REPUBLIC OF MALAWI

Ministry of Agriculture, Food Security
Ministry of Irrigation and Water Development

Irrigation, Rural Livelihoods and Agricultural Development Project (IRLADP)

PEST MANAGEMENT PLAN

DRAFT REPORT

Ministry of Agriculture, Irrigation and Water Management
Ministry of Irrigation and Water Development
Capital Hill - Capital City
Lilongwe 3
MALAWI

Updated May 2012

Table of Contents

LIST OF ACRONYMS

ADD	Agricultural Development Division
ADMARC	Agriculture Development and Marketing Corporation
ADP-SP	Agriculture Development Program – Subsidy Program
AEDC	Agriculture Extension Development Coordinator
AEDO	Agriculture Extension Development Officer
AEZ	Agricultural Ecological Zones
AF	Additional Financing
AGRES	Agriculture Gender Roles and Extension Support Services
AISP	Agriculture Input Subsidy Program
ASWAp	Agricultural Sector Wide Approach
ASWAp-SP	Agricultural Sector Wide Approach Support Project
ATCC	Agricultural Technology Clearing Committee
AVO	Agriculture Veterinary Officer
CAADP	Comprehensive Africa Agriculture Development Program
CFA	Core Function Analysis
CLRCO	Chief Lands Resources Conservation Officer,
CPM	Commission on Phytosanitary Measures
CSA	Common Services Assessment
DADO	District Agriculture Development Officer
DAES	Department of Agricultural Extension Services
DAHLD	Department of Animal Health and Livestock Development
DEA	Director of Environmental Affairs
DEC	District Executive Committee
DHS	Demographic and Health Survey
DoI	Department of Irrigation
EA	Extension Area
EAD	Environmental Affairs Department
EIA	Environmental Impact Assessment
EMC	Executive Management Committee
EMP	Environmental management plan
EPA	Extension Planning Area
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
EU	European Union
FAO	Food Agriculture Organisation
GDP	Gross domestic Product
GoM	Government of Malawi
IDA	International Development Association
Ifa	Inputs for Assets
IGA	Income Generating Activities
IHS2	Integrated Household Survey 2
IMF	International Monitory Fund

IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
IPMMP	Integrated Pest Management and Monitoring Plan
IPPC	International Plant Protection Convention
IRLADP	Irrigation, Rural Livelihoods and Agricultural Development Project
ISCRAL	Scheme for the Conservation and Rehabilitation of African Lands
ISP	Input Subsidy Program
ISPM	International Standards for Phytosanitary Measures
LHTC	Land Husbandry Training Centre
LRCO	Land Resources and Conservation Officer
MAWTCO	Malawi Agricultural Warehousing and Trading Company
MBS	Malawi Bureau of Standards
MDTF	Multi-Donor Trust Fund
MGDS	Malawi Growth and Development Strategy
MAFS	Ministry of Agriculture and Food Security
MOAFS	Ministry of Agriculture, Food Security
MOIWD	Ministry of Irrigation and Water Development
MPRS	Malawi Poverty and Reduction Strategy
NAC	National AIDS Commission
NHBG	National Herbarium and Botanic Gardens
NRCM	National Research Council of Malawi
NCE	National Council for the Environment
NEAP	National Environmental Action Plan
OPC	Office of the President and Cabinet
PCB	Pesticides Control Board
PDO	Project Development Objective
PLRCO	Principal Land Resources Conservation Officer
RA	Roads Authority
SADC	Southern African Development committee
SALRCO	Senior Assistant Land Resources and Conservation Officer
SAFEX	South African Commodity Exchange
SLRCO	Senior Land Resources Conservation Officer
SPGI	Sustainable Productivity Growth Initiative
SWAp	Sector Wide Approach
TCE	Technical Committee on the Environment
WB	World Bank
WUA	Water Users Association

EXECUTIVE SUMMARY

Agriculture is the single most important sector of the Malawi economy, contributing about 38% of value-added to GDP, employing 85% of the workforce, and contributing 80% of foreign exchange earnings in 2006. Agriculture continues to be the primary source of livelihood for the estimated 80% of the country's poor who are based in rural areas. Sustained improvements in agricultural productivity and stable food supplies remain essential for reducing high rates of malnutrition and poverty in Malawi.

