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RISK REDUCTION IN THE DEVELOPMENT OF AGRO-CHEMICALS IN THE AFRO-ARAB REGION

Technical report: Preparatory phase findings and recommendations*

Based on the work of

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Vol. 2

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* This document has not been edited.

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Preface

An Expert Group Meeting to discuss ways and means of Risk Reduction in the Development of Agrochemicals in the Afro-Arab Region is scheduled to take place in Mauritius during the third quarter of 1996 , with the aim of establishing an Afro-Arab Network. Such a meeting would address to Chapter 19, of Agenda 21, on Sound Management of Toxic Chemicals.

In order to collect all the necessary information for discusion in the Expert Group Meeting a preparatory phase was initiated in which a team of experts visited several countries in the region with the aim of assessing the existing capabilities within the countries and identifying possible focal points for coordination of the network.

The report presented in two volumes summarizes the findings and recommendations of the team of experts who covered a number of countries in the Afro-Arab Region. The following countries are covered for the starting of the network.

Africa region: Nigeria, Ghana, Kenya, Zambia, Zimbabwe, and Mauritius

Arab region: Morocco, Tunisia, Egypt, Syria, Lebanon and Saudi Arabia

Countries such as Tanzania, Malawi and Uganda were covered by UNIDO separately. In addition, Kuwait and West Bank and Gaza Strip are also included.

The teams had discussions with government officials, industry, universities, and nongovernmental organizations dealing with pesticides and fertilizers in order to gather information and assess the situation and needs of each country.

The country reports are structured as follows:

- **Section A:** Agriculture Profile
- **Section B:** Pesticide Supply and Production
- **Section C:** Key Actors involved in pesticide sector organization
- **Section D:** Participation in the Afro-Arab Network

Annexes are kept to a minimum in order to limit the size of the document. Despite all possible efforts some of the categorized information is still lacking but will be completed later before the Mauritius meeting.

LIST OF ABBREVIATIONS

CEHA	Regional Center for Environmental Health Activities
CIPAC	Collaborative International Pesticides Analytical Council Limited
FAO	Food and Agriculture Organization
GAP	Good Agricultural Practice
GDP	Gross Domestic Product
GIFAP	International Group of National Associations of Manufacturers of Agrochemical Products
GLP	Good Laboratory Practice
GTZ	German Agency for Technical Cooperation
IFAD	International Fund for Agricultural Development
IPM	Integrated Pest Management
NGO	Non Governmental Organization
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOH	Ministry of Health
MOI	Ministry of Industry
PIC	Prior Informed Consent procedure of FAO
RENPAP	Regional Network on Pesticides for Asia & the Pacific
TCP	Technical Cooperation Project
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Programme
USAID	United States Agency for International Development
WHO	World Health Organization

MEASURES:

sqm	square meters
ha	hectare (1 ha = 0.1 square Km)

CURRENCY:

N	= Naira	1 USD = 88 N	(av 1994)
C	= Cedi	1 USD = 956 C	(av 1994)
KSh	= Kenyan Shilling	1 USD = 56.05 KSh	(av 1994)
TSh	= Tansania Shilling	1 USD = 510 TSh	(av 1994)
ZK	= Kwacha	1 USD = 669 ZK	(av 1994)
Z$	= Zimbabwe Dollar	1 USD = 8.152 Z$	(av 1994)
MRs	= Mauritius Rupies	1 USD = 17.96 MRs	(av 1994)

USD = U.S. Dollar

EXECUTIVE SUMMARY

A. Country profile

The six countries visited are briefly characterized as potential participants in the network and the planned expert group meeting, in Mauritius, June 1996.

NIGERIA

Most populous country rich in natural resources (in addition to oil and gas), with large agricultural potential for staple crops.
The agricultural sector seems to be neglected in the light of huge revenues from oil export, and considered to be important verbally but not in practice. However, the high population growth will soon force the country to increase its efforts (in form of attention and support of agriculture) above lip service towards self subsistence in food production.
Needs: improvement in agricultural practices, first of all legislation.
Possible contribution: IITA (International Institute of Tropical Agriculture, Ibadan)

GHANA

The country has its main income from the export of gold and minerals. Its agriculture is based on subsistence farming with the exception of cocoa and a few minor cash crops. The production and export of cocoa is vertically integrated (also in aspects of agricultural practices, such as safe use of agrochemicals and technology) by the Ghana Cocoa Board.
Needs: improvement in agricultural practices, first of all legislation. Expressed need for assistance in occupational health, waste management, ecotoxicology.
Possible contribution: Example of the cocoa production seems to be a good case study.

KENYA

Advanced institutional infrastructure with a relatively small agricultural base. Trained human resources are available.
Implemented and relatively effective pesticide law. Strong awareness in IPM practices in some quarters.
Needs: Financial resources to implement promising projects.
Possible contribution: Local development and production of microbial and botanical pesticides (ICIPE), GIFAP's Safe Use of Pesticide project, formulation plant equipped with up to date facilities to minimize environmental hazards (possible case study).

ZAMBIA

This country may benefit the most from the network.
Needs: Implementation and enforcement of a pesticide law. Improvement in agricultural practices esp. low tillage to conserve fertilizers, reduce environmental pollution, and reduce soil erosion.
Possible contribution: Local branch of COMESA may serve as coordinator of regional market clusters within the region, thus assisting in the development of feasible local formulation plants.

ZIMBABWE

This country may contribute to the network:
Presentation of aspects of legislation aspects (regitration, enforcement of law) and occupational health will be useful, the system of standards may be interesting to participants.
It is worth mentioning that key persons of all the three issues (except Dr. Sithole) are women.
Need: Economical measures to help small farmers.

MAURITIUS

may also be recognized as a focal contributor to issues of legislation and occupational health. The three different but closely cooperating systems for monitoring residues of agrochemicals in the environment, in fresh water resources and in agricultural products are worth a presentation.
In addition to the above mentioned, the country particularly the Ministry of Health/Pest Control Board offered to host the expert group meeting planned in Mauritius scheduled for next June.

B. Workshops at the expert meeting

For practical reasons we recommend to group the issues to be discussed at the meeting in the following workshops:

1. Legislation

- pesticide law, registration of new pesticides
- import licences, quality control possibilities
- fertilizers (?)

2. Use (application)

- selection of proper pesticides
    - small farmers
    - commercial farmers plantations)
- extension services for training, education
- application technology
- occupational health
    - field inspectorates
- residue in food and feed
    - monitoring, authority
    - residue analysis

3. Biopesticides, microbials

- neem tree products (azadirachtin)
- pyrhetroids
- *Bacillus thüringiensis*
- new development possibilities

4. Environmental aspects

- legislation, environmental law, regulations
- enforcement, authority
- monitoring, sampling systems, residue analysis
- coordinating functions, authority
- disposal of obsolete pesticides

5. Economical aspects of the use (and production) of pesticides

- strategies, mesures for the support of agriculture in developing countries.
- support options for small farmers
- assistance for commercial farmers to enhance
  competitiveness (increase of quality, reduce residues)
- influencing prices by local production/formulation

6. Production/local formulation

- market size,
  regional market clusters
  role of existing organizations (e.g. COMESA, ECOWAS)
- selection of products
  grouping of products
    insecticides/fungicides - herbicides - others
  logistic/production planning/seasonal products
    utilization of capacity
  forms (granules, WPs, liquid forms, aerosols, WG)
- technological aspects
  optimal plant/equipment size
  selection of proper equipment
  planning and design
- environmental and working safety
- investment/financing
- governmental assistance, support

7. Activity, functions and structure of the Network

- future activities
- standing working group
- funding of activities
- UNIDO´s assistance
- cooperation, interaction with other organizations
  UNDP, FAO, WHO, UNEP etc.
  GIFAP, GTZ, etc.

NIGERIA

Population :	95.2 millions
Active population in agriculture :	63 %
Proportion of women in agriculture	%
GDP per capita :	(1993) 298 USD
Contribution of agriculture to GDP :	30.7 %

(figures of 1994 unless otherwise noted)

A. Agriculture profile

[in '000 ha]

total land:	92377
total arable land:	29850
permanent crops:	2535
irrigated:	957

- Field crops .....

of which cereals		10843
	(rice, maize, millet, sorghum)	
roots & tubers		4261
	(cassava 2000, taro, yam)	
pulses		2120
	- groundnuts	1048
	- soybeans	160
industrial crops		525
	(tobacco, cotton, sugar cane)	

- Vegetable crops 152
  (tomatoes, peppers, carrots)
- Tree crops 2535

of which	cocoa	733
	coffee	422
	rubber	287
	palm	279

- Other cultivated area (fallow) .....

- Cultivated area .....

1. Over 60 million Nigerians (63 %) are currently involved in agriculture and about 30 million hectares of arable land are available for cultivation. In many instances yields are low due to limited use of crop protection agents, small farm size, low price for commodities and lack of education and training in modern agricultural practices.

2. The major crops are maize, millet, sorghum, rice, cassava, cowpea and sugar cane. In addition cocoa palm, palm oil and peanuts are important cash crops.

3. Maize, millet and sorghum account for more than 50 % of cropland use.

4. Nigeria has a share of 52.5 % in Africa's palm kernel production (corresponding to 8.7 % of world production).

5. An IPM programme has been developed by Ciba Geigy for cocoa. The Ministry of Agriculture is presently trying to establish an IPM programme in mango for mealy bugcontrol, spider mite control in cassava and downy mildew control in maize.

