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D R A F T

INDICATIVE PROGRAMME FOR THE DEVELOPMENT OF THE PESTICIDES INDUSTRIAL SYSTEM IN ETHIOPIA

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PROGRAMME DESCRIPTION

ABBREVIATIONS

AISCO	–	Agricultural Inputs Supply Corporation
ARAD	–	Agricultural Research and Advisory Department
D	–	Dust Formulation
EC	–	Emulsifiable Concentrate
EEC	–	European Economic Commission
EMRDC	–	Ethiopian Mineral Resources Development Corporation
ESC	–	Ethiopian Sugar Corporation
FAO	–	Food and Agriculture Organization
GDP	–	Gross Domestic Product
IAR	–	Institute of Agricultural Research
IFAD	–	International Fund for Agricultural Development
MCTD	–	Ministry of Coffee and Tea Development
MOA	–	Ministry of Agriculture
MOI	–	Ministry of Industry
MFSD	–	Ministry of State Farms Development
NCC	–	National Chemical Corporation
PPRD	–	Plant Protection and Regulatory Department
RRC	–	Relief and Rehabilitation Commission
TYPP	–	Ten Year Perspective Plan
ULV	–	Ultra Low Volume
UNIDO	–	United Nations Industrial Development Organization
UNDP	–	United Nations Development Programme

The Birr is the Ethiopian currency and 2.07 Birr = US$1.

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he Author wishes to express his sincerest gratitude to the Backstopping
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UN agencies and private companies in Ethiopia, for their time and
ise.

UMMARY

This Study assesses the present pesticides industrial system in Ethiopia esigns strategies for its development. In doing this, both qualitative uantitative parameters of the major components of the system have been ified, together with the linkages between them. Constraints and enecks hindering the further development of the system were also ighted. Furthermore, strategies for developing the system by overcoming ottlenecks and constraints, including technical assistance and investment cts, together with pertinent policy measures, are included.

industrial systems, an explanation of the methodology to be used in carrying out the country studies and a detailed description of the report he is expected to prepare. He will be provided with a kit of materials to help collect information.

2. Using the information material available at UNIDO and other sources, the expert will prepare desk studies of the two countries he is going to report on and their pesticides industrial systems. In each study he will include a preliminary description of the pesticides industrial system in the country, a base diagram showing all main components of the system and their linkages, and a preliminary disaggregation of components and assessment of the system. These desk studies will be reviewed by PDSU and discussed before the expert leaves for the field, thus enabling him to make more efficient use of his time in the countries and helping to ensure that all experts follow a common approach in preparing the indicative programmes.

C. In the Field:

1. The expert will visit two countries for a period of approximately two weeks each. On the basis of the work done at UNIDO Headquarters, and the attached outline, he will study the pesticides industrial system in each of the countries he visits. The purpose of the study is, first, to identify qualitative and quantitative parameters for all major components of the system and the linkages between them: resources, trade flows, capacities and capacity utilization, the main actors in the system and all constraints and bottlenecks hindering the further development of the system; secondly, to design a strategy for developing the system by overcoming all the bottlenecks and constraints; and thirdly, to identify the actions necessary to implement the strategy, including technical assistance, investments and policy measures.

2. The expert will discuss the development of the pesticides industrial system with the relevant authorities in Government, specialized institutes and industry in order to identify the Government's development objectives with relation to the system.

D. At Home:

1. The expert will prepare an indicative programme for each of the two countries. Each indicative programme will include a description of the pesticides industrial system, all its main components and the linkages between them, the evolution and development potential of the system, the main bottlenecks and constraints hindering the further development of the system, as well as the resources and enhancements that can promote its development. It will include an identification of various options to overcome the bottlenecks and constraints and the selection of the best options to achieve the Government's objectives in relation to the development of the system. A group of complementary options will constitute a development strategy. Each strategy will be assessed against the Government objectives and one will be selected as the most appropriate. Finally, the indicative programme will include a package of technical assistance and investment projects as well as policy advice to implement the strategy selected.

2. After the indicative programmes have been submitted to and reviewed by UNIDO, the expert will make whatever revisions considered necessary before they are accepted by UNIDO as completed.

A base diagram for pesticides production and consumption system in Africa is shown in Figure 1a.

The variables identified by the PDSU (9 in all) were analysed by them using various statistical analysis techniques such as multivariate analysis, principal component analysis and clustering techniques, the PDSU of UNIDO has now grouped African countries into 9 clusters depicting the level of development of their Pesticides Industrial Systems. On the basis of these, Ethiopia has been classified in cluster 5 and Ghana in cluster 3.

Figures 1b - 1c show the base diagrams for the Pesticides Industrial System in Ethiopia.

PESTICIDES PRODUCTION AND CONSUMPTION SYSTEM IN AFRICA - BASE DIAGRAM

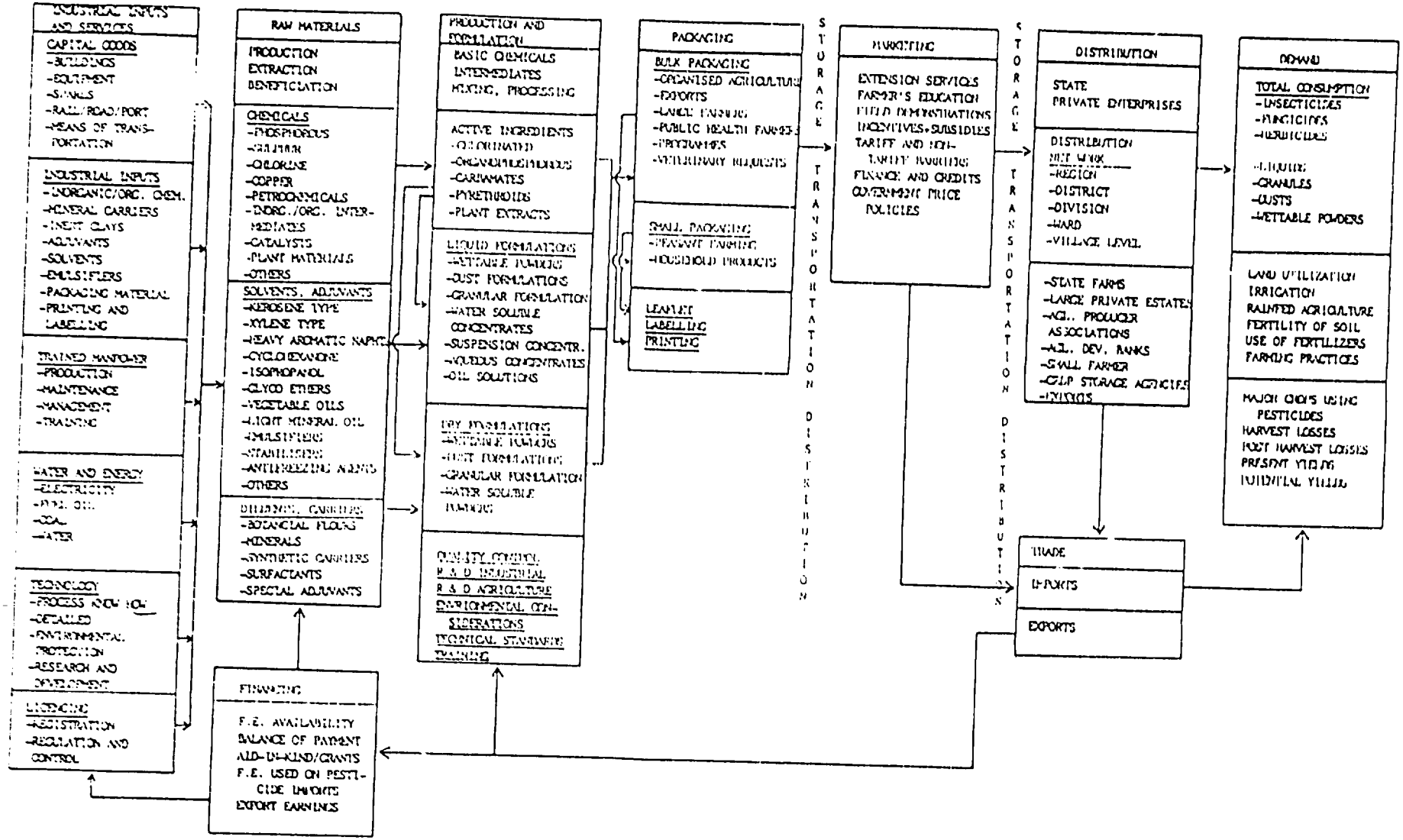
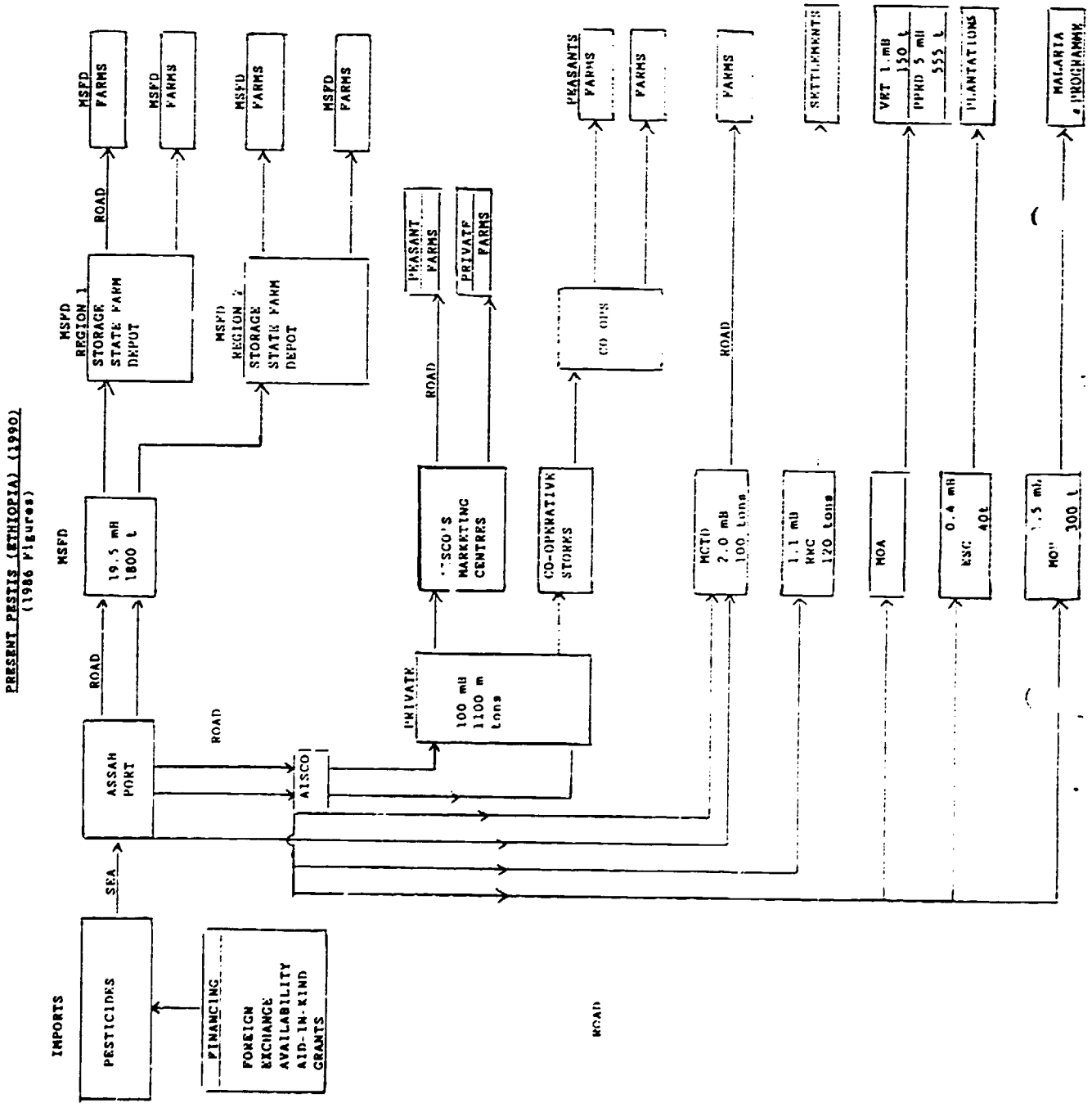
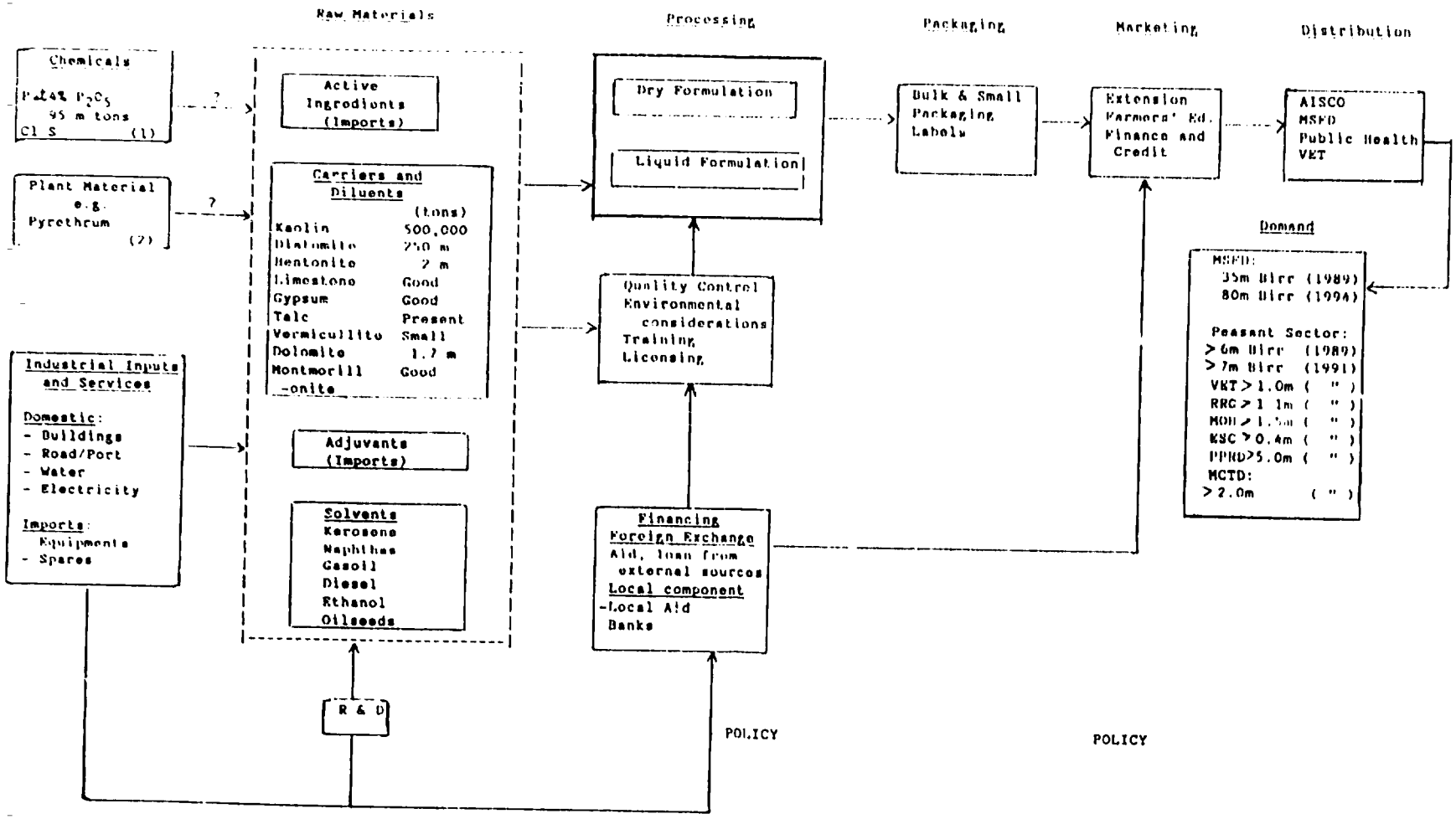