The Government of the Republic of Malawi has requested Additional Financing (AF) from the International Development Association (IDA) for the implementation of the Irrigation, Rural Livelihoods and Agricultural Development Project (IRLADP).

The Project Development Objective is to: *(i) increase agricultural productivity of poor rural households in all districts and (ii) strengthen recipient institutional capacity for long-term irrigation development*. The main project activities include rehabilitation of irrigation infrastructure and provision of a package of technical and advisory services for sustainable small-scale irrigation. IRLADP has four original components:

(i) *Irrigation Rehabilitation and Development and Catchment Conservation,* which supports rehabilitation and gradual management transfer of four Government-owned schemes to farmers; development of new small-scale gravity and mini-scale schemes; rehabilitation of small reservoirs; and construction of 400 group civil works for water harvesting and catchment conservation on a demand-driven basis.

(ii) *Farmer Services and Rural Livelihood Fund (FSLF),* provides support to beneficiary communities, especially those around the irrigation schemes to obtain complementary services needed to optimize returns to irrigation farming and access markets for their produce.

(iii) *Institutional Development and Community Mobilization,* supports restructuring, strengthening and/or formation of smallholder farmer organizations or water user associations for irrigation transfer, management and related activities aimed at ensuring the sustainable operation and maintenance (O&M) of rehabilitated schemes, and also supports limited policy and institutional capacity building measures in the MOAFS and MOWDI aimed at strengthening irrigation planning, design and supervision capacity.

(iv) *Project Coordination, Monitoring and Evaluation* of project implementation and ensuring that the project's funds are used for its intended purposes.

A proposed IRLADP AF II is being prepared to help finance the costs associated with scaling up the community-driven development (CDD) element of the project through enhanced demand-driven rural public works programs to create more community assets[1] and build community resilience to help cushion the rural poor while difficult economic reforms are undertaken. These activities are envisaged to be scaled-up from 11 original districts to all 28 districts in Malawi. In addition, the AF II will provide support to: (i) consolidating the project's gains, institutionalizing and improving water management in rehabilitated and

[1] These include catchment conservation works, feeder roads, orchards, afforestation, shallow wells, river rehabilitation, village grain banks and mini-scale gravity irrigation schemes.

constructed irrigation schemes under the parent project, improving in-field water management, rice agronomy and strengthening cooperatives, and input and output marketing arrangements in the value chain; and (ii) preparing an investment framework for future investments including technical, environmental, social and financial feasibility studies and designs for potential future investments.

This IRLADP pest management plan is based on the same principles and elements of the pest management plan prepared for the recently approved ASWAp-SP additional financing. Field investigations included visits to the project impact districts of Mwanza, Chikhwawa, Ntcheu, Salima and Chitipa. In addition, visits to the major agrochemical marketing companies in Lilongwe were undertaken. Consultations with various key stakeholders such as MOAFS, the Pesticides Control Board and the communities in the project impact districts were conducted. Interviews with farmers' organizations, farmers clubs and agrochemical companies were also conducted. 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.

This IPMP provides steps towards the establishment of IPM approaches as follows: Identification of the implementation team; Deciding on scale of implementation; Setting goals and measurable objectives for the IPM program; Analysis of current housekeeping, maintenance and pest control practices; Establishing a systems for regular IPM inspections; Defining treatment selection policy; Establishing communication protocols; Developing worker training plans and policies; and Tracking progress and rewarding success. This IPMP investigates several alternatives for pesticide control, including biological treatment, mechanical and manual methods with the ultimate objective of reducing the application of chemical pesticides and replacing them with more environmentally friendly options.