6. Pesticide consumption in Nigeria with 14 million USD is relatively small and represented only 50 % of the 1986 level.

7. Pesticide usage pattern :

   The dominant herbicides are atrazine in maize and other cereals, and propanil in rice. Insecticides are lindane for control of the cocoa capsid and granular diazinon and carbofuran as soil insecticides, carbaryl as a spray on many crops and dichlorvos for the household market. About 80% of fungicides applied in Nigeria goes into cocoa. Products include primarily copper formulations and metalaxyl+copper mixtures.

   - *Breakdown by pesticide type*

     - ... % insecticides used mainly in tree crops
     - ... % fungicides used mainly in cocoa (80%)
     - ... % herbicides for weed control in cereals
     - ... % others

8. Seed dressing has been widely used in sorghum and ground-nuts with lindane being a leading product.

9. Fertilizer consumption has risen from 5.7 kg/ha arable land in 1980 to 17.5 kg/ha arable land in 1993.

10. Although Nigeria has a potential as a producer of food and fiber staples, current limited financial and technical resources hinder such development. The 1994 Nigerian pesticide consumption amounted to only US$14 million, a 50% decrease from 1986 level.

B. Pesticide supply and production

number of products registered: ..... (1995)
number of registered active ingredients: ..... (1995)

local production of A.I.: none (1995)
local formulation appr.: .... % (1995)
number of local formulators : 2 (1995)

total pesticide imports in tons: appr. .....
value of pesticides imports: 15 mio USD (1993)

total pesticide exports: ./. mio USD (1993)

Table 1. Pesticide Imports to Nigeria

Year	Value
1990	15 mio USD
1991	14 mio USD
1992	16 mio USD
1993	15 mio USD
1994	14 mio USD

1. Currently there is no production of pesticide active ingredients in Nigeria and formulation is limited to dilution and repackaging.

2. There are four companies active in marketing of pesticides in Nigeria: Ciba, Zeneca (CAPL), Rhone Poulenc and BASF. Out of 500 million US$ for the African market, only 14 million were spent in Nigeria.

3. Companies involved in pesticide formulation are:

   - *Swiss-Nigerian Chemical Company (CIBA), Agricultural Division (Ikeja)*
   - *Donas & Company Ltd.*

   The major product of the company is dichlorvos (Nuvan, produced by Ciba). The imported emulsifiable concentrate is diluted and bottled into small containers and sold directly to the consumer. This insecticide is highly effective against mosquitoes, flies and cockroaches. However, due to its toxicological properties its use is severely limited and not allowed in households, but replaced by more safe products (e.g. certain pyrethroids) in developed countries.

C. Key actors involved in the pesticide sector organization

1. Federal Ministry of Agriculture. (Abuja)

Pest management has a long history in Nigeria. However, the emphasis has been on livestock protection. Currently the Ministry is trying to establish a crop pest management system. In this respect they are trying to establish integrated pest management (IPM) programs in mango for mealy bug control, spider mite control in cassava and downy mildew control in maize.

Several research institutes associated with universities conduct research on pest management in specific crops. Specifically cocoa research is conducted in the International Institute of Tropical Agriculture (Ibadan). In all there are 16 research institutes, financed by the federal government, in addition there are three universities of agriculture: Abekua (in Ogum State), Makadi (in Begin State) and Omudike (in Aba State). These institutes are responsible for efficacy testing of new agricultural technologies and pesticides on their respective crops.

There is a fertilizer production in Nigeria and research on fertilizers is conducted at an institute in Kaduna.

Extension service is provided to farmers by the National Agricultural Extension Research Liaison Service (NAERLS) within the framework of ADP (Agricultural Development Programme) supported by the World Bank.

In addition to the above mentioned organizations certain crops are produced under the supervision of dedicated associations which provide assistance in various forms, first of all technical and market information. (e.g. Cocoa Association of Nigeria)

2. National Agency for Food and Drug Administration and Control (NAFDAC)

NAFDAC has the sole regulatory authority (license of manufacture, import, distribution) over foods, cosmetics, agrochemicals and drugs. They follow the Codex Alimentarius and collaborate with FAO/WHO. Presently, NAFDAC is involved in drafting a pesticide law. Currently pesticides are only controlled by import permits. UNEP's list of toxic chemicals is used as guideline.

At this time there is no systematic monitoring of residues of toxic chemicals in food, feed and environment. Due to the importance of this issue NAFDAC has established a collaborative program with the National Institute of Environmental Health Sciences (NIEHS) Research Triangle, North Carolina, US.

3. Federal Environmental Protection Agency (FEPA), Lagos

Until 1989 environmental issues were within the mandate of various government agencies, subsequently the responsibility of environmental oversight and monitoring was transferred to FEPA as the umbrella agency. According to FEPA they will be charged with implementing the pesticide law whenever it is enacted.

4. International Institute of Tropical Agriculture (IITA), Ibadan

The Institute is a focal organization for the development of the agriculture of the region. Specifically cocoa research is conducted in the International Institute of Tropical Agriculture.

All in all there are 16 research institutes, financed by the federal government, in addition there are three universities of agriculture being somehow involved in or responsible for efficacy testing of new agricultural technologies and pesticides on their respective crops.

5. Ministry of Science and Technology

The Department of Agricultural and Natural Sciences belonging to this Ministry may be useful for supporting this project.

6. The pesticide industry has formed its own organization which is the 'Agrochemical Group of Manufacturers Association' in Lagos.

D. Participation in the Afro-Arab Network

1. The Ministry of Science and Technology through its Department of Agricultural and Natural Sciences is interested to play a role as coordinator of eco-toxicology and environmental monitoring for the proposed Mauritius conference and also make a presentation on the topic of rice ecosystems.

2. Also NAFDAC expressed their interest in the proposed networking conference in Mauritius and their particular interest in toxicological aspects of pesticide residue monitoring.

3. The Swiss-Nigerian Chemical Company (CIBA) pointed out that at this time there are many problems facing the agrochemical sector, such as:

   - lack of proper pesticide legislation
   - lack of technical information to farmers
   - inflational trends of the currency

   Both the IPM system developed by Ciba for cocoa including the new, more selective chemicals that are compatible with principles of IPM, and also the concept of a multi-product formulation plant could be a topic addressed at the Mauritius meeting.

4. The International Institute of Tropical Agriculture in Ibadan as a focal organization for the development of the agriculture of the region could play an important role with its contribution to the planned network and the conference.

GHANA

Population : ..... 17.1 millions
Active population in agriculture : ..... 48 %
Proportion of women in agriculture ..... %
GDP per capita : ..... 371 USD
Contribution of agriculture to GDP : ..... (1993) 47.6 %

A. Agriculture profile

[in '000 ha]

total land: 23854
total arable land: 2800
permanent crops: 1520
irrigated: 6

- Field crops .....

of which cereals 1195
(maize, millet, sorghum, rice)

roots & tubers 1010
(cassava 607, taro 173)

pulses 200
- groundnuts 130

industrial crops 109
(tobacco, cotton, sugar cane)

- Vegetable crops 80
(tomatoes, eggplants, peppers, onions)
- Tree crops 1520

of which cocoa .....
coffee 11

- Other cultivated area (fallow) .....

- Cultivated area .....

1. The country's agriculture is based on subsistence farming with the exception of cocoa and a few minor cash crops.

2. Two groups dominate Ghana's field cultivation: the cereals —mostly maize, sorghum and millet— with around 80 % of the arable land. Cocoa beans are one of the principal exports of Ghana, second after gold.

3. Women are reported to be the backbone of Ghana's agriculture in small farms and in need of further attention (together with children), especially in the field of pesticide application and safety.

4. The use of fertilizers has slightly decreased over the past decade, from 43 kg/ha of arable land in 1980 to 38 kg/ha of arable land in 1993.

5. The bulk of agrochemicals are insecticides and fungicides followed by herbicides. Insecticides are used mainly against the cocoa capsid, grasshoppers and army worms. Limited use of *Bacillus Thüringiensis Israeliensis* (BTI) is used to control Symmulium Fly (Black Fly) the vector of river blindness.

6. Pesticide usage pattern :

   - ..... % insecticides used mainly for _____
   - .... % fungicides used mainly for _____
   - .... % herbicides used mainly for _____
   - .... % other pesticides.

7. An IPM programme is being implemented in rice as part of a larger programme sponsored by the National Institute of Tropical Agriculture (Ibadan, Nigeria) and networking the countries Benin, Cameroon, Togo and Ghana. Presently 75 farmers are instructed in Ghana in the reduced use of pesticides and increased use of natural enemies. Good weed control is being achieved through water management and cultural practices. Yield increases from these practices are reported to have resulted in a net gain of 200,000 US$ per hectare.

B. Pesticide supply and production

number of products registered: ..... (1995)
number of registered active ingredients: ..... (1995)

local production of A.I.: none (1995)
local formulation appr.: ... % (1991)
number of local formulators : 4 (1995)

total pesticide imports in tons: appr. .....
value of pesticides imports: 8,0 mio USD (1993)

total pesticide exports: 0.03 mio USD (1993)

Table 2. Pesticide imports to Ghana

Year	Value
1990	15 mio USD
1991	14 mio USD
1992	16 mio USD
1993	15 mio USD
1994	14 mio USD

1. Pesticide imports valued in average to almost 15 million USD over the past five years with no comprehensive data available on the type and amounts of products.