Figure 1


PRESENT PESTIS (ETHIOPIA) (1990)
(1986 Figures)
IMPORTS
PESTICIDES
SEA
FINANCING
FOREIGN EXCHANGE AVAILABILITY AID-IN-KIND GRANTS
ASSAB PORT
ROAD
AISCO
MSPD
19.5 mB 1800 t
MSPD REGION 1 STORAGE STATE FARM DEPOT
MSPD REGION 2 STORAGE STATE FARM DEPOT
MSPD FARMS
PRIVATE 100 mB 1100 m tons
PEASANT FARMS
PRIVATE FARMS
CO-OPERATIVE STORES
CO OPS
PEASANTS FARMS
MCTD 2.0 mB 100 tons
1.1 mB RNC 120 tons
SETTLEMENTS
MOA
VET 1 mB 150 t
PPRD 5 mB 555 t
PLANTATIONS
0.4 mB ESC 40t
MALARIA & PROGRAMME

BASE DIAGRAM

PESTIS DEVELOPMENT IN ETHIOPIA (1990)



(1) Although available, technology to synthesize active ingredients is complex and not advisable at this time.

(2) Ethiopia is ecologically suitable to grow Pyrethrum, hence the possibility of a plant should be investigated.

Figure 1c

Over 90% of the agricultural land is farmed by individual peasant farmers who cultivate small areas (0.5 - 10 ha) with traditional technology. They, however, produce 90% of the agricultural output. Since 1975, the Government has been redistributing the land so that each farmer has a maximum of 10 ha, encouraging formation of co-operatives and establishing the heavily mechanised high technology State farms. These State farms are located in the prime agricultural land and they utilized 40% of Government expenditure between 1980 - 1985 and received 76% of fertilizer, 95% of improved seed and 80% of agricultural credit allocations. Despite this, they generated only 4.5% of agricultural output.

Presently 200,000 ha are under State farm cultivation and this is expanding annually. There is an on-going project to put 40,000 ha of mostly irrigated land under cultivation in the next 5 years. In general, State farms are 4,000 - 6,000 ha in size (irrigated cotton - 4,000 ha; rainfed cereals - 6,000 ha; irrigated horticultural crops - 2,000 ha). The major crops grown are mainly cereals like wheat, corn, barley and sorghum; fibres i.e. cotton (irrigated), sisal and kenaf; horticultural i.e. citrus (irrigated); minor crops (rotation crops) i.e. root crops, sunflower, rapeseed, phaseolus, peanuts. Wheat and cotton are supplied to the Ministry of Industry, while citrus, tomatoes and flowers are exported.

In the peasant sub-sector, agricultural output includes foodcrops (cereals, pulses and oilseeds) and coffee. Productivity has been generally low and mainly subsistence oriented The areas under various agricultural products in the various sectors and its projections are shown in Table 1.

The Settlements i.e. the resettlement farms of drought victims in more viable agricultural areas and the grouping of peasant households in new villages (villagization) in order to provide social and agricultural services more efficiently, have both been two of the Government's programmes to improve the agricultural sector. The Ministry of Coffee and Tea Development had 500,000 ha under coffee cultivation, but some of this have been affected by the drought hence the immediate priority is a census to ascertain the present acreage and their rehabilitation rather than further expansion.

Table 1

AREAS UNDER VARIOUS AGRICULTURAL PRODUCTS SECTORWISE ('000 Ha)

	CEREALS, PULSES & OILSEEDS		COFFEE		TEA		COTTON		SUGARCANE	
SECTOR	1983-84	93-94	1983-84	93-94	1983-84	93-94	1983-84	93-94	1983-84	93-94
State Farms	202.8 (3.1)	451.1 (6.0)	17.7 (3.8)	47.8 (8.7)	0.9 (100)	3.4 (100)	31.6 (100)	93.5 (100)	16.0 (100)	21.6 (100)
Producer Cooperatives	88.7 (1.4)	3938.8 (52.1)	3.7 (0.8)	57.3 (10.5)	-	-	-	-	-	-
Private Farms	6136.8 (94.9)	3048.2 (40.3)	446.3 (95.4)	442.7 (80.8)	-	-	-	-	-	-
Settlement Farms	39.6 (0.6)	121.8 (1.6)	-	-	-	-	-	-	-	-
Total	6467.9	7559.9	467.7	547.8	0.9	3.4	31.6	93.5	16.0	21.6
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

N.B. Figures in bracket indicate percentage area under each sector.

Source: Fertilizer Complex - Prefeasibility Study, Ministry of Industry.

Agricultural Research has been accorded high priority in the Ten Years Perspective Plan (1984/85 - 1993/94) with the MOA launching specific programmes in research, training and extension services to assist in improving the Agricultural Sector. Recently, to assist in strengthening the linkages between research, training and extension, a Research Extension Liaison Committee, comprising National and Regional Agents, including Development Agents, has been set up and meets every three months. In addition, the IAR organizes training programmes, demonstrations, etc., which have been very useful though not optimum. It is believed that only about 10% of the IAR recommendations are used and implemented to date. Some of the IAR priority research areas include survey of major pests of economic importance (insects, diseases and weeds) of crops including annuals, and the development of screening methods for resistance, control and preventive measures. In the State farms, the Agricultural Research and Advisory Department (ARAD) is responsible for organizing its own research activities.

ARAD organizes a Workshop every year before the onset of the crop season where representatives from corporations, the State farms and enterprises, review the previous programmes and results with a view to making new recommendations. Every State farm in the country has separate trial sites for experimentation. For pesticides, a Technical Committee reviews the previous year's successes and failures with each pest of each crop and makes recommendations on the type of pesticides, their rates of application, areas to be sprayed in the different zones, and the total quantities to be bought. Once approved, these recommendations form the basis of an international tender for purchase by the Agricultural Machinery and Technical Co-operations.

Other agricultural and crop protection research activities are undertaken at the MOA Crop Protection Department, the University, the Crop Protection Institute (Ethiopian Science and Technology Commission) and the Ethiopian Food Corporation amongst others.

4.1.2 Crop Protection

Large pre- and post-harvest losses (30-40%) in crop yields in Ethiopia have been attributed to the ravages of a wide variety of pests and diseases of

economic significance. It is expected that this problem will increase with increase in acreage, increased irrigation, increased fertilizer use and increased use of high yielding varieties.

Presently, it is regarded that the pest situation in the State farms are comparatively less severe, since more agrochemicals are utilized than in the peasant sub-sector, but infestation will certainly increase unless resistant varieties are produced.

Most peasant farmers lack the necessary pest perception, potential crop yields, and the economics of agrochemical usage. Extension and support services are usually grossly inadequate, education and sophistication likewise; organization is poor and availability, marketing and distribution problems are rampant in the peasant sub-sector. In addition, wrong usage of pesticides, inappropriate dosage, untimely application, lack of awareness of safety measures, ineffective co-ordination of spray schedules and trial and error approach to pest management, all previal in the peasant sub-sector. Furthermore, the absence of a formulation plant has resulted in inappropriate products and formulations, and packaging unsuitable for the small farmers. Also, sub-standard pesticides are often available in the market, though not efficacious in the field, either due to poor quality in the first place or due to prolonged gap between date of manufacture and usage. In these situations the farmers fail to see the advantage of using these costly pesticides.

In general, therefore, use of pesticides in Ethiopia is limited, being consumed primarily by the State farms which cultivate less than 4% of the land under agriculture. As far as the peasant sector goes, pesticides are not freely available due primarily to limitations in supply and inefficient distribution system.

Research at the IAR and in demonstration farms has revealed that crop yields in the peasant sector are usually lower since several inputs are invariably sub-optimal such as fertilizers, pesticides, improved seeds, irrigation and improved farming practices (Table 2). The economic benefits are regarded as the highest in optimising the use of pesticides compared with

the other inputs when considered individually. Emphasis should, therefore, be placed on safeguarding higher yields by improved pre- and post-harvest crop protection measures, thereby reducing the overall losses now estimated at 30-40%.

Table 2

Present and Potential Crop Yields (Tons/Ha)

Crop	IAR Station	Demonstration Fields	Peasant Sector
Cereals			
- Barley	5.7 - 6.0	4.0	1.0
- Maize	7.7 -12.0	5.0	1.6
- Sorghum	4.0 - 6.0	2.5 - 3.0	1.1
- Teff	1.2 - 2.8	1.0 - 2.2	0.8
- Wheat	3.0* - 5.3**	3.0 - 4.0	1.0
	* Durum Wheat	** Bread Wheat	
Oil Crops			
- Ground Nuts	4.0 - 5.0	3.5	0.4 - 0.5
- Sesame	2.0	1.0 - 1.2	0.3 - 0.4
Fibre Crops			
- Cotton	6.0	3.0	2.0***
	*** Yield as obtained in state farms.		
Pulses	1.5 - 2.5	-	0.8 - 1.0
Vegetables			
- Berbere	3.4	-	2.6
- Tomato	65	-	30 - 35
- Onions	60	-	30 - 35
- Cabbages	42	-	25 - 30
- Potato	28 - 30	-	15 - 20
- Sweet Potato	28 - 30	-	20 - 30
- Carrot	30	-	20
- Beet Root	30 - 35	-	18 - 20
- Green Bean	25	-	15

Source: Fertilizer Complex - Prefeasibility Study, Ministry of Industry.

Major Crops Using Pesticides in Ethiopia

There is a wide variety of agroclimatic zones in Ethiopia as a result of the range of altitudes and precipitation. This has made it possible to grow both tropical and temperate food and cash crops for export and for local consumption. The major crops in Ethiopia include teff (a local cereal), maize, barley, sorghum, wheat, oilseeds and pulses. Coffee is the main export crop and it yields more than 60% of the export earnings. Other export crops are oilseeds, cotton, pulses, sugarcane, fruits and vegetables.

In general the use of pesticides in the peasant sector has been very low, compared with the State farms.

Teff

A local cereal, it is a major crop of the country and is grown in almost all cultivable areas of Ethiopia. In 1983-84, the total area cropped was about 1.4 million hectares and production was about 1.09 million tons, which represented 20% of total cereals production. Teff is resistant to most pests but in some locations, it is attacked by a serious disease called smudge. It is sometimes also attacked by rust and bunt, bush cricket, red teff worm, barley fly and the African armyworm. Pesticides used against these insects include Malathion 50 EC, Fenitrothion 50 EC and DDT 10% dust (D).

Maize

In 1983-84, maize was grown in over 0.8 million hectares of land, with about 47,000 hectares in State farms. During this period about 1.54 million tons of maize was produced. The main insect problems are the maize stalk borer, the spotted stalk borer, maize aphids and other sucking insects, African bollworm and the armyworm. Minor diseases are the leaf blight and rusts. The pesticides used include DDT 10% dust (mainly used by the peasant sector), Cypermethrin 25 EC, 5 EC/ULV, 2.5 ULV; Endosulphan 35 EC, 25 ULV; Phosphamidon 50 SCW; Dimethoate 40 EC; Diazinon 600 EC/ULV; Methamidophos 600 soluble liquid (SL); and Thiometon 25 EC for various insects. Malathion 50 EC and Primiphos-methyl are used as sprays for surface areas, while

Aluminium phosphide is used for storage pests and Zinc phosphide for rodents. Atrazine, Metolachlor, Alachlor and Glyphosate alone or in combinations are used as herbicides.

The MSFD uses most of the pesticides. AISCO buys 10 and 20 tons of DDT 50 and 100 respectively, in 5 and 10 kg packets. Formerly (up to 1986), DDT 100 was produced in Ethiopia by the MOA for the control of stalk borer and it was quite popular with the peasant farmers. Migratory pests are controlled by the MOA with pesticides such as Endosulphan 35 EC, Fenitrothion 50 EC/95 ULV; Carbaryl 85 weltable powder (WP), Cypermethrin 5 EC; Diazinon 60 EC/ULV and Dieldrin 20 EC.

Sorghum

Data shows that sorghum which is the most drought resistant cereal was cultivated in about 900,000 hectares (13,000 on State farms), mainly in the eastern and northern parts of the country in 1983/84 and production was about 1.2 million tons.

