in the country with the participation of four implementing agencies: UNIDO, ITALY, SPAIN and CANADA, as follows: UNIDO US$ 4,204,857 &US$ 315,364 (7.5% support cost), ITALY US$ 2,000,000& US$260,000, (13% support cost), SPAIN US$ 1,600,000& US$ 208,000 (13% support cost) and CANADA US$1,417,522 &US$184,278 (13% support cost). The project will be implemented in four tranches:

Year	Soil fumigation (US$)			Commodities (US$)	Total funding (US $)
	MLF-UNIDO	Italy	Spain	Canada	
2008	1,000,000	2,000,000		500,000	3,500,000
2010	2,000,000		800,000	500,000	3,300,000
2012	1,000,000		800,000	200,000	2,000,000
2013	204,857			217,522	422,379
TOTAL	**4,204,857**	**2,000,000**	**1,600,000**	**1,417,522**	**9,222,379**

IMPACT OF PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS: By implementing this terminal project, Mexico would completely phase out MB by the end of 2013.

Prepared by: G. Castella Lorenzo and consultants **Date:** January 2008
Reviewed by: M Pizano **Date:** January 2008

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1. BACKGROUND

1.1 Mexican Agriculture

The Mexican territory comprises 1,972,550 km^2. Its geographical situation, climatic diversity and variety of natural resources favour the development of various economic sectors such as agriculture, industry, trade and tourism. However, agriculture represents only 5.6% of the country's GDP and thus only occupies the fourth place in the country's economy. In 2006 21.5 million hectares were destined to agriculture with an estimated production of 34.5 million tons.

About 6% of the total population (some 6,164,300 people) is presently employed in agricultural activities. This proportion however, has decreased from 18.6% 10 years ago, to 10.4%, although the sector's contribution to GDP increased an average 3.6%. Productivity of Mexican agriculture has therefore improved, but its performance in terms of output has been much lower than that of the services sector.

In general terms, two growing cycles occur: spring-summer (predominantly from April until September) and autumn-winter (between November and March). There are also two production regimes: agriculture that develops under natural rain and irrigated agriculture.

Due to scarcity of water on the main agricultural regions, almost 6 million ha out of a total extension of 20 million are presently cultivated with artificial irrigation, making Mexico one of the countries with the largest irrigated area in the world. The irrigated area is divided into 81 districts comprising 3.3 million ha out of which 2.9 million are cultivated by 300,000 small and medium size farmers. Around 55% of the national agricultural production and 70% of exported agricultural products are produced using artificial irrigation systems.

Two general forms of agriculture exist:

a) Traditional or extensive: carried-out during rainy periods by small farmers generally using rudimentary technologies and having poor infrastructure. It is inefficient in terms of yields.

b) Modern or intensive: practiced on relatively small areas with modern technology, modern machinery and high efficiency, by a comparatively small number of growers.

The main problems affecting agriculture are climatic changes, lack of water and soil issues such as erosion that leads to a loss of the organic layer.

Agricultural production in Mexico is mainly represented by:

- Basic food crops – grains such as: rice, oat, barley, dry beans, corn, sorghum and wheat.
- Oil seeds – sesame, cotton, saffron, and soybeans
- Fruit: strawberry, melon and watermelon.
- Vegetables: garlic, tomato, broccoli, hot peppers and cucumber.
- Industrial crops: tobacco

Although Mexico is a large grain producer with 10.28 million ha in production, it has also become a net importer of grains. Where basic grain production is concerned, a significant deficit between production and national consumption of grain is apparent. In 2006 for example, national production of basic crops, mainly grains, was around 33.61 million tonnes, but consumption was much higher as illustrated in Table 2 below.

Table 1. Mexico's Grain Consumption (1,000 Tons)

Basic crop	Production 2006	Apparent consumption	Deficit
Rice	337	631	-293
Beans	1,377	1,195	-182
Corn	21,893	27,400	-5,506
Wheat	3,378	6,154	-2,775

Mexico is not self-sufficient for two of its basic staple foods: dry beans and corn, which together accounted for 27.2% of total agricultural imports in 2006. Corn is the main crop in terms of area grown, production volume and number of growers, however Mexico is also the third largest corn market for the USA. The United States maintains their traditional leading position for corn and sorghum, supplying virtually 100% of Mexican imports.

This situation is however compensated by the exports of non-traditional crops mainly fruits and vegetables. Agricultural exports are thus mainly tomatoes, melons, strawberries and coffee, while imports are corn, soybean, wheat, sorghum, cotton, beans and barley.

Mexico produces 57 different kinds of fruit throughout the country; most of the production is allocated to the domestic market as a fresh product and only a small amount is exported. The domestic market is even more important for fruits than it is for vegetables. An estimated 85 to 90% of the vegetables are for internal consumption and it even appears that large quantity is not marketed at all.

1.2 The strawberry sub-sector

Strawberry production is mainly located in Baja California, Baja California Sur, Michoacán, Guanajuato, Estado de Mexico, Jalisco and Morelos due to the excellent climatic conditions prevailing in these states.

Strawberry runners are imported from the USA and planted at densities of about 55.000 to 60.000 plants per ha, yielding 45-60 tonnes per ha. 69 large and medium size growers dominate the sub-sector and all of them use MB applied as hot gas. The average dose is about 324 kg/ha per cycle calculated on the basis of a 98:2 formulation. Production areas, MB consumption and number of growers per state appear in Table 2 below.

Transplanting starts in October and harvesting occurs in the middle of December. The soil is covered with black or transparent plastic depending on the climatic conditions but black mulching is widespread.

Table 2. Strawberries: Production Area (Ha) and Mb Consumption (tonnes)

	Area cultivated (ha)	Area treated with MB (ha)	MB Consumption (tonnes)	Number of large growers	Number of small growers	Total growers
Baja California	1,517	677	265.3	9	5	14
Baja California Sur	181	35	13.5	2	3	5
Michoacán	3,117	255	99.9	6	14	20
Guanajuato	1,032	62	24.3	2	10	12
Estado de México	272	39	15	0	8	8
Jalisco	141	25	9.9	1	6	7
Morelos	9	4	1.5	0	3	3
TOTAL	**6,269**	**1,097**	**429.4**	**20**	**49**	**69**

The main soilborne pests and diseases affecting plants and reducing yields, and which lead to Mb use are fungi (*Phytophthora, Rhizoctonia, Fusarium, Verticillium,* etc) and nematodes, particularly root-knot (*Meloidogyne*).

1.3 The tomato sub-sector

Winter tomatoes are one of the most important crops in the States of Sinaloa, Baja California and Baja California Sur. About 67,000 ha of tomato are under production throughout the country, but this figure varies in response to market trends, climatic conditions, etc. Only about 36,000 ha are cultivated using modern techniques.

In the Sinaloa region, seedlings are transplanted in September for January harvesting, but in the Southern areas, such as Cruz de Elota, transplanting is done later. The winter tomato season ends in June-July.

Because of lower temperatures, early winter tomatoes in Baja California are planted in greenhouses or low tunnels in January-February, whilst late winter tomatoes are planted in March in open fields.

In Baja California Sur, average winter temperatures are between those of Sinaloa and Baja California. This allows for two growing cycles: an early cycle starting in August and a late cycle starting in February/March. Tomatoes are planted in open fields and production is almost continuous.

The main pests and diseases affecting tomatoes are fungi, nematodes, trips and whiteflies. Severe incidence of *Verticillium dahliae*, *Fusarium oxysporum* f.sp. *lycopersici*, *Phytophthora capsici*, *P. parasitica*, *Pyrenochaeta lycopersici*, *Erwinia carotonova*, *Verticillium* sp. and nematodes such as *Meloidogyne* sp., as well as some viruses are common and are the reason why growers use methyl bromide.

Only 10% of the more technically advanced growers use MB. As explained later, the rest prefer to rely on crop rotation using communal land, which can be rented at low rates.

Table 3. Tomato Sub-Sector in Mexico

STATE	Area cultivated (ha)	Area treated with MB (ha)	MB Consumption (tonnes)	Number of large growers	Number of small growers	Total growers
Baja California	4,927	145	47.5	4	12	16
Baja California Sur	3,400	60	18.4	2	8	10
Sinaloa	22,137	440	155.0	12	25	37
Jalisco	2,100	312	113.4	2	12	14
Sonora	2,359	60	20.2	2	6	8
Coahuila	804	6	2.1	0	5	5
TOTAL	**35,727**	**1,023**	**356.6**	**22**	**68**	**90**

Table 3 above describes the Mexican tomato sector. The main growing areas are in the States of Sinaloa, Jalisco, Baja California and Baja California Sur. The larger MB users are located in Sinaloa.

About 2,045 ha are managed by efficient farmers that plant selected varieties and fumigate soils with MB. These farmers rarely rotate crops and rather grow tomatoes continuously, fumigating with MB at least once a year.

There are also about 68 medium and small size farmers, who use MB at even higher dosages.

Medium and small farmers, who are not using MB, are getting much lower yields; they rely on crop rotation and to some extent use very high doses (over 1200 l/ha) of Metam Sodium.

The average price of MB is about 4.21 US$/kg, including advice on its application. Average consumption (98:2 formulation basis) is 349 kg per ha.

1.4 The pepper sub-sector

Chile Bell pepper cultivation is mostly concentrated in the central and Southern areas of Sinaloa, where more than 5,800 hectares are in production. However, only a relatively small proportion of this area is treated with MB. Growers that rely on MB are the most productive and generally grow peppers continuously, producing high yields and good quality.

Many of non-MB using growers rotate crops and use other fumigants namely Metam Sodium, but with relatively poor results due to inproper diffusion in the soil or because this material is unsuitable in areas heavily infested with nematodes.

In Sinaloa technically competitive growers fumigate the soil with MB before transplanting seedlings at a density of 36.000-40.000 plants per ha. The production cycle runs from September to January, depending on the market.

The more important soilborne diseases affecting peppers are *Phytophthora infestans*, *Rhizoctonia solanii*, *Pythium* sp., *Sclerotinia sclerotium* and root knot nematodes.

Chile Bell is mainly cultivated in open fields making disease control difficult. Large growers use black plastic but very few have greenhouses; substrate production is unknown to them.

MB doses calculated on the basis of the 98:2 formulation average 380-kg/ha. Table 4 below describes the Mexican bell pepper sector.

Table 4. Chile Bell: Production Area and MB Consumption

State	Area cultivated (ha)	Area fumigated with MB (ha)	MB consumption (tonnes)	Number of large producers	Number of medium/small producers
Baja California	7	7	2.6	1	
Baja California Sur	91	21	8.0	3	7
Sinaloa	5,834	98.25	37.3	7	42
Sonora	488	35	13.3	3	20
TOTAL	**6,420**	**161.25**	**61.3**	**14**	**69**

1.5 The Melon sector

Melon and watermelon consumption in Mexico is very high; the Ministry of Agriculture estimates a production of about 1,530,000 tonnes per year, with most of the production coming from very small plots where these crops are grown as a complement to others. The melon sector is described in Table 5 below.

Presently, the area cultivated with efficient agricultural practices is about 18,000 hectares. Out of these, only 570 hectares are using MB whilst the rest opted for crop rotation, since investment costs are much lower (communal land cost is about US$500/ha/year). However, yields and quality obtained with this system are much lower than when using MB and sometimes incidences *Fusarium* and MNSV attacks are devastating.

Growers using MB are more sophisticated and rely on high technical packages. They typically use planting densities of around 13.000 plants per ha and fumigate soils at an average rate of 168 kg/ha.

Fusarium spp, and some *Monosporascus* are the key diseases affecting melons. However, a fundamental problem that requires higher doses of MB and other chemicals is a viral infection transmitted by the soil fungus *Olpidium bornovanus*, which produces sudden melon decay (MNSV). The rate of infestation is growing and the doses of MB needed to control this disease are increasing sharply.

Some growers have already shifted to grafting, which has proved to be an efficient alternative; a commercial nursery is supplying grafted plants to one grower in the region of Colima.

Table 5. Melon: Area Cultivated, Number of Growers and MB Consumption in Tonnes

STATE	Area cultivated (ha)	Area treated with MB (ha)	MB Consumption (Tonnes)	Number of large growers	Number of small growers	Total growers
Coahuila	5137	168	27.6	6	19	25
Colima	1445	47	9	1	10	11
Durango	3374	105	17.4	5	18	23
Sonora	7932	250	42	10	25	35
TOTAL	**17,888**	**570**	**96**	**22**	**72**	**94**

1.6 The Berry sub-sector

Raspberries and blackberries are mainly cultivated in the States of Michoacán (Los Reyes, Jacona and Zamora) and Jalisco (Xocotepec). A complete production package (including MB) was introduced to growers by three multinational companies, who buy all production and organize its packing and export. A general description of this sector can be found in Table 6 below.

Table 6. Berries (Raspberries and Blackberries): Growers and MB Consumption in Tonnes

STATE	Area cultivated (ha)	Area fumigated with MB (ha)	MB Consumption (tonnes)	Number of large growers	Number of small growers
Baja California	76	38	15	1	10
Jalisco	344	170	66.6	2	35
Michoacán	3019	422	165.4	5	60
TOTAL	**3,439**	**630**	**247**	**8**	**105**

The main soilborne pests and diseases affecting berries are fungi (*Phytohphtora, Rhizoctonia, Fusarium, Verticillium,* etc) and root knot nematodes (*Meloidogyne*).

The average dosage rate of MB is 394.6 kg/ha, but it is customary for smaller farmers to use higher rates, due to psychological factors and also because sometimes they use MB in cans, which leads to higher amounts.

1.7 The Tobacco sub-sector

Tobacco is an important crop in Mexico and its production is in the hands of multinationals, which provide the technological package, inputs and seedlings to individual farmers. MB consumption has decreased steadily due to the adoption of the floating technology and in 2006 reported consumption was marginal.

1.8 The Garlic sub-sector

The main area of garlic production is the state of Guanajuato (Salamanca), where a garlic research centre is located (El Bajío). The largest producers and some small growers are using MB. However, the majority of the small and medium growers use crop rotation and occasionally Metam Sodium or Metam Potassium applied through the drip. Nevertheless, small farmers achieve lower yields.

MB is used by a small number of large farmers to control white rot caused by *Sclerotinium cepivorum.* MB is injected as a hot gas at a dose of 392 kg/ha based on a 98:2 formulation.

Table 7. Garlic: Area Cultivated, Number of Growers and MB Consumption in Tonnes

STATE	Area cultivated (ha)	Area fumigated with MB (ha)	MB Consumption (tonnes)	Number of large growers	Number of small growers	Total growers
Guanajuato	1172	53.8	21.1	2	26	28
TOTAL	**1172**	**53.8**	**21.1**	**2**	**26**	**28**

1.9 The Flower and Ornamental plants sub-sector

Production of flowers and ornamentals is widespread through the country, but the most important areas are located in the States of Mexico, Morelos and Puebla, which are near Mexico City (the largest market) and climatic conditions are good. More recent developments have taken place in Baja California with the aim of exporting to the USA. Table 8 illustrates the floriculture sector of Mexico.

A very large number of flower species and varieties are produced with none of them being really predominant. MB is used for soil fumigation and for sterilization of substrates. Most of the soil fumigation is for cut flowers, mainly long-term cultures such as roses, while short cycle pot plants are cultivated on substrates. Growers often mix their own substrates and usually sterilize them with MB in cans, which leads to a quite large consumption per cubic meter of substrate (680g/m^3).

Due to the large variety of species cultivated many soilborne pests and diseases are present, including root-knot and lesion nematodes (*Meloidogyne, Pratylenchus*), crown gall (*Agrobacterium tumefaciens), Fusarium oxysporum, Pythium, Verticillium Rhizoctonia, Phytophthora*, and more.

Table 8. Flowers And Ornamental: Growers and MB Consumption in Tonnes

STATE	Area cultivated (ha)	Area fumigated with MB (ha)	MB Consumption (Tonnes)	Number of large growers	Number of small growers	Total growers
Estado de Mexico	6,750	68	20.3	8	25	33
Distrito Federal	176	10	2.2	3	15	18
Morelos	3,000	4	1.1	3	10	13
Sinaloa	342	13	4.5	4	15	
Baja California	465	100	30	12	0	
Puebla	3,628	6	1.7	2	6	
Guanajuato	45	3	0.73	1	8	
Hidalgo	22	1	0.36	1	5	
TOTAL	**14,428**	**205**	**60.9**	**34**	**84**	**118**

1.10 Other horticultural products

There is a relatively small consumption of MB - less than 70 tonnes - used in soil fumigation in the greenhouse and open field production of a large number of different vegetables like cucumber, lettuce, spinach, celery and aromatic or medicinal plants.

Most of the growers are small and they use MB to fumigate soil at an average dose of 334 kg per ha. Information on this sector is given in Table 9 below.