The Integrated Pest Management Plan includes the following chapters:

- Chapter 1 provides a brief background of IRLADP.
- Chapter 2 gives a comprehensive exploration of Agriculture, and pest management in Malawi. The chapter proffers the key principles of selecting pesticides, the body of law regarding such selection, and acceptable pesticides under ASWAp-SP;
- Chapter 3 takes a highly technical approach, describing the systematic step by step road man to the implementation of an effective IPMP;
- Chapter 4 highlights the impacts of pest management practices, both positive, and negative. Furthermore the chapter conscientiously delves into the advantages of nonchemical pesticides;
- Chapter 5 focuses on the environmental management plan, accentuating the positive impacts of mechanical methods, the disadvantages of both biological controls and manual methods.;
- Chapter 6 presents an overview of the capacity needs, and punctuates the necessary training, in order to yield a successful implementation of a solid IPMP; it provides budgetary needs.

IRLADP stakeholders will benefit from the training plan developed under ASWAp-SP. Additional funding is being budgeted under the IRLADP AF II to develop further training needs and reach out more stakeholders.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 THE NATIONAL CONTEXT

Malawi has a population of about 13 million and is one of the poorest countries in the world; with average per capita income of only US$170. 52 percent of the population lives below the poverty line (Integrated Household Survey2004/2005); and poverty rates have only marginally improved since the 1997/98 household survey. GDP per capita incomes increased at only one percent annual rate between 1996 and 2005. One of the consequences of the prevailing poverty situation is persistently high malnutrition. Approximately 43% of the children are stunted, and 22% are underweight.

1.2 THE AGRICULTURE SECTOR

Agriculture remains the main source of growth and exports in Malawi. With 85 percent of the population residing in the rural areas, the sector accounts for over 80 percent of the country's employment, over one-third of GDP, and about 80 percent of merchandise exports. The primary staple food for most of these households is maize. Over 70 percent of all farmers in the country cultivate less than one hectare (ha) and a significant number of these farmers still struggle to produce enough food to meet their annual consumption requirements.

The country continues to experience dry spells, especially in the southern region, rendering a significant number of households in these regions perpetually food insecure. In areas where production has been good, poor roads have often prevented the marketing of surpluses. With the current low prices in the tobacco market, Malawi is facing a dramatic decrease in export revenues, leading to severe foreign exchange constraints, while leaving many tobacco farmers in need of alternative sources of cash income.

There is thus an urgent need to help the country to diversify the maize and tobacco-based production systems, and to encourage traditional (often subsistence) smallholder farmers to engage in more market oriented agriculture, through better market access and integration into agricultural value chains.

High population density and poverty have led to significant pressure and degradation of Malawi's natural resource base (land, water and forests). The growing population increases the land area under cultivation and exploits forests and woodlands for firewood and charcoal production. Deforestation, resulting in increased incidences of soil erosion, run-off and flash floods, and sedimentation are serious threats to the environment and natural resource base. These problems are a direct result of unsustainable land use and management practices, and increased use of chemical fertilizers without complementary soil conservation measures.

Malawi's agricultural development strategy is detailed in the Agricultural Sector Wide Approach (ASWAp) investment plan drafted by the Government of the Republic of Malawi (GoM) together with its Development Partners. The largest and most costly investment program in the sector is the Farm Input Subsidy Programme (FISP) targeted towards the poorer households, to attain food security. Notwithstanding the success of FISP, rates of malnutrition and especially stunting levels among children, remain high.

Box 1 – The Farm Input Subsidy Program in brief

- Smallholder family farms (1.4 million down from 1.6 million in 2010/11) receive 100 kg of fertilizer, 5 to 7.5 kg of maize seed, and 2 kg of legume seeds with a 90% subsidy. Last year 90,000 tons of fertilizer, and 17,000 tons of maize seed, were distributed through vouchers at a total cost of approximately K25 billion ($175 million). This year, 140,000 tons of Urea and NPK are distributed by the government, and 90,000 tons by private suppliers.
- Fertilizer subsidy vouchers have to be redeemed at parastatal fertilizer depots owned by the Agricultural Development and Marketing Corporation (ADMARC) and the Smallholder Farmers' Fertilizer Revolving Fund of Malawi (SFFRFM). The seed vouchers can be redeemed at any retail agro-dealer shop.
- Delivery of fertilizers, commissioned for 2011/12 cropping season has been very slow due to difficulty for suppliers to access letters of credit required by international suppliers and due to fuel shortage hampering fertilizer delivery to rural markets. With extra-support from bilateral donors, the GoM has now managed to deliver 85% of the fertilizer to rural distribution points.
- 12,730 tons of maize seed maize and 2,830 tonnes of legumes have been distributed.
- The DCAFS members helped the Government to finalize a medium term plan to improve the design, implementation and monitoring of the program. The proposed additional financing and MTDF to the on-going ADP-SP will support the implementation of this plan.