Sorghum is attacked by grain-eating birds, the African armyworm, the bollworm, aphids and the spotted stalk borer. Fungal diseases, i.e. the covered kernel smut and loose kernel smut are also serious diseases sometimes afflicting sorghum, as is the parasitic weed. The pesticides used are essentially the same as those used for maize.

Barley

A typical highland crop was grown in about 0.9 million hectares, 6,000 of which were on State farms. The 1983/84 production was about 0.8 million tons. Insect pests of barley include the African armyworm, the barley fly, aphids and the soil insects, while diseases include the net blotch and eyespot or scald. The pesticides used mainly in the State farms were Phosphamidon 100 SCW, Thiometon 25 EC, Dimethoate 40 EC (mainly for aphids and other insect pests); Chlorpyrifos 8 EC (for soil insects); Cypermethrin 5 EC/ULV, Malathion 50 EC, Diazinon 600 EC/ULV, Methamidophos 600 SL for complex insect pests. Various types of herbicides are used for weed control of barley in State farms.

Wheat

Also a highland crop, wheat is grown in about 700,000 hectares at altitudes between 1,800 and 2,200 metres. In 1983/84 production was 0.666 million tons.
A major crop of State farms, wheat was cultivated in 63,879 ha in 1983/84, and projections for 1994 are 90,255 hectares. Pests and pesticides, including herbicides are similar to those of barley.

Oilseeds

Mainly grown by the peasant farmers in an area of 256,000 hectares producing 98,500 tons in 1983/84. More hectarages (330,000 ha) were projected under the TYPP. The State farms, on the other hand, are expected to increase from 4,324 hectares in 1983/84 to 751,682 by 1994. Pests include the African boll worm, loop worm and aphids and pesticides being used are Cypermethrin 5 EC/ULV for worms and Thiometon 25 EC for aphids.

Pulses

Major crops include horsebean, chickpea and field pea, lentil, vetch and soyabean. The peasant sub-sector dominates in area (97%) and production (98%), however, expansion is envisaged in the State farms from 1,440 ha in 1983/84 to 29,383 ha in 1994. The main pests are leaf worm and sucking insects and the pesticides recommended are Cypermethrin 5 EC/ULV, Profenofas 250 EC/ULV and Methamidophos 600 SL (for leaf worm), Dimethoate 30 EC, Phosphamidon 100 SCW and Monocrotophos 40 SCW (for sucking insects).

Cotton

Cotton is mainly grown in the State sub-sector in the lowlands of Tandaho, middle Awash and in some parts of the south and northwestern regions. In 1984, 31,600 hectares were under cultivation and this is projected to 138,092 for 1994. A fair number of pests attack cotton, including spider mite, sucking insects, spiny, pink and Sudan boll worms, whitefly, African boll worm and leaf worm. Diseases include wilt and

bacterial blight. Cotton is the heaviest user of pesticides in Ethiopia and accounts for 50% of the pesticides expenditure in the State farms. In 1987/88, over 10 million Birr (US$5 million) worth of pesticides were proposed to be used on cotton alone, 90% of which were insecticides. Recommended pesticides include Amitraz 20 EC/ULV, Dicofol 18.5 EC, 42 EC, Tetradifon 18 EC and Prothoate 40 EC for the spider mite; Phosphamidon 250 ULV, 50 SCW, 100 SCW, Dimethoate 30 ULV, 40 EC for sucking insect pests; Azinphos ethyl 400 EC/ULV, Monocrotophos 40 SCW, 250 ULV for spiny, pink and Sudan boll worms; Endosulphan 25 ULV, Profenofos 250 EC/ULV, Cypermethrin 5 ULV, Amitraz 20 EC/ULV, Phoxim + Azinphos ethyl combination 800 ULV, 600 ULV, Monocrotophos + DDT combination 500 ULV and Methidathion + DDT combination 400 ULV for African boll worm; Amitraz 20 EC/ULV, Profenofos 250 EC/ULV, Chlorpyrifos 24 ULV, Primiphosmethyl 50 ULV, Triazophos 25 ULV, Monocrotophos 40 SCW, Endosulphan 35 EC, 25 EC for white fly; Chlorpyrifos 24 ULV, Profenofos 250 EC/ULV, Cypermethrin 5 ULV, Methamidophos SL 600, Methomyl 20 ULV, Fenvalerate 4 ULV, Decamethrin 0.6 ULV for leaf worm; Profenofos 250 EC/ULV, Phoxim + Azinphos ethyl combination 800 ULV, 600 ULV, Cypermethrin 5 ULV, Fenvalerate 4 ULV, Decamethrin 0.6 ULV for the African boll worm and leaf worm.

Sugarcane

For sugar production an integrated system from sugarcane cultivation to sugar production is in operation. The two main establishments at Metahara and Wonji Shoa are under the Ministry of Industry. The former occupied an area of 9,000 hectares in 1987 but is expected to be expanded soon. The latter cultivates an area of 7,000 hectares to be expanded also, and a third area at Finchaa of 6,000 to be started. The annual production was around 195,000 tons, 30,000 of which were exported. Beetles are a major pests of sugarcane in the country especially when humidity and temperature are high. Stalk and shoot borer are also of importance, while diseases include smut and leaf spots. The pesticides used are Lindane 25 WP or 25 EC. Aldrin is used to dip cane seeds before planting. Lindane dust or granules, if locally available could, however, be used instead of EC and WP. The ESC handles all its own inputs through open tender, and consumptions in 1987 were about 5,200 litres of Lindane 25 EC and 14, 280 bags of Lindane 25 WP. The ESC also utilizes about 4,000 litres of Malathion 50 EC and 3,000 litres of Methidathion 40 EC annually for use on citrus plantations in their estates.

Coffee

The home of Coffea arabica is believed to be Ethiopia and it is the most important cash crop and is grown in the northwestern and eastern plateau. It contributes over 60% of export earnings and some revenue through surtax and cess. In 1988 net export was 500 million Birr. Coffee is also an important consumer good, being drunk by most Ethiopians. This domestic consumption absorbs more than 50% of total production.

Coffee growing in Ethiopia is scattered and fragmented. In many parts, the trees grow widely and these account for a good size of the total commercial production. The remainder is of the plantation variety and is planted on smallholder farms. Presently coffee is grown on about 500,000 hectares. Usually farmers attend to coffee only during harvest, thus yields are generally low ranging from 300 - 400 kg per hectare. State farms comprising of about 15,000 hectares in 1987 were expected to expand to 50,000 hectares by 1994. Yields in these farms are higher (800 - 1000 kg per hectare), but the peasant sector produces over 95% of coffee.

In Ethiopia the most serious pest problem is the coffee berry disease caused by the fungus Colletrotrichum coffeanum and affecting up to 30% of the trees resulting in 15 - 20% loss in production. Other diseases include brown eyespot, leaf blight and leaf rust. The only insect pest of coffee in the country is the antestia bug which is a vector of the fungi which causes dry rot of beans. Weeds can also be problematic if the trees are not grown under shade. Most fungicides imported into Ethiopia have been used on coffee by the peasant sub-sector, the recommended ones were Captafol 80 WP and Dithianon 75 WP. Resistant cultivars have, however, been developed at the JAR, but adaptation of this has been rather limited. Daconil and Heptaclor have been recommended in recent times. Rust in the lowlands has been controlled by cultural practice. In 1988, 11,900 hectares were sprayed for the coffee berry disease with 277 tons of Daconil and for insects with 130 quintals of Heptaclor in the peasant forms. Insecticides have been used mainly for the control of termites and cutworms, but in general insect problems have not been very serious. Small quantities of Malathion 50 EC and Fenitrothion 50 EC have been used to control some insect pests. For the year 1988, 314 tons of fungicides (mainly Daconil); 4,800 litres of herbicides and

insecticides (560 litres (liq.); 130 quintals (dust) were used. Thus, total pesticides used in the peasant sector in 1988 were as follows:

Pesticide	Quantity	Pest	Price
Fungicide (mainly Daconil)	314 tons	Coffee berry disease	23 Birr 50 cents/kg
Herbicides	4,800 litres	Weeds	40 Birr/litre
Insecticides:			
Sumithion)	560 litres	Sucking bugs	6 Birr/kg
Malathion)		Sucking bugs	6 Birr/kg
Heptaclor	130 quintals	Termites	18 Birr/kg

For the State farms another 5-10% of the above is used in coffee plantations.

Other crops

Crops, including fruits, vegetables, pepper, tobacco, sisal and kenaf also consume their share of pesticides as well.

4.1.3 Pesticides Procurement

Almost all pesticide activities are in the hands of the Government. The private sector act only as supplier and technical advisor on special product lines. Shell once contracted a private company to formulate Lindane dusts using locally available diatomite and the MOA once formulated DDT dusts. In Ethiopia, subsidiaries or appointed agents of the major chemical companies are represented viz. Shell, Bayer, Ciba Geigy, Sumitomo, Union Carbide, Monsanto, Makteshin, May & Baker et al.

Pesticides procurement and distribution is rather individualistic and decentralized. The MSFD, for example, is responsible for all its plant protection activities in terms of procurement and distribution, etc. In comparison, quite a lot of pesticides are used by this sub-sector against

weeds, insects and pathogens since rotation is not very good in Ethiopia. Although on-going research in the production of resistant varieties exist, this is very slow. To break the cycle, 50,000 ha will have to be rotated every year. Thus, US$8-10 million are spent annually on pesticides. In 1988/89, US$8 million were spent on importation of pesticides. This was the minimum needed since foreign exchange shortage exists in the country. In reality, more pesticides were actually needed for solving the pest problems in this sub-sector.

Normally, the MSFD applies for foreign exchange like other establishments and the Government allocates accordingly, depending on availability. An international tender from Agrochemical companies is then issued and a suitable supplier chosen for the purchase and supply of the required pesticides, based on the recommendations of a Technical Committee. The majority of the pesticides supplied are in bulk packages of 200 kg or litres and the suppliers take full responsibility for their performance, i.e. efficacy, etc. of the pesticides. Funds for pesticide purchase are also received from various donor and loan agencies like the EEC, FAO, IFAD and Japan, etc.

For the registration of new pesticides, sample pesticides are tried for 2 years in small scale farms in collaboration with the chemical companies (10-20 sq. metre/plot/treatment). The more effective ones are then screened in large scale trials for 1 year (for fungicides, hectarages are 25-50 ha/100 ha, insecticides, 600 ha and herbicides, 300 ha) unreplicated.

Next, if new product is not convincingly more superior to the older chemicals, then 50% of area is treated with older chemicals and 50% with the new pesticide.

In general, it normally takes 4 years before a new pesticide is recommended for use in the State farms and only those approved and recommended by the MSFD are allowed for importation and eventual use by the MSFD. Furthermore, the MSFD conducts research and updates its recommendations on a yearly basis.

Like the MSFD, the Ministry of Coffee and Tea Development and the Ethiopian Sugar Corporation are also responsible for procuring their own pesticides directly. On limited cases, the private companies are allowed to import small quantities for supply to retailers.

As far as the peasant sector goes, the MOA identifies the types, quantities and formulation of pesticides required and then arrange procurement and distribution through AISCO, a parastatal under the MOA charged with the responsibility of handling (purchasing and distributing) agricultural inputs throughout Ethiopia. The Plant Protection Department of the MOA also offers free advice and services against migratory pests, epidemic plant diseases and pest outbreaks such as the desert locust, armyworm, grain-eating birds (e.g. qualea) and rodents. For these latter, pesticides are usually obtained as free gifts from donor agencies such as the EEC, IFAD, et al.

For example, in 1986, the MOA used 57,627 litres of liquid pesticides (including Fenithrothion 50 EC, 95 ULV; Endosulphan 35 EC; Cypermethrin 5 EC and Diazinon 60 EC) and 96,480 kgs of dry formulations (including Carbaryl 85 WP) against armyworm. More than 500 litres of Fenithrothion 60 ULV was also used against grain-eating birds.

AISCO presently has about 680 marketing centres throughout the country in different zones and districts, and organizes the sale and distribution of pesticides. It also procures pesticides for the Ministry of Coffee and Tea, the resettlement areas and the MOA for its mosquito programme, and hands it over to them for distribution. Normally it takes about 6 years research before a pesticide can be recommended for use by IAR.

In addition, AISCO also handles the input requirements of the Department of Animal and Fisheries Resources of the MOA for veterinary use and for other projects.

In the peasant sector, the farmers are organized into co-operatives (approximately 4,000 co-operatives representing 18 - 19,000 peasant associations). AISCO deals with co-operatives through its marketing agents. First, extension workers determine pesticides needs and the MOA reviews and complies lists for procurement by AISCO.

4.1.4 Distribution and Marketing

Presently Ethiopia relies completely on pesticide importation. All imports, including pesticides, arrive at the Assab port from where they are distributed to their respective locations.

Pesticides for the MSFD are distributed to the various areas e.g. Nazret (50-70 km from Addis Ababa) by trucks (i.e. by road), at an average cost of 15 Ethiopian cents i.e. US7 cents/quintal/kg depending on the state of the road. Usually, there is a 15% of the total pesticides cost attributed to transportation and handling cost. Transportation is regarded as a bottleneck for effective and efficient pesticide distribution to the various State farms.

Pesticide treated seeds, which are also graded, etc. are usually supplied by the Ethiopian Seed Corporation (under the Ministry of State Farms).

At the various farms, pesticides are stored on-farm until required. As the MSFD does not own its own plane for aerial spraying of pesticides, it rents from ADMAS Air Service (under Ethiopian Airlines), but this is sometimes problematic as the time of need sometimes does not coincide with availability of the plane. Planes are rented at the following cost: for ULV, 7 Birr/ha and for HV., 14-15 Birr/ha. Profits accrued by the MSFD are supposed to go back to the Government, but this is usually not adequate enough to give any to them. In fact loans are usually obtained from the bank, e.g. the Agricultural Industrial Development Bank, or the MSFD sometimes obtains Government equity on new projects. There are no subsidies on pesticides.

