

REPUBLIC OF MALAWI



Ministry of Agriculture, Irrigation and Water Development

Agricultural Commercialization Project

PEST MANAGEMENT PLAN

DRAFT REPORT

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ACRONMYS AND ABBREVIATIONS

ADD	Agricultural Development Division
ADMARC	Agriculture Development and Marketing Corporation
AEDO	Agriculture Extension Development Officer
AEZ	Agricultural Ecological Zones
BP	Bank Policy
DDC	District Development Committee
DEC	District Executive Committee
DAES	Department of Agricultural Extension Services
DADO	District Agriculture Development Officer
DARS	Department of Agricultural Research
DEA	Director of Environmental Affairs
DHO	District Health Officer
EAD	Environmental Affairs Department
EDO	Environmental District Officer
EIA	Environmental Impact Assessment
EMC	Executive Management Committee
EMP	Environmental management plan
EPA	Extension Planning Area
ESIA	Environmental and Social Impact Assessment
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GMO	Genetically Modified Organisms
GoM	Government of Malawi
IGA	Income Generating Activities
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
IPPC	International Plant Protection Convention
IRLADP	Irrigation, Rural Livelihoods and Agricultural Development Project
ISP	Input Subsidy Program
LGB	Large Grain Borer
LRCO	Land Resources Conservation Officer
MAWTCO	Malawi Agricultural Warehousing and Trading Company
MBS	Malawi Bureau of Standards
MGDS	Malawi Growth and Development Strategy
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
MoLGRD	Ministry of Local Government and Rural Development
MPRS	Malawi Poverty and Reduction Strategy
MSV	Maize Streak Virus
NEAP	National Environmental Action Plan
OIE	Office International Epizootie (World Animal Health Organization)
OP	Operational Policy
OPC	Office of the President and Cabinet

PCB	Pesticide Control Board
SADC	Southern African Development committee
SFFRFM	Smallholder Farmers' Fertilizer Revolving Fund of Malawi
SWG	Sector Working Group
TCE	Technical Committee on the Environment
TWG	Technical Working Group
WB	World Bank

EXECUTIVE SUMMARY

1.1 Project Background

The World Bank will support the Government of Malawi (GoM) in the implementation of the Agricultural Commercialization Project (AGCOM) with the objective of increasing commercialization of selected farm and agribusiness products for domestic and export markets. The project would also contribute to the higher level objectives of poverty reduction, improved gender and climate change mitigation and adaptation through supported CSA initiatives.

The programme will be implemented by the Ministry of Agriculture, Irrigation and Water Development and the Ministry of Trade.

The proposed program would have three components:

1.1.1 Building Productive Alliance The objective of this component is to support small-scale¹, emerging farmers integrate into value chains by improving their capacity to finance and execute productivity-enhancing investments and respond to the requirements of the end-markets and buyers. To do so, it will implement the high impact 'Productive Alliances' (PAs) model. Project support to PAs will be complemented by 'last mile' infrastructure investments in targeted areas.

It will address the following constraints: (a) inefficiencies along value chains due to inadequate integration of actors, information asymmetries, and coordination failures among stakeholders; (b) unreliable access to quality raw material; (c) poor rural access roads to connect producers to markets; and (d) limited access to finance in agricultural value chains. Addressing these through PAs has the proven potential to increase incomes, productivity and commercial viability, prospects for employment generation, and integration of youth and women.

1.1.2 Support Investment Enabling Services The objective of the component is to support business enabling services by addressing some of the systemic gaps and challenges that constrain investment and trade in the agribusiness sector. Unless addressed, these constraints may impede the formation of POs and prevent PAs from operating optimally. These include access to agricultural finance; access to land for commercial agriculture, policy dialogue on agribusiness; and removing some of the barriers to trade for agriculture business such as on standards and certification. The component will address processes in efficient access to finances, land and regulatory and operational business enabling services.

1.1.3 Contingent Emergency Response Component

This contingent emergency response component is included under the project in accordance with OP/BP 10.00, paragraphs 12 and 13, for situations of urgent need of assistance. This will allow for rapid reallocation of project proceeds in

¹ Defined by the project as those farmers who cultivate less than 5 ha of land.

the event of future natural or man-made disaster or crisis that has caused or is likely to imminently cause a major adverse economic and/or social impact during the life of the project. This component will not have funding allocation initially. In the event of a future emergency, it can be used to draw resources from the unallocated expenditure category and/or allow the government to request the Bank to re-categorize and reallocate financing from other project components to cover emergency response and recovery costs, if approved by the Bank.

1.1.4 Project Coordination and Management

This component will finance activities of the Project Implementation Unit (PIU). The PIU will oversee the implementation of project activities, ensure sound fiduciary management in the project (both procurement and financial management), carry out monitoring and evaluation (M&E), ensure social and environmental safeguards compliance, and engage in communication and reporting. A main responsibility of the PIU will be to comply with the World Bank's fiduciary reporting requirements. This includes submitting a project implementation progress report on a semi-annual basis. In addition, the PIU would be responsible for implementing the calls for proposals and administrating the grants component under Component 1.1 and 1.2. Additional support will be provided under this component to support any relevant research and analysis² that can inform implementation of the project, as well as provide an opportunity for learning and informing future operations. An example would be some [SME diagnostic](#).

1.1.2 Objectives of PMP

The activities proposed under AGCOM do trigger the World Bank safeguard policy on Pest Management (OP.4.09) and as such a standalone Pest Management Plan (PMP) has been prepared to meet the requirement. The objectives of the PMP include:

- Promote the use of environmentally friendly practices in pest control,
- Monitor pesticide use during implementation of AGCOM activities,
- Ensure that project activities comply with Malawi's laws and regulations on use of pesticides, and World Bank safeguard policy OP 4.09, and
- Provide an integrated pest management action plan which can be easily implemented in the event that pest management issues are encountered during implementation of proposed AGCOM activities.

1.3 Strategies to developing IPM

This PMP outlines steps towards the establishment of IPM approaches in the APPSA project impact locations as follows:

² Research and analysis will look at reviewing the value chains context, analyzing emerging opportunities/constraints for SME, drawing lessons from various experiences, analyzing market opportunities etc. Such evidence based analysis will inform current work, as well as future project operations.

1. Identification of the implementation team;
2. Deciding on scale of implementation;
3. Setting goals and measurable objectives for the IPM program;
4. Analysis of current housekeeping, maintenance and pest control practices;
5. Establishing a systems for regular IPM inspections;
6. Defining treatment selection policy;
7. Establishing communication protocols;
8. Developing worker training plans and policies; and
9. Participatory monitoring and evaluation

This PMP investigates several alternatives, including biological treatment, mechanical and manual methods for pesticide control, which are recommended for use, with the ultimate objective of progressive reduction in the application of chemical pesticides, by replacing them with the more environmentally friendly options. The PMP discusses these opportunities and makes recommendations for implementation. For AGCOM a strong capacity building program will be required to manage and monitor the use of pesticides that may be used by farmers to scale up their production.)

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 PROJECT BACKGROUND

The World Bank will support the Government of Malawi (GoM) in the implementation of the Agricultural Commercialization Project (AGCOM) with the objective of increasing commercialization of selected farm and agribusiness products for domestic and export markets. The project would also contribute to the higher level objectives of poverty reduction, improved gender and climate change mitigation and adaptation through supported CSA initiatives.

The programme will be implemented by the Ministry of Agriculture, Irrigation and Water Development and the Ministry of Trade.

1.2 OVERVIEW OF THE AGRICULTURE SECTOR

Agriculture remains the backbone of Malawi's economy. Agriculture accounts for 30% of Gross Domestic Product (GDP) and generates over 80% of national export earnings. Between 2005 and 2011, over 80% of the country's total exports were agricultural commodities, primarily tobacco, sugar and tea³. Tobacco alone however, represents on average 60% of Malawi's total exports. Agriculture employs 64.1% of the country's workforce⁴ comprising mostly the smallholder subsistence farmers. Agriculture also significantly contributes to the national and household food security and nutrition⁵.

The agriculture sector in Malawi comprises of smallholder and the estate sub-sectors, with more than 99% of households involved in smallholder subsectors which contribute 80% of overall production and 70% of agricultural GDP⁶. The smallholder cultivates 6.5 million ha of land which constitutes 85% of the total land. These farmers mostly grow food crops (including maize, rice, cassava, sweet potatoes, Irish potatoes, and legumes), some cash crops such as tea, tobacco, sugarcane, coffee and rear livestock such as cattle, goats, poultry, pigs, sheep and some non-conventional livestock like rabbits, doves, guinea fowls. The estate subsector focuses primarily on the commercial production of high-value cash crops and livestock such as tobacco, tea, sugarcane, macadamia and beef cattle, dairy cattle, commercial laying chickens and broilers respectively. Recently, there has also been a growing emergence of medium-scale farmers⁷.

³ 2015 Annual Economic Report

⁴The 2013 Malawi Labour Force Survey

⁵ National Agriculture Policy (2016)

⁶World Bank Support to Agriculture Strategy in Malawi

⁷ Defined as farmers cultivating at least five hectares but less than 25 hectares of land.

Agricultural production and productivity remains low. For example, maize yields are still far below yield potentials of between five and ten mt per ha, implying a yield gap of three to eight mt per ha. In the case of oilseeds, average yields are approximately one mt per ha compared to the potential of about two mt per ha⁸. Although Malawi has allocated considerable resources to agriculture over years, production and productivity of the sector has generally been below the country's potential and not sufficient to match growing domestic demand and export markets. This has been because of both climatic and systematic factors. Most of the areas of the country have been exposed to climatic shocks of floods and prolonged dry spells with the occurrences of the La Nina and El Nino phenomena. In addition, the systematic factors such as low adoption of agricultural technologies, low access to farm inputs, low mechanization, low technical labour skills, poor access to finance, weak linkages to markets, and limited irrigation among smallholder farmers have been responsible for the low productivity. Furthermore, land for agriculture in Malawi is becoming limited. Smallholder farmers cultivate small and fragmented land holdings of less than one hectare (on average 0.61 ha) and produce lower crop yields than those in the estate subsector.

There is limited irrigation infrastructure in Malawi with only 4% of the crop land under irrigation, which makes the country to have a single cropping cycle. The total area of land under irrigation stood at 104,000 ha in 2014 of which about 46% was estates and 54% was smallholder. The irrigation schemes are predominantly smallholder schemes serving 56,600 household, which represents 3.3% of all rural households. The contribution of irrigation to agriculture GDP is between 7% and 12% and to the economy as a whole of between 2% and 4%.⁹ However, the importance of the irrigation is greater than shown by its contribution to GDP as commodities produced under irrigation make up the bulk of Malawi's exports. Therefore, the smallholder irrigation is of particular significance to food and nutrition security, rural income generation and rural poverty reduction and thus should be expanded.

Trends in livestock production has not registered significant increase in the past ten or more years except for the poultry and pig industry. For example cattle population is estimated to have increased by 6%, poultry by over 50%, goat 10% and pigs by 31% from 2000 to 2014 (DAHLD 2014 annual report). 90% of the livestock farmers are from the small holder sector which is hampered by poor husbandry practices, rampant pests and diseases, limited access to quality veterinary services, expensive inputs, negative impacts of climate change on livestock production, farmers altitude towards livestock production as a business and disorganised market systems among others.

⁸National Agriculture Policy (2016)

⁹ Malawi Irrigation Master Plan and Investment Framework (2015)

Agricultural commercialization is further constrained by poor market systems and unorganized farmers. Agricultural marketing systems in Malawi are still rudimentary, especially in rural areas. This is partly due to inadequate infrastructure for efficient agricultural marketing, limited access to and poor quality of marketing service provision, and policy incoherencies that negatively affect marketing. Malawi has made efforts to commercialize agriculture. In recent years, the Malawi Government has formulated coherent strategies to support agriculture growth and commercialization through increased liberalisation, development of rural marketing infrastructure and agricultural market information systems, and the establishment of commodity exchanges.

Malawi trade is highly concentrated on agricultural commodities. The top ten products account for 82% of total export and 42% of total imports, with tobacco, sugar and tea being the most dominant products. However, there have been emerging export trends in processed legumes and livestock products. The processed legumes (for example toor dhal) and livestock products (for example dairy) have been the focus sectors under the agro – processing area in the National Export Strategy. In addition, the increasing domestic demand of the horticulture products is making its production popular among the farmers. So much is the demand that the supermarkets in Malawi are investing a lot of resources in capacitating the farmers for horticulture production so as to import substitute the horticulture produce coming from neighbouring countries, mainly South Africa. Malawi Trade is concentrated on few destinations/origins, channelled through few sea route ports of Dar-es-Salaam in Tanzania, Nacala and Beira in Mozambique and Durban in South Africa. Largest trading partner remains South Africa, with China and Dubai coming up as emerging trading partners. Trade of agricultural commodities is dominated by a very small number of large firms with transportation of these commodities through the road network system.

Value addition in agricultural sector is limited by a weak business and investment climate. In 2014, the annual average capacity utilization of enterprises in Malawi has been only 69% and annual labour productivity growth has been negative (-34.2%)¹⁶. Malawi continues to perform poorly in critical areas of economic recovery and competitiveness such as trading across borders, access to electricity, starting a business, and others. Even though the country has shown improvement in the 2017 Malawi Doing Business Report compared to last year, it is still poorly ranked at 133 out of 189 in the world and a lot of improvement can be made in terms of getting electricity, getting credit and starting business areas.