Table 9. Other Horticultural Crops: Area Cultivated, Number of Growers and MB Consumption

STATE	Area cultivated (ha)	Area fumigated with MB (ha)	MB Consumption (Tonnes)	Number of large growers	Number of small growers	Total growers
Baja California	3,513	116	23.2	2	10	12
Baja California Sur	1,559	40	8	2	12	14
Sinaloa	3,959	57	11.5	4	32	36
Sonora	584	24	4.9	2	8	10
Yucatán	1,004	104	20.9	2	25	27
TOTAL	**10,619**	**341**	**68.5**	**12**	**87**	**99**

1.11 Commodity fumigation

A significant amount of MB is used for treating stored products, structures, quarantine and pre-shipment (QPS) purposes in Mexico. Quarantine and official pre-shipment uses of MB are increasing, however they are not included in this project since they are not presently controlled under the Montreal Protocol.

This project will address MB fumigation of stored grains, other stored products and structures. The major grain growing and storage areas (states) in the North are Sonora, Tamaulipas and Sinaloa, in the central region the State of Mexico, Distrito Federal, Jalisco and in the south Puebla, Chiapas and Oaxaca. However, MB fumigation is also used for commodities and structures in various other regions, with the aim of controlling a wide range of pests including beetles, moths, mites, termites, roaches and ants.

A survey conducted during the preparation of this project identified the products and regions where fumigators and food factories utilize MB. Fumigators use MB on wooden products (27% of the users), products at flour mills and food factories (20%), products in railway carriages, trucks and shipping containers (17%), products in silos and warehouses (15%), artefacts in museums and historical buildings (7%), products in ships and airplanes (5%), and other materials (9%). Factories use MB to treat grain in silos, bins and warehouses (53% of factories that use MB), flour- mills (26%), products in railway carriages, trucks and shipping containers (11%) and other products in storage (10%).

Stored grains and other products

Products fumigated with MB include various stored grains, particularly wheat and corn. Breweries, for example, fumigate barley several times a year. MB is also used for the fumigation of dried fruit, nuts, other stored food products, museum items, artefacts and wooden products. Up to 140 tonnes MB is applied to these types of products in hundreds of warehouses and silos, or sometimes in trucks and railcars, in many states of Mexico. The typical MB dose is about 34 g/m^3 on grains, and the MB formulation is usually 98% MB with 2% chloropicrin.

Structures and transport vehicles

Flourmills, food factories and breweries in many regions of Mexico use MB. The latest survey results indicate that about 200 tonnes of MB were used for these types of structures in 2006. In addition MB is also used for warehouses and empty silos, and occasionally for airplanes and ships for non-QPS fumigations. Mills and food factories can be fumigated several times per year. Some mills contract fumigation companies to carry out their fumigations, but most premises carry out structural fumigations themselves, using their own fumigation crews.

Typical MB doses are about 34 g/m^3. The MB formulation is typically 98% MB with 2% chloropicrin.

2. METHYL BROMIDE CONSUMPTION

Of a total area of about 96,000 ha producing horticultural products on a commercial basis only 4.383 ha are being fumigated with MB. The quantities used by each sector described in the previous section are shown below.

Table 10. Methyl Bromide Consumption In Horticulture (ODS Tonnes) (2007)

	Mexico's cultivated area	Area using MB	MB Consumption	Number of farmers
Strawberries	6,269	1,097	429.4	69
Tomato	35,727	2,045	356.6	90
Chile Bell	6,420	161.25	61.2	83
Melon	17,888	570	96	94
Berries	3,439	630	247	113
Garlic	1172	53.8	21.1	28
Other	10,619	341	68.5	99
Flowers	14,428	205	60.89	118
TOTAL	**95,962**	**4,081**	**1,340.1**	**694**

Horticultural growers not using MB rely on crop rotation because they do not own the land and prefer to rent communal land at a lower cost, which is not higher than US$500 per season. Yields and returns are quite low, but so is the investment.

Growers with better financial possibilities or who have investing in fixed facilities like greenhouses, sophisticated irrigation systems, or simply those to whom communal land is not available, prefer to invest in soil preparation and fumigation in return of better yields, quality and profit. Most of these growers are relatively large, but there are still a substantial number of small growers who are able to invest in soil fumigation and get better returns.

MB is used for the fumigation of soil or substrates in the production of melons, tomatoes, strawberries, garlic, berries and other horticultural crops and in the production of flowers and ornamentals. It is also used in quarantine and pre-shipment as well as for the domestic fumigation of commodities. Approximate quantities allocated to each of these uses appear in the tables below.

Table 11. MB Consumption In Commodities Sector (2007)[1]

MB uses	MB consumption (Tonnes)	Volume fumigated with MB (m^3)	States where MB is used for this purpose
Warehouses and silos containing grain and other stored products	**60.4**	**1,776,470**	Aguascalientes, Baja California Norte, Baja California Sur, Campeche, Chiapas, Chihuahua, Coahuila, Colima, Distrito Federal, Durango, Estado de México, Guanajuato, Guerrero, Hidalgo, Jalisco, Michoacán, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, Querétaro, San Luis Potosí, Sinaloa, Sonora, Tabasco, Tamaulipas, Tlaxcala, Veracruz, Yucatán, Zacatecas and other states
Flour mills, food factories	**57.4**	**1,688,234**	Aguascalientes, Baja California, Campeche, Chiapas, Chihuahua, Coahuila, Distrito Federal, Durango, Estado de México, Guanajuato, Guerrero, Hidalgo, Jalisco, Michoacán, Morelos, Nuevo León, Puebla, Querétaro, San Luis Potosí, Sinaloa, Sonora, Veracruz, Yucatán, Zacatecas
Wooden materials (Non-QPS)	**7.0**	**205,883**	Campeche, Chihuahua, Distrito Federal, Guanajuato, Michoacán, Nuevo León, Veracruz, other States
Museums, historical buildings	**2.3**	**67,647**	Campeche, Distrito Federal, Michoacán and other states
Trucks, railcars, ships, airplanes	**17.6**	**526,650**	Chihuahua, Distrito Federal, Nuevo León, Querétaro, Sinaloa, Veracruz and other states
Miscellaneous uses, including dry chilli products, spices, dried fruit, nuts, tobacco products.	**6.0**	**176,471**	Nuevo León and other states
Total	**150.7**	**4,441,355**	**23 states**

[1] MB fumigations for QPS requirements are not included in this table

Table 12. Methyl Bromide Total Consumption (Excluding QPS Uses)

Year	MB TOTAL (ODS Tonnes)	MB TOTAL (ODP Tonnes)
Baseline	1885	1131
20% 2005	1508	905
2001	1833	1100
2002	1780	1068
2003	1613	968
2004	1647	988
2005	1485	891
2006	1204	723
2007	1491	895

Two main manufacturers are importing MB to Mexico at present: Great Lakes Chemical Corporation and Dead Sea Bromine Group.

The breakdown of the assessed consumption by sector is the following:

Table 13. MB Consumption by Sub-Sector and States (Tonnes)

STATE	Tomato	Chile Bell	Strawberry	Melon	Berries	Garlic	Other	Flowers	Commodities	TOTAL
Aguas Calientes									2.5	2.5
Cohauila	2.1			27.6					5	34.7
Baja California	47.5	2.6	265.3		15.0		23.2	30.0	4.3	238.4
Baja California Sur	18.4	8.0	13.5				8.0		2.5	50.4
Nuevo León									6.5	9.5
Michoacán			99.9		165.4				11	151.1
Sinaloa	155.0	37.3					11.5	4.5	35.6	252.8
Sonora	20.2	13.3		42.0			4.9		13.4	99.8
Tamaulipas									32.5	43.5
San Luis Potosí									2.5	2.5
Colima				9.0						9.0
Jalisco	113.4		9.9		66.6					146.8
Nayarit									2.5	2.5
Guanajuato			24.3			21.1			9	45.9
Veracruz									7	10.0
México			15.0					22.5	6.4	48.9
Querétaro									4.7	4.7
Morelos			1.5							1.5
Hidalgo								0.4		0.4
Yucatán							20.9			20.9
Durango				17.4						17.4
Morelos								1.1		1.1
Guanajuato								0.7		0.7
Puebla								1.7	5.3	9.0
TOTAL per CROP	**356.6**	**61.2**	**429.4**	**96.0**	**247**	**21.1**	**68.5**	**60.9**	**150.7**	**1491**

3. MB PHASE-OUT ACTIVITIES PREVIOUSLY-IMPLEMENTED IN MEXICO

Starting in 1998, a large project to demonstrate alternatives to MB was implemented in Mexico. The project was funded by the MLF and implemented by UNIDO. Trials were conducted with in all major MB alternatives including chemicals such as Metam Sodium, 1-3 Dichloropropene alone or in conjunction with chloropicrin, Dazomet, bio-fumigation with manure or vegetable compost, solarization, melon grafting, steam, tobacco seedling production in floating trays, and others. Commercial scale trials were conducted through this project in San Quintin, Culiacán, Sinaloa, La Paz, Colima, Arandas, Nayarit and Villa Guerrero.

In 2003, a technical assistance project to assist the Mexican Government in complying with the Montreal Protocol's 2005 20% reduction target was approved by the Executive Committee. The project will be shortly successfully completed and has eliminated about 400 metric tonnes of MB. For the Soil Fumigation Component, project activities focussed on providing training for implementing alternatives such as grafting, chemicals, soil less production and steaming. Reducing MB use by using low permeability films like VIF, lower dosages and MB formulations with higher concentration of chloropicrin like 50/50 was also encouraged. Project activities have been carried out together with farmers who volunteered their participation and are ready to adopt these alternative technologies. Furthermore, a number of workshops have been organized in all relevant States consuming MB in both soil and commodities fumigation, where results of the pilot cases were presented together with successful experiences from other countries.

The technical assistance project in relation to soil fumigation has started a subcontract with the University of Chapingo for the preparation of workshops on alternatives to the use of methyl bromide in different crops in various Mexican States. In addition, the contractor would prepare dissemination material, and assist to the farmers willing to use alternative to methyl bromide. The technical assistance project developed a MB consumption database, with information on consumers, interested farmers to adopt alternatives, and the alternatives and area of the crop.

Workshops in soil fumigation sector

Crops	*Place*	*Date*	*No. of Participants*
Nurseries	Morelos	July 2005	30
Flowers	Villa Guerrero	September 19-20, 2005	30
Tomatoes and Chile bell	Culiacan/ Sinaloa	October 10-11, 2005	45
Strawberry	San Quintín, Baja California	May 2 - 3, 2006	63
Strawberry/Flowes	Ixtapan de la Sal, Estado de México	August 22-23, 2007	54 strawberries 59 flowers
Tomatoes	Culiacán, Sinaloa	September 28, 2007	59
Total			350

Pilot cases have been established in the main methyl bromide consumer crops. The concept of the pilot cases is not to demonstrate the efficiency of the alternative, because it is already known, but to show its applicability under the condition of the grower and increase the use to a commercial scale. The participation in such pilot is voluntary and the project minimize the risk in adopting a new technology with the provision of the expertise.

Cut flowers and ornamentals.

During 2005 and 2006 two workshops were organized on alternatives to the use of methyl bromide in cut flowers and ornamental plants, held in Villa Guerrero. Approximately half of the production takes place in the state of Mexico, mainly around the towns of Villa Guerrero, Tenancingo and Texcoco. During the workshop, (mainly in the last one) an interactive, participative approach was used. Such approach led to high participation from the audience. The results of the workshop were important for identifying future steps that need to be undertaken. The workshops also provided a good opportunity for involving key stakeholders in future activities related to pilot cases and eventually an investment project. Invited speakers provided ample information on biofumigation, biocontrol, IPM, alternative fumigants, substrates and results of the demonstration project undertaken some years ago in Mexico by UNIDO.

Members from the board of directors of the Mexican Flower Council were present and offered to coordinate trials, information diffusion and other related activities among their members. Results of the different activities carried out during the project have been disseminated through this channel.

Several examples of MB phase-out in other countries (like Colombia) were also provided for both sectors involved. Consequently, a study tour was organized, with five leading farmers and four technicians.

During the discussions and subsequently missions, great interest was shown on different alternatives amongst MB users – both present and potential or recurrent. Several growers signed agreements with the Ozone Unit for trialing alternatives at their farms. The most frequent alternatives or options mentioned were composting, substrates, IPM, solarization and bio-fumigation.

In this connection the establishment of two“ pilot projects” where growers, which are implementing alternatives and provide demonstration sites for others, were implemented. The important condition of this pilot cases were the appropriate technical support be provided since most alternatives can fail if they are not properly used (e.g. if the application equipment is not appropriate; if soil conditions are not optimal; if the treatment is carried out for the incorrect length of time or at the incorrect dosage; and others).

Pilot cases were established on ornamentals and cut flowers for which the following alternatives are currenly being tested: ***Steaming:*** Bunker steaming (i.e. steaming of a limited volume of substrate inside a special container) has been proposed and demonstrated to these growers as an alternative to MB and is enjoying wide acceptance. Steam sterilization (pasteurisation) is a process by which pests, diseases and weeds in the soil at a given time are killed by heat. In very simple terms, this involves injecting or otherwise diffusing hot steamed water into the soil with the aid of a boiler and conductors. As a general rule, it is recommended to carry out treatment so that the coldest spot in the soil or substrate is held at 70 to 80°C for 30 mintuwa. If carried out properly, steam is probably the best alternative to methyl bromide, proving equally effective.

For this purpose, steam treatment has been demonstrated in Xochimilco by means of a small, portable boiler (300 kg steam/hour); initial trials have shown that this alternative is both technically and economically feasible, however it is strongly recommended that it be implemented within an Integrated Pest Management (IPM) approach. Of particular concern is the health condition of propagation material used, as it may already carry low populations of pathogens, which allows a quick recontamination of the treated substrate.

Contrary to the region above, cut flower growers produce cut flowers for the local market (Mexico City and other cities throughout Mexico) and also for export in much larger operations. The technical level is generally higher, sometimes up to international standards. Growers in this sector normally use MB in cylinders, injected into the soil that is then tarped with plastic. A good number of the growers interviewed in the course of the TAS project have indicated that they do not use MB any longer, but still need alternatives for controlling soil-borne pests and diseases urgently. Of particular importance within this sector are the regions of Villa Guerrero, near Mexico City using MB for flowers such as delphiniums, lilies, gerberas and sometimes roses and Baja California Sur in the North of the country, producing mostly carnations for export to the United States.

Melons and watermelons

During 2006, a workshop was organized on alternatives to the use of methyl bromide in cucurbitaceous (mainly melons and watermelons). It was held in Colima and organiZed by the University of Chapingo and Colima. Two international consultants from Spain (University of Almeria) were fielded and UNIDO staff from Headquarters also participated in this event.

As consequence of such workshop, a pilot case was established in the premises of one of the biggest melon producers of Coloma State. The producer has selected the grafting technology. In the season 2006/2007, the pilot case started with the installation of about 2 ha, which represent 2560 grafted watermelon plants and 0.5 ha for melons, which is the equivalent of 3000 grafted plants. In the current season, (2007/2008) and considering the excellent results, the farmer is strongly increasing the area of the grafted watermelons and melon to 40 and 8 ha respectively. In terms of grafted plants this means about 85,000 grafted watermelons and a similar amount of grafted melons. This has been done mainly at the expenses of farmer and with the technical assistance from the project. The most important conclusion is that the farmer are convinced of this technology and other farmers from the region and outside the region are also enthusiastic with the grafting technology, especially now, as the Fusarium problems is becoming a constant in the Mexican soils. It is expected that the investment project would continue the support of these alternatives in different states.

Strawberries

In May 2006, a workshop was organized in Baja California in one of the most difficult sector in accepting alternatives to MB, as consequence mainly of brokers from USA, who requested the strawberry farmers to use methyl bromide. . The participants came from other regions of Mexico that are producing of strawberry: Zamora, Bajïo and Villa-Guerrero and Baja California., specially from the Valley of San Quintín.

The presentation were focussing in two main areas: the strawberry nurseries and the strawberry production. A Spanish consultant explained in detail the case of Spain and the difficulties to replace the methyl bromide in strawberries nurseries with no chemical alternatives. A consultant from Australia was invited, who exposed the case of Australia, where the alternatives focuse mainly on the use of metam-sodium. Considering the importance of the event and the situation in the USA, we invited a consultant from the US and obviously from California. He exposed mainly chemical alternatives. Special relevance was the work accomplished on new molecules (methyl iodide, etc.) and the study of the physical properties of new products (water dissolution, diffusion in the ground, etc.). In main lines, it showed as effective chemical alternatives as the BM.

Following the workshop, three pilot cases were established in Baja California. The field trials were conducted last year and based on the suggestion of farmers and in line with the accomplishments in California, USA and Spain. The pilot cases are being now installed and show very promising results, they intend to: 1) evaluate the efficiency of three application rates of Iodomethane (IM) combined with chloropicrin (CP) (50:50 formulation) and 2) evaluate three formulations of IM:CP (33:67, 50:50, and 67:33) applied by shank injection to raised beds. In addition, 1,3-dichloropropene (1,3-D) combined with CP (Inline) has been also applied. Metham Sodium and Potassium have also been suggested as good alternatives following the experience in Australia. Obviously solarization has been a constant when combined with chemicals, in order to reduce dosages by improving the efficiency of the chemicals in the soil. However, as most the viable alternatives originally suggested by many farmers were only chemicals, a leading farmer in the region introduced the soil-less alternative with promising results.