2. The leading agro-chemical companies in Ghana are:

BASF
CHEMICO LTD
DANAFCO LTD
DIZENGOFF GHANA LTD
REISS & CO (GHANA) LTD
ABUAKWA FORMULATION PLANT

Chemico Ltd. in Tema is owned by Zeneca and the Ghana Cocoa Board and the Abuawa Formulation Plant is owned by Bayer [51%] and Ghana Cocoa Board [49%].

3. Two agrochemical products are formulated locally solely for use in cocoa. These are

Company	Product	Quantity (1989)
CHEMICO LTD ABUAKWA Plant	Gammalin	852,700 l
	Unden	500,049 l

4. Two companies are in are involved in the production of aerosols. JOHNSON WAX LTD is producing 'Raid' and SHELL (Ghana) used to produce 'Shelltox'.

5. Pesticide dealers and formulators have their national association called the 'Agrochemicals Association of Ghana' located in Tema.

C. Key actors involved in the pesticide sector organization

A number of institutions and ministries are involved in the pesticide sector and responsibilities are not fully defined yet.

> *A significant development, however, was the establishment of a multi country commission that will be involved in a regional program of cooperation in the field of plant protection and harmonization of registration. This activity, under the title 'Interafrican Phytosanitary Registration (HIP)', interlinks Benin, Ivory Coast, Ghana, Guinea and Togo.*

The main goals of the program are:

- harmonization of legislation and application
- inter-availability of products registration files
- support to national authorities
- quality control and assurance
- raising of moral standards of the pesticide market.

The project is also supported by the French Cooperation Agency and the GTZ (Germany).

1. Ministry of Food and Agriculture

This ministry, along with the Environmental Protection Council (EPC) are reported to be the main authorities responsible for approval and use of pesticides.

2. Ministry of Environment, Science and Technology

A pesticide regulatory law is still in draft form and has not been enacted. The EPC (Environmental Protection Council) will be charged with the responsibility to enforce the pesticide law and monitor safe use of pesticides.

3. Ministry of Trade and Industry (Accra)

All imported agro-, and household chemicals have to be approved by the Subcommittee on Pesticides of the National Toxic Chemicals Committee under the EPC (Environmental Protection Council) for clearance.

4. Ghana Standards Board

The Ghana Standards Board is reported to be the main authority responsible for establishing national maximum pesticide residue limits. They are also the Codex Alimentarius contact point.

5. Ghana Cocoa Board (GCB) in Accra

The GCB is responsible for the work of the whole cocoa industry, it is independent of all other ministries and reports directly to the office of the president. Introduction of new pesticides is carried out through the following stages:

- efficacy and safety are evaluated by the Cocoa Research Institute (Tafo City),
- results are communicated to the GCB,
- promising agrochemicals are demonstrated to farmers through the extension services of the GCB.

However, the use of agrochemicals is influenced by the financial status of the farmers and the lack of state subsidy has detrimental effect on it. During major pest outbreaks, the PPRS (Plant Protection and Regulatory Services) of the ministry of Agriculture assist the farmers by providing free spraying services and pesticides.

Prior to export pesticide residue levels in cocoa beans are determined in the quality control laboratory of GCB.

D. Participation in the Afro-Arab Network

1. FAO has been engaged in a massive pesticide assessment and evaluation project in the period 1988-1993. This study consists of a comprehensive survey for each country covering:

   - manufacturing and production
   - formulation
   - importation of active ingredients
   - pesticide legislation
   - infrastructure for quality control laboratories
   - application technology and practices

   Also IPM covering chemical/biological and cultural methods to reduce load of agrochemicals in the environment is one of the mayor topics handled by the FAO Regional Office. FAO's contribution will be most valuable to both, the Mauritius meeting and the planned Network.

2. Another significant development was the establishment of a multi country commission that will be involved in a regional program of cooperation in the field of plant protection and harmonization of registration. This activity comes under the title: Interafrican Phytosanitary Registration (HIP). Participating countries are: Benin, Ivory Coast, Ghana, Guinea and Togo.

   The main goals of the program are:

   harmonization of legislation and application
   inter-availability of products registration files
   support to national authorities
   quality control and assurance
   raising of moral standards of the pesticide market.

   The project is also supported by the French Cooperation Agency and the GTZ (Germany) and could significantly contribute to the Network.

   Need for assistance in the following areas was expressed:

   - occupational health and safety
   - industrial safety/waste management
   - ecotoxicology
   - application technology

3. Role of women in the national economy has also been raised. Women organizations active in Ghana are:

   National Council of Women Development
   31st December Women's Movement
   Ghana Association of Women Entrepreneurs

   Several cabinet posts are occupied by women including the Ministry of Environment and Sciences. However, women, being the backbone the agriculture especially in small farms, need further attention (together with children) especially in the field of pesticide application and safety.

KENYA

Population :	29.3 millions
Active population in agriculture :	75 %
Proportion of women in agriculture	%
GDP per capita :	(1993) 185 USD
Contribution of agriculture to GDP :	29.1 %

(figures 1994, unless noted otherwise)

A. Agriculture profile

[in '000 ha]

total land:	58037
total arable land:	4000
permanent crops:	520
irrigated:	66

- Field crops .....

of which cereals 1855

maize	1450
wheat	155
sorghum	120
millet	90
barley	27
rice	10

roots & tubers 216

cassava (1990)	101
potatoes	47
sweet potatoes	66

pulses 700

- beans, pigeon peas, cow peas
- groundnuts 23
- castor beans 13

industrial crops 99

(pyrethrum, cotton, sugar cane sunflower, tea)

- Vegetable crops.....

(tomatoes, onions)

- Tree crops 520

(coconut, cashew nut, coffee, neem)

1. Agriculture continues to dominate Kenya's economy, although its share of GDP has declined in recent years to presently 29 %. About 76% of the working population make their living on the land.

2. Agricultural output is still greatly depending upon weather although the area under irrigation has been increased over the past years.

3. Kenya's major field crops are maize and beans. Economically important is tea and coffee, the country's largest agricultural exports.

4. Fertilizer consumption is calculated at 41 kg/ha and relatively higher than in other countries within the area.

5. Pesticide usage pattern was reported to be

   35 % insecticides
   35 % fungicides
   25 % herbicides

6. Major pests on key crops include:

coffee	-	Antestia bug, spider mites and thrips,
vegetables	-	thrips, African bollworm,
fruits	-	medfly, codling moth,
maize	-	cornstock borer, cutworms and the Sciarid fly (vector of maize strip disease)

   Major pesticides used are:

   pyrethroids (Karate, Ambush)
   organophosphates,
   mitac
   seed dressing materials

7. IPM in Kenya has been further developed and propagated by the International Center of Insect Physiology and Ecology which is also engaged in R&D programmes of botanical pesticides . In GIFAP's project on safe use of pesticides which is implemented in cooperation with several organizations, ministries and the Nairobi university, IPM is used as a backbone.

8. The major agricultural exports for Kenya in 1994 were tea (301 million $), followed by coffee (233 million $) and pyrethrum extracts (28 million $).

B. Pesticide supply and production

number of products registered: ..... (1995)
number of registered active ingredients: ..... (1995)

local production of A.I.: none (1995)
local formulation appr.: n.a. % (1995)
number of local formulators : 4 (1995)

total pesticide imports in tons: ..... tons
value of pesticides imports: 45 mio USD (1993, PCPB)
27 mio USD (1993, FAO)

total pesticide exports: 3 mio USD (1993)

Table 3. Pesticide imports to Kenya

Year	Value
1990	24 mio USD
1991	21 mio USD
1992	25 mio USD
1993	27 mio USD
1994	.... mio USD

1. Comprehensive data on pesticide imports are available. Importation of pesticides in the year 1993 was valued at US$ 45 million and reported to have the following distribution:

   - 35% insecticides
   - 35% fungicides
   - 25% herbicides.

2. Local formulation of pesticides: - comprehensive data not available -

3. The establishment of a Pilot Fermentation Plant for production of Bacillus thuringiensis based biopesticides is planned.

4. Kenya is a producer of pyrethrum with outputs at 19,000 tons of dry flowers in 1982, and averaging 11,000 tons/year in 1991 to 1994 period. The main purchaser of Kenyan pyrethrum is McLaughlin, Gormley King of the USA.

5. Major agrochemical companies are:

- ICI (Twiga)
- Rhone-Poulenc
- Bayer
- Ciba
- Agrevo

4. *Bayer East Africa Ltd.*

Bayer's share of the Kenya market of pesticides (US$ 45 million) is 18%, the other formulators are Zeneca (ICI), Rhone Poulenc and Ciba. The break down of pesticide usage: fungicides 50%, insecticides 30%, herbicides 20%. (Slightly differing from the data of PCPB) Bayer's own products occupy 36% of the capacity, 20% toll manufacturing, the rest is idle capacity. The heart of the equipment is a double-cone rotating drum dedicated to formulate insecticide and fungicide granules. Sand and pumice are used as carriers. The active substance is sprayed during rotation onto the bulk carrier particles. The granules are transferred in containers to the hoppers and filled semi-automatically into the final packaging material. (Plastic containers, or sacks.)