Access to Finance comes out as the top most business obstacle in Malawi. The country was ranked 101 in the getting credit indicator according to Malawi Doing Business Report (Reference). Despite the reduction of inflation rate from 38% in 2013, to 22.6% in 2016, interest rates are still very high-around 40% per annum in the formal banking system and ranging between 50 and 80% per annum in the microfinance and informal banking systems. The consequence of this high interest

rate has been that only 40.1% of the firms have line of credit, only 20.6% of the firms use banks to finance investments and 51% of the firms identify access to credit as a major constraint in Malawi¹⁰. Furthermore, the financial sector in Malawi is small and focuses on a narrow range of products which constrains the bank to lend to the agriculture sector which is perceived as high risk because of high default rate and exposure to the climatic shocks. In 2015, the average Non Performing Loans to Gross Loans percentage was 12.35%, which was much more than the benchmark of less than 5% set.

Malawi's national electrification rate stands at about 10% with electrification in the rural areas much lower at 2%. The main source of power is from hydro power along the Shire River, which accounts for 90% of installed generation capacity in Malawi. Malawi is not able to meet the electric power demand of the country. ESCOM has an installed generation capacity of 365 MW against forecasted demand of about 440 MW. The electric power deficit has been caused largely due to water constraints and wear and tear of generation machinery due to age. Due to the effects of climate change, the country has experienced prolonged drought over the last two years. As a result of this, water levels at the Lake Malawi and the Shire River have significantly dropped leading to much lower generation than the installed capacity. The cost of the electric power in Malawi is 8 cents/ unit which is much lower than the Sub- Saharan Africa average of 15 cents/ unit.¹¹ (Link to the subject at hand eg. Agro processing, storage, etc)

Weak institutional and regulatory framework poses a challenge to agricultural enterprise development. According to the 2014 Malawi Enterprise Survey, over 35% of business enterprises experienced losses in a year due to theft and vandalism. On the other hand, about 24.2 per cent of firms reported one bribe payment request in a year, and 16.6% were expected to give gifts to public officials to get business support such as getting operating license, construction permit, or getting water or electricity connected. Regulatory barriers, high transaction costs and non-transparent procedures hamper new entrants. Malawi generally face high costs of trade, coming from high tariffs and non-tariff barriers, regulatory costs, border challenges as well as high transportation costs.

The gender gaps in the agriculture sector in Malawi are as follows: a) On average, plots managed by women produce 25% less (in terms of gross value of output) per hectare than plots managed by men, b) Women use lower levels of agricultural inputs – including improved seeds, inorganic fertilizer and extension services – on their plots compared with men. This disparity accounts for more than 80% of Malawi's gender gap in agricultural productivity. Differences in the quality of these inputs and the returns they yield drive the remainder of the gap and c) The agricultural labour comprises of 70% of women, but only 32% of the

¹⁰Malawi Enterprise Surveys from World Bank

¹¹Financial Viability of Electricity Sectors in Sub – Saharan Africa (Trimble et al)

land holders are women. To address these gaps, policy interventions aimed at alleviating the gender gap should focus on ensuring equal access to and use of agricultural inputs, and should take into consideration women's child-care responsibilities. The annual gender gap in Malawi is estimated to be \$100 million¹². These estimates can help policy makers understand the scale of the gains that could be made from designing better policies to improve women's ability to use agriculture to lift themselves and their families out of poverty and contribute to economic growth.

The climate of Malawi has been exposed to repetitive risks and shocks in the recent years which have necessitated increasing levels of humanitarian response. The country has experienced floods and prolonged dry spells in most of the areas because of the occurrences of the La Nina and El Nino phenomena. This has also resulted in having unstable and unreliable water balance, especially if population is factored into the climate change paradigm. Therefore, in order to break the cycles of disaster and food security for greater developmental impact, the government has launched the National Resilience Master Plan. The agriculture and food security strategy of the Plan will focus on developing new irrigation schemes, diversifying agricultural production, promoting integration of smallholder farmers into agricultural value chains and promoting small scale agro – processing.

1.3 MAIN GOAL OF THE AGRICULTURAL COMMERCIALIZATION PROJECT

The main goal of the Project is to increase commercialization of selected farm and agribusiness products for domestic and export markets.

1.3.1 AGCOM Project Components

The proposed program would have four components:

1.3.1.1 Building Productive Alliance The objective of this component is to support small-scale¹³, emerging farmers integrate into value chains by improving their capacity to finance and execute productivity-enhancing investments and respond to the requirements of the end-markets and buyers. To do so, it will implement the high impact 'Productive Alliances' (PAs) model. Project support to PAs will be complemented by 'last mile' infrastructure investments in targeted areas.

It will address the following constraints: (a) inefficiencies along value chains due to inadequate integration of actors, information asymmetries, and coordination failures among stakeholders; (b) unreliable access to quality raw material; (c) poor rural access roads to connect producers to markets; and (d) limited access to

¹²The Cost of the Gender Gap in Agricultural Productivity

¹³ Defined by the project as those farmers who cultivate less than 5 ha of land.

finance in agricultural value chains. Addressing these through PAs has the proven potential to increase incomes, productivity and commercial viability, prospects for employment generation, and integration of youth and women.

1.3.1.2 Support Investment Enabling Services The objective of the component is to support business enabling services by addressing some of the systemic gaps and challenges that constrain investment and trade in the agribusiness sector. Unless addressed, these constraints may impede the formation of POs and prevent PAs from operating optimally. These include access to agricultural finance; access to land for commercial agriculture, policy dialogue on agribusiness; and removing some of the barriers to trade for agriculture business such as on standards and certification. The component will address processes in efficient access to finances, land and regulatory and operational business enabling services.

1.3.1.3 Contingent Emergency Response Component

This contingent emergency response component is included under the project in accordance with OP/BP 10.00, paragraphs 12 and 13, for situations of urgent need of assistance. This will allow for rapid reallocation of project proceeds in the event of future natural or man-made disaster or crisis that has caused or is likely to imminently cause a major adverse economic and/or social impact during the life of the project. This component will not have funding allocation initially. In the event of a future emergency, it can be used to draw resources from the unallocated expenditure category and/or allow the government to request the Bank to re-categorize and reallocate financing from other project components to cover emergency response and recovery costs, if approved by the Bank.

1.3.1.4 Project Coordination and Management

This component will finance activities of the Project Implementation Unit (PIU). The PIU will oversee the implementation of project activities, ensure sound fiduciary management in the project (both procurement and financial management), carry out monitoring and evaluation (M&E), ensure social and environmental safeguards compliance, and engage in communication and reporting. A main responsibility of the PIU will be to comply with the World Bank's fiduciary reporting requirements. This includes submitting a project implementation progress report on a semi-annual basis. In addition, the PIU would be responsible for implementing the calls for proposals and administrating the grants component under Component 1.1 and 1.2. Additional support will be provided under this component to support any relevant research and analysis¹⁴ that can inform implementation of the project, as well as provide an opportunity for learning and informing future operations. An example would be some [SME diagnostic](#).

¹⁴ Research and analysis will look at reviewing the value chains context, analyzing emerging opportunities/constraints for SME, drawing lessons from various experiences, analyzing market opportunities etc. Such evidence based analysis will inform current work, as well as future project operations.

1.4 PROJECT IMPLEMENTING AGENCY

Project Implementation will be led by the Ministry of Agriculture, Irrigation and Water Development (MoAIWD) since agriculture will be the major practice area for the project. Furthermore, implementation will be done in collaboration with the Ministry of Industry, Trade and Tourism (MoITT) and Ministry of Lands, Housing and Urban Development (MoLHUD).

A Project Steering Committee (PSC) will be established to provide overall guidance and will include the Ministries of Agriculture, Irrigation and Water Development (MoAIWD), Industry, Trade and Tourism (MoITT), and Lands, Housing and Urban Development (MoLHUD). Private sector representatives (producer organizations and investors) will also be part of the PSC.

Given the multi-sectoral nature of the Project, a Project Implementation Unit (PIU) will be established to handle day to day activities of the Project.

The lead Ministry's contact address is The Ministry of Agriculture, Irrigation and Water Development. Capital Hill Government Offices, P O Box 30134, Lilongwe 3, Malawi

1.5 PROJECT COST ESTIMATES

The total project cost is approximately US\$95 million. The project financing plan is as provided in Table 1.1.

Table 1.1 AGCOM Components

Project Components	Project Cost	IBRD or IDA Financing	Trust Funds	Counterpart Funding
1 Building Productive Alliance	65.00	65.00	0.00	0.00
1.1 Horizontal Alliances (PO Formation)	15.00	15.00	0.00	0.00
1.2 Productive Alliances	32.00	32.00	0.00	0.00
1.3 Last Mile Infrastructure for Productive Alliances	18.00	18.00	0.00	0.00
2 Support Investment Enabling Services	18.00	18.00	0.00	0.00
2.1 Access to Agricultural Financing	7.00	7.00	0.00	0.00
2.2 Access to Land for Commercial Agriculture	6.00	6.00	0.00	0.00
2.3 Support for business enabling services	5.00	5.00	0.00	0.00
3 Contingent Emergency Response Component (CERC)	0.00	0.00	0.00	0.00
4 Project Coordination and Management	9.00	9.00	0.00	0.00
Total Costs				
Total project Costs	92.00	92.00	0.00	0.00
Physical Contingencies	1.20	1.20	0.00	0.00
Price Contingencies	1.80	1.80	0.00	0.00
Front End Fees	0.00	0.00	0.00	0.00
Total Financing Required	95.00	95.00	0.00	0.00

1.6 INTEGRATED PEST MANAGEMENT

Definitions have been fronted over the years to describe Integrated Pest Management (IPM). Food and Agricultural Organisation (FAO) defined IPM as the careful condition of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions t levels that are economically justified and reduce or minimize risks to human and animal health and/or the environment (FAO, 2014).

Key elements of an IPM program are:

- (i) Use of available, suitable, and compatible methods which includes resistant varieties/species, cultural methods (planting time, intercropping and crop rotation); biological control, safe pesticides etc to maintain pests below levels that cause economic damage and loss;
- (ii) Conservation of the ecosystem to enhance and support natural enemies and pollinators;
- (iii) Integrating the pest management strategies in the farming system; and
- (iv) Pests crop and livestock loss assessments

The following are key preconditions for an IPM approach:

- (a) Understanding of the ecological relationships within a farming system (crop, livestock, plant, pests organisms and factors influencing their development);
- (b) Understanding of economic factors within a production system (infestation: loss ratio, market potential and product prices);
- (c) Understanding of socio-cultural decision-making behaviour of the farmers (traditional preferences, risk behaviour);
- (d) Involvement of the farmers in the analysis of the pest problems and their management; and
- (e) Successive creation of a legislative and agricultural policy framework conducive to a sustainable IPM strategy (plant and animal quarantine legislation, pesticides legislation, pesticide registration, price policy)

1.7 JUSTIFICATION OF THE INTEGRATED PEST MANAGEMENT PLAN

It is anticipated that during the implementation of AGCOM activities, use of pesticides and agrochemicals will increase to improve productivity, therefore an integrated pest management (IPM) that is centred on farmer needs and is sustainable, appropriate, environmentally safe and economic to use is needed. The requirement for adoption of IPM in farming systems is emphasized in the World Bank operational policy, WB OP 4.09, which supports safe, effective, and

environmentally sound pest management aspects, such as the use of biological and environmental friendly control methods.

1.8 METHODOLOGY FOR PREPARATION OF THE IPMP

1.8.1 Consultations and Literature Review

The IPMP was prepared by a number of experts from Department of Crop Development, Department of Agricultural Research, Pesticide Control Board, Land Resources Conservation Department, Environmental Affairs Department, Ministry of Trade and Tourism and Department of Animal Health and Livestock Development. Appendix 1 gives details of the experts.

Consultations with various communities in selected districts were conducted. Key informant and lead farmer interview questionnaires were specifically developed as data collection tools to gather the relevant primary data required for developing the IPMP. Structured, semi-structured and open-ended interviews with farmers' organizations, /farmers clubs and agrochemical companies were also conducted. Appendix 2 provides a list of people and institutions consulted for the AGCOM Project.

Literature review was undertaken to identify priority concerns on pests/diseases, the legislation; and use of pesticides as well as IPM initiatives currently being undertaken or envisaged. Various project, legislative, and policy documents, including the following were reviewed:

- a) The World Bank Safeguard Policy on Pest Management, O.P. 4.09;
- b) Environment Management Act of 1996;
- c) FAO International code of Conduct on the Distribution and Use of Pesticides, 2002;
- d) FAO International code of Conduct on the Pesticide Management, 2014
- e) Integrated Pest Management Framework for Kenya Agricultural Productivity and Agribusiness Project (IPMF-KAPAP), 2009; and Livestock Development and Animal Health Project - Pest Management Plan (Volume III); and
- f) Bulletin of the World Health Organization, 66 (5): 545-551 (1988)
- g) OIE Terrestrial Animal Health Code 2016.
- h) DAHLD Annual Report 2014.

1.9 FORMAT OF THE INTEGRATED PEST MANAGEMENT PLAN

Chapter 1 provides a brief background of the project, highlighting the agricultural sector context and the Agricultural Commercialization Project (AGCOM). The Chapter narrates the three key components of the project namely support for agricultural productivity; strengthen market linkages and value addition; and

support investment enabling services. The Chapter also provides details of the project implementing agency, proposed project cost estimates and key elements of an IPM program and objectives as well as justification for preparing the IPMP are provided in this chapter.