Tomatoes

Two workshops took place in 2006 and 2007. They focussed on alternatives to methyl bromide with emphasis in the use of grafting as alternative and counted with the presence of international experts from Spain and several national experts. In these workshops the participation was very high and they were actively practising the grafting technique.

With respect to the Structures and Commodities Component of the project, the activities so far have included the development of a MB consumption database, awareness-raising activities with MB users, technical assistance for a pilot group MB-using companies and the application and demonstration of MB alternatives in those companies. The design of the MB consumption database has been concluded. The main fields of the database include information on consumer's location, type of companies and sectors where MB is applied, consumption volumes and alternatives used for its substitution, among others.

Four promotional and training workshops took place on alternative uses of methyl bromide in the structures and commodities sector:

Workshops in the structures and commodities sector

Place	*Date*	*No. of Participants*
Monterrey, Nuevo León	December 8, 2006	45
Ciudad Obregón, Sonora	January 26, 2007	75
Tultitlán, Estado de México	February 23, 2007	90
Guadalajara, Jalisco	March 28, 2007	60
Total		270

The workshops addressed a total of 270 participants associated with the structures and commodities sector in Mexico (company technicians and fumigators). Among the participants were the most renowned national and international experts of MB alternatives. The project also designed and produced training and awareness materials of MB alternatives, based on a communication strategy.

Finally, and based on the interest generated by the awareness and training workshops, 9 companies received technical assistance to support MB alternatives pilot projects in their plants:

COMPANY	CITY
Laboratorios Griffith	Monterrey, N.L
Harinera La Espiga	México,DF
Harinera de México	México,DF
Gamesa Planta Monterrey	Monterrey,N.L.
Chipiga	Monterrey,N.L.
Gamesa Planta Obregón	Obregón,Son
CP Ingredients	México,DF
Tablex Miller	Obregón,Son
Molinera de México	Obregón,Son

An individual diagnostic and implementation plan was carried out for each company in order to properly determine the most appropriate set of actions and alternatives to phase-out its use of MB. These companies have received technical assistance and training to switch to the most suitable alternatives for their circumstances. The experiences of these companies with the use of alternatives will continue to be monitored until March 2008 and, subsequently, the results of these experiments will be evaluated and disseminated in order to encourage other MB users to transition to alternatives. It is expected that this component of the technical assistance project will be completed latest in June 2008**.**

4. JUSTIFICATION OF THE PROJECT

The Montreal Protocol officially listed methyl bromide as an ozone depleting substance in 1992. Governments agreed that developing countries would limit (freeze) their consumption of MB in 2002 (at the annual average of 1995-98), reduce 20% in 2005 and totally phase out MB by 2015 at the latest. Mexico has signed the Vienna Convention for the protection of the ozone layer, the Montreal Protocol, the London Amendment and the Copenhagen Amendment.

Mexico has already received assistance for complying with the 2005 reduction, which was successfully achieved. The country is therefore eligible to receive further assistance to phase out MB from the Multilateral Fund for the Implementation of the Montreal Protocol for the following reason:

- Mexico is classified as an Article 5(1) country under the Montreal Protocol.
- The Copenhagen Amendment of the Protocol has been ratified.
- Mexico is a traditional user of MB and is eligible for investment projects according to the MLF Executive Committee's Strategy and Guidelines on MB projects.

Mexico's MB baseline is 1130.8 ODP tonnes (1884.7 ODS tonnes). In 2005, reported consumption was below 904.64 ODP tonnes (1507.7 ODS tonnes) in accordance with the Montreal Protocol freezing guidelines. Current consumption (2007) is 895 ODP tonnes (1491 ODS tonnes), which is well below the 20% requirement.

As mentioned previously, Mexico has received financial resources from the MLF to assist farmers to voluntarily reduce its MB consumption and thus gradually achieve a 20% reduction by 2005, as agreed under the Montreal Protocol[2.] The project has been successfully implemented and helped many farmers and users in adopting alternative technologies for different crops and production systems around the country. With the aim of preserving the momentum the Mexican Government has decided to further pursue efforts leading to a sustained reduction in consumption and finally a complete ban of MB in 2013.

5. PROJECT OBJECTIVE

The aim of the project is to phase out **895** ODP tonnes (1491 ODS tonnes) of Methyl Bromide by 2013 according to the phase out schedule given below.

Table 14. Phase-out Schedule in ODP Tonnes

YEAR	2008	2009	2010	2011	2012	2013
MB Phase-out	0	100	120	150	200	325
Maximum allowed consumption	895	795	675	525	325	

This amount is used (A) in the production of melons, tomatoes, strawberries, flowers and ornamentals, Chile bell pepper, berries, garlic, other horticultural crops and (B) in the fumigation of commodities and structures. The following table indicates the number of farmers/users in each sub-sector:

[2] Two summary reports highlighting the main results of the Technical assistance project in both sectors: soil and commodities fumigation are being submitted together with this project document.

Table 15. (A) Number of Farmers Involved in Phasing-Out MB in Soil Fumigation

STATE	Strawberry	Tomato	Chile Bell	Melon	Berries	Garlic	Flowers	Other	TOTAL
Baja California	14	16	1		11		12	12	52
Baja California Sur	5	10	10					14	34
TOTAL ZONE 1									86
Mexico	8						51		59
Morelos	3						13		13
Puebla							8		8
Hidalgo							6		6
TOTAL ZONE 2									86
Guanajuato	12					28	9		49
TOTAL ZONE 3									49
Michoacan	20				65				85
Jalisco	7	14			37				58
TOTAL ZONE 4									143
Colima				11					11
TOTAL ZONE 5									11
Sinaloa		37	49				19	36	141
Sonora		8	23	35				10	76
Cohahuila		5		25					30
TOTAL ZONE 6									247
Durango				23					23
TOTAL ZONE 7									23
Yucatan								27	27
TOTAL ZONE 8									27
TOTAL	**69**	**90**	**83**	**94**	**113**	**28**	**118**	**99**	**694**

Table 15. (B) Number of Users Involved in Phasing-Out MB in Commodities and Structures Fumigation

STATE	NUMBER OF TRAINEES
Aguascalientes	14
Coahuila	28
Baja California Norte	36
Baja California Sur	18
Nuevo León	59
Michoacán	71
Sinaloa	306
Sonora	112
Tamaulipas	290
San Luis Potosí	17
Colima	
Jalisco	
Nayarit	12
Guanajuato	48
Veracruz	49
México	68
Querétaro	12
Morelos	
Puebla	38
TOTAL	**1,178**

6. PROJECT DESCRIPTION

The project has been developed along two lines drawn by the results obtained during the implementation of technical assistance and by recognizing the importance of advancing in Mexico towards the elimination of methyl bromide. Building on the activities carried out and the potential of the alternatives and the needs: investment and training, the project will focus on advancing the adoption of the selected alternatives. The project will concentrate on conducting the training and on provide the necessary inputs. It is expected that the policy and legal framework will be in place by the authorities and would help in the adoption of the alternatives by limiting the methyl bromide in the country.

All alternatives selected, have thoroughly discussed with the farmers and, in many cases, as explained early, adopted. With the assistance of the database developed, we were able to practically contact all the growers and exchange views in selecting the best and most suitable alternatives.

6.1 Justification of Alternatives Selected

6.1.1 Tomatoes:

Although a large proportion of tomatoes are still grown in open fields, greenhouse production is on the rise and technologies have changed significantly since the first demonstration project was implemented. Availability of resistant rootstocks and compatible varieties has improved to the point that grafting has become one of the best alternatives at hand. The technical assistance project has demonstrated that Mexican farmers can easily adopt grafting technology and that small grafting units were feasible. In view of this, two alternatives have been chosen for replacing MB in tomato production:

- Grafting with infrastructure and technology adapted to Mexican conditions (81% of the area planted)
- 1-3 D dichloropropene plus chloropicrin (Telone) applied through the drip irrigation (emulsifiable formulation). (19% of the area planted)

Telone, although toxic and less environmentally friendly, was chosen for those areas or farms where grafting becomes too expensive due to the minimum viable size of the unit that is necessary to make this alternative economically feasible. Most farmers have already plastic PVC injectors and valves resistant to this chemical and the supplier provides safety return valves.

Tomato growers are in favour of grafting alternative in view of its large adoption all over the world, the enormous improvements in varieties and rootstocks that are now available and its inherent safety for the environment and workers.

Implementing this alternative requires the construction of complete grafting units for:

- Production of grafted plants for 20 hectares
- Production of grafted plants for 50 hectares
- Production of grafted plants for 100 hectares

When calculating the required capacity of the grafting units, the project has to consider that the "window" period for planting lasts about 2 months. Some growers produce two or even three crops per year, which means that the capacity of the grafting unit should be such as to produce a sufficient number of grafted seedlings during a period of 1.5 months. Whenever possible, calculations have been made using a two month " planting window", which is obviously cheaper.

6.1.2. Chile Bell Peppers:

Most chile bells are grown in open fields (protected) and therefore the best alternatives chosen by the farmers are:

- Bio-fumigation (47%)
- Grafting on resistant rootstocks (53%)

Although a large majority of growers prefer grafting or soil less cultivation, the costs of these alternatives are too high for small production units. Grafting requires a minimum unit size to be viable and the coco-fibre substrate requires a higher investment per hectare.

6.1.3. Strawberry

Strawberries are grown mainly in open fields (protected). In line with the results obtained from the demonstration project and pilot experiences since then, two alternatives have been chosen for strawberries growing, as follows:

- A combination of solarization and 1-3 D + Chloropicrin (Telone-C35, emulsify formulation) through the drip irrigation system. This option will be used on 95% of the production area.
- Soil less culture on coco-fibre for 5% of the planted area.

Telone, although toxic and less environmentally friendly, was chosen because of its relatively low cost. Most of the farmers already owe plastic PVC injectors and valves that are resistant to this chemical and the supplier provides safety return valves.

Soil less production was selected as an alternative for those areas where the application of 1-3 D/Pic is hazardous to urban or village populations or where concerns relating to contamination of the water table exist.

The coco-fibre system requires investing in substrates and plastic gutters, as well as special steel tripods to raise the growing beds about 1.3 metres above the soil. This system allows for great economies in plastic bags and water micro-diffusers, as these are no longer needed. The existing dripping system works well.

6.1.4 Melon

Melon growers are mainly located in the States of Cohauila, Colima, Durango and Sonora. The grafting system, as chosen, is the only effective alternative for controlling severe re-infestations by *Fusarium* and MNSV. In reality the demonstration project has shown that alternatives, which were apparently working well (like MS or 1-3 D/ Pic), become ineffective when the incidence of Fusarium or MNSV was high. Only grafted plants resisted attacks from these pests.

Growers have unanimously selected grafting as the only viable alternative.

6.1.5 Berries

Due to the special relationship between growers and buyers, two alternatives appear feasible alternatives follows:

- Fumigation with 1-3 D/ Pic EC (Telone, in emulsifiable formulation), which is applied through the drip irrigation system. This will be used for 93% of the production area.
- Soil less culture on coco-fibre, for the remaining 7%.

Berry cultivation follows the same pattern as strawberries.

Telone, although toxic and less environmentally friendly, was chosen in view of its relatively low cost. Most growers already own plastic PVC injectors and valves that are resistant to this chemical and the supplier provides safety return valves.

Production in substrates was selected for those areas where 1-3 D/ Pic poses hazard risks for to urban or village populations or where contamination of the water table is of concern.

The coco-fibre system requires investing in substrates and plastic gutters, as well as special steel tripods to raise the growing beds about 1.3 metres above the soil. This system allows for great economies in plastic bags and water micro-diffusers, as these are no longer needed. The existing dripping system works well.

6.1.6 Garlic

The main problem with garlic production is white rot (*Sclerotium cepivorum*), for which three alternatives have been identified:

- Selective fungicides such as Tebucanozole or Iprodione (Rovral) coupled with biological control with *Trichoderma harzianum*
    - A broader chemical approach for example a combination of solarization plus 1-3 D/ Pic EC applied through the drip irrigation system, or injected into the soil (in the appropriate formulation).
    - Solarization plus Metam Sodium.

Most growers have chosen Telone injected into the soil. This chemical, although toxic and less environment friendly was chosen in view of its relatively low cost. If applied through the drip irrigation, farmers already owe plastic PVC injectors and valves that are resistant to this chemical and the supplier provides safety return valves.

6.1.7 Other Agricultural Crops

About 70 tonnes of MB are reportedly used for soil fumigation in greenhouses and open field production of a large number of vegetables like cucumber, lettuce, spinach, celery and aromatic or medicinal plants.

The alternatives of choice for this large group of crops, grown in diverse climatic areas and attacked by various pests, have been selected on the basis of the results of the demonstration project. They are:

- Grafting for cucumbers (96.6 ha).
- Bio-fumigation combined with solarization for aromatic and medicinal plants (49 ha).
- 1-3 D/ PicEC applied through the drip irrigation system for the remaining products in this category (59 ha).

Grafting requires setting up grafting units, while bio-fumigation would not require additional equipment. Using Telone requires intensive training and this alternative has only been chosen in areas away from urban population and where risk of water contamination is low.

6.1.8 Flowers and Ornamentals

MB is used by growers to sterilize soil used in the production of cut flowers (mostly long cycle) as well as for fumigating substrates used for ornamental pot plant production.

Flower growers have selected three alternatives:

- Non-fumigated (new) coco fibre and/ or local substrates, which are quite cheap in Mexico. (48 ha). These can be used both for cut flower or pot plant production
- Solarization of recycled substrate with solar boxes. (58,240 m^3)
- Steam injection when substrate media would be too expensive (93 ha).

When the areas to sterilize are not too large, as in the case of Mexico, steam sterilization of the soil using newly developed steam injectors, is an environmentally sound and cost effective solution. Selection of this alternative is supported by the latest results of the demonstration project, as well as the excellent results obtained with this technology in Brazil, Argentina, Uganda, Zimbabwe, Colombia, etc. It is essential that these alternatives –steaming in particular– be implemented within the IPM concept, otherwise the arising costs may become prohibitive.

Table 16. Distribution of the alternatives by crops

Alternative		Surface effectively treated with the alternative (has)	STATE
Tomatoes	Grafting	824	
	Telone	199	
		1023	Baja California, Baja California Sur; Sinaloa; Jalisco; Sonora; Coahuila
Chile Bell Peppers	Grafting	86	
	Biofumigation	75	
		161	Baja California, Baja California Sur; Sinaloa; Sonora;
Strawberries	Solarization plus Telone	1,062	
	Soilless Coco Fibre	35	
		1,097	Baja California, Baja California Sur; Michaocan, Guanajuato, Estado de Mexico, Jalisco Morelos
Melon	Grafting	570	Sonora; Coahuila, Durango, Colima
Berries	Telone	599	
	Soilless Coco Fibre	31	
		630	Baja California, Jalisco Michoacan
Garlic	Telone	**54**	Guanajuato

Other crops	Grafting for cucumbers	96.6	
	Biofumigation for aromatic plants	49	
	Telone for other horticulture crops	**59**	
		205	Baja California, Baja California Sur; Sinaloa; Sonora; Yucantán
Flowers and ornamentals	Soilless Coco Fibre and/ or local substrates	48	
	Steaming	93	
	Substrate with solar boxes	**64**	
		205	Estado de México, distrito Federal; Morelos, Sinaloa, Baja California, Puebla, Guanajuato, Hidalgos
TOTAL Area with alternatives		**3945**	

6.1.9 Commodities and structures

Based on the experience generated from the companies, who received technical assistance to support MB alternatives pilot projects in their plants, for which individual diagnostic and implementation plan was carried out, discussions were held with many companies interested to replicate the alternatives.

As there are not one alternative, which depends of the intention and the environment of the application, we have selected the following alternatives: I

Grain and stored products in silos/bins, warehouses, railcars, vessels – alternatives selected for this use include fumigation with phosphine (tablets or pellets), and/or grain protectants such as cyfluthrin, chlorpyrifos methyl, malathion, delta methrin, DE or neem. In some circumstances, for example silos, it is necessary to use a recirculation system for phosphine.

Artefacts - cold treatment at -18°C for 6 days or more depends on the pest species present. Sulfuryl fluoride will also provide a useful option, once it becomes registered.

Wood, wooden products – kiln (heat) treatment or phosphine applied under tarpaulins.

Dried fruit and nuts – where rapid treatment is required, Carvex pressure chambers with carbon dioxide will be used. If treatment length is not an issue, phosphine or controlled atmospheres or vacuum-hermetic systems are feasible, depending on the type of product.

Flour mills, food factories, breweries, other buildings – IPM consisting of detailed cleaning programmes, monitoring, use of spot treatments, fogging with pyrethrins and insect growth regulators, pheromones, screens, and phosphine fumigation of inbound raw ingredients. IPM is combined with heat treatments as necessary. Fumigation with low concentrations of phosphine + CO_2 + heat, as used in the USA, will be introduced in a proportion of facilities during the project. Fumigation with sulfuryl fluoride will provide another option once it becomes registered.