1.3 THE IRRIGATION, RURAL LIVELIHOODS AND AGRICULTURAL DEVELOPMENT (IRLADP)

The GoM gives high priority to sustainable agricultural land and water managements, including irrigation development, which reduces dependence on favorable weather conditions, while boosting productivity. The ASWAp aims to increase the area under sustainable irrigation from 72,000 ha to 280,000 ha, through the Green Belt Initiative. Support to a thriving irrigated agriculture sector is predicated on a demand-driven, service oriented approach with the full participation of farmers and commercial interests, as spelled out in the National Irrigation Policy and Development Strategy (NIPDS). This has to take place in the context of ongoing economic and civil administrative reform and an over-arching need to shift from a centralized (top-down, supply-driven) system to a de-centralized (bottom-up, demand-driven) planning, development and management system in the irrigation sub-sector. The GoM and Development Partners have started a number of initiatives for irrigation financing and development, and while IRLADP has pioneered some of the reforms, irrigation development is still haphazard.

The Project Development Objective (PDO)[2] is to: *(i) increase agricultural productivity of poor rural households in all districts and (ii) strengthen recipient institutional capacity for long-term irrigation development*. The main project activities include rehabilitation of irrigation infrastructure and provision of a package of technical and advisory services for sustainable small-scale irrigation. IRLADP has four original components:

(v) *Irrigation Rehabilitation and Development and Catchment Conservation,* which supports rehabilitation and gradual management transfer of four Government-owned

[2] As formally revised in June 2012.

schemes to farmers; development of new small-scale gravity and mini-scale schemes; rehabilitation of small reservoirs; and construction of 400 group civil works for water harvesting and catchment conservation on a demand-driven basis.

(vi) *Farmer Services and Rural Livelihood Fund (FSLF),* provides support to beneficiary communities, especially those around the irrigation schemes to obtain complementary services[3] needed to optimize returns to irrigation farming and access markets for their produce.

(vii) *Institutional Development and Community Mobilization*, supports restructuring, strengthening and/or formation of smallholder farmer organizations or water user associations for irrigation transfer, management and related activities aimed at ensuring the sustainable operation and maintenance (O&M) of rehabilitated schemes, and also supports limited policy and institutional capacity building measures in the MOAFS and MOWDI aimed at strengthening irrigation planning, design and supervision capacity.

(viii) *Project Coordination, Monitoring and Evaluation* of project implementation and ensuring that the project's funds are used for its intended purposes.

1.4 IMPLEMENTATION ARRANGEMENTS

The implementation arrangements of the original project are satisfactory and will remain largely unchanged. The Project Coordination Unit (PCU) will continue to be responsible for day-to-day project implementation. To further strengthen the linkage with the ASWAp investment framework, the PCU will work in close coordination with the ASWAP Secretariat under the policy guidance of the ASWAp Executive Management Committee (EMC), chaired by the Principal Secretary of MOAFS. The Project will also contribute and receive advice from the Technical Working Groups established under ASWAp to provide guidance on technical issues and methodologies for implementation of activities and investments. The Project Executive Committee (PEC) provides technical oversight and has the responsibility for approving sub-projects following recommendations from the district authorities. Targeting of IFA beneficiaries will be closely coordinated with the FISP Coordination Unit in MOAFS.