Liquid formulations are also produced in a separate unit. Due to the usage of organic solvents, this part of the plant has been equipped with explosion proof machinery. The waste water (including wash liquids) is treated, finally filtered by the aid of a filter press. The cake is incinerated and only the clean water is discharged from the plant. The same applies to the fire-water: second containment is provided to collect the water used for fire extinguishing. The water is checked to be free of contaminants and only after this check is let into the communal sewage. The same practice is used for the water used for washing the rooms. In case of spillage a quick closing valve prevents the chemicals from being evacuated into the sewage.

C. Key actors involved in the pesticide sector organization

1. Pest Control Product Board (PCPB), Westlands

This organization is responsible for all pesticide registration in Kenya. Kenya established its pesticide legislation in 1982 and the PCPB has been enforcing the law since 1984. The pesticide legislation is based on the Canadian Model and FAO guidelines. The law covers import and export of pesticide, efficacy, safety, chemistry and environmental toxicology. Full registration of a pesticide may take as long as three years. The PCPB also inspects and licenses pesticide premises at a wholesale and retail level, manufacture and formulation plants. The PCPB collaborates closely with GIFAP in training programs for safe use of pesticides.

2. Ministry of Science and Technology, Dept. Crop Protection (Westlands)

The Department originally belonging to the Ministry of Agriculture, and since 1990 reporting to the Ministry of Science and Technology, is currently charged with the following functions:

- identification of pests
- pesticide application and use
- advisory service, esp. for export crops
- research on IPM

The Department contributes to the activity of the extension services throughout the country. They provide advice on pests and agricultural technology to the growers.

3. National Agricultural Research Laboratory (KARI), Westlands

This laboratory conducts residue analysis of pesticides in agricultural commodities, soil and water. Within their services offered they analyse export crops, such as French beans, to comply with tolerances established within the European Community. The laboratory also cooperates with GIFAP with regard to pesticide formulation testing. One of their research topics is investigating the sources of pollution of agrochemicals in Lake Naiwasha. The fresh water of the lake is currently over exploited for the irrigation of surrounding areas and simultaneously in danger by run-off of agrochemicals.

4. Ministry of Environment and Natural Resources, National Environmental Secretariat (NES)

The Secretariat functions as a coordinating inter ministerial committee on Environment. The NES has no staff and no line function.

D. Participation in the Afro-Arab Network

1. Kenya was selected by GIFAP as the pilot project for Africa because it faces population explosion problems common to other sub-saharan countries. In the last 30 years the population has doubled and will double again in the next 25 years. Consequently it is critical that food crop yields be increased with improved agricultural and environmental practices.

   The safe use project has been funded for three years and administered by GIFAP with IPM as a backbone of the project. Several ministries, organizations and the University of Nairobi cooperate with this project to educate and train pesticide personnel and farmers in the FAO code of conduct, in safe use, storage and handling of pesticides. GIFAP has trained to date 2500 extension workers and farmers and could share with the Network their experience in the African region.

2. Bayer could share their experience in waste management practices in pesticide formulation at the Mauritius meeting and later also with the Network.

3. GTZ with its seed dressing technology and application as well as the heavily founded neem research and development could contribute to and cooperate with the Network. GTZ has helped in performance evaluation, collection of seeds, drying-, dehusking-, and milling of kennels, pressing out the oil. The cake (residue after pressing) is planned to be the basis of a WP formulation. This new product and technology seems to be interesting because the trial samples of the material proved to be a promising very effective broad spectrum insecticide with potential for Kenya and the sub-saharan region.

4. The assistance of UNIDO in developing the suitable process for the formulation and selecting the proper equipment would be welcomed by local formulators.

5. The University of Nairobi in cooperation with Prof. Remboldt in Germany is researching another related botanical insecticide from Melia Volkensii tree, a native of east Africa. It produces large seeds the size of an olive. Alcohol extract of the dry seed yields 10% by weight a powder that is highly active vs. locusts at 4 g/ha, currently being tested in Mauritania.

6. The ICIPE (International Center of Insect Physiology and Ecology) in Duduville, founded 25 years ago as a pan-African R&D center for insect sciences serves today as a basis for post graduate training programs for Africa and as a leader in innovative IPM projects. ICIPE is also engaged in R&D of botanical pesticides and African strains of *Bacillus thüringiensis* (Bt).

   ICIPE offered to provide infrastructure support especially networking with other African countries, in support of the planned meeting in Mauritius.

ZAMBIA

Population :	9.25 millions
Active population in agriculture :	67 %
Proportion of women in agriculture	%
GNP per capita :	(1993) 380 USD
Contribution of agriculture to GDP :	32 %

(figures 1994 unless otherwise noted)

A. Agriculture profile

[in '000 ha]

total land:	75261
total arable land:	5265
permanent crops:	8
irrigated:	46

- Field crops .....

  of which cereals 633
  (maize, millet, sorghum)
  roots & tubers 120
  (cassava 115)
  pulses 49
  - groundnuts
  - soybeans 19

  industrial crops 58
  sugar cane 12
  cotton 33
  tobacco 13

- Vegetable crops.....
  (tomatoes 3, onions 3)
- Permanent crops.....8
  of which coffee 1
  citrus
- Other cultivated area (fallow) .....

- Cultivated area .....

1. Zambia's agriculture is tremendously depending on weather. Five of nine provinces have just been declared drought disaster areas.

2. The main staple crop is maize, which is heavily fertilized, because the soil is very poor due to constant cultivation and soil and erosion over many years.

3. Zambia imports 220,000 tons fertilizer per year, of this amount 90,000 tons are consumed by small farmers. Fertilizers are surface applied and approximately up to 40% of the applied dose is washed off in the rainy season. Much of the run off ends up in waterways, causing river and lake eutrophication.

4. Other crops consuming fertilizers are cassava, sorghum, millet, wheat and citrus. There are some large farms planted to sugar cane, coffee, wheat and soybean.

5. Pesticides are reported to be used intensively on citrus and on horticulture crops. Several pesticides banned in developed countries are still used in Zambia.

6. Pesticide usage pattern: - no information available

7. IPM programmes: - no information available -

B. Pesticide supply and production

number of products registered: ..... (1995)
number of registered active ingredients: ..... (1995)

local production of A.I.: none (1995)
local formulation appr.: .... % (1995)
number of local formulators : .... (1995)

total pesticide imports in tons: appr. .....
value of pesticides imports: 2,5 mio USD (1993)

total pesticide exports: 0,14 mio USD (1993)

Year	Value
1990	5 mio USD
1991	4.5 mio USD
1992	3.5 mio USD
1993	2.5 mio USD
1994	..... mio USD

1. Pesticide supply over the past years has steadily decreased. Essentially all pesticides are imported in finished form into Zambia; only repackaging and diluting in not significant quantities is reported as local production.

2. Liberalization of trade policies and limitation of financial resources along with reduction of subsidies for farmers is expected to result in significant reduction in the application of up-to-date pesticides and increased local formulation of cheap products in the country and the region.

3. Comprehensive and detailed data on pesticide market are not available.

4. The city of Lusaka is saddled with a major pesticide waste disposal problem. There is an accumulation of 150-200 tons of outdated and unknown pesticides and other chemical wastes of unknown origin. Due to the fact that there is no incineration facility in the country, Zambia is looking for urgent technical and financial support to dispose this hazardous waste.

5. A private association in industry exists as the Zambia Agrochemicals Association (ZAA) in Lusaka.

C. Key actors involved in the pesticide sector organization

1. Ministry of Agriculture, Food and Fisheries

The ministry of agriculture is reported to be the main organization responsible for applied research regarding pesticide use and information.

2. Environmental Council of Zambia

The National Environmental Council is the main authority responsible for approval, registration and use of pesticides. It has a special Pesticide and Toxic Substances Unit.

A law, covering pesticides and toxic substances was introduced in 1990 and the Environmental Council, charged with enforcing the law, was organized in 1992. However the very small staff of 16 of this Unit in insufficient to police the law by monitor and inspection.
The law covers:

- registration
- importation
- transport
- labeling and packaging
- safe use
- storage
- disposal

of pesticides.

For residue monitoring the Council is dependent on the Food and Drugs Control laboratory of the Ministry of Health and the laboratory of the National Council of Scientific Research.

3. Ministry of Health

The Ministry of Health is involved in establishing the national maximum pesticide residue limits (MRLs) together with the Environmental Council, the Bureau of Standards and the National Council for Scientific Research.

Food and Drugs Control Laboratory

Officially this lab is responsible for chemical analyses of residues of toxic substances including pesticides in raw agricultural commodities and foods. Although the staff of 20 professionals appears adequate to fulfill the mission, the critical shortage of analytical equipment makes this task almost impossible. Only one functional GC, one infrared-, and one uv- spectrophotometer are available, all rather outdated. In order to fulfill its mission

as a functioning pesticide residue laboratory, acquisition of a HPLC as well as a Mass spectrophotometer is urgently needed.

This laboratory works closely with the Environmental Council to which it reported until 1992, and with local government agencies. The country is divided into 9 provinces and 61 districts. Each district has an environment and health inspector reporting to the Min. of Health, however, there is no regular monitoring program for the environmental components (soil, water, air, wildlife etc.).

3. Ministry of Commerce Trade and Industry

Liberalization of trade and commerce has resulted in the problem, that the import of any kind of materials into the country is presently practically out of control. This concerns also the pesticide sector.

D. Participation in the Afro-Arab Network

1. COMESA's knowledge of regional and local conditions and government personnel in the countries of the region could be helpful in the activity of the network to be set up at the Mauritius meeting. Particularly the development of the concept of improving local formulation in COMESA countries is necessary. A fact finding mission/study is regarded as the first practical step.