Empty silos – pyrethrin fogging or treatment with a contact insecticide (eg. cyfluthrin, chlorpyriphos-methyl or diatomaceous earth) are good options for this use.

Airplanes – fumigation with CO_2 or other inert gas, as used in Europe.

6.2. Implementation Strategies per Sub-sector

The project will continue with the strategy followed by the technical assistance. The activities will be carried out together with farmers who firstly volunteered with their participation and are ready to adopt these alternative technologies. Furthermore, the project would focus during the first two years on crops, like melons, cut flowers and tomatoes. Sectors, such as strawberry would be attended in a later stage. However, at any time, all sectors would be addressed with farmers ready to agree of an elimination programme. Commodities sectors are going to be firstly addressed by main consumers and States.

Agreement with farmers or group of farmers, depending of the crop and/or area, would be established. In such agreement, the farmer or group of farmers would commit themselves to eliminate the use of methyl bromide, in exchange the project will provide the necessary inputs: equipment, training and the required technical assistance.

The project will implement the transfer of capital inputs including training programme in order to ensure that all MB users have access to alternative technologies. For that purpose, the experience gained in the technical assistance will be used. The national expertise already involved and the institutions who have worked during the technical assistance project would be an important asset to guaranteed sustainability of the project. During the implementation of the technical assistance project a great number of national experts from prestigious Universities or Associations or Research Institutes have been exposed and trained in the alternatives to the use of methyl bromide, it is envisaged to count with the participation of such expert or the relevant institutions.

In parallel, the Government will secure the application of legislation:

- To enforce import restrictions that help comply with the agreed phase-out schedule.
- To work closely with State authorities, Federal authorities and growers/users.
- To continue working in close contact and cooperation with MB importers, which are already registered.

Presently, all importers of MB are registered by COFEPRIS (Federal Commission for the Protection Against Sanitary Risk) and all import licenses are subject to approval by COFEPRIS as well as by SEMARNAT (Ministry of the Environment, Secretaría de Medio Ambiente y de Recursos Naturales) in compliance to the Montreal Protocol Agreement.

SEMARNAT is committed to enforce a maximum ceiling of imports in order to ensure compliance with the agreed phase-out schedule and at the end of the project a MB import ban will be implemented for the controlled uses of methyl bromide.

6.3 Activities and anticipated outputs

Output: Methyl bromide users in the main crops agreed on the elimination targets

Activity 1. Discuss with the farmers targets and work plans to reach such targets

Activity 2 Advance and sign agreements to the farmers or group of farmers to eliminate methyl bromide

Output: Farmers trained for the adoption of the new alternatives

Activity 1. Training workshops for trainers, technicians and farmers in the selected alternatives on grafting, soil less technology, steaming, application of the alternative chemicals, and bio-fumigation, all of the within the framework of integrated pest management.

Activity 2. The dissemination of information on successful alternatives already used by farmers.

The project will coordinate the training efforts with the existing training and extension services provide by Universities, National Institutions and/or Farmers associations

Output: Farmers adopted alternatives to the use of methyl bromide

Activity 1. Supply of the required equipment in accordance with crop and alternative selected.

Activity 2. Ensure the participation in the training sessions.

Activity 3. Direct technical assistance provided by national experts already aware of the alternatives.

Output: Companies using methyl bromide in commodities and/or structures adopted alternative to the use of methyl bromide.

Activity 1. Discuss and sign agreement with the companies, targets and work plan to reach such targets

Activity 2. Training workshops for fumigators and companies technicians on selected alternatives within the framework of integrated commodity pest control.

Activity 3. Supply of the required equipment in accordance with the alternative selected

Activity 3. Direct technical assistance provided by national experts.

6.4 Resources needed

6.4.1 Training Needs

Training to transfer the different technologies associated to the proposed alternatives may vary:

- Grafting requires comprehensive training in (a) the grafting technology itself, (b) management of the grafting unit and (c) crop management, which is completely different to that of non-grafted varieties, presently in use. The programme requires expertise at all levels.
- Soil less cultivation requires international and national expertise in fertilization, irrigation and crop management.
- Soil steaming requires training in its correct application (i.e. length of treatment, soil preparation and others) as well as in safe equipment handling and use. Further, steaming should always be implemented within a thorough IPM programme in order to remain economically feasible.
- Training on the correct application of 1-3 D/ Pic.
- Training on bio-fumigation.
- Training on the fumigation of commodities will reach 1.200 fumigators and pest control personnel with an average of 4 individuals per company.

In total, the project will need to train about 694 growers in the following States and Regions:

Table 17. Growers to be trained

STATE	Strawberry	Tomato	Chile Bell	Melon	Berries	Garlic	Flowers	Otherr	TOTAL
Baja California	14	16	1		11		12	12	52
Baja California Sur	5	10	10					14	34
TOTAL ZONE 1									86
Mexico	8						51		59
Morelos	3						13		13
Puebla							8		8
Hidalgo							6		6
TOTAL ZONE 2									86
Guanajuato	12					28	9		49
TOTAL ZONE 3									49
Michoacán	20				65				85
Jalisco	7	14			37				58
TOTAL ZONE 4									143
Colima				11					11
TOTAL ZONE 5									11
Sinaloa		37	49				19	36	141
Sonora		8	23	35				10	76
Coahuila		5		25					30
TOTAL ZONE 6									247
Durango				23					23
TOTAL ZONE 7									23
Yucatán								27	27
TOTAL ZONE 8									27
TOTAL	**69**	**90**	**83**	**94**	**113**	**28**	**118**	**99**	**694**

Details on the training programme and its costs are given in Annex II.

The magnitude of the project, the numerous inputs and activities to be coordinated in order to deliver the equipment, to train growers, to organize the phase-out schedule and to monitor application of technologies, as well as effective phase-out implementation fully justify contracting the services of experts or an institution during the entire project implementation.

6.4.2 Equipment Needs

6.4.2.1 Tomatoes

Equipment needed for setting up the grafting system and for fumigating with 1-3 D/ Pic appear in Table 17 below:

Table 18. Tomato Equipment

STATE	Area treated with MB (hectares)	MB Consumption (Tonnes)	Large growers	Small growers	Area with Telone (ha)	Area with grafting (ha)	Small (20 ha) grafting units	Medium (50ha) grafting units	Large (100 ha) grafting units
Baja California	145	47.5	4	12	28	117	1	2	
Baja California Sur	60	18.4	2	8	11	49		1	
Sinaloa	440	155.0	12	25	84	356		1	3
Jalisco	312	113.4	2	12	59	253		3	1
Sonora	60	20.2	2	6	11	49		4	
Coahuila	6	2.1	0	5	6	0			
TOTAL	**1,023**	**356.6**	**22**	**68**	**199**	**824**	**1**	**11**	**4**

Specifications and costs of grafting units for 20, 50 and 100 ha are given in Annex I.

6.4.2.2 Chile Bell Peppers

There is no need of extra equipment for bio-fumigation. The equipment needed for grafting appears below:

Table 19. Chile Bell Equipment

State	Area fumigated with MB (ha)	MB consumption (tons)	Large growers	Medium growers	Area with bio-fumigation (ha)	Area with grafting (ha)	Small (20 ha) grafting units	Medium (50ha) grafting units	Large (100 ha) grafting units
Baja California	7	2.6	1		7	0			
Baja California Sur	21	8	3	7	21	0			
Sinaloa	98.25	37.3	7	42	47	51.25		1	
Sonora	35	13.3	3	20	0	35	2		
TOTAL	**161.25**	**61.2**	**14**	**69**	**75**	**86.25**	**2**	**1**	**0**

Equipment specifications are given in Annex I

6.4.2.3 Strawberries

There is no need of additional equipment to fumigate with 1-3 D/ Pic (Telone EC). The equipment needed to set up the soil less system is the following:

Table 20. Strawberries Equipment

	Area treated with MB (ha)	MB Consumption (tonnes)	Number of large growers	Number of small growers	Total growers	Area using Telone (ha)	Area using soilless coco fibre (ha)
Baja California	677	265.3	9	5	14	663	14
Baja California Sur	35	13.5	2	3	5	33	2
Michoacán	255	99.9	6	14	20	242	13
Guanajuato	62	24.3	2	10	12	59	3
Estado de México	39	15	0	8	8	37	2
Jalisco	25	9.9	1	6	7	24	1
Morelos	4	1.5	0	3	3	4	0
TOTAL	**1,097**	**429.4**	**20**	**49**	**69**	**1,062**	**35**

Specifications on the equipment needed for setting up one hectare of soil less production are given in Annex I. 55 sets of the implements described in Annex 1 will be necessary.

6.4.2.4. Melon

Phase-out of MB would require the installation of the following grafting units:

Table 21. Melon Equipment

STATE	Area treated with MB (ha)	MB Consumption (tonnes)	Number of large growers	Number of small growers	Area using grafting (ha)	Medium (50ha) grafting units	Large (100 ha) grafting units
Coahuila	168	27.6	6	19	168	3	
Colima	47	9	1	10	47	1	
Durango	105	17.4	5	18	105	2	
Sonora	250	42	10	25	250	2	0
TOTAL	**570**	**96**	**22**	**72**	**570**	**8**	**0**

Grafting units specifications and unitary costs are given in Annex I

6.4.2.5 Berries

Equipment required consists of 44 sets of implements used for soil less cultivation, as described in Annex I

Table 22. Equipment For Berries

STATE	Area fumigated with MB (ha)	MB Consumption (Tonnes)	Number of large growers	Number of small growers	Total growers	Area with Telone (ha)	Area with soilless coco fibre (ha)
Baja California	38	15	1	10	11	36	3
Jalisco	170	66.6	2	35	37	158	12
Michoacán	422	165.4	5	60	65	405	17
TOTAL	**630**	**247**	**8**	**105**	**113**	**599**	**31**

6.4.2.6 Garlic

Large growers have chosen to apply Telone as hot gas and there is need for safety applications sets, as described in Annex I.

Table 23. Equipment For Garlic

STATE	Area fumigated with MB (has)	MB Consumption (Tonnes)	Number of large growers	Number of small growers	Total growers	Telone application (ha)
Guanajuato	53.8	21.1	2	26	28	54
Total	**53.8**	**21.1**	**2**	**26**	**28**	**54**

6.4.2.7 Other Horticultural Products

As described above, growers have chosen grafting for cucumbers (96.6 ha), bio-fumigation plus solarization for aromatic plants (49 ha) and 1,3-D/ Pic EC applied with the drip irrigation for other holticultural crops included in this section (59 ha).

Two 50 ha grafting units will be required. No extra equipment is needed for bio-fumigation or fumigation with chemicals.

Table 24. Other Horticultural Products Equipment

STATE	Area fumigated with MB (ha)	MB Consumption (Tonnes)	Number of large growers	Number of small growers	Area using Telone (ha)	Area with bio-fumigation (ha)	Area with grafting (ha)	Medium (50ha) grafting units
Baja California	69.6	23.2	2	10	24		46	1
Baja California Sur	24	8	2	12		24		
Sinaloa	34.2	11.5	4	32	9	25		
Sonora	14.4	4.9	2	8	14			
Yucatán	62.4	20.9	2	25	11.8		50.6	1
TOTAL	**204.6**	**68.5**	**12**	**87**	**59**	**49**	**96.6**	**2**

6.4.2.8 Flowers and Ornamentals

Five steaming units - mobile 1.000 kg/hr boilers with water softener, producing steam to feed a mobile steam injector are necessary. 60 meters of resistant flexible pipe (3 bar) are included in cost of the boilers.

551 solar boxes will be required for sterilizing substrates used in ornamental pot plant production by means of solar energy. Each box, composed of five aluminium pipes has a capacity of treating 0.12 m^3 of substrate.

For soil less production, coco fibre substrate and/or locally available substrates and auxiliary equipment (micro diffusers) are necessary. These are used for both cut flower and pot plant production and are described in Annex I.

Table 25. Equipment For Flowers And Ornamentals

STATE	Area fumigated with MB (ha)	MB Consumption (Tones)	Large growers	Small growers	Area with steaming	Steaming units	Substrate solar pasteurization (ha)	Solar boxes	Soilless area (ha)	Substrate pasteurization (m^3)
Estado de México	68	20.3	8	25	38	2	15	129	15	1860
Distrito Federal	10	2.2	3	15	10	1		0	0	0
Morelos	4	1.1	3	10				0	4	0
Sinaloa	13	4.5	4	15			5	43	8	620
Baja California	100	30	12	0	45	2	40	344	15	4960
Puebla	6	1.7	2	6				0	6	0
Guanajuato	3	0.73	1	8			3	26	0	372
Hidalgo	1	0.36	1	5			1	9	0	124
TOTAL	**205**	**60.9**	**34**	**84**	**93**	**5**	**64**	**551**	**48**	**7936**

6.4.2.9 Equipment for Commodity Fumigation

The total volume fumigated with MB is approx. 4,441,355 m^3, based on the typical average MB dose between 33-36 g/m^3 depending on the application and conditions.

Fumigation of grain/products with phosphine will require equipment for recirculation the gas in 96 locations, primarily silos, accounting for a volume of about 1,810,472 m^3. Fumigation of shipholds increase the volume by 110,294$m^{3.}$ Necessary equipment includes recirculation systems with blowers, circulation piping, and phosphine detection equipment.

Large chest freezers or access to commercial freezer storage facilities will be necessary for treating artefacts.

Dried fruit and nuts in 3 locations require rapid treatment that can be provided by Carvex pressure chambers.

Wood and wooden products will require either equipment for heat treatment or, in some cases, tarpaulins and equipment for detecting phosphine. Table 25 below describes incremental equipment needed for commodity treatment.

Table 26. Incremental Capital Equipment In Commodities Sector

Equipment	Volume requiring equipment (m^3)	No. units
Grains, stored products, wooden products - silos, bins, warehouses, trucks, railcars 66.25 tonnes MB. Volume treated with MB: 1, 810,472m^3		
Phosphine detection equipment (bellow pump and detection tubes)	Only for MB users who do not have equipment	**30**
Self contained breathing apparatus		**24**
Polyethylene sheets and tape for loose and bagged product	307,780	**15**
Phosphine tablet dispensers for silos and bins only	**1,502,692**	**40**
Recirculation system including blowers, recirculation piping and tape for silos and bins requiring phosphine recirculation	**1,502,692**	**150**
Products in ship holds **3.75t** MB. Volume treated with MB: **110,294** m^3		
Phosphine recirculation system including recirculation piping and tape	**110,294**	**9**
Phosphine detection equipment	**110,294**	**8**
Self-contained breathing apparatus	**110,294**	**6**
Products requiring rapid treatment, eg. dry spices, dried fruit 6t MB. Volume treated with MB: 176,471m^3		
Carvex chamber (controlled atmosphere, pressure) installation including related equipment	**176,471**	**1**
Museums, historical items **2.3 t MB. Volume treated with MB: 67,647 m3**		
Cold treatment equipment	**67,647**	**2**
Flour mills, food factories – phosphine + heat + CO_2 with IPM 57.4 t MB. Volume treated with MB: 1,688,236 m^3		
Heaters (electric)	**1,688,236**	**42**
Additional sealing of building, equipment etc.	**1,688,236**	**15**
Self contained breathing apparatus	**1,688,236**	**24**
Gas detection equipment (phosphine and CO_2)	**1,688,236**	**25**
Heaters (electric)	**588,235**	**42**
Changed sprinkler heads (replaced to 100°C rating)	**588,235**	**5**
Thermometers	**588,235**	**210**
Additional sealing of building, equipment etc.	**588,235**	**10**
Self contained breathing apparatus (heat)	**588,235**	**21**
TOTAL	**4,441,355**	

In food facilities the introduction of IPM programmes (consisting of cleaning programmes, monitoring, use of spot treatments, and phosphine fumigation of inbound raw ingredients) will require ULD foggers, pheromone traps, safety equipment and respirators. Heating equipment is also required. IPM + heat will be installed in about 75% of the facilities, representing a volume of about 1,688,236m^3. Fumigation with phosphine + CO_2 + heat will be introduced in the remaining 25% of facilities, a volume of about 588,235 m^3.

6. PROJECT IMPACT

By implementing this project, Mexico will completely phase-out Methyl Bromide by the year 2014. A 40% reduction would already be achieved in 2011.

7. PROJECT INPUTS

7.1 Capital Goods

The following items will have to be purchased and installed:

- 1-3 D/ Pic resistant Venturi injectors with all accessories, but without water tanks; security sets of water valves and devices for safely using this fumigant.
- Grafting units composed of (1) germination units and greenhouses for growing scions and rootstocks (2) grafting workshops (3) production units for grafted plants; grafting workshops for grafting, healing and rooting.
- Tray sowing machines and accessories for grafting.
- Steam boilers with pasteurization sheets for soil and substrate pasteurization.
- Recirculation system for phosphine in silos, phosphine detection equipment, pressure/CO_2 chambers, ultra low dose (ULD) foggers, traps for rodents and pheromones, safety equipment, thermometers, and heaters.