Pesticides destined for the peasant sector, are similarly received at the Assab port by AISCO and transported to the various marketing centres by road using AISCO's trucks (only 12) of 22 ton capacity, and trucks rented from the Ethiopian Freight Transportation Corporation at an average cost of 15 Ethiopian cents per quintal/km.

At the marketing centres and in the co-operative stores as well, pesticides are sold by the Extension Agents to co-operatives and private

farmers likewise. These would have obtained loans from the commercial banks. Usually pesticides are bought in pack of 10, 15 or 25 kg or 5 and 10 litres and only rarely are they sold in smaller units as in the case of herbicides which are sold in measured quantities into the farmers' own containers. Extension Agents are supposed to play an important role in advising farmers on the use of pesticides.

There are no incentives or subsidies and no taxes or duties. Also, there is no price control, however, AISCO sells to co-operatives with very little profit to cover overheads only. The Co-operatives likewise sell to farmers plus a small service charge. Large farmers can obtain bank credit and buy theirs directly. Usually no collaterals are needed.

There are no promotional or marketing activities by AISCO or any of the chemical companies for the benefit of the growers. Also, there are no benefits of after-sales service, farm demonstrations and technical back-up through field staff usually made available by pesticide companies, are absent. Infact, once a chemical company wins an order against tender, supplies are made and that ends the marketing activity of the company. In general, formulation and packaging are not based on the needs of the peasant farmers (usually in bulk packages of 200 kg or litres). Emphasis has been mainly on using high-value chemicals of higher concentrations than on low-cost ones such as dusts, granules, etc., which are more favourable to the peasant farmers needs. AISCO, with only about 680 marketing centres staffed with a limited number of marketing agents, is grossly inadequate in proper pesticide distribution. Frequently, it is the MOA extension workers (Development Agents) who carry out the marketing activities. When required, pesticides are frequently not available and the farmer has to travel long distances to buy his requirements. AISCO's distribution will thus need to be greatly improved and strengthened in order to go anywhere to meet the demands of the peasant farmers.

Ethiopia, with its very large agricultural population, has a large potential market for pesticides and efforts are needed to develop it through all possible sources, e.g improved AISCO's distribution network, improved extention services, distribution through other channels like village

retailers, co-operatives, extension workers and sales depots of pesticide companies in Ethiopia. This will invariably make available the desired inputs to the remote areas of the peasant farmer.

It is clear that most peasant farmers are not presently sufficiently aware of the benefits of the use of pesticides, hence promotional programmes have to be initiated in order to popularise the use of plant protection measures in the peasant sector by making use of extension workers. In this connection, Government is now aware of the need to improve extension services, (one for every 800 farmers) inputs, credit facilities, etc. More effort should, however, be made to improve farmers' education and training, plant protection demonstrations, mass meetings, seminars, workshops, distribution of leaflets (in local languages also), etc.

4.1.5 Total Consumption

The total pesticides consumption in Ethiopia varies remarkably over the years. Table 3 gives the quantity and value of the various classes of pesticides i.e. Insecticides, Fungicides, Herbicides and Disinfectants imported over the period 1976 to 1986. In 1987 the total pesticides imported was 5,618,040 kg, i.e. 51, 474, 719 Birr (US$25, 737,359), while in 1988 it was 2,292,034 kg, i.e. 25,954,789 Birr (US$12,977,395). In 1989/90 the total pesticides imported by the State farms alone was 17,188,982.26 Birr (US$8,594,491.13).

The wide fluctuations could be due to a variety of reasons ranging from pesticide stocks not consumed in one year being carried over to the next; pesticides entering the country as part of some aid package; pesticide imports not being related to needs but to availability of foreign exchange or as part of an aid or grant from bilateral or international sources; purchasing influenced by a campaign or a specific development programme.

CLASSWISE IMPORT OF PESTICIDES IN ETHIOPIA, 1976-1986

(Q - Quantity in Tons; V - Value in '000 Birr)

YEAR	INSECTICIDES		FUNGICIDES		HERBICIDES		DISINFECTANTS		TOTAL	
	Q	V	Q	V	Q	V	Q	V	Q	V
1976	2,528	7,986	92	1,311	971	4,704	100	562	3,691	14,563
1977	1,768	6,632	-	-	550	3,023	64	275	2,382	9,930
1978	1,617	29,580	-	-	1,804	4,796	716	2,468	4,137	36,844
1979	1,299	8,019	138	2,615	1,780	7,027	128	852	3,345	18,513
1980	2,080	13,909	436	1,128	255	2,217	96	727	2,867	17,981
1981	2,854	21,349	152	3,225	65	308	45	635	3,116	25,517
1982	1,323	10,996	32	300	13	33	292	2,789	1,660	14,118
1983	3,279	21,163	3	48	17	163	20	145	3,319	21,519
1984	2,298	25,660	476	1,779	51	293	121	1,403	2,946	29,135
1985	1,702	12,424	364	3,594	9	67	415	2,394	2,490	18,479
1986*	1,743	16,199	4	24	12	6	-	-	1,759	16,229

Table 3

- Importation of DDT (included under insecticides in the above data)

Year	1976	1978	1979	1982
Q	1,309	45	149	7
V	1,462	50	545	61

*First Half only

Source: Annual External Trade Statistics, Customs and Tax Administration, Addis Ababa.

The above classes of pesticides imported as finished formulations for the wide variety of pests in the different agroecologic zones include, as indicated earlier, most formulation types such as emulsifiable concentrates (EC), ultra low volume formulations (ULV), water soluble concentrates (WSC), flowables (Fl), soluble liquids (SL), wettable powders (WP), dusts (D), granules (G).

MSFD

The State farms of the MSFD are the largest users of pesticides in Ethiopia. Table 4 shows that consumption by the sector has significantly increased from about 7.8 million Birr in 1982-83 to almost 19 million Birr in 1987-88, and in 1989/90, to almost 17, 188, 982.26 Birr. For 1990/91 approximately 17 million Birr is estimated as the requirement.

As usual the wide range of insecticides constitute 70-75% of the total, followed by herbicides 17-20% and fungicides 6-8%. Others include rodenticides, termiticides, nematicides and the seed dressing, thiram, making about 1%. Cotton alone uses about 60% of the total (50% in value). Liquid pesticides are usually favoured for herbicides and insecticides since aerial spraying is used wherever possible using the aircrafts of the Adas Air Service, a subsidiary of Ethiopian Airways.

The Peasant Sector

The Ministry of Agriculture is responsible for all aspects of agricultural pest control in this sector. This service includes advice on control measures, provision of pesticides and equipment and control measures, provision of pesticides and equipment and conduct of control operations for migratory pests throughout the country.

AISCO, a parastatal of the MOA is responsible for procurement and distribution based on pesticide demand data collected and compiled by the district and zonal offices and scrutinized at the MOA Headquarters. Equipment is also purchased by AISCO who are usually guided by the allocation of foreign exchange by the Government. In 1987/88, 13.0 million Birrs were allocated for

Table 4

Classwise Pesticides Consumption – MSFD
(Crop Season 1982-83 to 1987-88)

Q – Quantity in Tons; V – Value in '000 Birr
L – Liquids; D – Dry Formulations; T – Total

Type	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88
1	2	3	4	5	6	7
a) Insecticides:						
L - Q	614.3	569.4	774.3	1405.3	1212.5	1176.0
L - V	4619.1	4794.3	6463.8	10288.2	10012.3	11215.2
D - Q	92.4	18.7	47.7	0.2	5.6	32.4
D - V	185.3	25.6	99.0	6.1	352.9	490.1
T - Q	706.7	588.1	822.0	1405.5	1218.1	1208.4
T - V	4804.4	4819.9	6561.8	10294.3	10365.2	11706.3
b) Fungicides:						
L - Q	1.3	1.2	43.2	-	0.6	29.8
L - V	15.9	21.8	971.6	-	14.7	219.8
D - Q	47.7	97.7	17.2	4.1	39.4	81.9
D - V	282.5	588.7	361.6	48.9	403.7	613.3
T - Q	49.0	98.9	60.4	4.1	40.0	111.7
T - V	298.4	610.5	1333.2	48.9	418.4	833.1
c) Herbicides:						
L - Q	200.8	241.2	339.8	364.3	481.0	429.4
L - V	2706.5	2315.5	4068.8	3936.3	6097.1	6230.4
D - Q	0.3	18.4	28.3	8.3	-	1.0
D - V	8.1	448.5	549.5	252.5	-	31.8
T - Q	201.1	259.6	368.1	373.1	481.0	430.4
T - V	2714.5	2764.0	-618.1	4189.1	6097.1	6312.2
d) Grand Total:						
Q	956.9	946.6	1250.5	1782.7	1738.5	1750.5
V	7817.3	8194.3	12513.3	14532.3	17880.6	18851.5

Source: Compiled from data given by MSFD, Addis Ababa

pesticides and equipments for sale and distribution to the peasant sector. They include insecticides, fungicides, herbicides, rodenticides and pesticide application equipments, but grossly inadequate to meet the total requirements of the peasant farmers. Presently, both the more expensive high and low active ingredient formulations are imported to Ethiopia in order to optimise on transportation costs. However, the low active ingredient dust and granule formulations are more popular with the peasant farmers in terms of applicators safety, environmental protection and ease of application. Thus, the more expensive high active ingredient liquid formulations should be substituted wherever possible with dust and granular formulations when locally produced, using locally available inert carriers and diluents. For example, the dry formulations currently being imported are 1% Cypermetrin granules, 2% Primiphos methyl and DDT dusts 5 and 10%. Thus, more than 96% of the formulated products are inert clays, which are available in Ethiopia in large quantities, being imported in the wake of scarce foreign exchange.

Settlement Schemes

After the 1984-85 food crisis, the Government of Ethiopia further increased the pace of the schemes so as to reduce vulnerability to famine and to address the degradation problems. The target is to settle 300,000 families, i.e. 1.5 million people to more fertile regions in the country (Western and Southwester Ethiopia). The Relief and Rehabilitation Commission (RRC) give help for the first four years after which the MOA takes over and the farmers brought under the Peasant Association. The RRC procures pesticides, fertilizers and equipments and distributes them free of charge. Large quantities of pesticides are, however, required but not all are met because of resource unavailability. The main pest problems for which pesticides are used are stalk borers, armyworms and other maize, sorghum and teff pests, as well as pests of cotton and pulses. The total pesticide consumption is about 300 kilolitres per annum. Recently reduced since 10,000 hectares of cotton has been reduced to 800, the remainder being handed over to the State farm sub-sector. Pesticides used include Malathion 50 EC, Fenitrothion 50 EC and Endosulphan 35 EC, totalling 100 kilolitres. Other insecticides approximately 200 kilolitres, cotton requirements 120 kilo litres (1.2 million Birr). In terms of preference, the RRC prefers low active ingredient dry formulations (if made available locally) to

the high concentrated liquid formulations being used presently so as to save on overseas transportation costs.

Migratory Pests

The Plant Protection and Regulatory Department (PPRD) of the MOA is responsible for the control of the desert locust, the African migratory locust and the two species of the tree locust; the grain-eating birds (qualea), armyworm and othe epidemic pest outbreaks. It also maintains stocks of pesticides and equipment obtained as gifts or purchased with the MOA budget. Services are provided free for these pests. Major pesticides used include Malathion, Diazinon, Fenitrothion, Endosulphan as liquids and Carbaryl, DDT and BHC as powder formulations. For 1987-91, requirements are shown in Table 6. Malathion already in storage will also be used.

Public Health

Large quantities of pesticides are also used in this sector especially against Malaria. This disease is endemic in Ethiopia (areas below 2,000 metres, i.e. 75% of the total land mass, about 65% of the population).

A National Programme for the control and eradication of malaria and other vector-borne diseases, initiated in 1959, is the largest programme in Africa with WHO assistance. In 1986/87, the Government allocated 3 million Birr for the purchase of pesticides. DDT 75 WP (about 2 million Birr) has been the main pesticide used but Malathion 50 EC (about 1 million Birr) has also been introduced. Temephos, Primiphos-methyl and Pyrethroids are also recommended products. For other domestic pests such as houseflies, cockroaches, bugs and fleas, etc., imported aerosols based on Pyrethroids or DDVP are used.

Veterinary

Livestock contributes about 15% of the GDP in Ethiopia: 95% of livestock in the private sector and 5% in the State sector. The herd in this country is the largest in Africa and in 1987 includes 27 million cattle, 24 million

sheep, 18 million goats, 1 million camels, 7 million equines and 53 million poultry birds. Exports in 1985-86 to the Middle East and to North and West Africa were 251,000 goats and sheep, and 10,000 cattle valued at 19.4 million Birr. In Ethiopia, the Animal and Fisheries Resources Development Department of the MOA organizes veterinary services in the country. The acaricide, Toxaphene 300 EC is used to control ectoparasites by dipping or spraying. Annual consumption is estimated at 2,400 kilolitres but in the past lower consumption rates have been used, e.g. in 1985, 120,000 litres were imported. Usually pesticides are imported through AISCO who distribute them through its various centres. Peasants utilize the paid treatment facilities at the animal clinics or purchase their own products directly. The Dairy Development Agency, under the Development and Meat Corporation (under MSFD), which owns several livestock farms also uses acaricides. Also, State farms under the MOA exist. With the advent of the TYPP, veterinary and other services are being expanded.

Other Consumers

The other consumers of pesticides in Ethiopia include coffee and tea. Pesticides for this latter, include Aldrin 48 EC for control of termites in nurseries, herbicides like paraquat 20 EC, Glyphosate 48EC and Dalapon 8/0 WSP Post-harvest storage pests of maize such as rats, insects and moulds are also a problem. Teff suffers contamination from birds and rats. Pulses are affected by bruchids and sorghum by insects and moulds. These post-harvest losses range from 10 to 60% in different regions and recommended insecticides include Malathion, Lindane, Primiphos methyl, Fenitrothion, Dichlorves, Pyrethroids and Bromophos.

In total, pesticides consumed in Ethiopia are estimated at over 40 million Birr (US$20 million), which for 1986 can be broken down as follows (Table 5). About 75% are insecticides, 16% herbicides and 9% fungicides.