2. The city of Lusaka, saddled with a major pesticide waste disposal problem. There is an accumulation of 150-200 tons of outdated and unknown pesticides and other chemical wastes of unknown origin. Due to the fact that there is no incineration facility in the country, Zambia needs urgent technical and financial support to dispose this hazardous waste.

3. The Food and Drugs Control Laboratory of the MOH should be included in the network and the Mauritius meeting in order to establish contacts with people and organizations having more experience in residue monitoring and analysis.

ZIMBABWE

Population:	10.9 million
Active population in agriculture:	66.2 %
Proportion of women in agriculture:	%
GDP per capita:	466 USD
Contribution of agriculture to GDP:	13.6 %

A. Agriculture profile

[in '000 ha]

total land:	39076
total arable land:	2750
permanent crops:	126
irrigated:	193

- Field crops .....

  of which cereals 1839
  (maize, millet, sorghum)

  roots & tubers 36
  (cassava 33, potatoes)

  pulses 71
  - groundnuts 140
  - soybeans 60

  industrial crops 279
  (tobacco, cotton, sugar cane)

- Vegetable crops .....
  (tomatoes 2, onions 2)

- Permanent crops 126
  of which oranges
  coffee

- Other cultivated area (fallow) .....

- Cultivated area .....

1. Zimbabwe has a diversified and well-developed agricultural sector, in terms of food production, cash crops and livestock. Almost 67 % of the total labour force are engaged in agricultural activity.

2. Agricultural production for some crops is greatly dependent on weather and rain fall; for instance has the wheat harvest been severely affected by the recent drought, and is likely to amount to 84,000 tons in 1995/96, compared with 290,000 tons in 1994/95.

3. The staple food crop is maize, and other cereal crops grown include wheat, millet, sorghum and barley.

4. Zimbabwe's principal cash crops are tobacco, cotton and sugar.

5. Fertilizer consumption is calculated at 48,1 Kg per hectare of arable land which is clearly higher than Zambia or Tanzania.

6. While the use of fertilizers is inevitable, practically no pesticides are consumed for the field crops (with exception of cotton) due to lack of financial resources. There seems to be, however, a massive use of pesticides in horticulture.

7. Pesticide usage pattern: - no information available

8. The fruit and vegetable production are composed of:

	[all data in '000 MT]
maize	1750
wheat	239
potatoes	31
cassava	130
vegetables	143
sugar	524
tobacco	182
cotton	60
tea	13
coffee	5

9. Record earnings are expected from the tobacco harvest of about 190,000 tons, representing at least 40 % of total marketed production in Zimbabwe's agriculture.

10. IPM programmes: - no information available -

11. Horticulture had tremendously grown and expanded over the past years with export earnings rising from 224 mio Z$ in 1994 to probably 290 mio Z$ in 1995, but there are growing concerns that floriculture is out of control, with occupational disease from the use of uncontrolled chemicals and pesticide rising rapidly.

12. The main exports crops from horticulture are:

- *temperate fruits* like apple, pear, peach, plum, apricot, nectarine and grape
- *tropical fruits and vegetables* like baby corn, butternut, citrus, chili, gem squash, kiwi, lychee, mango, passion fruit, pineapple and tamarillo
- *out of season fruit and vegetables* like asparagus, baby carrots, fine beans, cherry tomatoes, courgettes, mange tout peas, melon, strawberries and sweet corn
- *flowers* like roses, chrysanthemum, protea, asta and many others

Agricultural exports contribute 40 % of the country's foreign exchange earnings.

13. Many growers involved in export are located near Harare. Their farms are irrigated and have packing sheds with cold stores. A recent trend has been production under greenhouses.

B. Pesticide supply and production

number of products registered: N/A (1995)
number of registered active ingredients: N/A (1995)

local production of A.I.: none (1995)
local formulation appr.: .... % (1995)
number of local formulators : .... (1995)

total pesticide imports in tons: .....
value of pesticide imports: 25 mio USD (1993)

total pesticide exports: 1 mio USD (1993)

Year	Value
1990	35.9 mio USD
1991	40.2 mio USD
1992	29.4 mio USD
1993	25.0 mio USD
1994	..... mio USD

1. The pesticide market is roughly estimated at 25 to 30 Mio $ with no information on quantities imported or used.

2. The pesticide usage pattern: - no information available

3. No information on production of active ingredient and local formulation or repackaging.

4. The Agrochemical Industries Association (ACIA) is the national association in Harare.

C. Key actors involved in the pesticide sector organization

1. Ministry of Agriculture

The Ministry of Agriculture in Harare is the main authority for approval, registration and use of pesticides and also responsible for the control of pesticide residues in food..

Pesticide Research Institute

The Institute, reporting to the Ministry of Agriculture through the Department of Research and Specialist Services, is active in the following fields:

- entomology
- pathology
- nematology

In addition it is responsible for the registration of pesticides. The pesticide law has been enacted in 1953(!), up-dated in 1977 and is currently being revised. All new pesticides are to be registered. The application procedure is up-to date. The applicant (importer or local formulator) must provide all relevant information on the new product (efficacy, application, precaution measures, side effects, toxicological data etc.) usually required in developed countries. Efficacy is then confirmed by the Institute under local conditions. As a first step, initial quantities of 5 liter or kg. are used as pilot quantities. The investigations are carried out partly within the Institute, partly by subcontracting in other institutes.
The Dept. of Research and Specialist Services also coordinates the activity of the following institutes:

- Inst. of Chemistry and Soil
- Cotton Res. Inst.
- Henderson Res. Inst. (on herbicides)
- Coffee Res. Inst.

In addition, the following institutes are working in the field of agrochemicals:

- Zimbabwe Sugar Association
- Tobacco Research Board
- Mazoe Citrus Estates

The decision on registration is made by the Pesticides and Veterinary Remedies Committee in which the Ministry of Health and the Agricultural Labor Bureau are also represented.

Bacillus thuringiensis is registered as a pesticide in the country, but currently there is no on-going research on the development of microbial or biological pesticides.

In the years 1991-93 the Institute has been the focal point for the project: "Migrant Pest Control in SADC" (Southern Africa Development Community). The project was sponsored by GTZ and oriented against migrant pests, first of all locusts, Armyworm and Qualia bird.

2. Standard Association of Zimbabwe (SAZ)

The SAZ was founded in 1957 and active from 1960 as a non governmental, non parastatal, non profit making private company. About 80% of its total expenses are financed by the government (companies are paying 0,15% of their labor costs), the remaining 20% is covered by contractual services. The main activity of the organization is to prepare, publish and implement standards. The number of standards is around 540 at present, 6 of them dealing with pesticides:

- Disulfoton 5G
- Endosulfan 1G and 3G
- Trichlorfon 2.5G
- Protective apparel for use against pesticides
- The handling, storage and disposal of pesticides and their containers
- The handling, storage and disposal of pesticides and used pesticide containers

It is worth mentioning that standards are voluntary and prepared at the request and costs of manufacturers, and who must comply with it after the standard is enacted. Only those standards which are quoted in regulations are mandatory. The number of these is around 40, mainly in the field of building industry & civil engineering. In some cases standards happened to be precursors of laws. Standards are drafted on the basis of ISO standards by a technical committee consisting of all participants of the production, use and control of the product, and are circulated before publishing among foreign countries especially those which are suppliers or consumers.

SAZ also issues product certificates and makes regular and random inspections in the plants on the processes and/products involved. In frame of these activities the institute is dealing with control of processes, raw materials, quality control of intermediates and products and also total quality management. These standards and product certificates are useful for manufacturers in the market competition.

The chemical laboratories, however, are poorly equipped, mainly with obsolete instruments which hampers its efficacy.

3. Ministry of Health

The Ministry of Health is reported to be the main authority responsible for establishing national maximum pesticide residue limits.

Health's Hazardous Substances Unit

Health aspects of agrochemicals are touched in various forms by the Ministry, mainly through inter ministerial committees and other forums where it is represented, but also by field inspections. The "Pesticide and Veterinary Remedies Committee" is dealing with potential health hazards even before the product is registered. (Members are: Agrochemicals Industry Association, Agricultural Labor Bureau, Plant Protection

Research Institute, Department of Veterinary Services and the Health's Hazardous Substances Unit)

The "National Social Security Authority" is monitoring health conditions of manufacturing plants and workshops by its Factory's Inspectorate Section, while the "Zimbabwe Occupational Health & Safety Council" is a tripartital organ, consisting of representatives of the Government, trade unions and manufacturers.

In addition to those above, the Ministry is exercising its right to inspect working places. Farm inspections are carried by the Health's Hazardous Substances Unit through Environment Health Officers in different provinces of the country and using standard inspection forms. Once in a while officers from the Unit go out to the farms and carry out inspections themselves.

For cases of poisoning, especially by organophosphates, a standard reporting form is used in order to ensure proper follow up activities.

4. Ministry of Environment and Tourism

The activity and supervision of the Ministry of Environment and Tourism is carried out by three departments:

- *Department of National Parks and Wild Life*

The Department is looking after the protected areas, rivers of about 50,000 sqkm (13% of the country). Its annual budget is nearly equivalent to US$ 2 million. The responsibility of the department is to protect biodiversity, prohibit the degradation of environment. The major sources of danger are:

- mining
- oil exploration
- infrastructural development

Rivers and fish are regularly monitored.