7.2 Training

Training programme details are given in Annex II

8. PROJECT IMPLEMENTATION

The project will be implemented by UNIDO and Canada under guidance and coordination of the National Ozone Office Unit (NOU) of the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) of Mexico.

The contracts for the major component of the project, which is represented by equipment, will be awarded on the basis of competitive bidding. The final terms of reference for the subcontracts will be established after the project is approved. The bids will be organized by UNIDO and Canada and the selected subcontractor will be responsible for the supply and delivery of all necessary equipment.

Detailed specifications for the equipment and the work plan will be elaborated by UNIDO and Canada in consultation with key stakeholders in Mexico, once an implementation agreement (Memorandum of Understanding) has been reached with the NOU.

The implementing agencies will provide information concerning project implementation and financial disbursements to the Ozone Unit twice a year.

As implementing agencies, UNIDO and CANADA have the necessary experience and capabilities for the successful implementation of projects in the methyl bromide sector, being already present in many Article 5 countries. Upon approval by the Multilateral Fund for the implementation of the Montreal Protocol (MLF), the project budget will be transferred to UNIDO and Canada for the soil and commodities sectors, respectively. The UNIDO and Canada will then issue the corresponding project allotment document. Any substantive or financial deviation will be subject to approval by the MLF Executive Committee.

9. PROJECT COSTS

9.1 Capital Costs

Capital Cost Investment as per Annexes I and II, can be summarized as follows:

Table 27. Investment Costs in US$

	EQUIPMENT	TRAINING	SUB-TOTAL CAPITAL
Strawberries with Telone	0		0
Strawberries Soilless	917,562		917,562
Tomato with Telone	0		0
Tomato Grafting	4,112,379		4,112,379
Chile Bell Pepper Bio-fumigation	0		0
Chile Bell Pepper Grafting	434,351		434,351
Melon Grafting	2,226,763		2,226,763
Berries with Telone	0		0
Berries soil less	835,210		835,210
Garlic with Telone	0		0
Flowers soil less	516,000		516,000
Flowers substrate solarization in boxes	220,444		220,444
Flowers soil steaming	175,000		175,000
Other crops with Telone	0		0
Other crops with bio fumigation	0		0
Other crops with grafting	773,944		773,944
Commodities	901,510		901,510
Training in horticulture		1,256,000	1,256,000
Training in commodities		195,600	195,600
TOTAL	**11,113,163**	**1,451,600**	**12,564,763**

9.2 Incremental Operating Costs

The incremental operating costs as detailed in Annex III are summarized in the following table:

Table 28. Incremental Operating Costs in US$

CROPS/USES	OPERATING COSTS
Strawberries with Telone	-361,790
Strawberries Soilless	-110,496
Tomato with Telone	-68,556
Tomato Grafting	-2,215,181
Chile Bio-fumigation	-48,202
Chile Grafting	-333,063
Melon Grafting	-351,427
Berries with Telone	-594,421
Berries soilless	-130,251
Garlic with Telone	-50,122
Flowers soilless	-208,124
Flowers solarization with boxes	-192,567
Flowers soil steaming	17,627
Other crops with Telone	-9,347
Other crops with bio fumigation	4,864
Other crops with grafting	-158,506
Commodities	210,701
TOTAL	**-4,598,860**

9.3 Contingency Fund

A contingency fund consisting of 10% of the investment cost is included, in order to cover unforeseen expenses that might occur during project implementation such as the purchase of small testing equipment, price escalation, unforeseen transport costs, etc.

9.4 Total Project Costs

Table 29. Total Project Costs (US$)

	OPERATING COSTS	EQUIPMENT	TRAINING	SUB-TOTAL CAPITAL	CONTINGENCY	TOTAL PROJECT COSTS
Strawberries with Telone	-361,790	0		0		
Strawberries Soilless	-110,496	917,562		917,562		
Tomato with Telone	-68,556	0		0		
Tomato Grafting	-2,215,181	4,112,379		4,112,379		
Chile Bio-fumigation	-48,202	0		0		
Chile Grafting	-333,063	434,351		434,351		
Melon Grafting	-351,427	2,226,763		2,226,763		
Berries with Telone	-594,421	0		0		
Berries soilless	-130,251	835,210		835,210		
Garlic with Telone	-50,122	0		0		
Flowers soilless	-208,124	516,000		516,000		
Flowers solarization with boxes	-192,567	220,444		220,444		
Flowers soil steaming	17,627	175,000		175,000		
Other crops with Telone	-9,347	0		0		
Other crops with bio fumigation	4,864	0		0		
Other crops with grafting	-158,506	773,944		773,944		
Commodities	210,701	901,510		901,510		
Training in horticulture			1,256,000	1,256,000		
Training in commodities			195,600	195,600		
TOTAL	**-4,598,860**	**11,113,163**	**1,451,600**	**12,564,763**	**1,256,476**	**9,222,379**

10. PREREQUISITES

In accordance with the regulations of the Executive Committee of the Multilateral Fund, project funds will only cover incremental costs up to an amount of US$ 9,222,379. All other expenses, such as:

- Equipment installation
- Cost of technical staff needed to install such equipment
- Local transportation of melon grafting units from the nearest harbour to farmer's association sites
- Any additional equipment not included in the present project document
- Any deviation of costs of equipment to be purchased shall be borne by MB users

Prior to project initiation, a Memorandum of Understanding (MOU) will be prepared by the Implementing Agency in cooperation with the Ministry of the Environment. This memorandum will specify the above-mentioned responsibilities of the counterpart, the counterpart enterprises or institutions.

11. PROJECT MONITORING

MILESTONES FOR PROJECT MONITORING

Date of project approval: April 2008

Milestone	Date	Month	Results			Remarks
			Achieved	Not Achieved	Delay	
Memorandum of understanding submitted	05/2008	1				
Memorandum of understanding signed	06/2008	2				
First set of equipment and training bids prepared	07/2008	3				
Contract for equipment and training awarded	09/2008	5				
First Phase of training in horticulture initiated	09/2008	6				
Training in commodities initiated	09/2008	6				
First set of equipment installed	12/2008	9				
Bids for second set of equipment awarded	12/2009	21				
Second set of equipment installed	06/2010	27				
First Phase of training in horticulture and commodities completed	06/2011	39				
Second phase of training in horticulture initiated	01/2012	45				
Second phase of training in horticulture completed	12/2013	66				
Phase-out achieved	04/2014	72				
Project Completion Report	04/2014	72				

12. POLICY MEASURES AGREED BY THE GOVERNMENT OF MEXICO

The Government of Mexico ratifies its commitment to enforce 100% reduction of MB consumption by 2014 and the enforce the following agreed reduction schedule:

YEAR	2008	2009	2010	2011	2012	2013
MB Phase-out	0	100	120	150	200	325
Maximum allowed consumption	895	795	675	525	325	0

The Government of Mexico agrees to enforce these reductions by regulating the total amount of MB imported and issue administrative regulations to ensure that non-qualifying and qualifying enterprises will limit their consumption.

The policy presently in force, and which regulates the procedures for importing MB and establishes an import clearance from SEMARNAT, will continue to be enforced. This policy has successfully controlled MB consumption and allowed Mexico to comply with MB freeze in 2002.

SEMARNAT will monitor phase out and consumption at State level with the assistance of the Implementing Agencies.

After the implementation of this project, the Government of Mexico agreed to ban the import of methyl bromide for the controlled uses.

ANNEX I: EQUIPMENT COSTS

1. Soilless production technology for Strawberries and Berries

Equipment specifications and costs follow:

SOIL LESS PRODUCTION TECHNOLOGY FOR STRAWBERRIES

	Amount	US$/unit	TOTAL
Tripod steel bars	3840	1.7	6,528
Polystyrene containers (gutters). 3.5 mm thick and density 700 g/m^2	7680	1	7,680
Water collector funnel Diameter 25 mm	320	3	960
Gravel. 1cm layer on bottom of the plastic container. m^3	18.4	8	147
Coco fibre. m^3	275	30	8,250
Installation w/m	10	300	3,000
TOTAL			26,565

2. Tomato grafting

Specifications and cost for crop areas of 50 and 100 ha are given below:

	100 HECTARES			50 HECTARES		
	Amount	Unit price in US$	TOTAL	Amount	Unit price in US$	TOTAL
General Parameters						
Planting ¨window" 70 days						
External temperature range = 4º-45º						
Germination Unit						
Area (m^2)	58			31		
Isolated panel 1.1 m length, 80 mm thick and 2.6 m high. (m)	31.0	31.0	961.0	22.4	31.0	694.4
Isolated panel 1.1 m length, 80 mm thick and 6.2 m high. (m)	9.3	73.7	685.5	5	73.7	368.6
Floor in reinforced concrete (m^3)	5.8	91.0	527.8	3.1	91.0	282.1
Hermetic 2.5x3 m sliding door	1.0	1,053.0	1,053.0	1	1,053.0	1,053.0
Fogging irrigation system	1.0	285.0	285.0	1	176	176.0
Electrical Climate control System Delta= 20º	1.0	4,800.0	4,800.0	1	3545	3,545.0
Lighting	1.0	450.0	450.0	1	380	380.0
Installation	1.0	3,159.0	3,159.0	1	2,193.0	2,193.0
Sub Total Germination Chamber			11,921.3			8,692.1
Grafting Unit						
Area (m^2)	122.1			66		
Humidity has to be constant at 85%						
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	16.0	36.0	576.0	11.0	36.0	396.0
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	16.0	106.0	1,696.0	12.2	106.0	1,293.2
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	18.5	79.0	1,461.5	10.0	79.0	790.0
Floor in reinforced concrete (m^3)	12.3	91.0	1,119.3	6.6	91.0	600.6

	100 HECTARES			50 HECTARES		
Hermetic 2.5x3 m sliding door	1.0	1,053.0	1,053.0	1.0	1,053.0	1,053.0
Evaporation cooling unit 28 bars	1.0	31,590.0	31,590.0	1.0	21,060.0	21,060.0
Rolling galvanized tables 1.3x1.3x0.65	25.0	211.0	5,275.0	13.0	211.0	2,743.0
Chairs for grafters	25.0	32.0	800.0	13.0	32.0	416.0
Installation	1.0	5,265.0	5,265.0	1.0	3,700.0	3,700.0
Sub- Total Grafting Unit			48,835.8			32,051.8
Healing Unit						
Area	122.1			66		
Capacity: Trolleys of 30 trays (150 cells)	26			13		
Floor in reinforced concrete (m^3)	12.21	91	1,111.1	6.6	91	600.6
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	40.0	36.0	1,440.0	26.1	36.0	939.6
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	11.0	106.0	1,166.0	7.1	106.0	752.6
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	18.5	79.0	1,461.5	10	79.0	790.0
Hermetic 2.5x3 m sliding DOUBLE door	1.0	2,983.0	2,983.0	1	2,983.0	2,983.0
Fog spraying system 1.1-6.5 l/h, 0.23 Kw 280m3/h air P= 100-1000 kpa.	1.0	11,934.0	11,934.0	1	5,967.0	5,967.0
Evaporation cooling unit 28 bars	1.0	47,385.0	47,385.0	1	31,590.0	31,590.0
Trolleys. Capacity 30 trays	26.0	536.0	13,936.0	13	536.0	6,968.0
Installation	1.0	5,265.0	5,265.0	1	3,585.0	6,950.0
Sub-Total Healing			85,570.5			57,540.8
Cultivation units						
Area m2 (excluding present grower's area)	2200			1075		
Greenhouse height 4 m. Width 16 m. Sides polyethylene film rolling curtain. Roof 800 microns. Roof and east, north and west sidewall with insect proof screen 20/20. Inner aluminum screen (fabric open structure): only ceiling, horizontal retractable motorized screen, and 60% shade. One zenith vent along the structure (Per m^2)		35.0	77,000.0		41	44,075.0
Water irrigation system One overhead irrigation trolleys (Suspended rail) per span. Irrigation and fumigation nozzles on separated pipes. (Per m2)	3,583.0	15.8	56,575.6	1792	15.79	28,295.7
"T" rail frame benches for suspended trays cultivation. (Per meter)	7,190.0	3.2	23,008.0	3595	3.2	11,504.0
Motorized thermo screen in polyester	3,583.0	10.5	37,729.0	1793	10.5	18,826.5
Heating system. Delta 12. Hot water boiler at 40ªC and corrugated 20 mm PE pipes along the T rails	3,300.0	14.0	46,332.0	1612	14.0	22,568.0
Sub-Total Cultivation unit			240,644.6			125,269.2
TOTAL			386,972.2			223,553.8

3. Chile bell pepper grafting

Specifications and costs for cropping areas of 20 and 50 ha are given below:

	50 HECTARES			20 HECTARES		
	Amount	Unit price in US$	TOTAL	Amount	Unit price in US$	TOTAL
General Parameters						
Planting ¨window" 60 days						
External temperature range = 4º-45º						
Germination Unit						
Area (m2)	31			18.6		
Isolated panel 1.1 m length, 80 mm thick and 2.6 m high. (m)	22.4	31.0	694.4	18.4	31.0	570.4
Isolated panel 1.1 m length, 80 mm thick and 6.2 m high. (m)	5	73.7	368.6	3	73.7	221.1
Floor in reinforced concrete (m3)	3.1	91.0	282.1	1.9	91.0	172.9
Hermetic 2.5x3 m sliding door	1	1,053.0	1,053.0	1	1,053.0	1,053.0
Fogging irrigation system	1	176	176.0	1	176	176.0
Electrical Climate control System Delta= 20º	1	3545	3,545.0	1	2474	2,474.0
Lighting	1	380	380.0	1	351	351.0
Installation	1	2,193.0	2,193.0	1	1,590.0	1,590.0
Sub Total Germination Chamber			8,692.1			6,608.4
Grafting Unit						
Area (m2)	66			39.6		
Humidity has to be constant at 85%						
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	11.0	36.0	396.0	8.0	36.0	288.0
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	12.2	106.0	1,293.2	10.0	106.0	1,060.0
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	10.0	79.0	790.0	6.0	79.0	474.0
Floor in reinforced concrete (m3)	6.6	91.0	600.6	1.9	91.0	169.3
Hermetic 2.5x3 m sliding door	1.0	1,053.0	1,053.0	1.0	1,053.0	1,053.0
Evaporation cooling unit 28 bars	1.0	21,060.0	21,060.0	1.0	7,900.0	7,900.0
Rolling galvanized tables 1.3x1.3x0.65	13.0	211.0	2,743.0	5.0	211.0	1,055.0
Chairs for grafters	13.0	32.0	416.0	5.0	32.0	160.0
Installation	1.0	3,700.0	3,700.0	1.0	2,575.0	2,575.0
Sub- Total Grafting Unit			32,051.8			14,734.3
Healing Unit						
Area	66					
Capacity: Trolleys of 30 trays (150 cells)	13			6		
Floor in reinforced concrete (m3)	6.6	91	600.6	4	91.0	364.0
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	26.1	36.0	939.6	19.8	36.0	712.8
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	7.1	106.0	752.6	5.4	106.0	572.4
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	10	79.0	790.0	6	79.0	474.0

	50 HECTARES			20 HECTARES		
Hermetic 2.5x3 m sliding DOUBLE door	1	2,983.0	2,983.0	1	2,983.0	2,983.0
Fog spraying system 1.1-6.5 l/h, 0.23 Kw 280m3/h air .P= 100-1000 kpa.	1	5,967.0	5,967.0	1	2,983.0	2,983.0
Evaporation cooling unit 28 bars	1	31,590.0	31,590.0	1	7,897.0	7,897.0
Trolleys. Capacity 30 trays	13	536.0	6,968.0	5	536.0	2,680.0
Installation	1	3,585.0	6,950.0	1	2,567.0	2,567.0
Sub-Total Healing			57,540.8			21,233.2
Cultivation units						
Area m2 (excluding present grower's area)	1075			450		
Greenhouse height 4 m. Width 16 m. Sides polyethylene film rolling curtain. Roof 800 microns. Roof and east, north and west sidewall with insect proof screen 20/20. Inner aluminum screen (fabric open structure): only ceiling, horizontal retractable motorized screen, and 60% shade. One zenith vent along the structure (Per m2)		41	44,075.0		41	18,450.0
Water irrigation system One overhead irrigation trolleys (Suspended rail) per span. Irrigation and fumigation nozzles on separated pipes. (Per m2)	1792	15.79	28,295.7	755	15.79	11,921.5
"T" rail frame benches for suspended trays cultivation. (Per meter)	3595	3.2	11,504.0	1680	3.2	5,376.0
Motorized thermo screen in polyester	1793	10.5	18,826.5	838	21.0	17,598.0
Heating system. Delta 12. Hot water boiler at 40ºC and corrugated 20 mm PE pipes along the T rails	1612	14.0	22,568.0	675	14.0	9,477.0
Sub-Total Cultivation unit			125,269.2			62,822.5
TOTAL			223,553.8			105,398.3