Table 5

Consumption of Pesticides in Ethiopia

Consumer	Estimated Total Value (in Birr) Millions	Estimated Total Quantity (Tons) Millions	Insecticides (Tons)	Classwise Fungicides (Tons)	Herbicides (Tons)
1. Ministry of State Farm Development	19.5	1800	1260	110	430
2. Peasant Sector	10.0	1100	770	180	150
3. Plant Protection and Regulatory Department (Ministry of Agriculture)	5.0	550	440	50	60
4. Relief and Rehabilitation Department	1.1	120	120	-	-
5. Veterinary (MOA)	1.0	150	150	-	-
6. Ministry of Health	1.5	300	300	-	-
7. Ministry of Coffee and Tea Development	2.0	100	15	35	50
8. Ethiopia Sugar Corporation	0.4	40	40	-	-
9. TOTAL	40.5	4160	3095	375	690
			(75%)	(9%)	(16%)

4.1.6 Licensing

There are no Government regulations pertaining to the monitoring and regulation of pesticides importation to Ethiopia or its sale, distribution and manufacture or formulation. There is, however, a large potential demand for pesticides since the Government has pledged to increase agricultural productivity in order to meet its primary objective of self-sufficiency in food production. Thus, even though most pesticides are utilized in the large State farms, it is anticipated that use by the small peasant farmers will inevitably increase in the near future.

There have been several accounts of foreign suppliers dumping sub-standard and ineffective pesticides in third world countries. This is normally due to improper monitoring, inspection and quality control measures. In vew of this, a 'Pesticides Registration and Control Proclamation and Regulations' has been drafted by a Committee of Experts and submitted to the Council of Ministers for approval of the proposed legislation since about 6 years ago. Evidence exists that this Council actually did look at the document in 1989 but it still has to be submitted to the Council of State.

4.1.7 Pesticides Demand Projections

The diverse agroecologic zones in Ethiopia makes the country well endowed for agricultural development. Many more areas could be used in order to attain self-sufficiency in food. This would, therefore, mean increased agricultural inputs and improved farm management services. Thus, increased use of pesticides is now imperative to this integrated approach.

Relative to its size in acreage the State farms utilize phenominally more pesticides than the dominant peasant sector. This low level in the peasant farms has been due to a variety of factors on both the supply and the utilization. Supply constraints include resource shortages, transportation and distribution problems, inadequate data to facilitate decision making, non-availability of products consistent with needs of small peasant farmers. On the utilization side, low level of knowledge among the peasants, inadequate education and training, poor extension service, lack of promotional

activities, including suppliers/distributors' after sales service, farm demonstrations, lectures and seminars for the benefit of the smallholder farmers. Because of these inadequacies, use of pesticides must be strengthened if increased agricultural output is seriously planned.

As already mentioned, pesticide importation over the years have failed to show any trends. There have been wide yearly fluctuations and imports have certainly not been need-based. Imports have been influenced by a variety of factors, thus the figures do not give a true representation of the total market of agrochemicals in the country.

For working out demand projections, several methods have been used including extrapolation of present trends; linking consumption to cropped areas or previous crop production projected to the future; relationship to fertilizer use by the equation, $P = a + bF$. In this, P = pesticides consumed (g/ha); F = fertilizer consumed (kg/ha); a and b are constants. The above equation implies that pesticides use is directly proportional to fertilizer use. In Ethiopia, like pesticides, fertilizer consumption has shown a very erratic pattern with no clear trends. Imports, instead of being linked to needs, have been dependent on resource availability hence a correlation between fertilizer and pesticides may not be feasible. Yet another functional relationship used for working out projections is that between yields/unit area and pesticides consumption in a relationship of the type $Y = aP^n$ where Y = weighted yield of all crops in kg/ha; P = pesticide consumption in g/ha; a and n are constants.

In Ethiopia, even those years when large quantities of pesticides are purchased, the total requirements were still not met. They have still been low and inconsistent, that the assumption of a linear trend extrapolation or regression methods to project the future pesticides consumption will be absolutely unrealistic. Thus, a more realistic and workable approach must be employed e.g. estimates based on cultivated areas multiplied by the dosage/hectarage have been used with some success for both the State and peasant sector in Ethiopia.

Using these methods the pesticides demand by the MSFD has been calculated to be over 35 million Birr worth of pesticides in 1989 and over 80 million Birr in 1994. For the peasant sub-sector, however, projections will increase phenomenally while in the health sector, coffee, tea and sugar, increases are not envisaged to be substantially, and for veterinary a 10 per cent growth is anticipated (Tables 6 and 7).

4.1.8 Raw Materials

Introduction

For pesticide formulation, it is extremely important that cheap and readily available raw materials of consistent quality are used at all times. Locally available formulation ingredients, which meet the specifications, should be used whenever possible as these would reduce freight costs, insurance, long shipping lines, etc. Raw materials considered include active ingredients, solvents, carriers and packaging materials.

Active Ingredients

These are the chemicals in the formulation which actually possess the biological activity. All the other ingredients in the formulation are only used to facilitate the application of the active ingredients to the target organism. The physical properties of the active ingredients imposes a limit to the choice of formulation ingredients used for any given type of formulation. For example, the physical state (liquid or fine crystals, powdered flakes, solid cakes or small lumps) melting and boiling points, specific gravity (density), viscosity, solubility, stability, odour and colour.

Presently, no manufacturing of active ingredients is undertaken in Ethiopia. This is not surprising since such activity involves highly sophisticated and expensive chemical technologies which cannot be afforded at this time. Furthermore, since only small tonnages are required, local production may not be justified, hence, it is not advisable at this time.

Table 6

PLANT PROTECTION AND REGULATORY DEPARTMENT - MOA

CROP PROTECTION INPUT REQUIREMENTS FOR 1987-91

(Q - Quantity in Tons, Kiloliters or '000 Pieces: V - Estimated Value '000 Birr)

PRODUCT			1987		1988		1989		1990		1991	
			Q	V	Q	V	Q	V	Q	V	Q	V
Insecticides												
-Fenitrothion	95	ULV	50	518	55	569	60	621	65	673	75	776
-Diazinon	60	EC	40	331	45	373	50	414	55	455	65	538
-Cypermethrin	2.4	ULV	40	414	45	466	50	518	55	569	65	673
-Dimethoate	40	EC	40	331	45	373	50	414	55	455	65	538
-Endosulfan	35	EC	40	331	45	373	50	414	55	455	65	538
-Carbaryl	85	WP	50	414	55	455	60	497	65	538	75	621
-Cypermethrin	1	G	50	207	55	228	60	248	65	269	75	311
-Primiphos-methyl	2	D	75	155	80	166	85	176	90	186	100	207
-Aldrin	40	WP	50	518	50	518	50	518	50	518	50	518
Total			435	3219	475	3521	515	3820	555	4118	635	4720
Fungicides												
-Metalaxyl + Mancozeb			20	373	20	373	25	466	25	466	30	559
-Copper oxychloride			20	166	20	166	25	207	25	207	30	248
-Flutriafol + thiabendazole			20	331	30	497	30	497	35	580	40	662
Total				870		1036		1170		1253		1469
Rodenticides												
-Zinc Phosphide	80%		3	37	3	37	3	37	3	37	3	37
-Brodifacoum			50	414	50	414	50	414	50	414	50	414
Total				451		451		451		451		451
Avicide												
-Fenthion	60	EC	5	104	5	104	5	104	5	104	5	104
Total				104		104		104		104		104

Table 6

PRODUCT	1987		1988		1989		1990		1991	
	Q	V	Q	V	Q	V	Q	V	Q	V
Equipment										
-Knapsack sprayers	2	207	2.2	228	2.4	248	2.5	269	3.0	311
-ULV sprayers	1	62	1.2	75	1.4	87	1.5	93	2.0	124
-Overalls	1	41	1.1	46	1.2	50	1.4	58	1.5	62
-Boots	1	31	1.1	34	1.2	37	1.4	43	1.5	47
-Goggles	1	12	1.1	14	1.2	15	1.4	17	1.5	19
-Gloves	1	12	1.1	14	1.2	15	1.4	17	1.5	19
-Syphon Pump	1	21	1.1	23	1.2	15	1.4	29	1.5	31
-Cylinder	1	10	1.1	11	1.2	12	1.4	14	1.5	16
Total		396		445		489		530		629
Grand Total (Value)		5040		5557		6034		6456		7373

Source: Plant Protection and Regulatory Department, MOA.

Table 7

AREA UNDER DIFFERENT CROPS ON STATE FARMS

CROP TYPE	CROP AREA - HECTARES 1984	1988	1994
MSFD FARMS			
- Maize	47,347	61,414	69,480
- Sorghum	13,350	13,000	19,350
- Wheat	63,879	73,665	90,255
- Barley	5,667	10,000	10,000
- Rice	-	300	0,000
- Haricot	1,353	9,750	14,242
- Soya beans	87	9,950	15,141
- Sesame	2,001	15,000	40,500
- Sunflower	2,004	3,710	8,210
- Rape Seed	214	4,742	6,722
- Groundnut	105	5,700	20,250
- Cotton	31,760	56,390	138,092
- Sisal	8,000	1,000	1,000
- Kenafe	110	5,000	12,000
- Tobaco	663	1,900	3,200
- Vegetable	1,592	3,906	5,742
- Pepper	2,496	8,750	10,650
- Teff	937	-	-
Total	174,365	284,179	470,834
MCTD - COFFEE PLANTATIONS			
- Coffee	11,710	23,060	43,560
ESC - SUGAR PLANTATIONS			
- Sugarcane	14,860	27,300	31,800

Source: Data compiled from information given by ESC, MCTD and from Prefeasibility Study, Fertilizer Complex, Ministry of Industry.

Chemical companies already present in Ethiopia can, however, supply active ingredients as required (chloronated, organophosphorus, carbamates, pyrethroids or plant extracts). They can also provide the necessary back-up assistance relating to formulation development work based on utilization of local raw materials (carriers, solvents, etc.), analytical methods, safety requirements and application methods.

In terms of bulk, smaller quantities of active ingredients will be imported compared to finished formulated products, thus many inherent problems will be reduced such as transportation, foreign exchange, handling, etc.

Active ingredients for domestic pesticides production can be obtained from pyrethrum which grows in Ethiopia but has never been developed, though the potential is great.

Solvents

Present use of solvents produced in Ethiopia are as follows:

Kerosene - Although produced in Ethiopia, some are sometimes imported to augment local production. It is normally used as a jet fuel, for home use and a small proportion for the paint industry.

Naphthas - Gasoline, used to run cars. Presently production and consumption are at par, but consumption will soon exceed production at which time some will have to be imported.

Gasoil - A deficit product, used in automobiles.

Diesel - A deficit item also; 220,000 tons are imported annually.

Thus, it is quite feasible to include another 5,000 tons of any of these products annually, without any hardship on the refinery. However, it must be borne in mind that this would have to be a foreign exchange component.

Ethanol is produced in small quantities, but all is presently destined for the captive consumption of the Ethiopian Beverage Corporation. However, a proposal to establish a new plant to produce power alcohol for use in mixture with motor gasoline has been under Government consideration for some time.

Oilseeds

There is a very good production of oilseeds in Ethiopia; about 100,000 tons per annum. These are produced by both State farms and private farmers and include cotton, niger seeds, rapeseeds, groundnuts, sunflower, sesame and spices.

These oilseeds are processed by the Ethiopian Food Corporation and other privately owned factories for oil production or exported as seed as in the case of sunflower and sesame seeds.

Oilseeds supply has, however, been rather erratic due to drought. In 1988/89, 52,100 tons of cotton were obtained while the tonnage for all the others was 75,000 tons, making a total of 127,000 tons. The seed meals are also exported or used locally as animal feed, for example, cotton. The oilcake of rapeseed, because of rancidity has been shown to be of less value. Experiments are underway to use this to develop brickets (as fuel), or fertilizer. There is also the possibility of researching into use as a formulation carrier. Thus, some of the non-edible oils could be used as possible diluent in formulation of ULVs. This, however, needs to be investigated in the laboratory, in pilot plants, and in small field plots before any large scale production is made.

Before the detailed results of experimentation with locally available solvents are obtained, solvent requirements could be met through imports.

Surfactants

These are substances which reduce the interfacial tension between immiscible liquids or even between liquids and solid surfaces. Thus, in liquid formulations, surfactants of the non-ionic and the anionic types are

used as emulsifiers to reduce the interfacial tension between immiscible liquids. Water insoluble pesticides could form stable emulsions with an appropriate emulsifier and diluted with water. Surfactants are also added to water soluble concentrate formulations to give the spray liquid sufficient wetting powder. Other adjuvants added to improve quality or performance characteristics include stabilizers, thickners, dyes and similar agents. Emulsifier selection must be done systematically with laboratory trials being indispensable. Paired emulsifiers are now available from manufacturers who can also give the requisite advice. As none of these materials are available in Ethiopia, they would have to be totally imported.

There are two general types of pesticide formulations:

Liquid Formulations

Several types of liquid formulations exist and these include wettable powders, dust formulations, granular formulations, water soluble concentrates, suspension concentrates, aqueous concentrates and oil solutions.

Most pesticides (active ingredients) are insoluble in water thus, it is necessary to use some organic solvents for the preparation of liquid formulations or liquid concentrates used for the impregnation of dry formulations. The solvents include both polar and non-polar types. Among the non-polar solvents are aliphatic and aromatic hydrocarbons and petroleum distillates), while the polar ones include ketones, esters, glycols, acid amides and glycoethers. Choice of solvent will, therefore, be based on several considerations including water miscibility, economics, solubility of the active ingredients, phytotoxicity of the solvent, its toxicity, volatility and inflammability. Important functional properties of the solvents used in formulating pesticides are as follows: distilattion range and boiling point, specific gravity (density) aromatics content, solvency, kauri-butanol value, flashpoint, viscosity, water miscibility, toxicity, colour and odour.