1.5 RATIONALE AND OBJECTIVE OF THE ADDITIONAL FINANCING

A proposed IRLADP AF II is being prepared to help finance the costs associated with scaling up the community-driven development (CDD) element of the project through enhanced demand-driven rural public works programs to create more community assets[4] and build community resilience to help cushion the rural poor while difficult economic reforms are undertaken. These activities are envisaged to be scaled-up from 11 original districts to all 28 districts in Malawi. In addition, the AF II will provide support to: (i) consolidating the project's gains, institutionalizing and improving water management in rehabilitated and constructed irrigation schemes under the parent project, improving in-field water management, rice agronomy and strengthening cooperatives, and input and output marketing

[3] Such as extension/technology transfer, inputs and marketing including post-harvest assets.

[4] These include catchment conservation works, feeder roads, orchards, afforestation, shallow wells, river rehabilitation, village grain banks and mini-scale gravity irrigation schemes.

arrangements in the value chain; and (ii) preparing an investment framework for future investments including technical, environmental, social and financial feasibility studies and designs for potential future investments. The AF II will also introduce a contingent financing component which can be used for rapid response in future emergencies. No co-financing arrangements are proposed under the project. The project closing date will be extended from June 30, 2012 to December 31, 2014 in order to effectively carry out the planned scaled-up activities.

The key rationale for this additional financing of IRLADP under rapid response package is that a nationwide scale up of project activities can have a cushioning effect and enhance development impacts on the rural poor in all 28 districts while difficult economic reforms are undertaken. It would also consolidate the gains by IRLADP to irrigated agriculture, and prepare for future investments in the irrigation sub-sector, which is an implicit element of the PDO and a key recommendation on implementation readiness from the 2010 QAG review, but which has so far not received financing. The proposed IRLADP AF II is aligned with the new CAS (FY 12-15) under preparation as it addresses the pillar of promoting sustainable, diversified and inclusive growth, through the outcome of increased productivity and diversification in agriculture. The project is also consistent with the principles of the Agriculture Sector Wide Approach (ASWAp), developed through the Bank financed ASWAp-SP.

AF II Strategic objectives

Strategic objective	**M US$**
Scaling up Activities on Social Safety Net	30.40
Consolidating Project Achievements	12.05
Preparing for new investments in irrigation	7.55

Several financing alternatives were considered. Among them was (i) possible restructuring of ongoing agricultural projects, (ii) a no project option, and (iii) the option to channel support through a new investment lending operation. The first option to restructure ongoing agriculture projects was rejected as IRLADP was about to close and the ASWAp-SP has a different set of objectives and implementation arrangements that does not lend itself to emergency assistance. The no project option was dropped as the potential impacts on the rural poor were large and too acute to not justify an urgent scale up operation in support of rural social safety nets. Additional finance would still be required to achieve the original objectives of the Projects. Finally, a new operation would not only require more preparation time but it would not build on the well-performing IRLADP structures at national, regional and district levels to enable the fastest response.

Additional financing to IRLADP has the benefit of using a well established project mechanism that is geared towards diversified support to rural poor, has demonstrated its efficacy and satisfactory progress as well as its management and fiduciary controls, and is therefore considered the appropriate channel for rapid rural response.

1.6 PROJECT FINANCING AND COSTS

The original IRLADP project was co-financed by an IDA Sector Investment Grant of SDR 27.6 million (US$ 40 million equivalent) and by an IFAD Loan of SDR 5.5 million (US$ 8 million equivalent). An additional financing in the form of a Credit in the amount of SDR 8.6

million (US$12.7 million equivalent) was approved by the World Bank in September 2010. An additional Credit is proposed for an amount of US$50 million.