- *Department of Natural resources*

The Department carries out the monitoring of the country by significant field inspection forces with local offices on all provinces. First priorities are:

- prevention of destruction of vegetation
- prevention of desertification

Biggest problems are:

- soil erosion, due to logging of forests
- water run off
- silting of rivers

The activity of gold mining from river banks also contributes to the problems.

- *Forestry Commission*

The third department, which is the Forestry Commission, has the main task of reforestation in the country.

5. Zimbabwe Farmers Union

The Union represents about 1.3 million family farms, (approximately 6 million people, two thirds of the population of the country). Due to historical traditions these are small holders with inadequate knowledge in modern agricultural practices, limited financial resources, located in semi-arid areas with no access to irrigation, with a poor quality soil. While the use of fertilizers is inevitable, practically no pesticides are consumed (with exception of cotton) due to lack of financial resources. However, 75% of the cotton-, and 65% of the marketed maize production of the country is realized in this sector, in addition to soybean, vegetable and flower growing.

The situation of small farmers has been deteriorating recently and the trend seems to continue. By the liberalization of the national economy a transition period has started: prices of agrochemicals and other necessary inputs are inflating with higher rate than those of the agricultural products. Simultaneously some imported products e.g. maize may be imported at a lower price, due to subsidized domestic agriculture in foreign countries.

6. Commercial Farmers Union of Zimbabwe

The Union represents the commercial farmers, i.e. those who produce cash crops for the domestic market and for export. The number of them is around 4000 and they are working on large plantations. They use all up-to date agrochemical practices. Among the operation costs all sort of agrochemicals, including pesticides (grouped as insecticides, fungicides, herbicides, broken down to particular products) can be found. However, no summarized data on consumption of agrochemicals were available.

Producers of all important cash crops have their own union, which cares for their common needs. This relates also to the education and training of personnel involved. For example the Cotton Training Center (run by the Cotton Farmers Union, but also available for non member farmers) is utilizing the most recent results achieved in the Cotton Research Institute (run by the Government). All initiatives in enhancing agrochemical practice including risk reduction most probably will be welcome by these farmers. Commercial farmers have capitalized in the infrastructure as well, so some of them have their own water resources for irrigation.

D. Participation in the Afro-Arab Network

1. The Pesticide Research Institute could be a focal point in the planned network for legislation issues and present in the Mauritius Meeting their experiences in the registration of new pesticides, enforcement of pesticide law and results of joint efforts of countries in the control of migrant pests.

2. The Standard Association of Zimbabwe expressed its need for assistance from UNIDO in the introduction of total quality management (TQM) in various industries. The system of standards and the working of SAZ may be as worth for a presentation to members of the network at the Mauritius conference.

3. The MOH could present their way and experience in handling occupational health issues in Zimbabwe as a good example for other countries.

4. As a very good example for environment protection is the tap water supply of Harare: The source of water is Lake Chivero, into which the communal sewage of the city is fed back. The tap water is potable. The treatment of waste water, the biological cleaning effect of the lake and the water treatment before conducting into the network comprise a balanced system.

MAURITIUS

Population:	1.12 million
Active population in agriculture:	20.8 %
Proportion of women in agriculture:	
GDP per capita:	(1993) 2780 USD
Contribution of agriculture to GDP:	9.1 %

(figures of 1994 unless otherwise noted)

A. Agriculture profile

[in '000 ha]

total area:	185
total arable land:	90
permanent crops:	6
irrigated:	17

- Field crops

of which cereals	1
(rice, maize)	
roots & tubers	1
(potatoes)	
pulses	2
(groundnuts, beans)	
industrial crops	75
- sugar cane	74
- tobacco	1

- Vegetable crops 2
  (tomatoes, cucurbits, lettuce)
- Permanent crops 6
  of which coffee, mango, coconut
- Other cultivated area (fallow).....

- Cultivated area.....

1. Mauritius, till recently, used to be an agricultural country, with a monocrop economy based on irrigated sugarcane accounting for 90 % of the cultivable land. The terraining 10 % were for the production of tea, tobacco, maize, groundnuts, rice, coffee and vegetables.

2. Climatic conditions restrict crops such as tea, coffee and rice to specific areas whereas sugarcane is distributed all over the island. Maize groundnuts and vegetables may be grown in poor stands or in the cane interrows.

3. The crops and the most widely used pesticides are shortly summarized as follows:

sugar cane: - generally only herbicides, Atrazine, diuron, acetochlor, 2,4-D derivative, glyphosate, oxyfluorfen and some more.
Benomyl is used for the treatment of cuttings at planting.

potato, tomato, ground nut, bean:
- Mancozeb (with) Metalaxyl, Bitertanol Metamidophos, Pyrethroids, Cyromazine

maize: - herbicides and soil insecticides are used.

4. Mauritius has very few indigenous species of insects, and the majority of the pests have been introduced. The amoured scale insect can survive only in the drier coastal fields, the coconut beetle and the mangostem borer are also found only in the dry coastal regions.

5. All insect pests of sugarcane are controlled biologically with no insecticide treatment being necessary. The only pesticides applied to cane fields are herbicides. With increasing cultivation of other crops in cane interlines, insecticide use may become inevitable for these other crops only.

6. The country has a long history in biological control, nowadays using wasps, mites, sterile male release, pheromones and viruses.

7. The production figures for main crops in 1994 were:

maize	2000 tonnes
pulses	2000 tonnes
tobacco	1000 tonnes
potatoes	19000 tonnes
vegetables	57000 tonnes
fruits	11000 tonnes
tea	5000 tonnes
sugar	525000 tonnes

8. The principal exports in 1994 were sugar with app. 23 % of total export when in 1992 sugar still accounted for 43% of total exports. Tea exports amount to only < 0.4 %.

B. Pesticide supply and production

number of products registered: (1995)
number of registered active ingredients: (1995)

local production of A.I.: none (1995)
local formulation appr.: .... % (1995)
number of local formulators : .... (1995)

total pesticide imports in tons:
value of pesticides imports: 10 mio USD (1993)

total pesticide exports: 0,1 mio USD (1993)

Year	Value
1990	8.7 mio USD
1991	6.7 mio USD
1992	9.7 mio USD
1993	10 mio USD
1994	.... mio USD

1. The market for pesticides in Mauritius is estimated at around 10 million USD which is high compared to the size of the land used. .

2. There are a few pesticides which are formulated locally.

3. The production of agrochemicals is limited to one company dealing with formulation of fertilizers based exclusively on imported ingredients. The subject of a similar activity for pesticides has also been raised. Being a relatively small country oriented towards tourism and due to worries of potential hazards to environment the idea has been accepted with moderate enthusiasm.

4. Pesticide usage pattern: - no information available

C. Key actors involved in the pesticide sector organization

1. Ministry of Agriculture

The Ministry of Agriculture together with the Ministry of Health is reported to be responsible for the development of analytical methods and for toxicological evaluation of pesticide residues in food.

In the Min. of Agriculture the preparation of the following studies are currently going on:

- regulation for the import of pesticides
- IPM, formulation of botanical pesticides
- further development of the use of fertilizers.

Division of Agrochemistry

The division's laboratory yields analytical support to the DARE (Directory of Research and Extension) working in the FARC (Food and Drug Research Council). They target is residue analysis of 30 pesticides (first of all Tamaron) in all agricultural products. Their service for the public sector is free, for private farmers they charge a nominal fee (non profit basis).

Since 1986 a permanent "market basket survey" is going on, testing products purchased from various shops, markets. Roughly 1 per cent of the samples are above the permitted level. The Ministry has the authority to restrict or ban the use of, or confiscate the contaminated product. The lab has the authority to control the quality of the fertilizers formulated by M.C.F.I. (Mauritius Chemical Fertilizer Industry Ltd.). Every lot is sampled, analyzed and certified. The lab is properly equipped (HPLC, GLCs, but TLC is frequently used in order to spare the industrial gases, imported from abroad.)

2. Ministry of Health -

The Ministry of Health is reported to be the main authority responsible for approval, registration and use of pesticides. In the Ministry of Health the Pesticide Control Act (1972) is currently supervised and going to be diversified in order to be the regulation for all dangerous materials.

Occupational Health Unit

The Acting Consultant (Head) of the Department is also the Chairman of the Pest Control Board.

The Pesticides Control Act (1972) pesticide registration, import, manufacturing, formulation, storage, sale, use is administered by the Min. of Health through the Pesticides Control Board. Both its chairman and secretary are appointed from the staff of the Ministry by the Prime Minister.

Licenses for new premises, storage and retail facilities are given by the Pesticides Control Board in which all relevant organizations (Ministries of Agriculture, Environment, Labor etc.) are represented. The Pesticides Control Act is currently revised and going to be transformed into a new regulation to control the handling of all dangerous materials. The secretariat of the Board will be equipped with proper computer system and personnel to able to monitor pesticides throughout their whole life cycle. (At present only imported, not used, pesticides are registered. The collection and retrieving of data are executed manually.)

All premises designed for the storage, distribution or selling agrochemicals to the public need certification and are regularly supervised.

Concerning occupational health, all persons dealing with pesticides (especially those who are regularly in contact with carbamates and organophosphates) are obliged to be surveyed twice a year for blood cholinesterase level.