4. Melon grafting

Specifications and cost for crop areas of 50 and 100 ha are given below:

	100 HECTARES			50 HECTARES		
	Amount	**Unit price in US$**	**TOTAL**	**Amount**	**Unit price in US$**	**TOTAL**
General Parameters						
Planting ¨window" 60 days						
External temperature range = 4º-45º						
Germination Unit						
Area (m2)	58			31		
Isolated panel 1.1 m length, 80 mm thick and 2.6 m high. (m)	31.0	31.0	961.0	22.4	31.0	694.4
Isolated panel 1.1 m length, 80 mm thick and 6.2 m high. (m)	9.3	73.7	685.5	5	73.7	368.6
Floor in reinforced concrete (m3)	5.8	91.0	527.8	3.1	91.0	282.1
Hermetic 2.5x3 m sliding door	1.0	1,053.0	1,053.0	1	1,053.0	1,053.0

	100 HECTARES			50 HECTARES		
Fogging irrigation system	1.0	285.0	285.0	1	176	176.0
Electrical Climate control System Delta= 20º	1.0	4,800.0	4,800.0	1	3545	3,545.0
Lighting	1.0	450.0	450.0	1	380	380.0
Installation	1.0	3,159.0	3,159.0	1	2,193.0	2,193.0
Trays	11,000.0	1.1	12,100.0	5,500.0	1.1	6,050.0
Sub Total Germination Chamber			24,021.3			14,742.1
Grafting Unit						
Area (m2)	122.1			66		
Humidity have to be constant at 85%						
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	16.0	36.0	576.0	11.0	36.0	396.0
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	16.0	106.0	1,696.0	12.2	106.0	1,293.2
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	18.5	79.0	1,461.5	10.0	79.0	790.0
Floor in reinforced concrete (m3)	12.3	91.0	1,119.3	6.6	91.0	600.6
Hermetic 2.5x3 m sliding door	1.0	1,053.0	1,053.0	1.0	1,053.0	1,053.0
Evaporation cooling unit 28 bars	1.0	31,590.0	31,590.0	1.0	21,060.0	21,060.0
Rolling galvanized tables 1.3x1.3x0.65	25.0	211.0	5,275.0	13.0	211.0	2,743.0
Chairs for grafters	25.0	32.0	800.0	13.0	32.0	416.0
Installation	1.0	5,265.0	5,265.0	1.0	3,700.0	3,700.0
Sub- Total Grafting Unit			48,835.8			32,051.8
Healing Unit						
Area	356.4			184		
Capacity: Trolleys of 30 trays (150 cells)	62			31		
Trays capacity= 780						
Residence time in days: 5						
Floor in reinforced concrete (m3)	35.64	91	3,243.2	18.5	91	1,683.5
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	115.0	36.0	4,140.0	42	36.0	1,512.0
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	31.4	106.0	3,328.4	11.4	106.0	1,208.4
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	54.0	79.0	4,266.0	15.8	79.0	1,248.2
Hermetic 2.5x3 m sliding DOUBLE door	1.0	2,983.0	2,983.0	1	2,983.0	2,983.0
Fog spraying system 1.1-6.5 l/h, 0.23 Kw 280m3/h air .P= 100-1000 kpa.	1.0	35,802.0	35,802.0	1	14,917.0	14,917.0
Evaporation cooling unit 28 bars	1.0	82,485.0	82,485.0	1	47,385.0	47,385.0
Trolleys. Capacity 30 trays	62.0	536.0	33,232.0	31	536.0	16,616.0
Installation	1.0	11,407.0	11,407.0	1	8,775.0	6,950.0
Sub-Total Healing			177,643.4			94,503.1
Cultivation units						
Area m2 (excluding current grower area)	2946			1458		
Greenhouse height 4 m. Width 16 m. Sides polyethylene film rolling curtain. Roof 800 microns. Roof and east, north and west sidewall with insect proof screen 20/20. Inner aluminum screen (fabric open structure): only ceiling, horizontal retractable motorized screen, and 60% shade. One zenith vent along the structure (Per m2)		35.0	103,110.0		35	51,030.0

	100 HECTARES			50 HECTARES		
Water irrigation system One overhead irrigation trolleys (Suspended rail) per span. Irrigation and fumigation nozzles on separated pipes. (Per m^2)	4,194.0	11.4	47,811.6	2093	11.4	23,860.2
"T" rail frame benches for suspended trays cultivation. (Per meter)	8,697.0	3.2	27,830.4	4346	3.2	13,907.2
Motorized thermo screen in polyester	4,233.0	10.5	44,573.5	2094	10.5	21,987.0
Heating system. Delta 12. Hot water boiler at 40ªC and corrugated 20 mm PE pipes along the T rails	3,791.0	14.0	53,225.6	1,876.0	14.0	26,264.0
Sub-Total Cultivation unit			276,551.1			137,048.4
Trays						
TOTAL			527,051.6			278,345.4

5. Steaming in Flowers

Five mobile boilers: horizontal. Mono-Block. Capacity 600 kg/hr. Operating pressure: 3 bars. Fuel: diesel oil; with double security circuit and three pass steam circuit. The equipment includes 60 m flexible pipe to carry steam at 3 bars.

6. Substrate pasteurization with solar boxes in Flowers

551 pieces (Five hundred fifty one) solar collectors for substrate pasteurization. Dimensions 124x155x30 cm. In hard wood with 5 aluminum pipes of 120 cm each, regularly distributed and fixed at 7.5 cm from the bottom. Support at 1 m from the soil is included

7. Soil less Flower production

Specifications and costs are given below

SOIL LESS IN FLOWERS

	Amount	US$/Unit	TOTAL
Micro irrigation devices	10,000	0.25	2,500
Coco fiber. M3	275	30	8,250
TOTAL			10,750

8. Grafting other horticultural products (Cucumber)

Specifications and costs for cropping areas of 50 and 20 ha are given below:

	50 HECTARES			20 HECTARES		
	Amount	Unit price in US$	TOTAL	Amount	Unit price in US$	TOTAL

	50 HECTARES			20 HECTARES		
General Parameters						
Planting ¨window" 60 days						
External temperature range = 4º-45º						
Germination Unit						
Area (m2)	31			18.6		
Isolated panel 1.1 m length, 80 mm thick and 2.6 m high. (m)	22.4	31.0	694.4	18.4	31.0	570.4
Isolated panel 1.1 m length, 80 mm thick and 6.2 m high. (m)	5	73.7	368.6	3	73.7	221.1
Floor in reinforced concrete (m^3)	3.1	91.0	282.1	1.9	91.0	172.9
Hermetic 2.5x3 m sliding door	1	1,053.0	1,053.0	1	1,053.0	1,053.0
Fogging irrigation system	1	176	176.0	1	176	176.0
Electrical Climate control System Delta= 20º	1	3545	3,545.0	1	2474	2,474.0
Lighting	1	380	380.0	1	351	351.0
Installation	1	2,193.0	2,193.0	1	1,590.0	1,590.0
Sub Total Germination Chamber			8,692.1			6,608.4
Grafting Unit						
Area (m2)	66			39.6		
Humidity has to be constant at 85%						
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	11.0	36.0	396.0	8.0	36.0	288.0
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	12.2	106.0	1,293.2	10.0	106.0	1,060.0
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	10.0	79.0	790.0	6.0	79.0	474.0
Floor in reinforced concrete (m3)	6.6	91.0	600.6	1.9	91.0	169.3
Hermetic 2.5x3 m sliding door	1.0	1,053.0	1,053.0	1.0	1,053.0	1,053.0
Evaporation cooling unit 28 bars	1.0	21,060.0	21,060.0	1.0	7,900.0	7,900.0
Rolling galvanized tables 1.3x1.3x0.65	13.0	211.0	2,743.0	5.0	211.0	1,055.0
Chairs for grafters	13.0	32.0	416.0	5.0	32.0	160.0
Installation	1.0	3,700.0	3,700.0	1.0	2,575.0	2,575.0
Sub- Total Grafting Unit			32,051.8			14,734.3
Healing Unit						
Area	66					
Capacity: Trolleys of 30 trays (150 cells)	13			6		
Floor in reinforced concrete (m3)	6.6	91	600.6	4	91.0	364.0
Isolated panel 1.1 m length, 80 mm thick and 3 m high. (m)	26.1	36.0	939.6	19.8	36.0	712.8
Translucent panel 1.1 m length, 80 mm thick and 3 m high. (m)	7.1	106.0	752.6	5.4	106.0	572.4
Isolated panel 1.1 m length, 80 mm thick and 6.6 m high. (m)	10	79.0	790.0	6	79.0	474.0
Hermetic 2.5x3 m sliding DOUBLE door	1	2,983.0	2,983.0	1	2,983.0	2,983.0
Fog spraying system 1.1-6.5 l/h, 0.23 Kw 280m3/h air P= 100-1000 kpa.	1	5,967.0	5,967.0	1	2,983.0	2,983.0
Evaporation cooling unit 28 bars	1	31,590.0	31,590.0	1	7,897.0	7,897.0
Trolleys. Capacity 30 trays	13	536.0	6,968.0	5	536.0	2,680.0
Installation	1	3,585.0	6,950.0	1	2,567.0	2,567.0
Sub-Total Healing			57,540.8			21,233.2
Cultivation units						
Area m2 (excluding present grower's area)	1075			450		

	50 HECTARES			20 HECTARES		
Greenhouse height 4 m. Width 16 m. Sides polyethylene film rolling curtain. Roof 800 microns. Roof and east, north and west sidewall with insect proof screen 20/20. Inner aluminum screen (fabric open structure): only ceiling, horizontal retractable motorized screen, and 60% shade. One zenith vent along the structure (Per m^2)		41	44,075.0		41	18,450.0
Water irrigation system One overhead irrigation trolleys (Suspended rail) per span. Irrigation and fumigation nozzles on separated pipes. (Per m^2)	1792	15.79	28,295.7	755	15.79	11,921.5
"T" rail frame benches for suspended trays cultivation. (Per meter)	3595	3.2	11,504.0	1680	3.2	5,376.0
Motorized thermo screen in polyester	1793	10.5	18,826.5	838	21.0	17,598.0
Heating system. Delta 12. Hot water boiler at 40ªC and corrugated 20 mm PE pipes along the T rails	1612	14.0	22,568.0	675	14.0	9,477.0
Sub-Total Cultivation unit			125,269.2			62,822.5
TOTAL			223,553.8			105,398.3

9. Investment Costs for Commodities

Equipment	Volume requiring equipment (m^3)	No. units	Unit price US$	TOTAL (US$)
Grains, stored products, wooden products - silos, bins, warehouses, trucks, railcars 66.25 tonnes MB. Volume treated with MB: 1, 810,472m3				
Phosphine detection equipment (bellow pump and detection tubes)	Only for MB users who do not have equipment	**30**	640	**19,200**
Self contained breathing apparatus		**24**	1,345	**32,280**
Polyethylene sheets and tape for loose and bagged product	307,780	**15**	500	**7,500**
Phosphine tablet dispensers for silos and bins only	**1,502,692**	**40**	1,895	**75,800**
Recirculation system including blowers, recirculation piping and tape for silos and bins requiring phosphine recirculation	**1,502,692**	**150**	1,515	**227,250**
Products in ship holds **3.75t** MB. Volume treated with MB: **110,294** m3				
Phosphine recirculation system including recirculation piping and tape	**110,294**	**9**	1,515	**13,635**
Phosphine detection equipment	**110,294**	**8**	640	**5,120**
Self-contained breathing apparatus	**110,294**	**6**	1,345	**8,070**
Products requiring rapid treatment, eg. dry spices, dried fruit 6t MB. Volume treated with MB: 176,471m3				
Carvex chamber (controlled atmosphere, pressure) installation including related equipment	**176,471**	**1**	225,000	**225,000**
Museums, historical items **2.3 t MB. Volume treated with MB: 67,647 m3**				

Cold treatment equipment	**67,647**	**2**	640	**1,280**
Flour mills, food factories – phosphine + heat + CO2 with IPM 57.4 t MB. Volume treated with MB: 1,688,236 m3				
Heaters (electric)	**1,688,236**	**42**	1,120	**47,040**
Additional sealing of building, equipment etc.	**1,688,236**	**15**	1,453	**21,795**
Self contained breathing apparatus	**1,688,236**	**24**	1,345	**32,280**
Gas detection equipment (phosphine and CO2)	**1,688,236**	**25**	640	**16,000**
Flour mills, food factories – heat + IPM 15 t MB. Volume treated with MB: 588,235 m3				
Heaters (electric)	**588,235**	**42**	1,120	**47,040**
Changed sprinkler heads (replaced to 100°C rating)	**588,235**	**5**	15,427	**77,135**
Thermometers	**588,235**	**210**	11	**2,310**
Additional sealing of building, equipment etc.	**588,235**	**10**	1,453	**14,530**
Self contained breathing apparatus (heat)	**588,235**	**21**	1,345	**28,245**
TOTAL	**4,441,355**			**901,510**

ANNEX II: TRAINING COMPONENTS AND COST

1. HORTICULTURE

The aim of the training in horticulture is to transfer the selected technologies to 694 growers:

STATE	Strawberry	Tomato	Chile Bell	Melon	Berries	Garlic	Flowers	Other	TOTAL
Baja California	14	16	1		11		12	12	52
Baja California Sur	5	10	10					14	34
TOTAL ZONE 1									86
Mexico	8						51		59
Morelos	3						13		13
Puebla							8		8
Hidalgo							6		6
TOTAL ZONE 2									86
Guanajuato	12					28	9		49
TOTAL ZONE 3									49
Michoacan	20				65				85
Jalisco	7	14			37				58
TOTAL ZONE 4									143
Colima				11					11
TOTAL ZONE 5									11
Sinaloa		37	49				19	36	141
Sonora		8	23	35				10	76
Coahuila		5		25					30
TOTAL ZONE 6									247
Durango				23					23
TOTAL ZONE 7									23
Yucatán								27	27
TOTAL ZONE 8									27
TOTAL	**69**	**90**	**83**	**94**	**113**	**28**	**118**	**99**	**694**

Training in Grafting:

Grafting is the most popular, efficient and environment friendly alternative available and has experimented extraordinary success in the past five years. However, it is essential that users master all steps of the technology including:

1. Management of the germination unit for scions and rootstocks
2. Management of the grafting operation in the grafting unit
3. Management of the healing process
4. Grafted seedling production management
5. Grafted crop management in the field, which completely different to that of regular non-grafted varieties used at present.

Mastering this technology requires permanent contact with grafting experts at two levels:

- Two years grafting trainers permanently assigned to areas where grafting units will be erected. These should preferably be Mexican agronomists and will train about 200 grafters, who will then become focal points for further dissemination of this technology (point 2)
- International grafting specialists providing regular advice on all other aspects (1 to 5) through 2 week missions every 3 months over a period of thee years

Grafting trainers will be assigned to: Zone 1 (Baja California and Baja California Sur); Zone 4 (Michoacan and Jalisco); Zone 5 (Colima); Zone 6 (Sinaloa, Sonora and Cohahuila) and Zone 7 (Durango)

TRAINING PROGRAMME AND ITS COST (GRAFTING)
(Tomato, Melon, Chile and Cucumber)

	Number	W/M	Total w/m	US$/Month	TOTAL
Permanent grafting experts	5	36	180	2,000	360,000
International experts	12	1	6	16,000	96,000
Transportation	5	36	180	400	72,000
Sub-total grafting					**528,000**

Training in Chemical Fumigation

Training in soil fumigation with fumigants such as 1-3 D/ Pic has the following requirements:

1. Determination of the type/ level of infestation, type of soil and irrigation system in each field
2. Selection of the best application procedure in cooperation with commercial applicators
3. Pest monitoring and IPM implementation

The most appropriate way to deliver such programme is to build up a team composed by:

- An experienced International Expert specialized in 1-3 D/ Pic to train one national agronomist. This international specialist will monitor Telone applications by leading growers whose farms will act as “demonstration centres”
- A National expert to disseminate technology among local growers.

TRAINING PROGRAMME AND ITS COST (CHEMICAL FUMIGANT)
(Strawberries, Tomato, Garlic and other agricultural Products)

	Number	W/M	Total w/m	US$/Month	TOTAL
International experts	1	4	4	16,000	64,000
National expert	1	36	36	2,000	72,000
Sub-Total Telone					**136,000**

Training in Soil less cultivation

Soil less cultivation is an attractive fumigant free technology. However, although in Mexico coco fibre is not expensive and available, the technology requires good knowledge of the plant's nutritional needs (ferti-irrigation) and careful water management. Phyto-sanitary issues should also be considered.

Application of this technology, would require then, training in:

- Control of substrate composition
- Pasteurisation of substrates when these are re-used
- Use of steam and/or solar boxes for substrate pasteurisation
- Water needs/ Irrigation programmes
- Specific fertilizer needs and use of soluble fertilizers
- Pest and disease management practices to protect cultures against common infestations

This programme will be implemented in four crops, namely strawberries, Chile peppers, berries and flowers. It cover six zones: Zone 1 (Baja California and Baja California Sur); Zone 2 (México, Morelos, Puebla and Hidalgo); Zone 3 (Guanajuato); Zone 4 (Michoacan and Jalisco); Zone 6 (Sinaloa, Sonora and Cohahuila) and Zone 8 (Yucatan).