There are minieral oil resources in Ethiopia and prospecting is being conducted presently. Crude oil and hydrocarbons are imported from the USSR: approximately 800,000 tons per annum of crude oil and 250,000 tons per annum

of hydrocarbons. Imported crude are refined in Ethiopia by the Ethiopian Petroleum Corporation, who has a capacity to process one million tons of crude per annum.

The various fractions obtained from the distillation of crude oil include kerosene, naphtha, gasoil and diesel oil. These could be experimented for use as solvents or diluents in the preparation of oil concentrates/ULVs either alone or in combination with other more powerful imported solvents. In addition, distillates of slightly different characteristics could also be produced from the refinery to suit specific needs. It must, however, be ensured that all important characteristics of the local solvents such as aromatics content, flashpoint, distillation range, solvency, water miscibility, water content, etc. are within the specification limits. Emulsifier balance must also be determined with respect to the local solvent before any substitution is made.

Dry formulation

Carriers and diluents

In the establishment of any local dry formulation plant it is important that there is a continued and assured supply of carrier or diluent from an indigenous source. The most important dry carriers and diluents used in pesticide formulations are inorganic materials mainly of natureal origin. These include diatomite, vermicullite, attapulgite, montmorillonite, talc, kaolinite and pyrophyllite. They are usually processed for use in pesticide formulations by techniques ranging from simple drying and pulverising to washing, airfloating and calcining. Important properties of powdered carriers and diluents include particle size, sorptivity, bulk density, surface acidity and chemical compartibility, flowability, dustability and abrasiveness.

In granular formulations, carriers may be of mineral or vegetable origin. Examples of mineral carriers are montmorillonite and attapulgite while carriers of vegetable origin include maize cobs, wood flour, ground tobacco stem, rice hulls and cotton seed meal. In some cases, silica sand,

grains of limestone, brick chips, gypsum and granulated fertilizers are also used. Important characteristics also include particle size, sorptivity, flowability and abrasivity. It is also extremely important for the carriers and diluents to be compartible with active ingredients.

In Ethiopia there is a vast mineral potential, including a wide variety of minerals for use as carriers and diluents for making dry formulations. These include kaolinite, diatomite, limestone, bentonite and dolomite. Kaolin is already being mined on a small scale. A DDT dust formulation plant once in operation in Tigray and using local kaolin as the base, is no longer in operation. A Lindane dust formulation plant owned by a private individual in Addis Ababa which once supplied Shell and the MOA has not been hired for some time now.

The status of important carriers present in Ethiopia are as follows:

(a) Diatomite: Three deposits have been studied so far. One at Gademota (150 km from Addis Abba, in the Rift Valley) already explored by shafts. This deposit is about 250 million tons. Preliminary studies in the Addis Ababa on the chemical and physical properties indicate that it meets the requirements for pesticide formulation. Further confirmatory tests are being conducted in Italy.

(b) Chefe Jila Deposit: Regarded as the best to date. About 180 km from Addis Ababa and approximately 55,000 tons. It is recommended as a filter and is also suitable for pesticide formulation.

(c) Adami Tulu Deposit: About 200 km from Addis Ababa and approximately 205,7000 tons. Also suitable for pesticide formulation.

So far more that 20 Diatomite depostis have been found in Ethiopia and the possibility of the occurrence of different grades for different purposes exist.

A feasibility study has been planned for 1990 and a German Company has shown some interest. However, a definite local market is needed before

development is embarked upon. It is envisaged that these mines will be developed in about 3 years. Diatomite located near Nazret has already been used to produce Lindane for Shell.

Kaolin

The EMRDC is purchasing equipment for mining and processing for ceramics and an Aluminium sulphate factory. It will produce 10,000 kaolin per annum, which will not be adequate to meet the needs of the pesticide plant as well.

Kaolin deposits studied. Bombawoha deposits about 410 km from Addis Ababa contain 105,000 tons ceramic grade (based on iron content), i e.less than 40 grain size. There are, however, 700,000 tons of kaolinitic material in the Bombawoha deposits. Other deposits are also being explored. There should be no problem supplying a formulation plant about 75 tons per annum. So far, the known reserves are estimated at 500,000 tons, mostly in the south of Ethiopia, where detailed mapping and drilling has been done.

Dolomite

Deposits in Kenticha (in Sidamo area) about 550 km from Addis Ababa. Nine sites have been located. In site No.1 about 200,000 tons are present while at site No.9 about 1.5 million tons. Quality of dolomite was high grade. This site is quite accessible by road and there is water and electricity available. There is presently a proposal for development and a market study has already been completed

Bentomite

Over 2 million tons of bentomite deposits have been located in District Gewane around 375 km from Addis Ababa. Several deposits have been studied:

For drilling mud	- not very good.
Bleaching agent	- preliminary results encouraging
Agricultural purposes	- draining (to retain water)

Montmorillonite This is present in the bentomite.

Gypsum

There are large deposits of this in the Blue Nile area, estimated at billions of tons. Although some analysis indicating that the quality is good has already been undertaken, further analysis is still required. Gypsum is used for cement and for plaster of Paris. Presently, small scale private mining is being carried out.

Talc

Deposits are located in the south, near the goldmines and detailed work is scheduled for 1990.

Vermicullite

Only small occurrence is Ethiopia while pyrophyllite and attapulgite have not been located.

Limestone

More than 95% Calcium carbonate exist in Ethiopia, about 400 km from Addis Ababa. There is a possible micronisation project to produce micronised fillers from some of these minerals (70% Calcium carbonate and 30% of dolomite, bentonite, kaolinite, fieldspar and quartz mixtures) for paints, etc. This project is scheduled to start in 1991. Presently, cement plants in Addis Ababa, Diredawa, Massawa and Mugher under the Ethiopian Cement Corporation are in operation using limestone from nearby quarries.

Thus, depending on their physical and chemical characteristics, i.e. molecular and crystalline structure, composition, particle size and sorptivity, these minerals could be used for the production of dry formulations. However, their suitability as carriers as well as that of the

local solvents and the final formulated pesticides must be checked in the laboratory, on a pilot scale and in field plots before any large scale use is implemented.

In dry formulations, important characteristics of the surfactant are the wetting and dispersing of wettable powders (WP) in water during spraying in the field. Common wetting agents are the sodium salt of Alkyl benzene sulphonates, while dispersant used in the formulation of water-dispersible powder pesticides may be of the Lignosulphonate type with cations such as Sodium or Calcium or the Sodium or Calcium sulphonates of Polymeric phenols. Other materials used are anti-caking agents (e.g. hydrated Calcium silicates, micronised silica with low bulk density, large surface area and oil absorption) to prevent lump and solid mass formation during storage. Others are deactivators, stickers, anti-foam agents and structuring agents, etc.

Other Raw Materials

Phosphorus - Phosphate rocks are found in the eastern part of Ethiopia. Some drilling and geophysical work have already been undertaken and deposits with up to 12% Phosphorus pentoxide (P_2O_5) have been identified. Thus, this area seems very promising.

Sulphur - Pyrites are sources of sulphur. These have been found in several places. Sulphur is also obtained from volcanic rocks. Pyrites have been found in the Assamara area (about 3 million tons). Galcopyrite (about 1 million tons). Sulphur content was about 35% (a by-product). Elemental sulphur deposits have been found in the Dallo area, where potash deposits are also located. For Galcopyrite, only small scale drilling has been conducted, a more detailed one needs to be done. A 2,000 tons deposit of elemental sulphur has been found in the south, near Dafan, about 250 km south of Addis Ababa.

Chlorine - Vast quantities of Sodium chloride occurs in Ethiopia, from which Chlorine can be obtained.

Copper - Some deposits exist but no smelter is available.

Packaging

Packaging of formulated pesticides is extremely important especially from a safety point of view. Packages used must of necessity be durable and resistant to corrosion, so as to prevent breakage and leakage during transportation and storage. Packages should also be in small enough sizes that can be conveniently utilized by farmers of all levels, and for household uses, so as to avoid repackaging. Packages are usually made of metal, glass or plastics, depending on the type of pesticides.

Ethioplastics and the Foam and Plastic Factory are reputable companies in Addis Ababa that produce plastic containers of all sizes. Enough capacity exist to cope with the demand. Raw material availability is, however, sometimes a problem since they are imported, hence a foreign exchange component. For example, low density polyethylene used by Ethioplastics to make plastic bags suitable for packing dry formulations and bottles are all imported. The Foam and Plastic Factory use high density Polypropylene, etc. and has blow and injection moulding units that can made any type of plastic containers. Ethioplastics presently produces 2,500 tons per annum, i.e. 30 million Birr/annum. Sealing of plastics is readily being done. Presently prices of plastic bags are based on 7 Birr and 90 cents/kg for plain bags and 8 Birr and 60 cents/kg for printed bags. Plastic bottles on the other hand of various sizes can also be produced, e.g. 300, 500, 800 ml sizes. Paper labels can be attached to these. Prices for these are 11.55 Birr/kg.

Glass bottles are produced mainly for the beverage industries, by the Addis Glass and Bottles Factory.

Ethiopian Petroleum Corporation will be producing steel drums of 160 litre capacity. With suitable arrangement they may be able to produce tin and aluminium drums, coated with suitable coatings to meet the specific needs of pesticide packaging.

The Ethiopian Printing Corporation has 8 printing presses throughout the country (4 in Addis Ababa), 2 paper converting factories and 1 shared company

that makes corrugated boxes. The output of these can be increased by increasing shifts or capacity. Their present annual turnover is 60 million Birr. Pulp is, however, imported. There are plans for producing pulp from bagasse (22,000 tons per annum). Presently 10,000 tons of paper are produced and there are plans for another 33,000 tons in 5 years. Most paper is produced by the paper mill, but specialized ones are imported. Simple paper packets of various sizes and with 1 or more layers in thickness can be produced. Adequate printing facilities exist for providing labels in English and the local languages.

Thus, it would appear that most packaging materials exist in Ethiopia. However, suitable trials will be necessary to determine which packaging material is used for which purpose. In addition, tests for shelf life during storage, and compatibility, together with tests during transportation, should of necessity be carried out. Until these tests are confirmed, materials should be imported if required, for example, internal enamel drums for liquid pesticides.

In general, regarding all raw materials (local carriers, solvents, adjuvants and packaging materials) for pesticide formulation, it is of paramount importance that their suitability be ascertained not only in the laboratory but in the field, before production on a commercial scale is undertaken. They should all meet standard acceptable specification. In this regard, suppliers could be utilized at stages where local facilities and expertise do not exist. UNIDO can also be asked for assistance in testing local raw materials for suitability, and in training local personnel. Ultimately local laboratory facilities should be developed for testing all raw materials fully. Presently, the EMRDC does conduct some laboratory tests on local carriers

4.2 Importance of the System in the Country's Economy

The pesticides industrial system in Ethiopia contributes significantly to the national economic and nutritional goals of the country. Pests and

diseases are important contributions to the low crop yields in Ethiopia, contributing an average loss of 40% or more. In realization of this, Ethiopia spends some US$20,000 per annum on the importation of pesticides (still inadequate), to minimize both the pre-and post-harvest losses of both cash and food crops, and hence contributing to achieving food self-sufficiency and raising the living standards of the people. Pesticides are also important in the public health and veterinary fields in Ethiopia.

With this large pesticides consumption and the Government's pledge to increase food production and increase crop hecacreages in both State and peasant sub-sectors, it is imperative that a local formulation plant be established in Ethiopia based on the utilization of suitable locally available raw materials such as carriers, diluents, solvents, packaging, etc. This will go a long way in improving agriculture, reducing the foreign exchange requirements and transportation costs and supply standard pesticide products of local recipes at the right time, more appropriately labelled, and packed in containers of the right types and sizes.

4.3 Government Development Objectives related to the System

The Government of Ethiopia, in its quest to achieve self-sufficiency in food production, has emphasized the need to strengthen and improve agricultural productivity in both State and peasant sectors, thus increasing food production and alleviating shortages; to expand production of agricultural raw materials for meeting the needs of local industries and expand industrial production, to improve the quality of exportable crops such as coffee, sesame, etc. and to raise living standards.

To achieve this, the Government is placing emphasis on improved farming by optimising agricultural inputs through the introduction of high yielding varieties, improved seeds, fertilizers, pesticides and other farm management services (irrigation, improved farming practices). This will inevitably increase yields of agricultural crops throughout the country.

The Government is thus pledging to raise food production and health standards for a sustained economic growth of Ethiopia, through increased availability of pesticides for agriculture, public health and animal health. This can be achieved by finding a viable basis for the local manufacture of a variety of pesticide formulations utilizing maximum indigenous raw materials as far as possible.

In view of the current heavy burden on the economy by pesticides importation (US$20 million, still less than required), and the presence of many raw materials within the country, the Government has been seriously considering the establishment of a local pesticide formulation plant which could cater to the local needs on a selective basis and reduce imports, hence valuable foreign exchange.

4.4 On-going Development Activities related to the System

Because of the Government's pledge to improve agricultural productivity for sustained economic growth of the country and the growing awareness of the importance of agricultural chemicals such as pesticides, there is now an urgent need to search for ways of improving the availability of pesticides and to find a suitable way for the local manufacture of a variety of pesticides utilizing as much as possible local raw materials.

At present all pesticide requirements are imported or obtained as gifts from abroad. Importation places a heavy financial burden on the economy and since many of the raw materials are available locally the Ethiopian Government has for some time been considering the establishment of a pesticide formulation plant. Since 1978, the State farms had requested assistance from UNDP to set up a plant. In 1981, the NCC of the Ministry of Industry justified the establishment of such a plant. In early 1986, an "opportunity study" was conducted by East German experts who recommended the establishment of a liquid pesticide formulation plant in Ethiopia. Following this, UNIDO conducted a techno-economic feasibility study in 1986 and in early 1989, UNIDO conducted an evaluation of offers for a pilot scale pesticide formulation plant.