The Department is closely cooperating with the extension service of the Min. of. Agriculture in organizing seminars, workshops and monitoring the use of pesticides.

Chief Government Analyst - Public Health Laboratory (Candos)

The laboratory is located in the Victoria Hospital (Candos) and is responsible for the analysis of samples originating from (suspected) poisoned persons. The vast majority of the poisoning cases (5 to 6 per month [!]) committed with pesticides are due to suicide (!) attempts. To reduce or eliminate their occurrence needs a multidisciplinary approach and seems to be the most sophisticated element of the effort of reducing risks of the use of pesticides in Mauritius.

The lab is not involved in, nor equipped with instruments to carry out residue analysis. They analyze food samples only in case of suspected poisoning, when the level of contamination is high and can be detected with available instruments. They use moderate, conservative instruments (GC, TLC). They have also an HPLC, but need training in order to be able to use it.

Food residue analysis is done by the Principal Agrochemist in the Min. of Agriculture, while the Pesticide Control Board / Ministry of Health has the authority to ban the use of contaminated food.

3. Ministry of Environment and Quality of Life

The main task of the Ministry is to coordinate the activities of all agencies having responsibility in the enforcing of the Environment Act. The main partners are the Ministries of Agriculture, Health and Energy.

The Ministry is practicing its executive power through the Environmental Coordination Committee, which has a mandatory meeting monthly. Reported incidents against environment are investigated. Samples from natural waters, soil, plants, animal organs are tested in several dedicated labs of the mentioned ministries or parastatal bodies. Their activity is coordinated and monitored by the Central Laboratory of the Ministry.

4. Central Water Authority (CWA)

The CWA has a laboratory whose head is also a permanent member of the Pest Control Board. The lab is providing analytical support to the activity of CWA. The monitoring of 10 selected pesticides in ground water is a routine, some 4-5 of them could be detected in lower concentrations than permitted. Cooperation with the labs of M.S.I.R.I. is very strong. Currently a data base is going to be set up for all chemicals (including heavy metals). Residues of fertilizers is monitored on a daily basis. Supervision of industrial waste waters also belongs to the responsibility of CWA. Another new project will deal with residues of pesticides. Monitoring the level and condition of ground waters in the country is supported by the International Atomic Energy Agency . A study on the overuse of fertilizers with the title "Eutrophication at La Ferme Reservoir" has been recently completed. The lab is equipped with all necessary instruments. Another monitoring lab has been set up p a monitoring lab on the Rodrigues Island.

5. Mauritius Sugar Industry Research Institute (M.S.I.R.I.), Réduit

The Institute is oriented towards the large estates (above 40 ha), but also involved in the assistance of the extension services of the Ministry of Agriculture for small farmers by paticipating in workshops organized for the members of the network.

Entomology Division

The work of the division aims at maintaining the healthy stalks of sugar cane, as far as insect pests are coverned and implementing an IPM Strategy for the control of pest or crops associated with sugar cane.

Plant Pathology Division

The division is dealing with the sugar cane as a first priority, but about 40 per cent of its capacity is used to investigate pathogen and determine the proper defense and prevention in other crops as well. The lab is equipped properly to diagnose plant diseases.

Agricultural Chemistry Division

The laboratory investigated degradation of herbicides and the leaching potential of herbicides used in sugar cane cultivation.

Monitoring of 10 pesticides is going on throughout the country at 20 bore holes and eight rivers. Only few of the monitored pesticides could be detected in few cases, however in concentrations well below the permissible limits of Code Alimentarius.

Their new project will investigate the transport of agrochemicals by surface run-off waters.

Weed Agronomy & Cultural Operations Division

The head of this division has been a permanent member of the Pesticide Control Board since 1980. Comments from the division are that the relative high level of legislation and monitoring within the country seem to be comfortable, however, there are fields which need further development:

- statistical data can sometimes be misleading, due to improper handling of figures, (quantities of active substances are mixed with those of formulated products)
- bio-assay (residue analysis) in fruits and vegetables is to be enhanced
- waste disposal or treatment of left over (expired) pesticides (insecticides and fungicides) is to be solved (left over herbicides are used after the date of expiry, so no further measures are necessary)

6. University of Mauritius

Faculty of Agriculture

Mauritius has the distinction of first country in the world to have attempted biological control in 1762 (!), and research is conducted in the field of "green" pesticides for the control of pests in the country. Up till now 3 plants have been selected from 25 as potential sources for alternative pesticides in frame of an on going World Bank project.

The Faculty is conducting a permanent survey throughout the country since 1979 on the misuse (overdose) of pesticide by small farmers. The enthusiasm of students is also used in this activity, which may be a good example for other countries.

Faculty of Sciences - Department of Biological Sciences

The Department is conducting research work which in some points is related to environmental protection. Currently a workshop is going to be organized on the exploitation of algae. Excellent instrumentation is available for the identification of microorganisms.

D. Participation in the Afro-Arab Network

1. The Government of Mauritius has offered to take a leading role through its Ministry of Health in getting the Network going and offered to host the first Expert Group Meeting scheduled to take place in mid 1996. The Ministry of Health will also maintain the linkages to all other ministries concerned.

2. The Ministry of Agriculture will also play a major role along with the Ministry of Health especially with regards to use of bio- and botanical pesticides, quality control, fertilizer use, etc.

3. The Ministry of Environment and Quality of Life promised the assistance of th Ministry to the meeting and participation in the planned network. They are open to learn and ready to participate in reciprocal change of information and experience in the field of environmental protection. The on-going legislation procedures in the Ministries of Agriculture and Health resp. mentioned above may also benefit from the experience of members of the network.

4. Mauritius Sugar Ind. Res. Inst. in Reduit (MSIRI) can be strongly recommended as focal point for research on pest control of sugar cane and other mentioned crops and also for monitoring of leaching of pesticides. Their contribution to the networking meeting is also desirable.

5. The systems of monitoring natural waters in order to prevent contamination is worth of presentation at Mauritius meeting which could be done by a representative of the Central Water Authority.

TANZANIA

Population:	27.4 million
Active population in agriculture:	77 %
Proportion of women in agriculture:	
GDP per capita:	(1993) 75 USD
Contribution of agriculture to GDP:	57.1

A. Agriculture profile

[in '000 ha]

total land:	94509
total arable land:	3000
permanent crops:	500
irrigated:	150

- Field crops .....

of which cereals		3024
(maize, rice, sorghum, millet)		
roots & tubers		933
- cassava	693	
- sweet potatoes	205	
- potatoes	33	
pulses		625
- groundnuts	113	
- beans	300	
- castor beans	10	
industrial crops		
- tobacco	32	
- cotton	275	
- sugar cane	14	

- Vegetable crops.....
  (tomatoes, onions)
- Permanent crops.....500
  of which coconuts ..... coffee .....
  bananas ..... citrus .....
- Other cultivated area (fallow) .....

- Cultivated area .....

1. The agricultural sector is the backbone of Tanzania's economy, accounting for more than 60 % of export earnings

2. No more than about 8 % of the country's land area is cultivated, mainly as rain fed agriculture. Only 2-3 % of the cultivated area is irrigated.

3. The dominant crop is maize accounting for about 54 % of total arable land use, followed by sorghum accounting for 22 % of the total arable land use.

4. Fertilizer inputs are with 13.7 kg per ha still relatively low compared with other countries of the region.

5. Data on pesticide inputs and usage pattern were not available.

6. Production quantities of various agricultural goods are as follows:

cashew nuts	30.0 mio tons
cassava	7.2 mio tons
maize	2.2 mio tons
fruits	2.2 mio tons
vegetables	1.0 mio tons
rice	614000 tons
potatoes	230000 tons
wheat	59000 tons
coffee	34000 tons
tobacco	23000 tons
tea	22000 tons

7. The principal agricultural exports in 1994 were:

coffee	115.2 mio $
cotton	104.8 mio $
cashew nuts	52.0 mio $

8. IPM programmes: - no information available -

B. Pesticide supply and production

number of products registered: ..... (1995)
number of registered active ingredients: ..... (1995)

local production of A.I.: yes (1995)
local formulation appr.: .... % (1995)
number of local formulators : ..... (1995)

total pesticide imports in tons: .....
value of pesticides imports: 22,0 mio USD (1993)

total pesticide exports: 0,3 mio USD (1993)

Year	Value
1990	18 mio USD
1991	20 mio USD
1992	22 mio USD
1993	22 mio USD
1994	.... mio USD

1. The pesticide market is roughly estimated at 20 to 25 Mio US$ with no information on quantities imported or used.

2. The pesticide market is limited mainly due to the limited foreign currency available.

3. A few companies are involved in production of active ingredient

   - Pesticides Manufacturing Co in Moshi which belongs to NCI, the National Chemical Industries

   - .....

   The production and formulation plant in Moshi is a new and modern plant designed to produce copper-oxy-chloride from common salt and metal copper. The technical product is then formulated to standard concentration and readily packed. Facilities cover WP and flowables formulation.

5. The national association is the Agrochemical Association of Tanzania (AAT) is located in Dar es Salaam.

C. Key actors involved in the pesticide sector organization

1. Ministry of Agriculture

The Ministry of Agriculture along with the Tropical Pesticides Research Institute (TPRI) in Arusha is the main authority responsible for approval, registration and use of pesticides.