Chapter 2 gives an insight of the pest management practices in Malawi. Problems and challenges of chemical pesticides are also presented in this Chapter.

Chapter 3 narrates the non-chemical plant protection approaches of biological control agents, cultural and crop management practices, mechanical control methods, physical control methods and legislative measures. The Chapter narrates how some of these controls are used in Malawi.

Chapter 4 presents the international and national legislation and policies for pesticides management. It also presents regulations for pesticides storage, distribution and disposal.

Chapter 5 highlights the key steps and elements of an Integrated Pest Management Plan. Key elements, among others, include good housekeeping, maintenance and pest control. The Chapter also emphasizes the establishment of a regular system of IPM inspections.

Chapter 6 presents impacts of pest management practices, which are broadly classified as chemical and non-chemical. The non-chemical practices are further grouped into biological, manual and mechanical. Positive and negative impacts, as well as their enhancement/mitigation measures are presented in this Chapter. The Chapter also presents common maize pest problems and the recommended IPM practices to deal with these problems. Principles of selecting pesticides and pesticides to be accepted for the AGCOM are described in this Chapter.

Chapter 7 focuses on the Integrated Pest Management and Monitoring Plan, providing the responsible persons or institutions to implement the mitigation measures and monitoring activities.

Chapter 8 presents an overview of the capacity needs, and the necessary training, in order to yield a successful implementation of the IPMP;

Finally, Chapter 9 gives the conclusions and recommendations.

CHAPTER TWO: CURRENT PEST MANAGEMENT PRACTICES IN MALAWI

2.1 AGRICULTURE AND PEST MANAGEMENT IN MALAWI

Production of both crops and livestock in Malawi is limited by a number of factors, which include aspects of weather, low soil fertility, poor agronomic practices and the incidence of insect pests and diseases. Outbreaks of insect pests and diseases in Malawi are currently on the increase as they are known to cause crop losses of up to 30% (Coffman *et al*, 1992).

Malawi, like most of the countries that depend on agriculture, uses considerable amounts of pesticides as one way of combating pest problems. Pesticides used in Malawi include insecticides, fungicides, herbicides, nematicides, Acaricides and rodenticides. Other products such as growth regulators, repellents, molluscicides and parasiticides are also used. In addition, some botanicals have been released.

In Malawi there exists some indigenous knowledge in plant protection. Some farmers have reported that they practice the use of botanical plants to control some insect pests and diseases. For example, leaves from the fish bean plant, *Tephrosia vogelli* have been used to control a number of pests in maize and beans. The neem leaves are used to prevent maize from weevils and dewormer for livestock. Some farmers use Aloe vera leaves as a remedy for some diseases.

Stemming from this knowledge, Malawian entomologists initiated various trials on using botanicals to control insect pests. A concoction of ash-50g; nicotine-50g; and 1/4bar soap-25g has been recommended for the control of red spider mite (*Tetranychus evance*) on tomatoes. The use of neem (*Azadirachta indica* A. juss), Fish beans (*Tephrosia vogelli* Hook F.), M'pungabwi (Sweet basil) have given promising results on the control of diamondback moth (*Plutella xylostella* (L) on crusiferus. *Azadirachta indica* A. juss is also used to control root knot nematodes *Meloidogyne* species on bananas.

Table 2.1 shows botanicals that are being used for the control of various pests.

Table 2.1: Botanicals being tested for the control of various pests

Scientific Name	Local Name	Pest on which it is used
<i>Combretum ternifolium</i>	Kadale	Storage pests
<i>Elephantorrhiza goetzei</i>	Chiteta	Storage pests
<i>Cassia spp.</i>	Muwawani	Storage pests
<i>Mucuna spp.</i>	Dema	Storage pests
<i>Tephrosia vogelli</i>	Wombwe	Storage pests / cabbage pests
Neem	Nimu	Storage pests / vegetable pest

<i>Lasiosiphon kraussianus</i>	Katupe	Storage pests
-	Katswatswata	Storage pests
-	Kangaluche	Storage pests
<i>Dicoma spp.</i>	Somphole	Storage pests

Other non-pesticide control methods being used in Malawi are mostly biological control. Examples include:

- (a) *Apoanagyrus lopezzi* on cassava mealy bug;
- (b) *Teretrius nigrescens* on Larger Grain Borer (*Prostephanus truncates* (Horn));
- (c) *Cofesia flaripe* on cereal stem borer (*Chilo partellus*);
- (d) *Cales noack* on citrus woolly whitefly (*Aleurothixus floccosus*); and
- (e) *Tiphlosromolus aripo* on cassava green mite (*Monorychelus tanajoa*)

The major crops grown in Malawi, for which pesticides are used, include tobacco, sugarcane, coffee, maize, cotton and tea. Pesticides are used for these crops to prevent and control various pests and diseases that attack them. Table 2.2 illustrates the estimated use of pesticides in Malawi by crop.

Table 2.2 Pesticides use in Malawi for the Major Crops

CROP	USAGE IN 2017 (According to Pesticides Control Board)	CURRENT USAGE
Tobacco	40-50%	Mostly uses pesticides
Tea	5%	Second position
Sugarcane	10-15%	Third Position
Coffee	15-20%	Fourth Position
Cotton	10%	Fifth Position
Maize	8%	Least used

Malawi does not manufacture pesticides. This means that all pesticides used in the country are imported. There are some chemical companies that import pesticides into the country and in turn supply them to various stakeholders for both crops and livestock production. The most commonly used products are insecticides, followed by herbicides, fungicides and rodenticides. Herbicides are mostly used in sugar plantations, whereas fumigants are mostly dominant in the tobacco industries. Insecticides are mostly used in field crops, particularly maize.

The major importers of pesticides in Malawi are:

- (a) Farmers Organizations Limited;
- (b) Chemicals World;
- (c) Export Trading Group
- (d) Osho Chemicals

- (e) Agricultural Trading Company (A.T.C); and
- (f) Fordhan Limited.

2.2 PESTICIDE MANAGEMENT TECHNIQUES APPLIED IN SOME DISTRICTS

During consultations, pest management approaches and techniques in table (Table 2.3) were identified as being used. These approaches and techniques if properly coordinated and managed, would positively contribute to the implementation of IPM.

Table 2.3: Pesticides Management Application Techniques used in Malawi

Approach	Management techniques	Source of Information	Challenges	Recommendations
Cultural	<p>Selection of early maturing plants are used;</p> <ul style="list-style-type: none"> • Weeding and • Good crop storage (cement storage units are encouraged) • Intercropping • Closed seasons • Crop rotation • Mulching • Ploughing • Field sanitation • Recommended crop spacing • Timely harvesting 	All ASWAp and APPSA districts	<ul style="list-style-type: none"> • A detailed oriented and meticulous process, which is not common sense information to all rural farmers. • An approach, which if practiced for a protracted period, can psychologically condition rural farmers' agricultural practices. Once rural farmers are accustomed to such practices, it is a formidable challenge to introduce new tested and proven farming techniques. 	<ul style="list-style-type: none"> • Train Local farmers through example. • Supply farmers with simple but inexpensive equipment such as meteorological charts and rain gauges to facilitate forecasting.
Mechanical		All ASWAp	<ul style="list-style-type: none"> • Expensive. 	Where applicable, the

	<ul style="list-style-type: none"> • Hand-picking and crushing of pests • Netting • Bagging of fruits • Traps 	and APPSA districts	<ul style="list-style-type: none"> • Limited target of intervention (soil). 	technique may still be used prior to use of chemicals.
Biological	Use of living organisms to control pests through predation such as parasitoids, predators, pathogens	All ASWAp and APPSA districts	<ul style="list-style-type: none"> • Pest specific. • Process takes a long time. • System requires expansive technical know-how. May be too complicated and expensive for most rural farmers. • Difficult to measure results with certainty. 	<ul style="list-style-type: none"> • Train rural farmers on the general principles of biological control methods, and how to best maximize the benefit of biological methods of pest control when applied in the farmers' respective areas.
Botanical	Use of plant extracts to spray pests e.g. neem, mucuna, tephrosia vogelli, etc.	Pesticide Control Board (PCB)	<ul style="list-style-type: none"> • Cumbersome process. 	<ul style="list-style-type: none"> • Train farmers on easier methods of obtaining extracts, such as boiling (where appropriate)
Chemical / Mechanical Composite	Pheromone traps	Bvumbwe Research Station	<ul style="list-style-type: none"> • Expensive 	<ul style="list-style-type: none"> • Train farmers on methods of maximizing the potential of the process wherever the system is employed
Genetic	Use of pests and diseases resistant crop varieties	Bvumbwe Research Station	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •

	and breeds of livestock			
Legislative or regulatory	Such as quarantine	PCB		

2.3 CHEMICAL PESTICIDE CHALLENGES IN MALAWI AND RECOMMENDATIONS

During consultations it was revealed that there is a disparity between the challenges as perceived by farmers and those expressed by officials from agricultural sector. Some of the general challenges are that Malawi does not manufacture pesticides and in addition, Malawi does not have ultimate pesticides disposal facilities (such as pesticide incinerators). Other observed challenges with their associated recommendations, are summarised as follows:

2.3.1 Use of Unregulated Pesticides

Malawi shares borders with Zambia, Mozambique and Tanzania and this geographical proximity to these countries facilitates both trade and accessibility to unregulated and illegal chemical pesticides especially for the districts close to these bordering countries. Negative effects of the prevalent supply of unscreened chemicals include:

- A threat of the introduction of highly toxic substances into the environment, putting human beings, plant and animals at risk.
- Development of pest resistance and economic loss on the part of the farmers for using substandard chemicals.
- Incessant expansion of Malawi government's regulatory duties and responsibilities; stretching its finances and resources too thin and seriously diluting its role and capacity of chemical pesticide regulation; and rendering it ineffective.

Recommendation(s):

- i. Enhance capacity of regulatory institutions to facilitate thorough monitoring of unregulated pesticides, in relation to the demands due to the AGCOM.
- ii. Educate/sensitise farmers on basic relationship between pesticides toxicity, exposure and hazard.
- iii. Team up, delegate and collaborate with neighbouring countries and share responsibilities to curb sale of illegal pesticides.

2.3.2 ADDs Limited Role:

The ADDs have limited involvement in the assessment and regulation of pesticides. ADDs can check, report, but not impound any illegally used pesticides. With limited resources as discussed above, government does not have the capacity to fully regulate pesticides use in Malawi and therefore involvement of ADDs would complement government's efforts.

Recommendation(s):

- i. Set up a team that consists of ADDs management staff and the government's pesticides inspection team so that inspections are jointly conducted; permitting instantaneous discovery of illicit pesticides, followed by immediate impounding and appropriate legal action;
- ii. Institute illegal pesticides impounding capacity to ADD.

2.3.3 Use of expired pesticides:

During consultations, there were reports of indiscriminate use of expired chemical pesticides by farmers; a problem emanating from shared negligence between the farmers and chemical pesticide marketers. Both parties contribute to the situation partly due to ignorance. Unlicensed chemical pesticide marketers also contribute to the proliferation of expired chemicals.

Recommendation:

- i. Train farmers in:
 - a) Disadvantages of using expired pesticides, which includes compromised pesticides effectiveness;
 - b) Identifying expired pesticide;
 - c) Acquiring pesticide quantities that are likely to be needed to avoid the potential for creating obsolete stock; and
 - d) The general environmental risks associated with the use of expired chemical pesticides.
- ii. Use visual aids to communicate the negative implications of the application of chemical pesticides (e.g. show videos and documentaries to farmers, on dire consequences of use of unapproved and expired pesticides.
- iii. Government must establish reliable systems to screen and monitor registration and business operations of pesticide marketers.

2.3.4 Lack of appropriate skills:

Implementation of an effective pest management plan requires an interdisciplinary approach, due to the breadth and depth of the subject. Junior officers usually lack appropriate training in pesticides management.

Recommendation:

- i. Initiate or improve trainer, training programs.

2.3.5 Inadequate protective gear.

A combination of ignorance of the potential risks associated with chemical pesticides, with the lack of sufficient funding, imposes formidable strains on the safety methods of chemical pesticide application.

Recommendation:

- i. Adopt a “safety is the number one priority” approach in IPM.
- ii. “Safety packages” to be made available to farmers of AGCOM Project. Packages must include the minimum requirements for safe pesticide application (e.g. gloves and goggles, mouth mask).
- iii. Sensitize farmers on the dangers of handling chemical pesticides and equipment without sufficient and appropriate protective gear.
- iv. Encourage farmers to engage trained operators to reduce the risk of exposure to pesticides.

2.3.6 Out-dated Crop Policy, Plant Protection Act, Livestock Policy and Animal Disease Act

An outdated crop production policy (1987) and a plant protection act (1969) are a deterrent to the adoption of progressive and contemporary agricultural methods. The policy aims at ensuring quality in crop production and that there is no risk of pesticides contamination as a result of any use of chemicals. The policy also mentions the need to ensure careful use of pesticides for tobacco, ground nuts, cotton, irish potato, and vegetables. The crop production policy does not include information on the current trends in the agriculture sector such as changes in agricultural methods, introduction of new pesticides, and regulation on the use of the pesticides. In addition, the plant protection act would also negatively impact on the implementation of an IPMP because of low penalty fees stipulated in the Act. Penalty fees in the Crop Protection Act are not adjusted to reflect inflation and therefore are not a meaningful deterrent. This encourages non-compliance by farmers, since the punitive effects are inconsequential.