4.5 Institutional Framework for the Development of the System

The Government of Ethiopia is the lead agent for all industrial development in the country. The National Chemical Corportation of the Ministry of Industry is responsible for all chemical industrical development. Thus, the development of any new chemical industries such as pesticides and fertilizers is handled by the NCC. This Corporation works very closely with all other pertinent Ministries, Corporations and Institutions, as in the case of pesticides - the Ministry of Agriculture, AISCO, Ministry of State Farms, Ministry of Health, Ministry of Mines, the Development Banks, AID Agencies, et al.

The AID Banks can provide the necessary local financial components while it is anticipated that the foreign exchange components will be provided by external agencies, e.g. UNDP, UNIDO, FAO, etc. in the form of technical assistance project and investments projects, etc. In the past, the Agricultural and Industrial Development Bank of Ethiopia has financed domestic components and to some extent foreign exchange components as well, depending on the magnitude required and the quantum of foreign capital available at the time. The Bank also provides loan to farmers for pesticide purchase, inter alia.

Normally an application for foreign exchange is made to the central bank, but because of the present shortage, the amount obtained is usually for less than that required. However, it is hoped that the foreign exchange normally allocated for pesticide purchase will be diverted to the pesticide formulation plant once it is set up in the country.

5 PROGRAMME JUSTIFICATION

5.1 Problems to be addressed

There is presently no pesticides formulation plant in Ethiopia. A small, private plant that was used to make DDT and Lindane dust is now used for gypsum for use in the cement industry. Hence, all pesticides utilised in the

country are either imported with valuable foreign exchange or are obtained as gifts from external donor agencies. Furthermore, freight and transportation costs from the suppliers to the Asab Port and to the users are high and in some cases inefficient and unreliable. Thus, there is the need to establish an indigenous pesticides formulation plant thereby importing relatively small quantities of active ingredients and some adjuvants, as compared to the substantially large tonnages of finished formulation, which contain more than 90% of raw materials that are present in Ethiopia. This plant should, therefore, provide pesticides for both the agricultural and health needs of the country, using local resources hence going a long way to improving agriculture, reducing foreign exchange requirements and the cost of the products by saving on transportation and supplying standard pesticides at the right time.

However, several constraints and bottlenecks to the development of the pesticide industrial system, including an indigenous pesticide formulation plant exist, which much be addressed. These include the following:

1 Active ingredients not available locally - no production of chemical intermediates suitable for use as active ingredients.

2 Carriers, though many, are locally available and have not yet been fully developed and tested.

3 Local solvents, though some are available locally, have not been fully developed and tested.

4 Other raw materials such as adjuvants should be investigated for local sources.

5 Foreign exchange policy does not exist for purchase of raw materials in Ethiopia.

6 Quality control, including training, technology know-how, R and D environmental protection are weak or non-existent.

7 Packaging specifically for pesticides poorly developed.

8 Marketing - credit, pricing, etc. need improvement.

9 Distribution networks and transportation are poor.

10 Expertise in contract negotiations is lacking.

11 Policy to phase out imports of products to be formulated does not exist.

12 Extension services are weak.

On the contrary, various enhancement variables, i.e. factors which potentially could enhance the development of Ethiopia's pesticides industrial system are as follows:

1. Materials suitable as dust carriers for dry formulation are present in Ethiopia.

2. Solvents suitable for liquid formulation are produced.

3. Great demand for pesticides utilization in both State and private sectors since present pesticides imports are high; potential free land expansion is good and envisaged; increase in export of cash crops is durable; food imports should be substituted by local production wherever possible.

4. Packaging facilities exist in the country.

5 Government has accorded high priority to increased agricultural development and greater productivity.

6 Assistance in the form of credit available to farmers.

5.2 Analysis of Alternative Development Strategies

Repackaging of formulated products, establishment of a formulation plant and/or manufacture of active ingredients are the three possibilities for most dveloping countries. However, for Ethiopia at the present time, manufacture of active ingredients, even though some of the ingredients are locally available, should not be considered because it is capital intensive and complex to operate. Importation of pesticidal products in bulk packages for local repackaging or dilution into smaller packs could be a viable alternative for Ethiopia but because of the vast quantities of raw materials available in Ethiopia presently, establishment of a local pesticide formulation plant (initially a pilot plant) would appear to be the best alternative in the circumstances and should be exploited. This latter is probably further justified because of the large present and future pesticides markets, the need for shortening the long distribution lines and for the prompt response to local market demands. From an economic and even logistics point of view it is more beneficial to import small tonnages of active ingredients and some of the adjuvants as compared to substantially larger tonnages of the finished pesticide formulations. The present system of importation of large quantities of finished formulations also involves high transportation costs.

Thus, a pesticide formulation plant providing pesticides for both the agriculture and health needs of the population using as best as possible local resources can reduce the foreign exchange components, reduce cost of product and supply standard pesticides at the right time, in the right packages. This indigenous formulation plant will inevitably provide flexibility in producing various products, and in synchronising production with local needs. In addition products can be readily adapted to local needs e.g. in terms of label (in local languages and English), small sizes of containers and packages and local recipes.

5.3 Strategies for Developing a Pesticides Formulation Plant

Pesticides formulation involves the physical mixture of one or more biologically active chemicals (active ingredients) with inert ingredients (carriers, diluents, solvents, surfactants and adjuvants) which provide effective and economic control of pests in the field.

The strategies to be used are as follows:

Active ingredients (technical pesticdes) will of necessity be imported since, inter alia, the small tonnages required do not warrant setting up an indigenous manufacturing plant as discussed earlier. Several companies are represented locally which can supply the active ingredients.

An international tender from various agrochemical companies will be issued and a suitable one chosen for the purchase and supply of the desired technical pesticide. Aspects such as price, quality and security of supply, technical back-up services and adequate shipping arrangements all have to be agreed upon. Suppliers should also agree to assist in developing local compositons, training of local staff and the supply of basic information about each product supplied. Examples of suggested pesticides include Endosulphan, DDT and Malathion which are presently widely used in Ethiopia.

Even when estimated price for local raw materials are slightly higher, local ones must be used in order to encourage domestic industries to grow and to save foreign exchange. Carriers and diluents must be available locally. However, thse indigenous materials must be tested to ensure that they meet all the specifications required for formuatlion. Furthermore, the performance of the formulations thus produced should be confirmed in the field. Thus the diatomite, kaolin and bentomite locally available, should be tested in this regard. In fact, preliminary testing has already been conducted by the FMRDC in Ethiopia, while further testing is being conducted in Italy. All sources of raw materials should be thoroughly investigated as an active part of the overall project and imported ones replaced as appropriate.

Some important factors to be considered for dust carriers and diluents are particle size, sorptivity, bulk density, flowability and dustability.

Apart from having all the requisite characteristics, the carriers and diluents must be tested for compatibility with the active ingredients, these are normally specified by the suppliers The sources of these carriers must

be consistent, the quality uniform and the reserves adequate and accessible. In this connection large deposits of carriers locally available are quite accessible. Deactivators to prevent decomposition at high temperatures of the active ingredients must also be tested for compatibility with the carrier and active ingredients. For DDT, deactivators like Ethylene glocol, Propylene glycol or the combination of the different types of Glycols have been shown to have some effect in neutralising the carrier.

Endosulphan is slowly decomposed by some clays and fillers e.g. kaolin type, but talc and calcium carbonate are inert. Dipropylene glycol can deactivate the carriers hence stabilize the finished product. Malathion is slowly hydrolyzed by alkaline conditions but weak acids like tall oil and rosin acids prevent this decomposition.

For the production of Malathion 25% dust concentrate, for example, the active ingredients (2%) could be mixed with a mixture of Diatonite and Kaolin in acidic conditions at the rate of 1:3 or 1:2 ratio.

Solvents

The Ethiopian Oil Refinery produces a wide range of solvents including kerosene and diesels which could be used for liquid formulations of pesticides. For the production of 1,500 cubic metres of liquid insecticides, 800 cubic metres of different types of solvents will be required as follows:

320 cubic metres of Aromatic hydrocarbon, e.g. Xylene and its mixtures
160 cubic metres of Alcohols
160 cubic metres of Ketones
160 cubic metres of Aliphatic solvents such as Kerosene, White spirit, etc.

Important considerations in the choice of a solvent are solubility of active ingredients, phytotoxicity, flammability, volatility, water miscibility, toxicology and costs. In addition, all the other characteristics of the local solvent should be similar to those of the imported solvent, such

as distillation range, aromatics content, solvency, flashpoint, water miscibility, water content phytotoxicity, etc. For the local solvents in Ethiopia these test have not yet been done, hence they must be undertaken and unless found satisfatory, should they be used for the formulation. These solvents can be tried for the formulation of insecticides for structural uses, household pests control by adding masking agents. Also water-based emulsion type formulations can save on costs of organic solvents.

Other raw materials should be actively investigated for local sources and their suitability thoroughly ascertained through laboratory, bench scale and field trials before commercially produced. They must all meet the required specifications.

Packaging

There is at present no standard policy to distribute pesticide in small packages for use by the small peasant farmers, in public health and even household pest controls. Most pesticides are dispensed from drums into all kinds of containers brought by the farmers such as glass or plastic bottles for liquids and polyethylene paper bags or sacks for solids. Hence, there are no labels, toxicological information, directions for use, name of product, pre-harvest intervals for food crops, warning symbols, etc. This is wrong and must be corrected in any local formulation plant.

Ethioform in Addis Ababa can make containers (5 litre) that can hold kerosene-based and water-based formulations, but first, compatibility and storage tests must be conducted before widescale use.

Ethioplastics presently make 500 ml and 1 litre yellow bottles and 800-1000 ml light density polyethylene. These can be used for kerosene-based liquid pesticides or water-based products for household, public health or institutional pest control. Labels can be printed on plastic or cellophane film in sleeve shape and put outside the bottle. Metal containers can be obtained from the factory at Assab, but it is recommended that it should be lined or coated and of sizes 5l, 20l and 200l. Shell Company in Addis Ababa will also be producing 200l metal drums for oil products.

For glass containers, the Addis Ababa Glass Factory can produce this if the required mould for threaded neck 250-500 ml glass bottles is available.

A 350 ml bottle costs about 0.6 Birr.

Paper bags lined with polyethylene film can be made by Ethioplastics, while cartons can be provided by the Ethiopian Pulp and Paper Factory in Wonji.

Before widespread use of local packaging materials are made they must meet the requisite international standards.

Industrial Inputs and Services

Capital Goods

Buildings will be provided by the Government once any industrial development project is approved. In Ethiopia this will be constructed by a local enterprise under the Ministry of Construction, called the Building and Transport Construction Design Authority (BATCODA). Drawings will be supplied by the foreign company, submitted to BATCODA for approval, who will then cost and prepare bill of quantities, detailed drawings, etc. and then construct or assign contract to private contractors. Raw materials for building construction are either locally available or can be easily imported by BATCODA.

Equipment and Machinery will be supplied by the foreign company. Depending on the mutually acceptable, negotiated and signed contract, a loan or aid may be needed to purchase these items or alternatively a suppliers' credit could be issued by the foreign company. UNIDO's assistance may be required in contract negotiations in Ethiopia and either UNIDO or other AID agencies may be approached for assistance (aid/loan) in the purchase of equipments and machinery.

Water and Energy

Water is readily available in Ethiopia from the local water supply, ground water and from lakes. Water for processing, cleaning and sanitary

services could be obtained from lakes, while those for drinking and laboratory use from the local water supply or ground well. The rate for municipal water in Ethiopia is 0.50 Birr/cubic metre. Thus, the water requirements for any formulation plant could be easily met by the above sources

Electricity

This is obtained from two main sources: from petroleum imported into Ethiopia and from hydroelectric power. Petroleum imports were about 1.1 mn tons in 1988, part of which was used for electricity production. Other sources of energy include wood and charcoal. Oil exploration started in the thirties but although gas was found, no oil has been found. The gas reserve found in 1987 was 25 bn m^3. Ethiopia's hydroelectric potential is estimated at 56,000 gwh/year, but only 1,200 ghw/year is exploited. In 1986, 879,000 kwh of hydroelectricity was produced, i.e. 95% of total electric power generated. Present cost of electricity amounts to 0.22 Birr/kw hour supplied at 380 volts 3-phases and 220 volts single phase.

Geothermal resources are also substantial in Ethiopia and contributed 55 gwh in 1983.

Trained Manpower

Training of local staff in pesticide formulation technology should be carried out. Pertinent areas should include assessment of raw materials, development of formulation recipes and know how, quality control, registration and monitoring and other safety and operational aspects of pesticide formulation.

Specialist knowledge in the design and construction of a pesticides formulation plant is not present in Ethiopia, hence this should be provided by the foreign agency. Specialized knowledge on the maintenance of equipments and on general technical services are also non-existent but must be provided. There are, however, engineers who could provide the more general expertise. Once the plant has been installed and is in operation, the important technical

support that would be needed are the repair and maintenance of plant equipment, such as mills, compressors, valves, motors, laboratory equipment and general facilities.

For production and maintenance, Engineering and Chemistry Graduates from the University could be trained. The foreign company should provide the necessary training both abroad and on-the-job. This company will also provide the required personnel to instal the plant and to conduct the on-the-job training.

The University of Ethiopia produces 75-85 BSc Graduates in Chemistry every year, 25% of which are destined for industry. There are presently 10 MSc and 2 PhD students. The Polytechnics also produce chemists at diploma level who could be trained as technicians.

For management level there are local expertise in other chemical industries within the country who have acquired the necessary experience.

However, where specialist training is required, Graduates or technicians could be further trained by attending short courses or attachements for 3-4 months duration. For example, training in quality control and formulation chemistry. Quality control is extremely important inorder to ensure consistently high quality pesticides, hence a well-equipped laboratory to conduct quality control of raw materials, and finished products, together with formulation development work must be part of the plants activity.

Environmental Considerations

Environmental considerations is a necessary and important prerequisite in any pesticide formulation plant. Risk can arise from machinery and moving parts but also by exposure of personnel to toxic pesticides in the liquid, vapour and dust forms and from fire and explosion hazards. Thus, an awareness of all possible risks must be created and education on how to deal with the hazards provided so that international safety standards are met. For example, operational staff should be provided with rubber boots, protective clothing,

rubber gloves, helmets, goggles, filter type masks, etc. Showers and taps should be located at suitable sites. Smoking should be discouraged; naked flames and electric welding should be prohibited and regular classes and drills held to educate employees in the use of first-aid and fire-fighting. Furthermore, due regard must be given to safety of pesticides in storage, in transit, and in the disposal of any waste pesticides and empty containers.