Tropical Pesticides Research Institute

Pesticide Registration in Tanzania is governed by act of Parliament No. 18 of 1979 which also established the Tropical Pesticides Research Institute (TPRI) and provided it with a broad mandate of conducting research on all fundamental aspects of pesticide application and behaviour in relation to the control of tropical pests.

TPRI ensures that all pesticides in the country are registered and tested for their effectiveness against the pests or plant diseases they are meant to control and that they are safe to humans, lifestock and the environment.

The pesticide registration procedure is quite tedious and costly and requires submission of full dossiers, label specimen and samples for testing along with the duly filled application form.

The registration scheme provides for 4 categories of pesticide registration, namely

* Experimental Registration
* Provisional Registration
* Full Registration
* Restricted Registration

2. Ministry of Health

The Government Chemical Laboratory of the Ministry of Health is reported to be involved in the development of analytical methods and for the toxicological evaluation of residues in food.

D. Participation in the Afro-Arab Network

1. The expert mission to Tanzania was not undertaken but a separate mission visited the country and met several people to discuss the Afro-Arab Network.

2. The Ministry of Agriculture and the Ministry of Industry can play an important role. The Tropical Products Research Institute at Arusha and the National Chemical Industry which has a pesticide formulation plant at Moshi could be the key players.

3. Seed dressing and post harvest treatment could be taken up as the main theme by Tanzania to assist the region. This would depend on the status of the Moshi formulation plant.

4. In addition SADDC has some projects related to botanical pesticides and these will be considered for inclusion in the regional project.

ANNOTATIONS

Data and information for above compilation were taken from several sources, such as:

1. mission report of Messr. F. Kovats and J. Menn dated 27 December 1995
2. statistical data given by countries
3. FAO production yearbook 1994
4. FAO fertilizer yearbook 1994
5. World Directory of Pesticide Control Organizations, 1994
6. Fischer Weltalmanach '96, ISSN 0430-5973
7. own notes and reports

Cross reference is made to the explanatory notes of the FAO production yearbook 1994. Generally crop areas refer to harvested areas, although for permanent crops data may refer to total planted area.

The term 'arable land' refers to land under temporary crops (whereas double-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens (including cultivation under protective cover) and land temporarily fallow (less than five years). The abandoned land resulting from shifting cultivation is not included in this category. Data for 'arable land' are not meant to indicate the amount of land that is potentially cultivable.

The term 'land under permanent crops' refers to land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee and rubber; this category includes land under flowering shrubs, fruit trees, nut trees and vines, but excludes land under trees grown for wood or timber.

During the compilation of the data on the actual situation of pesticide related issues in the region, some gaps of data or information were realized. These shall be filled during the Mauritius meeting.

All concerned parties are invited to complete, up-date or correct the information tackled in this compilation; to do this, respective information or data should be submitted in writing prior to/or during the Mauritius conference mid of 1996 to be included into the final version of above document.

ADDENDUM

Uganda

A separate mission was organized to visit Uganda to explain to the authorities UNIDO's Afro-Arab Network for risk reduction in agrochemicals development.

The Ministry of Agriculture which has a number of research stations especially on seed progation, post harvest treatment, seed certification, forest seeds etc. The National Agricultural Research organizations attached to the MOA would be ideally linked to the network.

In addition the National Environment Management Authority (NEMA) covers ecological aspects related to industrial chemicals and agrochemicals and liase with lead agancies. They are at present expanding and recruiting specialists in the field. They want to develop EIA (Environmental Impact Assessment) guidelines, environmental audits and water and air quality. National Agricultural control was established in 1987 and use of pesticides is increasing. A Government Agency Laboratory has analytical facilities for environmental monitoring and need mobile monitoring units and capacity building.

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Malawi

The Mission did not visit Malawi but the topic was discussed in detail at the Tripartite Review meeting of a UNIDO Seed Dressing Project where there was a keen interest in the networking concept. According to the head of the Plant Protection Dr. Daudi that management of agrochemicals needs upgrading . Malawi is importing all its pesticides and has no registration scheme and the country needed a legal framework for control of pesticides and the proper management of hazardous chemicals. According to FAO the country has a large stock of obsolete pesticides which needs proper disposal. Institutes such as Chitedze Agricultural Research Station , Pesticide Industry Association and the Bvumbwe Research Station could contribute to functioning of the network in Malawi.

The local FAO representative expressed keen interest in UNIDO's Seed Dressing Project and the Networking Concept. Mention was also made about FAO project for introduction of registrations scheme in Malawi, training on safe use of pesticides and renovation of pesticide analysis laboratory.

APPENDIX A

Afro-Arab Network
- possible focal points -

INFORMATION COLLECTION & DISSEMINATION

covering pesticide production, import & export, data on accumulation of pesticides, waste data from industries, ware houses etc., toxicity data, pesticide registration requirements

FORMULATION TECHNOLOGY

low risk agrochemicals (pesticides & fertilizers) and modern formulation techniques
information on new developments

QUALITY CONTROL & QUALITY ASSURANCE

harmonization and implementation of quality standards and quality control by industries and governments

BIO/BOTANICAL PESTICIDE DEVELOPMENT

development of bio- and botanical pesticides specially making use also of local resources where possible

IPM CONCEPTS

concepts of integrated pest management making use of chemical, biological and cultural methods to reduce the load of agrochemicals in the environment

SEED DRESSING TECHNOLOGY

further development or adaption of seed dressing technology and post harvest treatment

APPLICATION TECHNOLOGY

further development and/or adaption of application technologies

INDUSTRIAL HYGIENE / OCCUPATIONAL HEALTH & SAFETY

further development / adaption of industrial hygiene and occupational health and safety

INDUSTRIAL SAFETY & WASTE MANAGEMENT

adaption of industrial safety standards, development and adaption of waste management concepts

ECOTOXICOLOGY & ENVIRONMENTAL MONITORING

development and implementation of ecotoxicology & environmental monitoring programmes

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

XP/INT/95/012/11-03B

Title:	Pesticide Specialist with emphasis on low risk pesticides in support of IPM
Duration:	1.5 months
Time required:	November/December 1995
Duty Station:	Vienna (briefing 2 days), Lagos (4 days), Accra (4 days), Nairobi (4 days), Mauritius (3 days), Lusaka (3 days), Harare (4 days), Lilongwe (3 days), Kampala (3 days), Vienna for debriefing (via Nairobi 3 days) Home based 1 week.
Purpose of the Project:	To promote risk reduction in agrochemcials development in the Afro-Arab Region by networking.
Duties:	The expert will be part of a team of four experts divided into two teams one covering the Africa region and the other one covering the Arab region. The team will visit selected countries in the region to discuss with government officials dealing with agrochemicals, visit agrochemcial industries, institutions which have facilities to deal with agrochemcials and discuss ways and means of setting up coordinate efforts for risk reduction in pesticide development. He/she alone or along with other members is expected to explain the recent developments in agrochemicals, their proper management and all efforts to create awareness and capability to effectively promote risk reduction in agrochemcials development. The team he/she is expected to explain UNIDO's aim to catalyze regional networking, asses the capability of the country for technically contributing to the functioning of the networking. He/she should identify qualified national/ regional counterparts who could participate in the proposed regional networking. He/she should advise UNIDO the modalities of setting up of a network and should submit a joint report with other experts. The report will be used as a basic document for discussion in a proposed preparatory meeting to be held in Mauritius during June 1996.
Qualification:	A chemist chemical engineer with vast experience in pesticide development with emphasis on safer, low risk low volume formulations in support of IPM. He/she must have a good knowledge of use of alternatives to synthetic pesticides to support IPM and should have long standing experience in industry in production and R&D and his work should be supported by publications. Experience in developing countries would be an advantage. Should be
Language:	English with knowledge of French

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

XP/INT/95/012/11-03A

Title: Pesticide Specialist on bio-pesticides (IPM methods)

Time required: November/December 1995

Duration: 1.0 m/m over a period November -December 1995.

Duty Station: Vienna (briefing and debriefing 3 days), Lagos (4 days) Accra (4 days), Nairobi (4 days), Mauritius (3 days), Lusaka (2 days), Home Based (1 week)

Purpose of the Project: To promote risk reduction in agrochemcials development in the Afro-Arab Region by networking.

Duties: : The expert will be part of a team of four experts divided into two teams one covering the Africa region and the other one covering the Arab region. The team will visit selected countries in the region to discuss with government officials dealing with agrochemicals, visit agrochemcial industries, institutions which have facilities to deal with agrochemcials and discuss ways and means of setting up coordinate efforts for risk reduction in pesticide development. He/she alone or along with other members is expected to explain the recent developments in agrochemicals, their proper management and all efforts to create awareness and capability to effectively promote risk reduction in agrochemcials development. The team he/she is expected to explain UNIDO's aim to catalyze regional networking, asses the capability of the country for technically contributing to the functioning of the networking. He/she should identify qualified national/ regional counterparts who could participate in the proposed regional networking. He/she should advise UNIDO the modalities of setting up of a network and should submit a joint report with other experts. The report will be used as a basic document for discussion in a proposed preparatory meeting to be held in Mauritius during June 1996.

Qualification: A chemist or biochemist or chemical engineer with vast experience in bio-pesticide development for promoting safety in the development of pesticides. He/she must have a good knowledge of use of alternatives to synthetic pesticide to support IPM and should be supported by publications. Experience in developing countries would be an advantage. Should be familiar with safety aspects in formulation, storage, distribution and disposal of pesticides.

Language: English with some French and/or Arabic