In response to the challenges currently being faced, the Pesticides Control Board and the Government, particularly the Ministry of Agriculture and Food Security,

are making diligent efforts to update the Pesticides Act (2000), to reflect the current position in relation to use and management of pesticides. The Registrar has consulted farming communities for necessary information to be included in the updated version of the Act.

The registrar alluded to the general challenges facing both the implementation of the Pesticides Act and IPMP. These include:

- Lack of capacity (urgent need to scale up)
- Lack of infrastructure (need for lab facilities and equipment for the PCB to conduct independent testing to confirm presence of unregulated pesticides)

Recommendation:

Review and update Malawi's crop policy and adjust penalty fees appropriately.

2.3.7 Farmer's Attitude.

Consultations revealed a misinformed approach amongst farmers, where chemical remedies for pests are sought in the first instance.

Recommendation:

- Use visual aids in communicating the negative implications of overdependence on chemical pesticides.
- Advocate for IPM.

CHAPTER THREE: NON-CHEMICAL PLANT AND LIVESTOCK PROTECTION METHODS AND INTEGRATED PEST MANAGEMENT

3.1 NON- CHEMICAL PLANT PROTECTION

Some of the main features of Integrated Pest Management (IPM) involve the use of non-chemical methods of pest control which include the following:

3.1.1 Biological Control Agents

Biological control means use of living organisms to suppress pest populations and damage. These living organisms can be parasitoids, predators or pathogens. Environmentally friendly chemical interventions such as the use of semiochemicals (e.g. pheromones and parapheromones), biopesticides and relatively less toxic insecticides can be used together with biological control agents.

3.1.2 Cultural Control Practices

Cultural control means use of usual crop production practices to suppress pest population and damage in the field. These practices include ploughing to expose and kill soil pests, using pest and disease free seed, planting in time, intercropping, timely weeding, mulching, field sanitation and harvesting in time to minimise exposure of the crop to pests and practicing crop rotation.

3.1.3 Mechanical control methods

Mechanical control means using manual devices to suppress pest population and damage. This involves hand picking, netting and bagging of fruits and use of traps.

3.1.4 Physical control methods

Physical control means killing pests or suppressing their population by modifying physical factors of their environment to their detriment. This involves techniques such as irradiation, heat treatment, cold treatment, ultrasonic vibrations and drying.

3.1.5 Legislative measures

This involves setting up and effecting acts and regulations which help in pest management. Examples are quarantine services, seed certification, produce inspection, etc.

3.1.6 Genetic control measures

They involve production and use of crop varieties or animal breeds which are resistant to pests and/or diseases. These include insect and disease resistant varieties/breeds and rootstock.

3.2 INTEGRATED PEST MANAGEMENT AND ITS ADVANTAGES

Integrated Pest Management (IPM) fundamentally differs from the traditional pest control programs in that IPM emphasizes the growth of a healthy crop with the least possible disruption to agro – ecosystems and encourages natural pest control mechanisms (FAO, 2014) while conventional pest management basically relies on chemical pesticides only.

The advantages of IPM are:

- Environmentally friendly
- Reduces human health risks (exposure to chemical pesticides)
- Relatively cheaper
- IPM is more effective in controlling pests over long periods.

IPM requires wider knowledge unlike traditional programs. Managing pests with less pesticide requires a strong working knowledge of pest biology and behaviour, current pest control technologies and practices, climate and its effects on pest proliferation, greenhouse and storage structural characteristics and staff behaviour. Without this knowledge, it will be difficult, if not impossible, to prevent infestations.

Investing in IPM programs may initially cost more than traditional methods but for the long-term; IPM is analogous to preventive health maintenance. IPM is more cost-effective in terms of time, personnel and materials to prevent pest problems than the practice of remediating the same problem again and again.

CHAPTER FOUR: INTERNATIONAL AND NATIONAL PESTICIDES LEGISLATION AND REGISTRATION

4.1 INTERNATIONAL LEGISLATION AND POLICIES

4.1.1 World Bank Operational Policy on Pest Management, OP 4.09 (1998)

The Bank uses various means to assess pest management in a country and support integrated pest management (IPM) and the safe use of agricultural pesticides. It also supports economic and sector work, sectoral or project-specific environmental assessments, participatory IPM assessments, and adjustment or investment projects and components aimed specifically at supporting the adoption and use of IPM.

In Bank-financed agriculture operations, the Bank advocates pest populations reduction through IPM approaches such as biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest.

According to the Bank, rural development and health sector projects have to avoid using harmful pesticides. A preferred solution is to use Integrated Pest Management (IPM) techniques and encourage their use in the sectors concerned.

If pesticides have to be used in crop protection or in the fight against vector-borne diseases, the Bank-funded projects should include a Pest Management Plan (PMP), prepared by the borrower, either as a stand-alone document or as part of an Environmental Assessment.

The procurement of any pesticides in a Bank-financed project is contingent on an assessment of the nature and degree of associated risks, taking into account the proposed use and the intended users. With respect to the classification of pesticides and their specific formulations, the Bank refers to the World Health Organization's Recommended Classification of Pesticides by Hazard and Guidelines to Classification (WHO 2009). The following criteria apply to the selection and use of pesticides in Bank-financed projects:

- (a) They must have negligible adverse human health effects;
- (b) They must be shown to be effective against the target species;
- (c) They must have minimal effect on non-target species and the natural environment;
- (d) The methods, timing, and frequency of pesticide application must aim to minimize damage to natural enemies; and
- (e) Their use must take into account the need to prevent the development of resistance in pests.

At a minimum, pesticide production, use and management should comply with FAO's Guidelines for:

- i. Packaging and storage;
- ii. Good labelling practice; and
- iii. Disposal of waste pesticide containers on the farm.

The Bank does not finance formulated products that fall in WHO classes Ia (extremely hazardous) and Ib (highly hazardous); or formulations of products in Class II (Moderately hazardous), if (a) the country lacks restrictions on their distribution and use; or (b) they are likely to be used by; or are accessible to lay personnel, farmers, or others without training, equipment, and facilities to handle, store, and apply these products properly.

The proposed project will trigger OP 4.09, since it will support post-harvest pest control, to minimise post-harvest pest damage from eroding crop productivity gained through the program's improved technology adoption by farmers. Demonstrations may require pesticides based on the IPM approach but it should be noted that APPSA will not procure pesticides to be supplied to farmers. However, during implementation, particularly demonstrations, maximum caution should be taken into consideration to ensure that local capacity exists to adequately manage their post-harvest environmental and social impacts from use of pesticides, in compliance with OP 4.09 as described above.

4.1.2 International Plant Protection Convention of FAO (1952)

The International Plant Protection Convention (IPPC) is an international treaty to secure action to prevent the spread and introduction of pests of plants and plant products, and to promote appropriate measures for their control. It is governed by the Commission on Phytosanitary Measures (CPM) which adopts International Standards for Phytosanitary Measures (ISPMs).

4.1.3 World Food Security and the Plan of Action of November 1996

This declaration seeks to secure effective prevention and progressive control of plant and animal pests and diseases, especially those which are of trans-boundary nature, such as rinderpest, cattle tick, foot-and-mouth disease and desert locust, where outbreaks can cause major food shortages, destabilize markets and trigger trade measures. It promotes regional collaboration in plant pests and animal disease control; and widespread development and use of integrated pest management practices.

4.1.4 OIE World Animal Health Organization

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4.2 NATIONAL LEGISLATION AND POLICIES

Although the amount of pesticides used in Malawi is generally low, as compared with other countries, there has been considerable abuse of these toxic substances. In the absence of a regulatory body, pesticides were just imported by some organizations, as deemed necessary. As a result, there were more pesticides than actually required. This resulted in the build-up of pesticides products that became obsolete.

The Ministry of Agriculture, Irrigation and Water Development conducted a survey in 1996/97 and subsequently in 1999/2000 crop seasons to take stock of pesticides. The survey revealed that some 127 tonnes and 112 tonnes of pesticides, for the two periods respectively, were of obsolete stocks.

4.2.1 The Pesticides Act, 2000

Upon realisation of the importance of having a regulatory body on the management of pesticides, the Pesticides Act, 2000 for Malawi was approved by Parliament. This Act enables Malawi to have control on the import, export, manufacture, distribution, storage, disposal and use of pesticides.

The establishment of the Pesticides Control Board (PCB) was accomplished and the office of the registrar is now in place. The Pesticides Regulations were gazetted on 22 February 2002, and this resulted in the enforcement of the law on 1 May 2002, with a grace period of 2 years; and its launch took place on 21 November 2002.

The enforcement of the law facilitates the following outputs/results:

- (a) Registration of all marketed pesticides in Malawi;
- (b) Registration of all pesticides according to the crops and the target pests and diseases;
- (c) Documentation of all import permits, export permits, pest control operators and licenses for selling and storage of pesticides;
- (d) Conducting stakeholders' workshops to create awareness to the general public on the Pesticides Act;
- (e) Encouragement on safe usage of pesticides;
- (f) Carrying out quality control in collaboration with the Malawi Bureau of Standards;
- (g) Harmonization of pesticides registration through international bodies such as SADC;
- (h) Labelling of pesticides containers according to international standards; and
- (i) Carrying out proper disposal of obsolete pesticides stock.

The general goal of having the PCB is that all pesticides used in Malawi should be registered and that all importers and dealers should be licensed. The benefits from this are:

1. Only safe and effective pesticides will be marketed;
2. There will be less risk for farmers, consumers and the environment;
3. There will be higher export opportunities for agricultural products.

4.2.2 Regulation of Pesticides Storage, Distribution and Disposal

The office of the Registrar is mandated to ensure that all registered and licensed pesticide dealers conform to the regulations for safe handling of the pesticides. Pesticides dealers should follow the “safety” guidelines on transportation, distribution, application, storage and disposal of pesticides.

The PCB must ensure that all stakeholders observe safe handling of pesticides. The Registrar is mandated to make frequent checks in all premises where pesticides are stored to ensure safety. The Registrar is also mandated to take stock of obsolete pesticides in all premises.

The PCB will advise the Malawi Government on how to dispose of obsolete stock. This will involve collecting obsolete stocks from all premises and arranging for disposal.

4.2.3 Control and Diseases of Animals Act (Cap 66:02)

The Control and Diseases of Animals Act is the main Act regulating animal health matters in Malawi. Its main purpose is to protect the national herd and the general public from transmissible disease considered to have (i) have potential for serious spread, (ii) socio-economic and /or public health importance and (iii) major importance in international trade of animals and animal products. Although the bulk of the provisions this Act remains valid law to-date there is a need to update it to reflect the demands of the recent 1994 Republic of Malawi Constitution and to conform with new societal expectations under the decentralised institutional arrangements and more importantly to be compliant with the current international standards and regulations.

The process of reviewing and amending this Act was initiated with some sections being amended, however not yet to be completed.

4.2.4 Meat and Meat Products Act (Cap 67:02)

This Act is responsible for the regulation of quality control and marketing of meat and meat products i.e it ensures that meat and meat products on the market are wholesome and fit for consumption by the general public. Most importantly, it

protects the general public from zoonotic and food borne diseases of animal origin.

This Act also requires reviewing in line with the prevailing public health situation and this process was already initiated by the Department of Animal Health and Livestock Development and is yet to be finalised.

4.2.5 Milk and Milk Products Act (Cap 67:05)

The purpose of this Act is to ensure that milk and milk products on the market are wholesome and fit for human consumption. In essence it is to protect the general public from known Zoonotic diseases transmitted through milk and milk products.

Just like meat and meat products Act, this act has recently been reviewed in line with prevailing public health situation, the market structure and diversity of stakeholders in the dairy industry. The new bill is yet to be presented to the cabinet committee on legal affairs.

4.2.6 Protection of Animals Act (Cap 66:01)

The Protection of Animals Act Cap 66:01 is intended to protect the “welfare” of domestic and tame animals which are kept for use by man. The purpose is to protect animals against unnecessary pain and suffering. It provides for the prevention of cruelty against animals and prescribes punishment against offenders.

In reality this Act has not been ably enforced, mostly probably due to lack of civic education on animal welfare.

There is a need to review this Act in line with the prevailing views and sensitivity of animal welfare issues globally.

4.2.7 Hide and Skin Trade Act (Cap 50:02)

This Act is to provide for the regulation of the trade in hides and skins. The provisions of this Act relate to dealing in hides and skins and to licences authorising such dealing extending to designated areas and such classes of hides and skins.

This is very important Act which also requires reviewing so as to include acceptable current standards and also improve on enforcement of imports and exports

4.2.8 Veterinary and Para-veterinary Practitioners Act 2001 (Cap 53:04)

This Act has just been reviewed to address notable shortcomings in the old act ('the Veterinary Surgeons Act') and was enacted into law recently in 2001. The main purpose of this Act is to regulate the veterinary profession in the country.

CHAPTER FIVE: STEPS IN SETTING UP INTEGRATED PEST MANAGEMENT

5.1 IDENTIFY THE IMPLEMENTATION TEAM

Transition to an IPM program requires a diverse, action-oriented IPM Committee. This IPM Committee will be an environmentally conscious Committee and will be part of the District Development Committee lead by the District Agricultural Development Officer (DADO) as a member of the District Development Committee (DDC). A representative of the Farming Group will be a member of this Committee. The leader of this team should be familiar with pests, pesticides and pesticide regulations. This arrangement is appropriate, because implementation of an IPM program can be tracked as a performance indicator.