Costs by component

Component	*Original cost (IDA only) M US$*	*Changes with AF I M US$*	*Changes with AF II M US$*	*Revised cost M US$*	*Total including IFAD, GoM and beneficiaries M US$*
1) Irrigation rehabilitation and development and catchment conservation	10.32	4.70	14.25	29.27	32.81
2) Farmer Services and Livelihood Fund	19.26	2.80	29.60	51.66	57.47
3) Institutional Development and Community Mobilization	8.52	4.30	3.45	16.27	18.84
4) Project Coordination, Monitoring and Evaluation	1.90	0.90	2.70	5.5	6.08
5) Contingency for Disaster Risk Response	-	-	0	0	0
Total	**40.0**	**12.70**	**50.0**	**102.7**	**115.2**

1.7 PROPOSED ADDITIONAL ACTIVITIES

Component 1: Irrigation Rehabilitation and Development and Catchment Conservation (US$14 million)

(a) Preparation for future investments (US$7.5 million): Prominent will be a strategic study on the future of irrigation development and management in Malawi. The strategic study will help to inform a comprehensive investment framework and master plan for irrigation development. Malawi has considerable irrigation potential, but it is poorly identified and prioritized. There have been a number of studies in the country, but these have been mainly supported disconnected irrigation development interventions, not addressing the breadth and width necessary for a national irrigation planning and investment framework. The absence of such planning in turn has led to a haphazard and isolated approach to feasibility studies for specific investments which have both precluded a prioritization at national level and have caused delays in project implementation.

(b) Scale up of Small Scale Irrigation (US$5 million): The project would support a modest expansion on the program supporting Small Scale Irrigation, funding construction of a limited number of schemes that have already been designed and for which cost estimates, Environmental and Social Management Plans (ESMPs) and bidding documents have already been prepared and are ready for tendering. This would cover about 900 ha of small scale schemes (a few schemes will be up to 100 ha in size).

(c) Support to Water use efficiency in existing rice schemes (US$0.5 million): Under this component there will be limited infrastructure development support to increase water use efficiency in existing rice schemes beyond the 4 schemes supported under IRLADP. Investments will be incremental in nature, and support interventions for improved water management as they would be supported under Component 2 and institutional support under Component 3 with minor infrastructure investments in flow measurement devices (flumes) and minor upgrading of flow distribution infrastructure (gates, distribution boxes, etc).

(d) Catchment Conservation and Rainwater harvesting (US$1.0 million): Additional financing will support limited expansion of catchment conservation activities beyond what was already planned in the critical hotspots upstream of the supported irrigation areas. This means that more hotspots and catchments for new irrigation areas will be supported by the project. The proposed scale up will further ensure the environmental sustainability of the schemes, reduce inflow of silt and in time increase the base flow in rivers. The AF II will also consolidate and follow-on support to the current activities under the rainwater harvesting and catchment conservation programs in the targeted catchments, and especially support the establishment of a geographic information system (GIS) based planning, monitoring and evaluation framework.

Component 2: Farmer Services Livelihood Fund (US$28.6 million)

(a) Support for extension (US$2.4 million): Under the proposed AF II, the project will provide additional agricultural technical advice to beneficiary producers with a focus on consolidating results achieved so far on irrigation infrastructure rehabilitation or construction. Particular attention will be given to increasing rice agronomic performances focusing on four critical elements: (i) cropping techniques in connection with water management and promotion of the system of rice intensification (SRI) to improve productivity while reducing water consumption; (ii) test and introduction of improved and high performing rice varieties; (iii) development of locally-produced rice seeds; and (iv) introduction of animal-drought equipment and power tillers for soil preparation and other small cropping equipment to reduce drudgery in irrigations schemes. To achieve these objectives, the AF II will support implementation of farmer-led demonstrations and on-farm trials through the farmer field schools and farmer business schools which are already functional. It will also scale up the lead farmer approach by increasing the coverage of farmers reached through project extension activities. The project will continue providing basic support to community mobilization, beneficiary sensitization and farmer group dynamic to ensure strong commitment to project objectives, ownership of activities and sustainability of investments.

(b) Inputs for Assets (IFA)Voucher Program(US$25.0 million): The AF II will scale-up support towards the IFA program to help farmers raise their productivity through increased cropping intensity and diversification in their agricultural livelihoods, both in the wet and the dry season, thereby helping them avert food shortage. So far, the Project has reached over 192,000 beneficiaries. Planned allocation for this component from AF II is US$25 million, to cover for IFA programs in all districts in the country, reaching an additional 250,000 beneficiaries in the coming growing seasons[5].