TRAINING PROGRAMME AND ITS COST (SOILLESS CULTIVATION)
(Strawberries, Chile, Berries and flowers)

	Number	W/M	Total w/m	US$/Month	TOTAL
International experts	2	4	8	16,000	128,000
National experts (part time)	6	18	108	2,000	216,000
Sub-Total Soilless					**344,000**

Training on steaming in flowers

Steam sterilization and steam equipment operation in the flowers sector needs the following technology transfer requirements:

- Boiler operation and maintenance
- Use of steam injectors and their requirements in terms of soil preparation, length of treatment, sterilization of borders, handling of the sterilized substrate etc.
- Prevention of re-contamination
- IPM

This programme will be implemented in Zone 2 (Mexico, Morelos, Puebla and Hidalgo) and will need the following inputs:

TRAINING PROGRAMME AND ITS COST (STEAM IN FLOWERS)

	Number	W/M	Total w/m	US$/Month	TOTAL
International experts	1	1	1	16,000	16,000
Boiler and movilvap specialist	1	2	2	12,000	24,000
National experts (part time)	1	12	12	2,000	24,000
Sub-Total Steaming					**64,000**

Training in Bio-fumigation

Regional trainers will be trained by an international expert

TRAINING PROGRAMME AND ITS COST. BIO-FUMIGATION IN OTHER CROPS

	Number	W/M	Total w/m	US$/Month	TOTAL
International experts	1	1	1	16,000	16,000
Sub-Total Bio-fumigation					**16,000**

Management of the Training Programme

The magnitude of the project, the numerous inputs and activities to be coordinated in order to deliver the equipment, to train growers, to organize the phase-out schedule and to monitor application of technologies, as well as effective phase-out implementation fully justify contracting the services of a part-time coordinator during the entire project implementation.

Sub-Total Training Costs in Horticulture

Total training costs, which include the management of the entire training programme, are the following:

TRAINING COSTS HORTICULTURE

	Number	W/M	Total w/m	US$/Month	TOTAL
Field National Experts	5	36	180	2,000	360,000
International experts	12	1	6	16,000	96,000
Transportation	5	36	180	400	72,000
Sub-total grafting					**528,000**
International experts	1	4	4	16,000	64,000
National expert	1	36	36	2,000	72,000
Sub-Total Telone					**136,000**
International experts	2	4	8	16,000	128,000
National experts (part time)	6	18	108	2,000	216,000
Sub-Total Soilless					**344,000**
International experts	1	1	1	16,000	16,000
Boiler and Movilvap specialist	1	2	2	12,000	24,000
National experts (part time)	1	12	12	2,000	24,000
Sub-Total Steaming					**64,000**
International experts	1	1	1	16,000	16,000
Sub-Total Bio-fumigation					**16,000**
Project Management	1	48	48	3,500	168,000
Sub-Total Project Management					168,000
TOTAL HORTICULTURE TRAINING					**1,256,000**

2. TRAINING IN FUMIGATION OF COMMODITIES AND STRUCTURES

Most fumigators treat a wide range of different commodities and structures. Therefore it is necessary to train them in the appropriate and specific range of alternative techniques chosen for the specific uses comprised by the project. Topics to be covered include:

- Insect identification
- Calculation of dosage rates
- Monitoring fumigant concentration to ensure that the correct levels are reached
- Principles of phosphine fumigation, heat treatments, etc. as appropriate to the users
- Proper use of relevant safety equipment

The specialized training will be conducted by a consultant on stored products at the Universidad Autonoma de Nuevo León in Monterey.

Requirements in terms of w/m are given in the following table, where costs of the training programme are also included.

	Amount	W/M	Total w/m	US$/Month	TOTAL
Commodity sector					
National Trainers	3	18	54	2,000	108,000
Transportation	3	18	54	400	21,600
Field workshops	8				16,000
Training of trainers workshops	2		2	9,000	18,000
International experts for training trainers	1	2	2	16,000	32,000
TOTAL COMMODITIES					**195,600**

3. TOTAL TRAINING COSTS

Total training costs for the entire project have been calculated as follows:

TOTAL TRAINING COSTS

	Amount	W/M	Total w/m	US$/Month	TOTAL
Horticulture sector					
Permanent grafting experts	5	36	180	2,000	360,000
International experts	12	1	6	16,000	96,000
Transportation	5	36	180	400	72,000
Sub-total grafting					**528,000**
International experts	1	4	4	16,000	64,000
National expert	1	36	36	2,000	72,000
Sub-Total Telone					**136,000**
International experts	2	4	8	16,000	128,000
National experts (part time)	6	18	108	2,000	216,000
Sub-Total Soil less					**344,000**
International experts	1	1	1	16,000	16,000
Boiler and Movilvap specialist	1	2	2	12,000	24,000
National experts (part time)	1	12	12	2,000	24,000
Sub-Total Steaming					**64,000**
International experts	1	1	1	16,000	16,000
Sub-Total Bio-fumigation					**16,000**
Project Management	1	48	48	3,500	168,000
Sub-Total Project Management					168,000
TOTAL HORTICULTURE					**1,256,000**
Commodity sector					
National Trainers	3	18	54	2,000	108,000
Transportation	3	18	54	400	21,600
Field workshops	8				16,000
Training of trainers workshops	2		2	9,000	18,000
International experts for training trainers	1	2	2	16,000	32,000
TOTAL COMMODITIES		38	56		**195,600**
TOTAL TRAINING COSTS					**1,451,600**

ANNEX III: INCREMENTAL OPERATIONAL COSTS

1. Strawberries with Telone

Eligible operating costs for Methyl Bromide in Strawberries (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	324	Kg	4.21	1	1,364	1,364	1,364	1,364
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**1,392**	**1,392**	**1,392**	**1,392**
Eligible operating costs for Telone "in line" (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Telone	240	Liters	5.1	1	1,224	1,224	1,224	1,224
Labour for fumigation	1	wd	14.00	1	14	14	14	14
Labour for covering	4	wd	12.0	1	48	48	48	48
TOTAL COSTS (B)					**1,286**	**1,286**	**1,286**	**1,286**
INCREMENTAL OPERATING COSTS (B minus A)					-106	-106	-106	-106
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-96.84	-88.32	-79.81	-75.55
Net present value over 4 years/ha								-341
Hectares treated								1,062
TOTAL								**-361,790**

2. Soil les strawberry production

Eligible operating costs for Methyl Bromide in Strawberries (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	324	Kg	4.21	1	1,364	1,364	1,364	1,364
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**1,392**	**1,392**	**1,392**	**1,392**
Eligible operating costs for soilless substrate (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Soluble fertilizer	187	Kg	2.1	1	393	393	393	393
TOTAL COSTS (B)					**393**	**393**	**393**	**393**
INCREMENTAL OPERATING COSTS (B minus A)					-1,000	-1,000	-1,000	-1,000
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-909.74	-829.76	-749.78	-709.80
Net present value over 4 years/ha								-3,199
Hectares treated								35
TOTAL								**-110,496**

Tomato with Telone

Eligible operating costs for Methyl Bromide in Tomato (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	349	Kg	4.21	1	1,468	1,468	1,468	1,468
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**1,496**	**1,496**	**1,496**	**1,496**
Eligible operating costs for Telone "in line" (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Telone	260	Liters	5.1	1	1,326	1,326	1,326	1,326
Labour for fumigation	1	wd	14.00	1	14	14	14	14
Labour for covering	4	wd	12.0	1	48	48	48	48
TOTAL COSTS (B)					**1,388**	**1,388**	**1,388**	**1,388**
INCREMENTAL OPERATING COSTS (B minus A)					-108	-108	-108	-108
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-97.85	-89.25	-80.65	-76.35
Net present value over 4 years/ha								-344
Hectares treated								199
TOTAL								**-68,556**

Tomato Grafting

TOMATO: INCREMENTAL OPERATING COSTS								
Eligible operating costs for Methyl Bromide (per hectare)								
Item	**Quant.**	**Unit**	**US$/ unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	349	Kg	4.2	1	1,468	1,468	1,468	1,468
Labour for covering	4	wd	12	1	48	48	48	48
Transplanting	20.0	wd	12	2	480	480	480	480
Subtotal open field					**1,996**	**1,996**	**1,996**	**1,996**
Seeds	19,950	Seed	0.009	2	359	359	359	359
Substrate	0.6	M^3	30	2	36	36	36	36
Sowing	2	wd	5	2	20	20	20	20
Heating	463	m^2 x days	0.00	2	0.00	0.00	0.00	0.00
Fertilizer and pesticides	463	m^2 x days	0.0006	2	0.56	0.56	0.56	0.56
Cultivation	463	m^2 x days	0.005	2	4.63	4.63	4.63	4.63
Subtotal nursery					**420**	**420**	**420**	**420**
TOTAL COST (A)					**2,416**	**2,416**	**2,416**	**2,416**
Eligible operating costs for Grafting (per hectare)								
Item	**Quant.**	**Unit**	**US$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Transplanting	10.8	wd	12	2	259	259	259	259
Subtotal open field					**259**	**259**	**259**	**259**

TOMATO: INCREMENTAL OPERATING COSTS								
Rootstocks seeds	15,400	Seeds	0.016	2	493	493	493	493
Scion seeds	15,400	Seeds	0.010	2	308	308	308	308
Substrate	1.6	M^3	30	2	96	96	96	96
Sowing	2.0	wd	5	2	20	20	20	20
Heating/cooling	1,320	m^2 x days	0.02	2	52.80	52.80	52.80	52.80
Fertilizer and pesticides	1,657	m^2 x days	0.0006	2	1.99	1.99	1.99	1.99
Cultivation	1,657	m^2 x days	0.005	2	16.57	16.57	16.57	16.57
Labour for grafting	21.9	wd	5	2	219	219	219	219
Selection and cleaning graft	10.9	wd	5	2	109	109	109	109
Subtotal nursery					**1,316**	**1,316**	**1,316**	**1,316**
TOTAL COSTS (B)					**1,575**	**1,575**	**1,575**	**1,575**
INCREMENTAL OPERATING COSTS (B minus A)					-840	-840	-840	-840
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-765	-697	-630	-597
Net present value over 4 years/ha								-2,689
Hectares treated								824
NET PRESENT VALUE								**-2,215,181**

Chile bell pepper with bio-fumigation

Eligible operating costs for Methyl Bromide in chile bell (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	380	Kg	4.21	1	1,598	1,598	1,598	1,598
Plastic sheet 0.2 mm	600	Kg	1.00	1	600	600	600	600
Labour for covering	4	w/d	12.00	1	48	48	48	48
Labour for fumigation	2	w/d	14.00	1	28	28	28	28
TOTAL COST (A)					**2,274**	**2,274**	**2,274**	**2,274**
Eligible operating costs for bio-fumigation and IPM (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Organic manure	45	m3	41	1	1,845	1,845	1,845	1,845
Labour for rotovator and covering	4	wd	12.0	1	48	48	48	48
Special plastic sheet 0.05 mm for solarization	180	kg	1.0	1	180	180	180	180
TOTAL COSTS (B)					**2,073**	**2,073**	**2,073**	**2,073**

Eligible operating costs for Methyl Bromide in chile bell (per hectare)				
INCREMENTAL OPERATING COSTS (B minus A)	-201	-201	-201	-201
Discount factor	0.91	0.83	0.75	0.71
Net present value/ha	-182.77	-166.70	-150.63	-142.60
Net present value over 4 years/ha				-643
Hectares treated				75
TOTAL				**-48,202**

Chile Bell Pepper Grafting

CHILE BELL: INCREMENTAL OPERATING COSTS								
Eligible operating costs for Methyl Bromide (per hectare)								
Item	**Quant.**	**Unit**	**US$/ unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	380	Kg	4.2	1	1,598	1,598	1,598	1,598
Labour for covering	4	wd	12	1	48	48	48	48
Transplanting	29.4	wd	12	2	706	706	706	706
Subtotal open field					**2,352**	**2,352**	**2,352**	**2,352**
Seeds	21,000	Seed	0.009	2	378	378	378	378
Substrate	0.6	M^3	30	2	36	36	36	36
Sowing	2	wd	6	2	24	24	24	24
Heating	488	m^2 x days	0.00	2	0.00	0.00	0.00	0.00
Fertilizer and pesticides	488	m^2 x days	0.0006	2	0.59	0.59	0.59	0.59
Cultivation	488	m^2 x days	0.005	2	4.88	4.88	4.88	4.88
Subtotal nursery					**443**	**443**	**443**	**443**
TOTAL COST (A)					**2,795**	**2,795**	**2,795**	**2,795**
Eligible operating costs for Grafting (per hectare)								
Item	**Quant.**	**Unit**	**US$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Transplanting	10.8	wd	12	2	259	259	259	259
Subtotal open field					**259**	**259**	**259**	**259**
Rootstocks seeds	15,400	seeds	0.015	2	462	462	462	462
Scion seeds	15,400	seeds	0.010	2	308	308	308	308
Substrate	1.6	M^3	30	2	96	96	96	96
Sowing	2.0	wd	5	2	20	20	20	20
Heating/cooling	1,320	m^2 x days	0.02	2	52.80	52.80	52.80	52.80
Fertilizer and pesticides	1,657	m^2 x days	0.0006	2	1.99	1.99	1.99	1.99
Cultivation	1,657	m^2 x days	0.005	2	16.57	16.57	16.57	16.57
Labour for grafting	21.9	wd	6	2	263	263	263	263
Selection and cleaning graft	10.9	wd	5	2	109	109	109	109
Subtotal nursery					**1,329**	**1,329**	**1,329**	**1,329**

CHILE BELL: INCREMENTAL OPERATING COSTS				
TOTAL COSTS (B)	**1,588**	**1,588**	**1,588**	**1,588**
INCREMENTAL OPERATING COSTS (B minus A)	-1,207	-1,207	-1,207	-1,207
Discount factor	0.91	0.83	0.75	0.71
Net present value/ha	-1,098	-1,002	-905	-857
Net present value over 4 years/ha				-3,862
Hectares treated				86
NET PRESENT VALUE				**-333,063**

Melon grafting

MELON: INCREMENTAL OPERATING COSTS								
Eligible operating costs for Methyl Bromide (per hectare)								
Item	**Quant.**	**Unit**	**US$/ unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	168	Kg	4.2	1	709	709	709	709
Labour for covering	4	Wd	12	1	48	48	48	48
Labour for fumigation	2	Wd	12	1	24	24	24	24
Transplanting	14.0	Wd	12	2	336	336	336	336
Subtotal open field					**1,117**	**1,117**	**1,117**	**1,117**
Seeds	13,650	Seed	0.010	2	273	273	273	273
Substrate	0.6	M^3	80	2	96	96	96	96
Sowing	2	Wd	6	2	24	24	24	24
Heating	317	m^2 x days	0.00	2	0.00	0.00	0.00	0.00
Fertilizer and pesticides	317	m^2 x days	0.0006	2	0.38	0.38	0.38	0.38
Cultivation	317	m^2 x days	0.005	2	3.17	3.17	3.17	3.17
Subtotal nursery					**397**	**397**	**397**	**397**
TOTAL COST (A)					**1,514**	**1,514**	**1,514**	**1,514**
Eligible operating costs for Grafting (per hectare)								
Item	**Quant.**	**Unit**	**US$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Labour for covering	2	Wd	12	1	24	24	24	24
Transplanting	10.8	Wd	12	2	259	259	259	259
Subtotal open field					**283**	**283**	**283**	**283**
Rootstocks seeds	11,000	Seeds	0.018	2	396	396	396	396
Scion seeds	11,000	Seeds	0.010	2	220	220	220	220
Substrate	1.6	M^3	30	2	96	96	96	96
Sowing	2.0	Wd	5	2	20	20	20	20
Heating/cooling	1,320	m^2 x days	0.02	2	52.80	52.80	52.80	52.80
Fertilizer and pesticides	1,657	m^2 x days	0.0006	2	1.99	1.99	1.99	1.99
Cultivation	1,657	m^2 x days	0.005	2	16.57	16.57	16.57	16.57
Labour for grafting	15.6	Wd	5	2	156	156	156	156

MELON: INCREMENTAL OPERATING COSTS								
Selection and cleaning graft	7.8	Wd	5	2	78	78	78	78
Subtotal nursery					**1,038**	**1,038**	**1,038**	**1,038**
TOTAL COSTS (B)					**1,321**	**1,321**	**1,321**	**1,321**
INCREMENTAL OPERATING COSTS (B minus A)					-193	-193	-193	-193
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-175	-160	-145	-137
Net present value over 4 years/ha								-617
Hectares treated								570
NET PRESENT VALUE								**-351,427**