IPM leadership is guided by pest management principles and environmental issues. Leadership with such academic background and experience qualifies to serve as an authority to supervise IPM implementation. Other team members include Environmental District Officer (EDO), agronomists, crop protection experts (entomologists, pathologists) and District Health Officer (DHO).

5.2 DECIDE ON THE SCALE OF IMPLEMENTATION

To determine the scale of implementation, a strategic approach will be taken. IPM will be clearly defined and discussed by the DDC as is done for all other development projects. A representative of the EMC of the AGCOM must attend these meetings to help explain the IPM approach and give examples of similar documented success studies. Through these discussions comprehension will be achieved, and potential objections will be addressed with successful practical examples.

5.3 REVIEW AND SET MEASURABLE OBJECTIVES FOR THE IPMP

The IPM Committee will set measurable objectives and refine the IPM indicators to be relevant to their district; and determining factors such as:

- When the IPM program will start
- How much it will cost
- What will be accomplished by choosing IPM
- How success shall be monitored

The determination above must be done prior to IPM implementation. Additionally, measurable goals will be set, to track:

- Pest management costs;

- Monitoring of pest activity before and after implementation of the IPM program;
- Number of calls related to pest problems and toxic chemical use reduction.

Furthermore, the time when the shift to IPM will occur must be discussed and agreed upon prior to implementation. The initial step will be to establish an implementation timeline that includes time to execute all of the steps outlined in the implementation plan. It is imperative to include time to organize the administration of the IPM and conduct any farmer training as well as manage the IPM process.

The IPM Committee will gather information on previously implemented or currently being implemented IPM programs; the time it took to develop them and how successful they have been. They will obtain the budgetary and any technical information for the previously implemented IPM programs and analyse the elements to establish lessons to learn. Field visits to currently running programmes will be conducted to get a practical insight.

Reduced pesticide use is the substantive yardstick in measuring an IPM's ability to create a safer environment. Baseline study will be conducted and therefore an information database that includes annual quantities of pesticides used will be designed to enable comparative analysis to the previous years. The goal will be a downward trend over time or ideally, a specific reduction amount, ultimately leading to a scant usage of highly toxic pest control chemicals.

5.4 ANALYSE CURRENT HOUSEKEEPING, MAINTENANCE AND PEST CONTROL PRACTICES

While preparing to make a transition to IPM, the IPM Committee will familiarize itself with the organization's current policies and practices with respect to structural maintenance, sanitation and pest control. Occasionally, current practice may be consistent with IPM principles. Familiarization will provide the flexibility necessary to adapt to, and prepare for the necessary changes.

Structural maintenance is arguably the most efficient way to keep pests out of a facility because it physically stops pests from entering wherever possible. Structural maintenance will therefore be a regular part of the IPM. Cracks, crevices or other unnecessary openings in the building exterior that can be used by pests as harbourage areas or entry points regardless of size, will be sealed appropriately.

Sanitation deprives pests of food and water. A sanitation plan must therefore be accounted for in the development of an IPM. Staff must be provided with special sanitation training

5.5 ESTABLISH A SYSTEM OF REGULAR IPM INSPECTIONS

IPM's central focus is regular facility inspections. Such inspections are the "lifeblood" for a continuous cycle of IPM activities that may or may not include chemical treatments. Activities will include:

- a) Routine Inspections
- b) Pest Identification
- c) Selection of Control Methods
- d) Monitoring and Evaluation

IPM inspections must emphasize on the four "zones" of pest activity:

- (1) Entry points
- (2) Water sources
- (3) Food sources
- (4) Harbourage areas.

During inspections, all existing pest issues and potential problem areas, inside and outside, must be noted for follow-up.

For in-house IPM programs, the greatest inspection challenge will be establishing routine, proactive surveillance by trained specialists. To ensure this is done, the EMC or an independent consultant will conduct inspections and audits twice a year.

5.6 DEFINE THE TREATMENT POLICY SELECTION

A clear written policy on how the facility will respond to pests when they appear must be developed. Included in the policy will be definitions of both non-chemical and chemical treatment options and the sequence or prioritization in which they will be considered. It should be unequivocal on when and where chemical treatments are appropriate. Finally, it should include an "approved materials" list to ensure informed choices when chemical treatments are applied.

The key to an effective IPM is to correctly identify pests that have invaded the area before. Due to pest behaviour variations from one species to the other, the appropriate response will vary accordingly.

Once the pest is identified and the source of activity is pinpointed, the treatment policy will call for habitat modifications such as exclusion, repair or better sanitation. These counter measures can drastically minimize pest presence before chemical responses are considered. Additional treatment options—chemical and nonchemical—can then be tailored to the biology and behaviour of the target pest.

The final step in the pest response cycle is Monitoring. The information gained through on-going monitoring of the problem will facilitate determination of supplemental treatment options if required.

5.7 ESTABLISH COMMUNICATION PROTOCOLS

Communication protocols must be developed to assist environmental services, facility maintenance, facility management and service providers. IPM is a cooperative effort and therefore effective communication between various parties is essential for success. IPM Committee and farmers must document pest sightings. The IPM Committee will make recommendations and notify AGCOM of pesticide treatments. They will also communicate with the maintenance team to make the necessary repairs.

5.8 DEVELOP FARMER TRAINING PLANS AND POLICIES

The Farmer Groups will serve as a pool of “inspectors” charged with reporting pest sightings to expedite response times and help limit the scope of new infestations. Training sessions will be conducted to acquaint farmers with IPM principles and their responsibilities for the success of the IPM program.

5.9 TRACK PROGRESS AND REWARD SUCCESS

Measurable objectives set at the beginning, must be measured against the IPM program’s performance at least once a year. Documentation to facilitate the evaluation process is as follows:

- a. Detailed description of the parameters and service protocols of the IPM program, stating the ground rules;
- b. Specific locations where pest management work was performed;
- c. Dates of service;
- d. Activity descriptions, e.g., baiting, crack-and crevice treatment, trapping, structural repair; and
- e. Log of any pesticide applications, including:
 - Target pest(s);
 - The brand names and active ingredients of any pesticides applied;
 - PCB registration numbers of pesticides applied;
 - Percentages of mix used in dilution;
 - Volume of pesticides used expressed in kilograms of active ingredient;
 - Applicator’s name(s) and certification identity (copy of original certification and recertification should be maintained);
 - Facility floor plan on which all pest control devices mapped and numbered;

- Pest tracking logs (sightings and trap counts);
- Action plans, including structural and sanitation plans, to correct any pest problems;
- Pest sighting memos for IPM Committee to use in reporting pest presence to DEC; and
- Using these records, and the goals of the IPM program (increased efficacy, lower costs and reduced pesticide use), the IPM Committee must see:
 - Fewer pest sightings and farmer complaints;
 - Lower monitoring-station counts over time;
 - Lower costs after the first 12-18 months, once IPM's efficacy advantage has had time to take effect; and
 - Downward trend in volume or frequency of chemical pesticide usage

IPM is a team effort. Therefore the IPM Committee will track and report the program's successes following each evaluation; and encourage good practices by recognizing farmers who played a role. Communicating the success of the program in reducing toxic chemical use and exposure, reducing pest complaints and lowering costs will help farmers to understand the purpose of the program and appreciate its success. The more they understand, the more likely they will participate willingly in helping expand and institutionalize the IPMP.

After the program has been in place for long enough to show significant results, it is recommended for the IPM Committee to work with AGCOM to publicize successes more broadly and to demonstrate the environmentally responsible approach to effective pest management and control. IPM Committee and AGCOM will lead by example by sharing success with other stakeholders.

CHAPTER SIX: IMPACTS OF PEST MANAGEMENT PRACTICES

IPM will play a key role in the agricultural productivity; leading to a wide range of socio-economic impacts and overall economic development of the country. Agricultural productivity in Malawi is closely related to reduction of poverty and malnutrition. Hence, small-scale farmers in particular, will play an important role in reducing poverty and malnutrition and creating widespread growth through the implementation of IPM for the AGCOM.

On the other hand pest management practices, if not implemented properly, will have negative impacts on the environment as well as harmful effects on human beings and animals. The following sections provide positive and negative impacts of pest management practices.

6.1 POSITIVE IMPACTS OF CHEMICAL PESTICIDES

Continued application of chemical pesticides results in long term negative impacts which are presented in Section 6.2. On the other hand, chemical pesticides may improve yields in the short term, although this is to the detriment of the soil quality in the long term. The short term positive impacts of chemical pesticides are as follows:

Increase in crop yields

Application of chemical pesticides will protect crops from damaging pests. This will lead to an increase in crop yields, for the short term.

Enhancement measures

Apply chemical pesticides in accordance with recommendations of the IPMP to sustain crop productivity. Adhere to the IPMP recommendations to progressively reduce the use of chemical pesticides.

Increase in economic growth

Increase in crop yields will lead to food self-sufficiency as well as surplus crop for sale; thereby contributing to the overall economic growth of the country, albeit for the short term.

Enhancement measures

Assist farmers in marketing produce and maintain access roads to markets. Train farmers in IPM practices to retain good soil quality and to progressively reduce use of chemical pesticides.

6.2 NEGATIVE IMPACTS OF CHEMICAL PESTICIDES

Soil degradation

Frequent and continuous application of chemical pesticides to agricultural fields will lower the soil potential for good crop yields. This would negatively affect crop growth and productivity in the long term.

Mitigation measures

- Apply soil conditioning measures which would also be part of IPM
- Train farmers in proper handling and application of chemical pesticides as recommended by the IPMP and AGCOM

Poisoning of non-target species

Poisoning of non-target flora and fauna species may occur due to negligence or lack of knowledge of chemical pesticide potency; equipment malfunction and use of wrong type of equipment; wrong time and method of application (spraying). Chemical pesticides and residues can be dangerous to non-target wild animals; fish and invertebrates as well as aquatic arthropods.

Mitigation Measures

- Supervise and control use of chemical pesticides to ensure that only approved and recommended ones are used;
- Use recommended equipment and approved methods of application;
- Use recommended rates of application
- Regularly maintain and clean the equipment as recommended in the IPMP
- Use recommended and appropriate protective clothing;
- Conduct training seminars in IPM; and
- Clean equipment and dispose old equipment as recommended by manufacturer.

Water, soil and environmental pollution

Water, soil and environmental pollution may occur due to spillage during loading and offloading of vessels and during storage. This can also result from farmers' carelessness as they use the pesticides e.g. washing sprayers in water streams, poor disposal of empty pesticide containers and expired pesticides.

Mitigation measures

- Provide suitable storage warehouse;
- Use bio-beds, draining channels and draining dams for waste pesticides treatment;
- Use chemical remains to re-spray crops;
- Clean equipment in one place designated for such activities;
- Take regular stock of pesticides for early tracking of leaks and waste;

- Provide farmers and other relevant authorities with information on appropriate remediation measures in case of spills and accidents,
- Apply Integrated Pesticide Management; and
- Train staff and farmers in proper handling and use of pesticides.

Health and safety risks

People around pesticides storage facilities, farmers handling pesticides and spray service providers may be exposed to hazardous pesticides. Lack of appropriate knowledge in handling of pesticides may also increase health and safety risks to humans due to misuse, underuse or overuse of these pesticides. Pesticides, if not stored correctly, will result in corroded containers, lost labels and release of the chemicals into the environment. Pesticide stockpiles pose a very serious health and safety risk of contaminating drinking water, food or the air.

Mitigation Measures

- Provide personal protective equipment to workers and ensure its good use
- Inspect pesticides handling and storage facilities regularly;
- Train staff and farmers in proper handling of chemical pesticides and conduct routine medical examination for workers; and
- Promote IPM to replace harmful pesticides
- Encourage farmers to only acquire pesticide quantities that are likely to be needed to avoid potential for creating obsolete stocks
- Pesticides whose handling and application require use of PPE that is uncomfortable, expensive or not readily available should be avoided.
- Washed and emptied containers that the pesticide supplier does not intend to reuse should be punctured or otherwise rendered unusable for any other purpose.
- Empty containers and pesticide-related waste should not be burnt, dumped or buried but returned to source
- Introduce pesticides in ready-to-use containers
- Discourage farmers from buying and using decanted pesticides
- Initiate education programmes that will be run by farmer cooperatives, Farmer Field Schools, NGOs, extension services to raise awareness of the correct use of pesticides and disposal of the empty containers

Accidental or intentional poisoning

Improper labelling and storage of chemical pesticides may increase chances of accidental poisoning. Availability of pesticides and increased accessibility by staff and farmers may increase the risk of poisoning to kill intentionally or commit suicide due to social pressures and frustration.

Mitigation Measures

- Label and store chemicals in properly labelled shelves;
- Ensure responsible, mentally sound and mature persons are given charge and control of approved chemical pesticides;
- Restrict accessibility to chemical pesticides; and conduct regular spot checks to balance stock;
- Pesticides should be kept in secure place to which children, animals, or unauthorised personnel do not have access;
- Pesticides should never be transferred into containers other than those they were supplied; and
- Pesticides must be stored safely and securely away from food and water supplies.