Other important environmental considerations relate to site selection and waste disposal. The plant should be located on level ground not subject to flooding, ideally away from towns or at least, not on the windward side, and accessible to a source of labour. For the disposal of wastes, an evaporation pond should be constructed, so that contamination of nearby water and food supplies could be minimized, which may cause damage to human and animal health, kill fish, and damage crops. However, since only a pilot plant producing only 3,000 tons/year is initially recommended, only very small quantities of pollutants are envisaged. Despite the small scale an environmental impact assessment must of necessity be conducted before implementation.

Policy Issues

a. Licensing and Registration

If required before the Government Codes are approved, the methods of the MSFD code of conduct could be employed.

b. Pesticides Aid-in-kind

The Government receives quite a lot of pesticides as aid-in-kind from various donor agencies, hence all pesticides activities in the country must be co ordinated since farmers become easily dependent on gifts. Furthermore, pesticides use should be co-ordinated with other pest management strategies such as cultural practices, seed dressing, biological control plus a strong extension system in an integrated pest management strategy.

c. Active ingredients imported into Ethiopia for the local formulation plant should be exempted from all import duties and taxes.

d. Foreign exchange allocations should be provided by the Central Bank for the purchase of raw materials and spare parts.

e. Important of finished formulated products which are locally produced should be phased out.

f. Loans should be made available to consumers of all sectors, including the State, Co-operatives, private and peasant sub-sectors.

g. Finished products should be reasonably priced so that peasant farmers could afford them.

h. Pyrethrum must be made a priority crop and all efforts made to develop a plant as soon as possible.

5.4 Expected End-of-Programme Situation

At the end of the programme it is anticipated that the overall pesticides industrial system would have greatly improved. All components of the pesticides scenario in Ethiopia would be strengthened. A multi-purpose pilot plant for pesticides formulation in Ethiopia based on local raw materials would provide the right type of pesticides at the right time in the most appropriate package form suitable to the needs of the consumers. This will invariably improve agriculture in the country hence contribute to raising the living standards of the Ethiopian people. Valuable foreign exchange will also be saved by the reduction of pesticides imports. Other improvements expected include planning for pesticides and their distribution; improved monitoring, extension and other farm services for plant protection, thereby reducing the irrational use of pesticides, and disposal methods in a well co-ordinated manner. Furthermore, employment opportunities will be generated together with the development of new skills and technology, and the industrial sector would have been further expanded and diversified. Research activities into the incorporation of pesticides into an integrated pest management strategy would also be improved.

6 ANNEX

6.1 List of Personnel Interviewed

Mr. Wodaje Abebe
General Manager
Ethiopian Mineral Resources Development Corporation

Mr. Kefyalew Achamyeleh
Deputy General Manager
National Water Resources Commission

Mr. Shansudin Ahmed
Head, Industrial Minerals
Ethiopian Mineral Resources Development Corporation

Mr. Tsegaye Asfaw
General Manager
Agricultural and Industrial Development Bank

Mr. Awgichew
Ministry of Coffee and Tea Development

Mr. Busa Badasa
General Manager
Agricultural Inputs Supply Corporation
Ministry of Agriculture

Mr. A. Belisa
Project Co-ordinator
Agricultural Inputs Supply Corporation
Ministry of Agriculture

Dr. Birru
Vice-Minister
Ministry of Coffee and Tea Development

Mr. Zewdie Bishu
Ethiopian Printing Corporation

Mr. Asrat Bulbula
Head, Technical and Production Department
National Chemical Corporation
Ministry of Industry

Mr. Belay Desta
Chief Geologist
Ethiopian Institute of Geological Surveys

Mr. Bekele Destu
United Nations Economic Development Agency
OSCER

Dr. A. Gebreyesus
Head, Chemistry Department
University of Addis Ababa

Mr. Mulugeta H. Georges
Head, Production and Technical Department
Ethioplastics

Head, Institute of Agricultural Research
Ministry of Agriculture

Dr. Hailu Kassa
Head, Crop Protection and Regulatory Department
Ministry of Agriculture

Mr. Abate Limenih
General Manager
Ethiopian Food Corporation

Mr. Tesfalidet Mehari
Head, Planning and Programming Services
Agricultural Inputs Supply Corporation
Ministry of Agriculture

Mr. Mesfin Mehbratu
Ministry of State Farms Development

Mr. Tesfayesus Mengistu
Head, Department of Mineral Reserve Evaluation
Ethiopian Mineral Resources Development Corporation

Mr. Mano Gebre Meskel
General Manager
Ethiopian Petroleum Corporation

Mr. A. Musfin
Food and Agriculture Organization

Dr. V. Sugavanam
United Nations Industrial Development Organization
Vienna

Mr. Terefe
Acting Head, Plant Protection
Ministry of State Farms Development

Mr. Tefera Teshome
Shell Ethiopia Limited

Mr. Makonnen Tessema
Chemical Engineer
National Chemical Corporation
Ministry of Industry

Mr. Joseph Tuskera
General Manager
Ethiocypsum Company

6.2 Technical Assistance/Investment Projects

To implement the strategies already outlined, a package of technical assistance/investment project concepts are attached on a "Liquid and Dust Pesticides Formulation Plant" and a "Prefeasibility Study for a Pyrethrum Production and Extraction Pilot Project".

With all pesticides project, it is important that an environmental impact assessment be conducted.

18th of December 1989
Addis Ababa

INVESTMENT PROJECT

Liquid and Dust Pesticides Formulation Plant

a) Total Investment Cost

	US$
Cost of plant machinery and Equipment (Liquid + Dust)	3,400,000
Cost of Plant and Storage Buildings construction (Liquid + Dust)	1,900,000
Total	5,300,000

b) Source of Finance Possibilities

UNIDO Financial Assistance is needed to cover the foreign currency component for the design of plant machinery and equipment, supply, supervision of erection, start-up and commissioning of the Pilot Liquid and Dust Pesticides Formulation Project.

c) Joint Venture Partner

No Joint venture partner

d) Request From

Ministry of Industry

e) Promoter

National Chemical Corporation which is a state enterprise under the Ministry of Industry.

f) Background

Ethiopia is an Agricultural country agriculture constitutes the backbone of its economy. Therefore, in addition to providing employment to about 90% of its

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Population, it contrubutes the largest share toward foreign exchange earnings. Notwithstanding the climitic conditions which are sutiable for intensive agricultural practices, Ethiopian agriculture has been charraterised by very low productivity due to the considerable loss of potential crop yields caused by plant diseases and pests both in the stage of standing crops and stored grains. Various Agricultural Authorities place this loss at 30 to 40% of the total yearly harvest. In view of these facts, since food crops are still generally grown in the old age manner without use of agrochemical inputs such as Pesticides as well as fertilizers, the major approach envisaged by the Authority, with a view to ensure effective Pesticides usage, is to establish domestic pesticides formulation capabilities in order to achieve self-sufficiency in food production.

g) Proposal

a) UNIDO assistance is needed to cover the foreign currency component for the design, supply, supervision of erection, start-up and commissioning of the Pilot Liquid and Dust Pesticides Formulation plants.

b) Total foreign currency component requirenemt needed to be financed by UNIDO

US$ 3,400,000

c) Training of key formulation and laboratory personnel

d) UNIDO Expert Assistance

a) For contract preparation and negotations
b) For supervision of erection and test-run.

c) Sample contract for Pesticides Project

18th of December, 1989
Addis Ababa.

TECHNICAL ASSISTANCE PROJECT
COVER PAGE

Country/Region : Ethiopia
Proposed Title : Liquid and Dust Pesticides Formulation Project
Estimated Duration :
UNIDO Contribution :
Estimated Government Contribution:

- in kind :
- in cash :

Brief Description of the Project:

A. Problem(s) to be addressed by the proposed project

1. Ethiopia, being a predominantly an agrarian country, agriculture is the main stay of the majority of its population. In general food crops are still grown in the old age manner without use of agrochemical inputs such as pesticides as well as fertilizers. In the country, there is yearly a considerable loss of potential crop yields caused by plant diseases and pests both in the stage of standing crops and in the stored grains. Various agricultural authorities place this loss at between 30 to 40% of the total harvest.

2. In view of these facts, the major approach envisaged by the authority with a view to tackle these problems and ensure self-sufficiency in food production, is to establish its own pesticides formulation capability in the country.

B. Concerned parties/target beneficiaries

1. These problems were identified by various agricultural institutions and the National Chemical Corporation brought the case to the attention of UNIDO through the Ministry of Industry and officially requested

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assistance for carrying out techno-economic study on Domestic Establishment of Pilot Pesticides Formulation Plant.

2. The state farms development and in particular the peasants sector will benefit from the proposed project.

C. Pre. project and expected end of project situation

1. Pre-project:

- the feasibility study on the proposed project is completed.
- tender offers for design, supply, supervision of erection, start-up and commissioning of the project are evaluated and the winner foreign supplier is selected.
- plant location for the establishment of the pilot project and subsquent operation of the plant is identified and selected.

2. End-of-project:

- UNIDO assistance is needed to finance the foreign currency component for the design, supply, supervision of erection, start-up and commissioning of the pilot project.
- the local currency component for the detailed design of the civil engineering works and construction of the plant and storage buildings shall be obtained from the Government or through loan from the Agro-Industrial Bank of Ethiopia.

D. Special considerations

1.

2.

E. Other projects executed by UNIDO, or by other donors in the same subsector and country

F. Major elements

1. Project objectives

To promote pesticides usage particularly in the peasant agricultural sector with a view to minimize the loss of potential crop yields caused by plant diseases and pests both in the stage of standing crops and in the stored grains.

2. Project outputs

Anticipated initial project outputs operating on eight-hour single shift basis per day and 300 working days per year are:

- 1500 kilolitres of liquid pesticides
- 1500 metric tons of dust pesticides

3. Project activities

- Feasibility study is completed
- Tender offers are evaluated and the winner foreign supplier is selected.
- Contract documents for the design, supply, supervision of erection and commissioning of the pilot project is under preparation.
- Plant site is acquired to start site preparation and development.

G. Host country commitment

1. The degree of interest already expressed by the Government. The Ministry of Industry officially requested the assistance of UNIDO for carrying out techno-economic study on Domestic Establishment of Pilot Pesticides Formulation Plant.

2. Possible counterpart institution(s)

The National Chemical Corporation is the counterpart institution which undertakes the implementation of the project and subsequent operation of the plant.

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H. Risks

1. Factors which at the outset may cause delays or prevent achievement of the project outputs and objectives.

2. Factors which could appear overtime and cause delay or prevent achievement of the project's outputs and objectives.

I. Inputs

1. Skeloton budget	UNIDO contribution ($)	National inputs (specify currency & UN exchange rate)
Personnel		
Sub-contractors		
Training		
Equipment		
Miscellaneous		
Totals		

Country : Ethiopia

Project Title : Prefeasibility study for the possibility of Pyrethrum production and extraction pilot project

Estimated duration : 4 years

UNIDO contribution : $ 54,000

Estimated government contribution : 114800 Birr

Brief Description of the Project

It is proposed to establish a pilot project to extract pyrethrin. The implementation of the project consists of mainly:

I. The production of pyrethrum flower
II. The extraction of pyrethrin from pyrethrum flower
III. The involvement of the highland farmer in the production of pyrethrum flower.

Background & Justification

A. Ethiopia is a country with different Agro-ecological zones which enables it to grow a wide variety of plants. Among the many plants, pyrethrum is a crop with high potential, based on evidences on the highland regions of Kenya, and results of some research data from Holleta and Kulumsa.

Pyrethrum is a perennial plant bearing white flowers with yellow center which grows well in the highland areas of about 2500 m.a.s.l. It requires a rainfall of 1000mm well distributed throughout the year and well drained fertile soil.

The flower contains a powerful insecticide known as pyrethrum, which kills household insects. At the same time it is harmless to human and domestic animals. It also controls many of the common pests of stored grains.

Some experimental work indicate that it thrives well in the highland regions of Ethiopia. Some farmers co-operatives were once engaged in the production of pyrethrum.

Although at its infant stage some splits of pyrethrum have been brought from Zwei and planted at Wondo Genet. (Our experiment site for plants known as a source of Chemicals.) This will serve as a source of planting material and in the mean time some agronomic data will be collected.

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Although the quantity is not quantified at this moment, quite a substantial amount of pesticides are imported every year. Some of the imported pesticides are even known as hazardous and undegradable. At present, some pyrethrum extracts are filled as aerosol here in Addis.

The production of pyrethrum locally will help in the substitution of the imported pyrethrin.

The development of the Agro-industry based on pyrethrum production would create additional employment. Besides it creats additional cash income for the highland farmers by involving the farmer as supplier of raw materials for the industry.

Project Objectives

1. To establish a pilot project farm
2. To develop a package for outgrowers scheme
3. To substitute the imported extract from abroad.
4. To study the effect of pyrethrum flower in powder form and extracts.

Project Output

I. The pilot project is sought to be both a research and production center and envisage to establish all production and processing equipments, manpower development publication in releated field.

II. Develop appropriate packages for large and small scale production.

III. Comprehensive terminal report in the development of pyrethrum production for use as insecticides.

Project Activities

I. Identification of the proper type of pyrethrum and aquisition and introduction of authenticated cultivar.

II. Identification of the proper processing methods

III. Conduct market study

IV. Prepare data for out growers scheme

V. Identify appropriate agro-ecological zones for pyrethrum production.

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Estimated Cost Breakdown

Input	Government (Birr)	UNIDO $
Personel (BSc.)	14,800	-
Labour	24,000	-
Land development cost	20,000	-
Equipment	10,000	20,000
Vehicles	-	18,000
Training	6,000	14,000
Administrative support	20,000	-
Miscellaneous	20,000	2,000
Total	114,800	54,000