Berries with Telone

Eligible operating costs for Methyl Bromide in Berries (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	394	Kg	4.21	1	1,659	1,659	1,659	1,659
Labour for fumigation	2	w/d	14.00	1	28	28	28	28
TOTAL COST (A)					**1,687**	**1,687**	**1,687**	**1,687**
Eligible operating costs for Telone "in line" (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Telone	250	Liters	5.3	1	1,325	1,325	1,325	1,325
Labour for fumigation	1	w/d	12.00	1	12	12	12	12
Labour for covering	4	w/d	10.0	1	40	40	40	40
TOTAL COSTS (B)					**1,377**	**1,377**	**1,377**	**1,377**
INCREMENTAL OPERATING COSTS (B minus A)					-310	-310	-310	-310
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-282.41	-257.58	-232.75	-220.34
Net present value over 4 years/ha								-993
Hectares treated								599
TOTAL								**-594,421**

Soil less berry production

Eligible operating costs for Methyl Bromide in Berries (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	394	Kg	4.21	1	1,659	1,659	1,659	1,659
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**1,687**	**1,687**	**1,687**	**1,687**
Eligible operating costs for soilless substrate (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Soluble fertilizer	187	kg	2.1	1	393	393	393	393
TOTAL COSTS (B)					**393**	**393**	**393**	**393**
INCREMENTAL OPERATING COSTS (B minus A)					-1,295	-1,295	-1,295	-1,295

Eligible operating costs for Methyl Bromide in Berries (per hectare)				
Discount factor	0.91	0.83	0.75	0.71
Net present value/ha	-1,178.12	-1,074.55	-970.98	-919.19
Net present value over 4 years/ha				-4,143
Hectares treated				31
TOTAL				**-130,251**

Garlic with Telone

Eligible operating costs for Methyl Bromide in Garlic (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	392	Kg	4.21	1	1,651	1,651	1,651	1,651
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**1,679**	**1,679**	**1,679**	**1,679**
Eligible operating costs for Telone "in line" (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Telone	260	liters	5.1	1	1,326	1,326	1,326	1,326
Labour for fumigation	1	wd	14.00	1	14	14	14	14
Labour for covering	4	wd	12.0	1	48	48	48	48
TOTAL COSTS (B)					**1,388**	**1,388**	**1,388**	**1,388**
INCREMENTAL OPERATING COSTS (B minus A)					-291	-291	-291	-291
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-264.93	-241.64	-218.35	-206.71
Net present value over 4 years/ha								-932
Hectares treated								54
TOTAL								**-50,122**

Soil less flower production

Eligible operating costs for Methyl Bromide in Flowers (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	297	Kg	4.21	1	1,250	1,250	1,250	1,250
Fertilizer	276	Kg	1.70	1	469	469	469	469
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**1,748**	**1,748**	**1,748**	**1,748**
Eligible operating costs for soilless substrate (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Soluble fertilizer	187	kg	2.1	1	393	393	393	393
TOTAL COSTS (B)					**393**	**393**	**393**	**393**
INCREMENTAL OPERATING COSTS (B minus A)					-1,355	-1,355	-1,355	-1,355
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-1,233.03	-1,124.63	-1,016.23	-962.03
Net present value over 4 years/ha								-4,336
Hectares treated								48
TOTAL								**-208,124**

Flowers solar boxes

Eligible operating costs for SOLAR BOXES In flowers (per m3 of substrate)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	0.68	Kg	4.21	1	2.86	2.86	2.86	2.86
Plastic sheet 0.2 mm	20	Kg	1.1	0.10	2.20	2.20	2.20	2.20
Labour for covering	0.20	wd	10	1	2.00	2.00	2.00	2.00
Labour for fumigation	0.18	wd	14	1	2.52	2.52	2.52	2.52
TOTAL COST (A)					**9.58**	**9.58**	**9.58**	**9.58**
Eligible operating costs for solarizing per m3 of substrate								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Labour for operation	0.20	wd	10.00	1	2.00	2.00	2.00	2.00
TOTAL COSTS (B)					**2.00**	**2.00**	**2.00**	**2.00**
INCREMENTAL OPERATING COSTS (B minus A)					-8	-8	-8	-8
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-7	-6	-6	-5
Net present value over 4 years/ha								-24
M3 of substrate treated								7,936
TOTAL								**-192,567**

Flowers steaming

Eligible operating costs for MB in flowers (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	297	Kg	4.21	1	1,250	1,250	1,250	1,250
Plastic sheet 0.2 mm	600	Kg	1.1	1	660	660	660	660
Labour for covering	4	wd	12	1	48	48	48	48
Labour for fumigation	2	wd	14	1	28	28	28	28
TOTAL COST (A)					**1,986**	**1,986**	**1,986**	**1,986**
Eligible operating costs for steaming per hectare								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Labour for operation	4.0	wd	12.00	1	48	48	48	48
Labour for steaming	2.0	wd	13.00	1	26	26	26	26
Salt	54.0	kg	0.40	1	22	22	22	22
Fuel	6,500	liters	0.30	1	1,950	1,950	1,950	1,950
TOTAL COSTS (B)					**2,046**	**2,046**	**2,046**	**2,046**
INCREMENTAL OPERATING COSTS (B minus A)					59	59	59	59
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					54	49	44	42

Eligible operating costs for MB in flowers (per hectare)				
Net present value over 4 years/ha				190
Hectares treated				93
TOTAL				**17,627**

Other crops with Telone

Eligible operating costs for Methyl Bromide in other horticultural products (Ha)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	335	Kg	4.21	1	1,410	1,410	1,410	1,410
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**1,438**	**1,438**	**1,438**	**1,438**
Eligible operating costs for Telone "in line" (per hectare)								
Item	**Amount**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Telone	260	liters	5.1	1	1,326	1,326	1,326	1,326
Labour for fumigation	1	wd	14.00	1	14	14	14	14
Labour for covering	4	wd	12.0	1	48	48	48	48
TOTAL COSTS (B)					**1,388**	**1,388**	**1,388**	**1,388**
INCREMENTAL OPERATING COSTS (B minus A)					-50	-50	-50	-50
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-45.05	-41.09	-37.13	-35.15
Net present value over 4 years/ha								-158
Hectares treated								59
TOTAL								**-9,347**

Other crops with bio-fumigation

Eligible operating costs for Methyl Bromide in other crops (per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	335	Kg	4.08	1	1,366	1,366	1,366	1,366
Plastic sheet 0.2 mm	600	Kg	1.00	1	600	600	600	600
Labour for covering	4	wd	12.00	1	48	48	48	48
Labour for fumigation	2	wd	14.00	1	28	28	28	28
TOTAL COST (A)					**2,042**	**2,042**	**2,042**	**2,042**
Eligible operating costs for bio-fumigation and IPM(per hectare)								
Item	**Quant.**	**Unit**	**$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Organic manure	45	m3	41	1	1,845	1,845	1,845	1,845
Labour for rotovator and covering	4	wd	12.0	1	48	48	48	48
Special plastic sheet 0.05 mm for solarization	180	kg	1.0	1	180	180	180	180
TOTAL COSTS (B)					**2,073**	**2,073**	**2,073**	**2,073**
INCREMENTAL OPERATING COSTS (B minus A)					31	31	31	31

Eligible operating costs for Methyl Bromide in other crops (per hectare)				
Discount factor	0.91	0.83	0.75	0.71
Net present value/ha	28.23	25.74	23.26	22.02
Net present value over 4 years/ha				99
Hectares treated				49
TOTAL				**4,864**

Grafting in other crops

Eligible operating costs for Methyl Bromide (per ha)								
Item	**Amount**	**Unit**	**US$/ unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	250	Kg	4.21	1	1,020	1,020	1,020	1,020
Plastic sheet 0.2 mm	600	Kg	1	1	780	780	780	780
Labor for covering	4	wd	9	1	36	36	36	36
Labor for fumigation	2	wd	12	1	24	24	24	24
Transplanting	19.1	wd	9	2	344	344	344	344
Subtotal open field					**2,204**	**2,204**	**2,204**	**2,204**
Seeds	13,650	Seed	0.010	2	273	273	273	273
Substrate	0.6	M^3	80	2	96	96	96	96
Sowing	2	wd	5	2	20	20	20	20
Heating	317	m^2 x days	0.00	2	0.00	0.00	0.00	0.00
Fertilizer and pesticides	317	m^2 x days	0.0006	2	0.38	0.38	0.38	0.38
Cultivation	317	m^2 x days	0.005	2	3.17	3.17	3.17	3.17
Tray disinfection	68	n	0.006	2	0.82	0.82	0.82	0.82
Subtotal nursery					**393**	**393**	**393**	**393**
TOTAL COST (A)					**2,597**	**2,597**	**2,597**	**2,597**
Eligible operating costs for Grafting (per hectare)								
Item	**Amount**	**Unit**	**US$/unit**	**Cycles**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Plastic sheets 0.2mm	600	Kg	1	1	780	780	780	780
Labour for covering	4	wd	9	1	36	36	36	36
Transplanting	14.6	wd	10	2	291	291	291	291
Subtotal open field					**1,107**	**1,107**	**1,107**	**1,107**
Rootstocks seeds	11,000	seeds	0.023	2	506	506	506	506
Scion seeds	11,000	seeds	0.010	2	220	220	220	220
Substrate	1.6	M^3	80	2	256	256	256	256
Sowing	2.0	wd	5	2	20	20	20	20
Film protection for tray	131	n	0.5	2	118	118	118	118

Eligible operating costs for Methyl Bromide (per ha)								
Heating	2,688	m^2 x days	0.02	2	107.54	107.54	107.54	107.54
Fertilizer and pesticides	2,688	m^2 x days	0.0006	2	3.23	3.23	3.23	3.23
Cultivation	2,688	m^2 x days	0.005	2	26.88	26.88	26.88	26.88
Labor for grafting	14.1	wd	5	2	141	141	141	141
Selection and cleaning graft	7.0	wd	5	2	70	70	70	70
Tray disinfection	264	n	0.006	2	3.17	3.17	3.17	3.17
Subtotal nursery					**1,472**	**1,472**	**1,472**	**1,472**
TOTAL COSTS (B)					**2,579**	**2,579**	**2,579**	**2,579**
INCREMENTAL OPERATING COSTS (B minus A)					-18	-18	-18	-18
Discount factor					0.91	0.83	0.75	0.71
Net present value/ha					-17	-15	-14	-13
Net present value over 4 years/ha								-59
Hectares treated								588
NET PRESENT VALUE								**-34,671**

Commodities fumigation

Eligible operating costs for Methyl Bromide in Commodities (1)								
Item	**Volume MB (m^3)**	**Dose (g)**	**Amount (kg)**	**Unitary cost ($/kg)**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Methyl bromide	4,441,355	34	150,700	4.21	634,447	634,447	634,447	634,447
TOTAL COST (A)					**634,447**	**634,447**	**634,447**	**634,447**
Eligible operating costs for Phosphine in Silos, Bins, Warehouses etc.								
Phosphine (1)	1,920,766	2.5	4,802	32.86	157,791	157,791	157,791	157,791
Labour incremental cost (2)			410	300	123,000	123,000	123,000	123,000
Eligible operating costs for Heat and Phosphine + CO2 + Heat in Structures (4)								
PH3 + CO2 + heat	1,688,236		60	4,215	252,900	252,900	252,900	252,900
Heat treatment	588,235		20	8,330	166,600	166,600	166,600	166,600
TOTAL COSTS (B)					**700,291**	**700,291**	**700,291**	**700,291**
INCREMENTAL OPERATING COSTS (B minus A)					65,844	65,844	65,844	65,844
Discount factor					0.91	0.83	0.75	0.71
Net present value					59,918	54,650	49,383	46,749
TOTAL for 4,441,355 m3								**210,701**

(1) Unitary cost of phosphine is calculated as follows: One 21 kg case of phosphine-releasing product costs $230 and provides 7 kg phosphine active ingredient (a.i). So phosphine a.i. costs $230 divided by 7 = $32.86 per kg a.i.

(2) Incremental costs of labour resulting from longer fumigation period.

ANNEX IV: PROJECT BUDGET

Summary of project costs in the soil sector

Soil Fumigation		
Crops	**Operational Costs**	**Investment**
Strawberry	(472,286)	917,562
Tomato	(2,283,737)	4,112,379
Chile	(381,265)	434,351
Melon	(351,427)	2,226,763
Berries	(724,672)	835,210
Garlic	(258,245)	736,444
Flowers	(174,940)	175,000
Other crops	(162,989)	773,944
Training in soil fumigation		1,256,000
SUB TOTAL	(4,809,561)	11,467,653
TOTAL		6,658,092
CONTINGENCY		1,146,765
TOTAL SOIL FUMIGATION		**7,804,858**
Commodities		
	Operational Costs	Investment
Commodities	210,701	901,510
Training in commodities		195,600
Sub TOTAL	210,701	1,097,110
TOTAL		1,307,811
CONTINGENCY		109,711
TOTAL COMMODITIES		**1,417,522**

PROJECT COSTS IN US$

	UNIDO implementation Horticulture sector				**Government of Canada** Commodities sector			
Incremental cost	6,658,092				1,307,811			
Contingency fund (10%)	1,146,765.31				109,711			
TOTAL COST per sector	**7,804,858**				**1,417,522**			
TOTAL PROJECT COST	**9,222,379**							
	2008	**2010**	**2012**	**2013**	**2008**	**2010**	**2012**	**2013**
Canada contribution					500,000	500,000	200,00	217,522
Italy contribution	2,000,000							
Spain contribution		800,000	800,000					
MLFS to UNIDO	1,000,000	2,000,000	1,000,000	204,858				
Support costs Canada (13%)	260,000				65,000	65,000	26,000	28,278
Italy (13%)								
Spain (13%)	0	104,000	104,000					
UNIDO (7.5%)	75,000	150,000	75,000	15,364				
TOTAL COST MLF	**3,335,000**	**3,054,000**	**1,979,000**	**220,222**	**565,000**	**565,000**	**226,000**	**245,800**
TOTAL for MLF per year 2008	**3,900,000**							
2010	**3,619,000**							
2012	**2,205,000**							
2013	**466,022**							
GRAND TOTAL for MLF	**10,190,022**							

TO THE PHASE-OUT OF METHYL BROMIDE IN MEXICO
(DRAFT)

1. The Executive Committee:

(a) At its 42nd Meeting, approved US $1,105,000 as the total funds that will be available to Mexico in order to achieve the 2005 allowable level of methyl bromide consumption (phase-out of 162.4 ODP tonnes) by 2005;

(b) At its 54th Meeting, approved in principle an additional US $9,222,379, as the total funds that will be available to Mexico to achieve the complete phase out of controlled uses of methyl bromide in soil and commodities fumigation (895 ODP tonnes).

2. As reported to the Ozone Secretariat, the methyl bromide baseline for compliance for Mexico is 1,130.8 ODP tonnes; the 2007 methyl bromide consumption was 894.8 ODP tonnes. Accordingly, Mexico has achieved compliance with the Montreal Protocol's 2002 freeze obligation and is in compliance with the Protocol's 20 per cent reduction in 2005.

3. Reductions in accordance with the terms of the above-mentioned projects and other commitments presented in the project document will ensure that Mexico meets the reduction schedule presented below. In this regard, Mexico will reduce the national consumption of controlled uses of methyl bromide, excluding quarantine and pre-shipment applications, to no more than the following levels of consumption in the years listed below:

Year	Annual phase-out (ODP tonnes)	Allowable consumption (ODP tonnes)
2008	0	895
2009	100	795
2010	120	675
2011	150	525
2012	200	325
2013	325	

4. Mexico commits to permanently sustaining the consumption levels indicated above through the use of import restrictions and other policies it may deem necessary.

5. Funding for the projects will be disbursed by UNIDO, Italy, Spain and Canada in line with the following yearly budget breakdown:

Year	Soil fumigation			Commodities	Total funding (US$)
	UNIDO (US$)	Italy (US$)	Spain (US$)	Canada (US$)	
2008	1,000,000	2,000,000		500,000	3,500,000
2010	2,000,000		800,000	500,000	3,300,000
2012	1,000,000		800,000	200,000	2,000,000
2013	204,857			217,522	422,379
Total	4,204,857	2,000,000	1,600,000	1,417,522	9,222,379

6. The Government of Mexico has reviewed the consumption data identified in all sectors covered by the project and is confident that this is correct. Accordingly, the Government is entering into this agreement with the Executive Committee on the understanding that, in case any additional methyl bromide consumption be identified at a later date, the responsibility to ensure its phase-out will solely lie with the Government.

7. The Government of Mexico, in agreement with UNIDO, and the Governments of Canada, Italy and Spain will have the flexibility in organizing and implementing the project's components that it deems more important in order to meet methyl bromide phase-out commitments noted above. UNIDO, and the Governments of Canada, Italy and Spain agree to manage the funding for the project in a manner designated to ensure the achievement of the specific MB reductions agreed upon.

8. UNIDO shall report annually to the Executive Committee on the progress achieved in meeting the methyl bromide reductions required in all sectors, as well as on annual costs related to the use of the alternative technologies selected and the inputs purchased with the project funds.