Pest resistance

Lack of appropriate knowledge in pesticide may result in incorrect pesticide application. This may reduce effectiveness of the pesticides on pests, thereby promoting development of pest resistance.

Mitigation Measures

- Train staff and farmers in correct application of pesticides
- Initiate education programmes that will be run by farmer cooperatives, Farmer Field Schools, NGOs, extension services to raise awareness of the correct use of pesticides

6.3 POSITIVE IMPACTS OF NON CHEMICAL PEST CONTROL

Non chemical pest control which include biological control agents, physical measure, cultural measure, genetic, and mechanical methods of managing pests entails the use of environmentally and socially acceptable methods on the host, to eliminate pests or diseases.

6.3.1 Biological control agents

Reduced environmental and health risks

The use of natural enemies in controlling pests is more environmentally friendly in comparison with chemical control methods.

Enhancement Measures

- Establish demonstration plots to disseminate information on environmental and health benefits of biological control agents to the communities for them to appreciate the advantages.

Reduction in time spent on application of pesticides

Planting of pest resistant crops in a particular growing season guarantees the farmer of effective pest control for several growing seasons. This reduces the time spent by the farmer in applying pesticides to the same agricultural fields for a good number of growing seasons during which the biological control will be effective. Biological control methods can also be easily integrated in other IPM control methods.

Enhancement measures

Prepare an inventory of indigenous and established biological control methods and conduct community awareness seminars to enhance and exchange community knowledge base.

Increase in soil stability and reduction in soil erosion

The wider environmental benefits of increasing tree cover as biological control of pests will result in increase in soil stability and reduction of erosion.

Enhancement measures

Conduct awareness campaigns on the importance of using new and improved pest resistant seed varieties in controlling pests.

Resistance to pests through improved varieties

The use of resistant clones in the control of diseases; and adoption of fast methods of propagating plantings has environmental benefits as well as advantages of crop resistance to pests.

Tissue culture technology also has the potential to increase biodiversity by replacing the stocks of rare and endangered tree species. The wider environmental benefits of increasing biodiversity and tree cover include improving soil stability, reducing erosion, preventing desertification and stabilizing global climate.

Enhancement measures

Rural people have a tendency of resisting to introduction of new varieties and sticking to traditional seed varieties. Awareness campaigns on the benefits of new and improved seed varieties, which are resistant to pest will help reduce application of chemical pesticides.

6.3.2 Mechanical methods

Reduced pollution on the environment

Use of labour with simple implements/tools is environmentally friendly in the sense that it has no significant impacts on water or air pollution.

Enhancement measures

- Train farmers on the appropriate and efficient use of simple farm implements to significantly minimize environmental pollution; and

6.4 NEGATIVE IMPACTS OF NON CHEMICAL CONTROL METHODS

6.4.1 Mechanical methods

Human health risk

Hand picking of insect pests may be risky to the farmer since some pests may be injurious.

Presence of other injurious non pest organisms e.g. snakes in the field can pose as a health risk to the farmer

Mitigation measures

Encourage use of PPE when hand picking pests.

Poor crop development

Mechanical control of pests by fruit bagging may lead to poor development of the fruits due to shading from light for instance green bananas need to photosynthesise as they develop.

Mitigation measures

Encourage use of transparent bags to allow entry of light.

6.4.2 Physical methods

Human health risk

Accidental exposure to radiation in the process of treating planting materials against pests may be a risk to human health

Mitigation measure

Training in proper use of the technique

Damage to planting materials

Accidental overheating of planting materials during hot water treatment can render them unviable

Mitigation measure

Training in proper use of the technique

6.5 POSITIVE IMPACTS OF IPM

Increase in agricultural yields

IPM practices will contribute to an increase in agricultural yields through prevention of crop damage and preservation of produce.

Enhancement measures

Train farmers in the use of appropriate IPM techniques to protect crops from pest damage.

Contribution to Food Security

Application of IPM will result in enhanced food security, yields and efficient preservation of produce, subsequently providing and contributing to the overall national goals on food security.

Enhancement measures

- Train pesticides marketers in selection and handling of IPM-compatible pesticides;
- Train farmers in appropriate application of the various IPM techniques; and
- Educate farmers on how to preserve natural enemies and timeframes of different integrated pest management options.

Saving in foreign exchange

Promotion and increased application of non-chemical pesticides will result in reduced importation of chemical pesticides thereby saving foreign exchange.

Enhancement measures

- Train suppliers in selection of appropriate pesticides to be eligible for supplying to AGCOM
- Train farmers in appropriate application of the various IPM practices to reduce application of chemical pesticides; and

Contribution to offsetting rural/ urban migration

Increase in farm income-generating opportunities due to better yields and availability of surplus produce for sale in the rural areas will help offset rural – urban migration.

Enhancement measures

Assist local communities to establish cooperatives and to market produce to potential markets for additional income.

Improved environmental protection

Increased application of IPM, through the use of biological controls, mechanical methods and indigenous control mechanisms will mean reduced application of polluting chemicals such as organochlorides, pyrethroids and triazines which are harmful to the environment. It will also help reduce application of banned pesticides such as DDT and dieldrin, which are sometimes smuggled across the borders.

Enhancement Measures

- Enforce regulation prohibiting importation of banned chemical pesticides;
- Sensitise pesticides users on the dangers of using prohibited pesticides; and
- Educate farmers on harmful consequences of banned chemical pesticides.

6.6 PRINCIPLES GOVERNING SELECTION OF PESTICIDES

Selection of pesticides, under the AGCOM project will be guided by the consideration of several pest management approaches for cultural, physical and biological measures before resorting to application of chemical pesticides.

The use of pesticides must be guided by the principles of cost efficiency, safety to humans, the bio-physical environment and effectiveness in controlling the pests. Pesticides selection will be made in accordance with the World Bank guidelines for the selection of pesticides (World Bank Operational Manual, GP 4.03) as follows:

- (i) Pesticides requiring special precautions should not be used if the requirements are not likely to be met;
- (ii) Pesticides to be selected from approved list, taking into consideration of: toxicity, persistence, user experience, local regulatory capabilities, type of formulation, proposed use, and available alternatives;
- (iii) Type and degree of hazard and availability of alternatives; and the following criteria will be used to restrict or disallow types of pesticides under Bank loans:

a. Toxicity: acute mammalian toxicity, chronic health effects, environmental persistence and toxicity to non-target organisms;

b. Registration status in the country and capability to evaluate long-term health and environmental impacts of pesticides.

6.7 PESTICIDES TO BE ACCEPTABLE TO AGCOM

The selection of pesticides to be acceptable under the project will be in line with (a) the World Bank Safeguard Policy OP 4.09 on pest management, and will depend on (b) the hazards and risks associated with pesticide use, and (c) the availability of newer and less hazardous products and techniques such as bio-pesticides.

In addition to the toxic characteristics of the pesticide, the hazards associated with pesticide use depend on how the pesticides are handled. Precautions to minimize environmental contamination and excess human exposure are needed at all stages from manufacture, packaging and labelling, transportation, and storage to actual use and final disposal of unused and contaminated containers. The guidelines in Appendix 2 provide internationally accepted standards on pesticides to minimize the hazards associated with pesticide use.

The use of pesticides under the project will also be guided by the FAO Publication on International Code of Conduct, on the Distribution and Use of Pesticides 1991; *FAO Guidelines for the Packaging, Storage, Good Labelling Practice, Transportation and Disposal of Waste Pesticide and Pesticide Containers 1985.*

CHAPTER SEVEN: PEST MANAGEMENT AND MONITORING PLANS

7.1 PEST MANAGEMENT PLAN

The Integrated Pest Management and Monitoring Plan (IPMP) in Table 7.1 is developed from the impacts and mitigation measures identified in Chapter 6. The IPMP include impacts from application of chemical as well as non-chemical pesticides. The reason why chemical pesticides are included is that in the initial stages of implementation of the IPM, chemical pesticides will still be used but will be gradually phased out as the IPM gets established.

The purpose of the IPMP is to ensure that the identified impacts related to application of pesticides are mitigated, controlled or eliminated through planned activities to be implemented throughout the project life. The IPMP also provides opportunities for the enhancement of positive impacts. The IPMP gives details of the mitigation measures to be implemented for the impacts; and the responsible institutions to implement them.

Implementation of the IPMP may be slightly modified to suit changes or emergencies that may occur on site at the time of project implementation. The plan therefore should be considered as the main framework that must be followed to ensure that the key potential negative impacts are kept minimal or under control. In this regard, flexibility should be allowed to optimize the implementation of the IPMP for the best results in pest management.

The IPMP consists of generic or typical environmental impacts that are derived from the site investigations, public consultations and professional judgment. This is because the specific and detailed impacts cannot be predicted without details for the project design and construction activities as well as the specific project locations. The IPMP will however, provide guidance in the development of more detailed IPMP's, once the project design and construction details are known.

Site specific Integrated Pest Management and monitoring plans will depend on the scope of identified major impacts to be addressed in the implementation of the project. Presented in Table 7.1 below is a generic or typical environmental management and monitoring plan, which would easily fit in the implementation of the AGCOM.

7.2 PEST MONITORING PLAN

Successful implementation of the AGCOM Integrated Pest Management Plan in the project locations will require regular monitoring and evaluation of activities undertaken by the farmers to be involved in the project. The focus of monitoring and evaluation will be to assess the build-up of IPM capacity among the farmers

and the extent to which IPM techniques are being adopted in agricultural production, and the economic benefits that farmers derive by adopting IPM. It is also crucial to evaluate the prevailing trends in the benefits of reducing pesticide distribution, application and misuse.

Indicators that require regular monitoring and evaluation during the programme implementation include the following:

- 1 Number of farmers engaged in IPM capacity building in the project locations:
- 2 Number of farmers who have successfully received IPM training in IPM methods
- 3 Number of trainees practicing IPM according to the training instructions
- 4 Number of women as a percentage of total participating in IPM and successfully trained
- 5 Number of youth as a percentage of total participating in IPM and successfully trained

- 6 Number of farmers as a percentage of total applying IPM
- 7 Rate of IPM adoption (number of people as a percent of total) every year
- 8 Improvement in farm production due to adoption of IPM as a percent of production without IPM
- 9 Increase in farm revenue resulting from adoption of IPM practices, compared with revenue from conventional practices
- 10 Improvement in the health status of farmers
- 11 Extent to which crops and livestock are produced using chemical pesticides compared with total crop production
- 12 Efficiency of pesticide use and handling
- 13 Reduction in chemical pesticide poisoning and environmental contamination
- 14 Number of IPM participatory research project completed
- 15 Overall assessment of activities that are going according to IPMP; activities that need improvement; and remedial actions required

7.3 ESTIMATED COSTS FOR PEST MANAGEMENT AND MONITORING

Estimated costs for managing and monitoring some of the recommended enhancement and mitigation measures are provided in Table 7.1 and summarised in Table 7.2. As it can be noted for Table 7.1, not all the mitigation measures have been assigned costs. It is assumed that some of the mitigation measures will be part of the normal responsibility of the respective government ministries, agro-dealers, transporters, farmers and other relevant stakeholders, within their institutional mandates and budgets.

It is important to appreciate that some of the stakeholder institutions may not have sufficient capacity to manage environmental and social impacts of pesticides and to adequately monitor implementation of the enhancement and mitigation measures. Therefore, it is necessary to train them. The cost of training for the

managing impacts has been provided for table 8.1. The table also includes costs for conducting awareness and sensitisation campaigns on pesticides application, management and adoption of IPM in the project areas. Costs for setting-up, adoption and use of IPM by farmers are provided in table 8.2. The costs for managing and monitoring various mitigation and enhancement measures provided in tables 7.1 and 7.2 are estimated for 1 year.

Table 7.1: Integrated Pest Management and Monitoring Plan

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
1. POSITIVE IMPACTS OF CHEMICAL PESTICIDES							
1.1	Increase in crop yield		Implement a long term IPM programme to sustain productivity and combat negative effects of chemical pesticides.	AGCOM, participating institutions and farmers Cost included in the IPMP overall cost	IPMP	MoAIWD	Semi annually
1.2	Increase in economic growth			AGCOM, participating institutions and farmers Cost included in the IPMP overall cost	IPMP	MoAIWD	Semi annually
2. NEGATIVE IMPACTS OF CHEMICAL PESTICIDES							
2.1	Soil degradation	Persistent use of chemical pesticides	<ul style="list-style-type: none"> • Apply soil conditioning measures which include IPM • Train farmers in proper 	Farmers	IPMP	AGCOM EMC	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			handling and application of pesticides				
2.2	Poisoning of non-target species including natural biological agents	<ul style="list-style-type: none"> Lack of knowledge of chemical pesticide potency Equipment malfunction Use of wrong type of equipment Wrong time and method of application (spraying) 	<ul style="list-style-type: none"> Supervise and control use of chemical pesticides so that only approved and recommended ones are used Provide PM equipment Regularly maintain and clean equipment as recommended by supplier Dispose old equipment as recommended 	AGCOM and participating farmers <u>21000.00</u> <u>30,000.00</u>	IPMP	MoAIWD AGCOM EMC PCB	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			<ul style="list-style-type: none"> by manufacturer. • Provide recommended protective gear • Use recommended and appropriate protective gear • Conduct trainings in IPM 				
2.3	Health and safety risks	Exposure to pesticides	<ul style="list-style-type: none"> • Provide protective clothing and ensure it is used. • Train farmers in proper pesticides handling. 	<ul style="list-style-type: none"> • Agro-dealers • Transporters • Farmers <p>Cost for five districts on</p>	<ul style="list-style-type: none"> • Labour regulations • PCB regulations 	-Min. of Labour. -PCB -DA -AGCOM <u>5,000.00</u>	Semi annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			<ul style="list-style-type: none"> Routine medical examination 	farmer random sampling basis <u>10,000.00</u>			
2.4	Water, soil and environmental pollution	<ul style="list-style-type: none"> Inappropriate building for storage of pesticides. Cleaning of equipment, Disposal of remains of pesticides Disposal of containers and equipment 	<ul style="list-style-type: none"> Construct suitable warehouse Construct bio-beds, draining channels and draining dams. Use chemical remains to re-spray. Clean equipment in one designated place. Take regular stock of pesticides Use IPM 	<ul style="list-style-type: none"> Pesticides Transporters and Suppliers AGCOM EMC Farmers <p>Cost for five district warehouses <u>150,000.00</u></p> <p>Cost for construction of bio-beds in five districts <u>20,000.00</u></p>	<ul style="list-style-type: none"> Pesticides and equipment manufacturer's recommendations. Water pollution standards. 	<ul style="list-style-type: none"> PCB Environmental Affairs. Water Resources Board 	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			<ul style="list-style-type: none"> • Train farmers not to spray toxic chemicals close to water sources • Train farmers to maintain spray equipment in safe operational order 				
		Wrong shelving or stacking	Routine inspection and inventory checks	Agro-dealers	<ul style="list-style-type: none"> • PCB regulations, • Manufacturer's guidelines 	<ul style="list-style-type: none"> • PCB • DA 	Semi annually
		<ul style="list-style-type: none"> • Inadequate storage space. • Bad housekeeping 	Provide adequate and separate storage space for pesticides	Agro-dealers	<ul style="list-style-type: none"> • PCB regulations, • Manufacturer's guidelines 	<ul style="list-style-type: none"> • PCB 	Semi annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
		<ul style="list-style-type: none"> Multipurpose use of warehouse 					
		Multi-purpose use of equipment or pesticides	Control use of equipment and pesticides <ul style="list-style-type: none"> Thorough cleaning of equipment Training Integrated Pesticide Management 	Farmers	Pesticides Act	<ul style="list-style-type: none"> PCB EMC DA 	Quarterly
		Illegal disposal of pesticides	Prohibit discharge of pesticides wastes to open dumps where children, domestic animals, rodents and some wildlife species scavenge	Agro-dealers AGCOM	EMA Pesticides Act	EAD EMC <u>5,000.00</u>	Semi annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
		<ul style="list-style-type: none"> Equipment malfunction Wrong type of equipment. Time and method of application (spraying) 	<ul style="list-style-type: none"> Regular maintenance of equipment. Use recommended equipment. Use approved methods of application. Use recommended protective clothing. Training seminars Integrated Pesticide Management 	Farmers AGCOM	<ul style="list-style-type: none"> Manufacturer's recommendations. Equipment maintenance policy 	-PCB -EMC	Semi annually
		<ul style="list-style-type: none"> Improper cleaning of equipment. 	<ul style="list-style-type: none"> Clean equipment and dispose equipment as 	Farmers	<ul style="list-style-type: none"> Manufacturer's recommendations. 	<ul style="list-style-type: none"> PCB EMC DA 	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
		<ul style="list-style-type: none"> Improper disposal of cleaning water and old equipment 	<p>recommended by manufacturer.</p> <ul style="list-style-type: none"> Use bio-beds and draining dams to dispose cleaning and drainage waters. Integrated Pesticide Management. 		<ul style="list-style-type: none"> PCB regulations. Water resources regulations 		
		Over-stocking	Buying the required and approved quantities only	Agro-dealers	Pesticides Act	PCB	Quarterly
2.5	Air pollution and contamination	<ul style="list-style-type: none"> Exposure of pesticides to air. Disposal of pesticides 	<ul style="list-style-type: none"> Store pesticides in closed containers Dispose chemical 	<ul style="list-style-type: none"> Pesticides Suppliers Farmers 	<ul style="list-style-type: none"> Pesticides and equipment manufacturer's recommendations. 	<ul style="list-style-type: none"> PCB Environmental Affairs. 	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
		<p>remains in the open</p> <ul style="list-style-type: none"> Disposal of pesticides containers and equipment in the open 	<p>remains according to supplier recommendations.</p> <ul style="list-style-type: none"> Train farmers in appropriate spraying techniques to avoid chemicals being blown away by wind. Train farmers to maintain spray equipment in efficient operational order 		<ul style="list-style-type: none"> Air pollution standards. 		
		<ul style="list-style-type: none"> Bad housekeeping 	Provide adequate and enclosed storage space for pesticides	Agro-dealers	<ul style="list-style-type: none"> PCB regulations, Manufacturer's guidelines 	PCB	Half yearly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
		Illegal disposal of pesticides	Prohibit disposal of pesticides wastes into open dumps where they will be blown away by wind	Agro-dealers AGCOM	EMA Pesticides Act	EAD EMC City/District Councils	Half yearly
		<ul style="list-style-type: none"> • Equipment malfunction • Wrong type of equipment. • Time and method of application (spraying) 	<ul style="list-style-type: none"> • Regular maintenance of equipment. • Use recommended equipment. • Use approved methods of application. • Training farmer in appropriate spraying methods 	Farmers AGCOM	<ul style="list-style-type: none"> • Manufacturer's recommendations. • Equipment maintenance policy 	<ul style="list-style-type: none"> • PCB • EMC 	Annually
2.6	Health risk from chemical	Lack of appropriate knowledge	Training and awareness campaigns	AGCOM	Pesticide manufacturers regulations, IPMP	<ul style="list-style-type: none"> • PCB • EAD 	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
	pesticide misuse (over/under use)						
2.7	Accidental or Intentional poisoning	Improper labelling or storage Frustration, Social pressures	<ul style="list-style-type: none"> • Label and store chemicals in properly labelled shelves • Ensure responsible, mentally sound and mature persons are given charge and control of pesticides. • Restrict accessibility to pesticides. • Spot checking 	Farmers Agro-dealers	Pesticides Act	<ul style="list-style-type: none"> • PCB • Min of Labour • DA • AGCOM 	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
2.8	Pest resistance	Lack of appropriate knowledge in pesticides application	<ul style="list-style-type: none"> • Train farmers in correct application of pesticides • Initiate education programmes 	Farmers AGCOM	Pesticides Act	PCB	Half yearly
3. POSITIVE IMPACTS OF BIOLOGICAL CONTROL AGENTS							
3.1	Reduced environmental and health risks		Establish demonstration plots to disseminate information on environmental and health benefits of biological control agents to the communities for them to appreciate the advantages	AGCOM	EMA	-EAD -MoAIWD	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
3.2	Reduction in time spent on application of chemical pesticides		Prepare an inventory of indigenous and established biological control methods and conduct community awareness seminars to enhance and spread knowledge base	AGCOM	IPMP	Department of Land Resources	Annually
3.3	Resistance to pests through improved varieties	Rural people have a tendency of resisting to introduction of new varieties and sticking to traditional seed varieties.	Awareness campaigns on the benefits of new and improved seed varieties, which are resistant to pest will help reduce application of chemical pesticides	AGCOM	IPMP	MoAIWD	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
3.4	Increase in soil stability and reduction of soil erosion	Increasing tree cover as biological control of pests will result in increase in soil stability and reduction of erosion	Conduct awareness campaigns on the importance of using new and improved and pest resistant seed varieties in controlling pests	AGCOM	IPMP	MoAIWD	Annually
4. NEGATIVE IMPACTS OF BIOLOGICAL CONTROL AGENTS							
4.1	Risk of damage to crops	The slowness of biological agents to act may frustrate IPM programmes as farmers are used to the rapid results of chemical pesticides	<ul style="list-style-type: none"> • Educate farmers on the long term benefits of the biological methods to facilitate their adoption; and • Phase transition from biological to IPM methods to ensure no appreciable 	AGCOM	IPMP	EMC MoAIWD	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			loss of production during transition				
5.0 POSITIVE IMPACTS OF MECHANICAL METHODS							
5.1	Reduced pollution on the environment		Train farmers on the appropriate and efficient use of simple farm implements to significantly minimize environmental pollution	AGCOM	IPMP	MoAIWD	Annually
6.0 NEGATIVE IMPACTS OF MANUAL METHODS							
6.1	Human health risks	Snake bites, hippo or crocodile attacks	<ul style="list-style-type: none"> • Provide protective clothing to workers and ensure it is properly used; • Train farmers in proper operations 	AGCOM	N/A	Department of Land Resources	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			and handling of farm equipment; and <ul style="list-style-type: none"> Promote IPM to replace mechanical methods 				
6.2	Poor crop development		Encourage use of transparent bagging to allow entry of light	AGCOM	N/A	MoAIWD	Annually
7.0 POSITIVE IMPACTS OF IPM							
7.1	Increase in agricultural yields	Non chemical methods are generally slow	Train farmers in timely and appropriate use of pest management techniques to protect maize from the great grain borer and other pests; and to protect other	AGCOM	IPMP	MoAIWD	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			crops from pest damage				
7.2	Contribution to Food Security	Non chemical methods are generally slow	<ul style="list-style-type: none"> • Train pesticides marketers in selection and handling of approved pesticides • Train farmers in the appropriate application of the various IPM practices • Educate farmers on preservation techniques and timeframes of different integrated 	AGCOM	IPMP	MoAIWD	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			pest management options.				
7.3	Saving in foreign exchange	Banned chemicals	<ul style="list-style-type: none"> • Train pesticides suppliers in selection of appropriate pesticides to be eligible for supplying to ASWAp-SP; • Train farmers in the appropriate application of the various IPM 	AGCOM	Pesticides Act	PCB	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			practices to reduce application of chemical pesticides; and <ul style="list-style-type: none"> • Enforce regulation prohibiting importation of banned chemical pesticides 				
7.4	Contribution to offsetting rural/urban migration	Banned chemicals	<ul style="list-style-type: none"> • Enforce regulation prohibiting importation of banned chemical pesticides; • Educate farmers on harmful consequences of banned 	Farmers AGCOM	Pesticides Act	PCB <u>5,000</u>	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			chemical pesticides; and <ul style="list-style-type: none"> • Assist local communities to establish cooperatives and to market produce to potential markets for additional income. 				
7.5	Improved environmental protection		<ul style="list-style-type: none"> • Enforce regulation prohibiting importation of banned chemical pesticides; and • Educate farmers on harmful consequences of banned 	AGCOM	IPMP	AGCOM	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution and Cost per year per district (\$)	Standards/Regulation	Monitoring Institution and Cost per district per year	Monitoring Frequency
			chemical pesticides.				

Table 7.2 Summary of Management and Monitoring Costs for 1 Year

Impact	Management Costs (US\$)	Monitoring Costs (US\$)
Provide PM equipment (sprayers)	10,000.00	
Provide recommended protective gear	30,000.00	
Pesticide inspection, sampling and testing		10,000.00
Routine medical examination	10,000.00	5,000.00
Rehabilitation of laboratories	100,000.00	
Construct bio-beds, draining channels and draining dams.	20,000.00	
Disposal of chemical pesticides remains according to supplier recommendations		5,000.00
Enforce regulation prohibiting importation of banned chemical pesticides		4,000.00
Grand Total	170,000.00	24,000.00

CHAPTER EIGHT: CAPACITY, TRAINING NEEDS AND BUDGET FOR IMPLEMENTATION OF THE IPMP

8.1 CAPACITY NEEDS

IPMP is a knowledge intensive and interactive methodology. It calls for a precise identification and diagnosis of pests and pest problems. Comprehending ecosystem interplays equips farmers with biological and ecological control knowledge and assists them in making pragmatic pest control decisions.

The success of IPMP is largely dependent on developing and sustaining institutional and human capacity to facilitate experiential learning. Experiential learning is a prerequisite to making informed decisions in integrating scientific and indigenous knowledge. This assists in tackling district, ward and village specific problems.

Ineffective communication between farmers, extension agents and researchers from research institutes and universities has often translated into poorly-targeted research or to poor adoption of promising options generated by research. Essentially, the full potential of agricultural research is compromised.

Closer farmer-research investigator interaction, adaptive research and participatory learning approaches in capacity building efforts serves as a remedy to narrowing this gap, making research results more applicable to farmers. Farmers must at least be trained in:

- (a) Biological and ecological processes underpinning IPM options;
- (b) The practical application of newly acquired knowledge, to choose compatible methods to reduce production and post-harvest losses, through frequent field visits, meetings and demonstrations; and
- (c) Adaptive research trails.

Capacity building will be achieved through farmer-based collaborative management mechanisms where all key stakeholders shall be regarded as equal partners. Beneficiary farmers shall be the principal actors facilitated by other actors from research institutes, academic institutions, sector ministries, NGOs, etc. as partners whose role will be to facilitate the process and provide technical direction and any other support necessary for the implementation of IPM. Pilot IPMP implementation must be built on and to some extent strengthen existing national capacities for the promotion and implementation of IPM.

The major actors and partners will include the following:

The programme beneficiary farmers: As the principal beneficiaries, they will be organized into Farmer Groups for training and adoption of IPM practices. The

farmers will receive assistance from Community IPM Action Committees, to coordinate IPM activities in their areas.

At the District level, the **District Development Committees**, through the District Agricultural Officers, will assist the farmers to form the Farmer Groups through whom IPM activities will be implemented. The District Agricultural Officer will provide the technical assistance to the Farmer Groups.

The **Agricultural Development Divisions (ADD's)** will backstop the District Development Committees and assist them with the technological advancements in IPM development. They will coordinate with research institutions and organise field days to disseminate the information.

The MoAIWD will provide logistical and technical support to the AGCOM EMC. They will thus provide capacity and policy guidance and oversight for implementation of the IPM at National level. MoAIWD will, through the AGCOM, provide the necessary budgetary support and overall monitoring of the IPM activities. **The MoAIWD** and the respective districts will provide staff for training local farmers and play a major role with NGOs/CBOs in the public awareness campaigns, production of extension materials, radio and television programs in the respective districts.

Agricultural sector departments have the national mandate in the implementation of crop protection and pest management research. They will provide technical support to AGCOM, through the respective Agricultural Development Divisions, in the implementation of IPM. EMC will exploit the sector department's experiences in the implementation of IPM and management of outbreak and migratory pests.

AGCOM will undertake to build the capacities of extension workers to train farmers and community leaders in promoting IPM activities. They will also facilitate information sharing with local farmers.

The Pesticides Control Board will provide the necessary information on pesticides and train the Farmer Groups in all aspects of pesticides including application rates, methods, storage and disposal of residues. They will also monitor pesticides stocks and potency at the dealers.

The Ministry of Health (MoH): through the District Health Officers, will set up databases on incidence of poisoning, effect of pesticides on human health and environmental contamination. This data will then be used to measure and validate the ameliorating effects of IPM adoption and implementation that is expected to reduce risks to pesticides exposure.

Ministry of Justice and Constitutional Affairs: they have a national mandate to review laws They provide the legal advice on legal instruments that need to be reviewed.

The Environmental Affairs Department (EAD): through the Environmental District Officers, will conduct environmental monitoring in relation to IPM. EAD will contribute towards training the beneficiary Farmer Groups in pesticides management.

Partners in capacity building and training will include **Agriculture Services Providers and NGOs** that are providing services to farmers and improving agricultural productivity, environmental management and rural health matters will be identified to provide services and technical support in the implementation of IPM.

8.2 TRAINING

8.2.1 Training Content

Training key role players and stakeholders in IPM is necessary to ensure that they possess appropriate skills for IPMP implementation. The IPMP training program is designed for four levels as presented in the following sections and the training areas for key role players and stakeholders of IPM are provided in Table 8.1.

National level workshop

A total of 30 participants including representatives from the institutions listed in table 8.1 will attend a one day training workshop in Lilongwe. Members from these key stakeholder institutions will prepare and make presentation on their specific areas of expertise and demonstrate how their technical know-how would be applied in the implementation of IPMP. The main focus of the training workshop will be to establish institutional coordination for implementation of the IPMP.

Training of trainers

25 people will participate in the 3-day training of trainers in IPM. The main objective of this training will be for the participants to acquire and share the necessary knowledge to be able to train district staff and extension workers in the AGCOM participating districts. Participants will be drawn from AGCOM and District Executive Committees of the project districts, selected IPM Trainers from Agricultural Research and Development Service Providers and NGOs including pesticides marketers.

Training at district level

Training at the districts level will be targeted to district staff, extension workers, members of the Area Executive Committee (AEC) and community leaders. This group of participants, with the assistance of the trainers, will be responsible for imparting the IPM knowledge and practices to the farmers. 35 participants, with the extension workers being the majority (more than fifty percent of the participants) will be trained to assist the farmers in skills to implement the IPMP.

Community level (farmers)

Being beneficiaries, 50 farmers from each of the five districts, will be selected to participate farmer community training in IPM to be conducted in three strategic areas of the district. Areas of training focus will be to inform the farmers about the IPMP implementation and general discussions on indigenous as well as formal pest management practices currently in use.

Table 8.1: Training areas for key role players and stakeholders of IPM

Participants in the training	Roles of participants in IPMP	Training content	Cost US\$ and Duration
<p>National level institutions</p> <ul style="list-style-type: none"> • Department of Agricultural Research Services • Land Resources Conservation Department (LRCD) • MoAIWD • AGCOM EMC • Ministry of Health (MoH) • Environmental Affairs Department (EAD) • Pesticides Control Board (PCB) • DCD • MBS • Trade • DAES 	<ul style="list-style-type: none"> • Providing capacity and policy guidance and/or oversight for IPMP implementation • Monitoring and evaluation of IPMP implementation • Providing logistical and technical support for AGCOM training • Training IPM trainers. • Institutional coordination • Monitoring of IPM inputs supply by the dealers • Monitoring illegal stock of pesticides in boarder regions of Malawi 	<ul style="list-style-type: none"> • General overview of the project • Roles of IPMP stakeholders • Institutional IPMP supportive roles in IPMP implementation • IPMP and environmental and social management • pesticide regulation on: imports, transportation, use, registration and disposal of residues 	<p>Cost for 1 day training workshop \$16,354</p>
<p>Training of Trainers</p> <ul style="list-style-type: none"> • AGCOM • PCB • DEC • IPM Trainers 	<ul style="list-style-type: none"> • Supervising IPMP implementation • Preparation of IPM training materials • Training extension workers 	<ul style="list-style-type: none"> • General overview of the project and the IPMP for the AGCOM • IPMP stakeholders and their roles 	<p>Cost for a 3- day training: \$9,784</p>

Participants in the training	Roles of participants in IPMP	Training content	Cost US\$ and Duration
<ul style="list-style-type: none"> • Agricultural Research and Development Service Providers and NGOs • Pesticides marketers • PCB 	<ul style="list-style-type: none"> • To be fully abreast with AGCOMs IPMP and to conduct research in IPM. • To engage farmers in participatory learning and knowledge sharing • To foster Farmer/trainer coordination • To maintain Databases on incidence of poisoning, effects of pesticides on human health and environmental contamination. • To conduct IPMP scientific study, data collection, analysis and storage 	<ul style="list-style-type: none"> • Pesticides (types, classification, labelling registration etc.) • Leadership and training for IPMP • Pesticides and environmental and social impacts; and mitigation measures • Safety and precautionary measures for handling pesticides • IPM tools, indigenous, contemporary and other pest management practices and methods • Management of outbreak and migratory pests. • Pesticide regulations on: imports, registration, transportation, use and disposal of residues • Farmer/Trainer coordination 	
<p>District level</p> <ul style="list-style-type: none"> • District staff • Extension workers 	<ul style="list-style-type: none"> • Supervision of farmers and provision of extension support • Preparation of farmer training materials, leaflets, demonstration 	<ul style="list-style-type: none"> • General overview of the project and the IPMP for the AGCOM 	<p>Cost for a 3- day training \$5,000</p>

Participants in the training	Roles of participants in IPMP	Training content	Cost US\$ and Duration
<ul style="list-style-type: none"> • Members of the AEC • Lead Farmers 	<ul style="list-style-type: none"> material, radio and TV messages etc • Training farmers and community leaders in IPM and safety • Organising farmers for participatory learning and knowledge sharing events 	<ul style="list-style-type: none"> • IPMP stakeholders and their roles • Pesticides (types, classification, labelling registration etc.) • Skills in preparing IPMP work plans and budgets. • Pesticides and environmental and social impacts; and mitigation measures • Indigenous and other pest management methods • Safety and precautionary measures while handling pesticides • Management of outbreak and migratory pests. • Pesticide regulation on: imports, transportation, use, registration and disposal of residues • Farmer/Trainer coordination 	<p>Cost for training in the 5 districts: \$ 25,000</p>
<p>Community level (farmers)</p>	<ul style="list-style-type: none"> • Attending IPM trainings and demonstrations • IPMP implementation 	<ul style="list-style-type: none"> • General overview of the project and the IPMP for the AGCOM 	<p>Cost for a farmer community training in one district: \$5,000</p>

Participants in the training	Roles of participants in IPMP	Training content	Cost US\$ and Duration
		<ul style="list-style-type: none"> • IPMP stakeholders and their roles • Pesticides (types, classification, labelling registration etc.) • Pesticides and environmental and social impacts; and mitigation measures • Indigenous and other pest management methods • Safety and precautionary measures while handling pesticides • Management of outbreak and migratory pests. • pesticide regulation on: imports, transportation, use, registration and disposal of residues • Farmer/Trainer cooperation 	Cost for training in 5 districts: \$25,000
Total			76,138

8.3 COSTS FOR SETTING UP THE IPMP

In line with the steps for establishing the IPM approaches as outlined in chapter five of this IPMP, table 8.2 presents one year's estimated budget for setting up the IPMP in each of the project districts.

Table 8.2 Budget for setting up integrated pest management and implementation

Activity	Methodology	Cost (\$)
Identify the implementation team Decide on the scale of implementation Review and set measurable objectives for the IPMP Establish a system of regular IPM inspections Define the treatment policy selection Establish communication protocols Develop farmer training plans and policies	Three day workshop	10,000.0
Analyze current housekeeping, maintenance and pest control practices	Consultant	20,000.0
Provide protective gear		30,000.0
Track progress and reward success	Monitoring and evaluation	10,000.0
TOTAL COST PER DISTRICT		40,000.0
TOTAL COST FOR FIVE DISTRICTS PER YEAR		200,000.0

8.3 TOTAL COSTS FOR THE IPMP

The total cost for the IPMP comprises of pest management and monitoring costs, Training costs for IPM, and the Initial costs for setting up the IPMP. The total cost, which is \$518,252, is summed from costs derived in the respective chapters of the IPMP

Activity	Cost (\$)
Pest management and monitoring costs (Table 7.2)	195,000.00
Training for IPM (Table 8.1)	76,138.00
Cost for setting up IPMP	200,000.00
Contingency (10%)	47,114.00
GRAND TOTAL FOR THE IPMP	518,252.00

CHAPTER NINE: CONCLUSIONS AND RECOMMENDATIONS

Among other things, this IPMP has established that there are some initiatives in the use of indigenous knowledge and non-chemical practices for pest management. The IPMP has also proposed activities that need to be carried out to set up IPM practices in the AGCOM target districts.

It is noted that not all IPM practices would be applicable for the AGCOM in the short term. Specifically, mechanical methods may be difficult to implement in small scale farming communities where heavy machinery for weeding will be inappropriate. Biological methods are a possible option under the AGCOM but they take a long time and they need technical know-how as well as patience to adopt. Generally, IPM practices take some time to adopt and to bear the required results. However, IPM practices are highly recommended for long term and sustainable agricultural productivity. AGCOM should therefore:

- i. Introduce the IPM in the AGCOM target districts by using the systematic approach presented in Chapter 5. This will ensure application of all appropriate alternatives prior to resorting to chemical pesticides as remedy for pests;
- ii. Adopt a collective community effort and dissemination of appropriate tools and training. This will maximize IPMP implementation and accelerate progress towards reaching both measurable and tangible results in pest management;
- iii. Adopt a use of chemicals as a last resort approach to prioritize IPM remedies, consistent with sound environmentally sustainable practices;
- iv. Set up a team that incorporates ADD's management staff with the government's pesticides inspection team so that inspections are jointly conducted, permitting instantaneous discovery of illicit pesticides, followed by immediate impounding and appropriate legal action;
- v. Train farmers in (a) identifying approved pesticide; (b) acceptable disposal practices for expired chemical pesticides; and (c) the general environmental risks associated with the use of expired chemical pesticides;
- vi. Adopt a "safety is the number one priority" approach in IPM approach
- vii. Equip ADDs with "safety packages" to be made available to farmers for free under AGCOM. Packages must include the minimum requirements for pesticide application such as gloves and eyewear, nose mask; and
- viii. Thoroughly inform farmers on the dangers of handling chemical pesticides and equipment without sufficient and appropriate protective gear

As the process of pesticides registration in Malawi continues, it is proposed that the following factors, spearheaded by the PCB, must be implemented:

1. Priority list and importance of pesticides by crop must be supplied to government by farming organizations, to assist government in setting up quantity limits for importation;

2. The Malawi Bureau of Standards (MBS) must conduct pesticides residue and quality control tests in products; and
3. The programme should assist with the disposal of the farmers and household's pesticides related waste by establishing infrastructures for the collection and appropriate management of small quantities of pesticides and contaminated materials.

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APPENDICES

APPENDIX 1 IPMP DEVELOPMENT TEAM

Id	Name	Post	Institution
1	John Mussa	Director	Land Resources Conservation Department
2	Gilbert Kupunda	Deputy Director	Land Resources Conservation Department
3	Joseph Kanyangalazi	Principal Land Resources Conservation Officer	Land Resources Conservation Department
4	Kefasi Kamoyo	Land Resources Conservation Officer	Land Resources Conservation Department
5	George Lungu	Principal Agricultural Officer (Crop Protection)	Department of Crop Development
6	Dr Donald Kachigamba	Entomologist	Department of Agricultural Research Services
7	Walunji Msiska	Environmental Officer	Environmental Affairs Department
8	Young Chakana		Pesticide Control Board
9	Cosmas Luwanda	Programme Coordinator	ASWAp Secretariat
10	Dr Gilson Njunga	Chief	Department of Animal Health and Livestock Development

APPENDIX 2 PEOPLE AND INSTITUTIONS CONSULTED

APPENDIX 3