[5] 2012 rainy season, 2013 dry season, 2013 rainy season, 2014 dry season and the 2014 rainy season.

(c) Support for marketing and post-harvest assets (US$1.2 million): Through a matching grant mechanism, the project has supported 75 farmer groups in developing income generating activities through the acquisition of marketing and post-harvest equipment. Supported activities cover poultry and dairy production, post-harvest processing (rice milling mainly) and transformation (bakery, cassava, juice). The AF II will provide additional managerial and technical assistance to these groups to consolidate results achieved so far and ensure their sustainability beyond project closure. The AF II will extend the approach developed so far to reach out more farmer groups and cooperatives as a way to strengthen producer access to markets, to add more value into production through agricultural produce processing, proper handling, storage and packaging. Cooperatives will also be supported in organizing proper input supply to access fertilizer and seeds, as well as veterinarian medicines, fodder and feed for groups in livestock production. Market information remains a critical service to farmers for timely and affordable access to agricultural inputs and for rewarding marketing of produce. The Project has piloted the establishment of 8 Market and Agribusiness Information Centers. These centers will be closely monitored to confirm farmer interest, check replicability and assess sustainability beyond project closure.

Component 3: Institutional Capacity Building (US$1.5 million)

(a) Capacity enhancement to public irrigation service delivery (US$0.75 million): The capacity enhancement support program will be targeting, among others, elements of the Department of Irrigation's training plan, and include short courses, three MSc degrees in regional/international universities on integrated irrigation management and scheme design to enhance knowledge and expertise in DoI. Furthermore, AF II will support the provision of a pilot short term course for fresh graduates from Bunda College and Natural Resources College on practical principles of irrigation design, contract management and water management, addressing deficiencies in practical skills to complement the theoretical knowledge from the colleges.

(b) Water User Associations and Irrigation Management Transfer (US$0.75 million)*:* An important element of support to institutional capacity building for irrigation concerns consolidation and further support to WUAs and Water User Groups. The governing principle in irrigation management remains full management responsibility of irrigation schemes by the water users through legally constituted organizations that oversee all matters related to operation and maintenance and the financial sustainability of the schemes. In all the small scale and large scale schemes supported by IRLADP these WUAs have been formally established and trainings provided. However, these are to be continued during the joint management phase of the next two years with practical hands-on training on scheme management, budgeting and accounting and infrastructure maintenance. In order to scale up the processes of WUAs and Irrigation Management Transfer this will be extended to other rice schemes where this process may not be completed. This will complement support to improving water management, flow measurements and in-field water management for rice irrigation that will be supported under Component 2 of the project.

1.8 IRLADP INTEGRATED PEST MANAGEMENT PLAN

The IRLADP integrated pest management plan is based on the same principles and elements of the pest management plan prepared for the recently approved ASWAp-SP additional financing.

Field investigations, Consultations and Literature Review: The field investigations included visits to the project impact districts of Mwanza, Chikhwawa, Ntcheu, Salima and Chitipa. In addition, visits to the major agrochemical marketing companies in Lilongwe were undertaken. Consultations with various key stakeholders such as MOAFS, the Pesticides Control Board and the communities in the project impact districts were conducted. Key informant and 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.

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 have been reviewed including the following legal instruments:

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) Integrated Pest Management Framework for Kenya Agricultural Productivity and Agribusiness Project (IPMF-KAPAP), 2009; and

e) Livestock Development and Animal Health Project - Pest Management Plan (Volume III)

f) Bulletin of the World Health Organization, 66 (5): 545-551 (1988)

Definitions have been fronted over the years to describe Integrated Pest Management (IPM). In 1967, FAO defined IPM as a pest management system which utilizes all suitable techniques and methods in as compatible manner as possible, and maintains the pest population at levels below those causing economic injury.

Key elements of an IPM program are: (i) Use of available, suitable, and compatible methods which includes resistant varieties, 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 and crop loss assessments.

The following are key preconditions for an IPM approach:

(a) Understanding of the ecological relationships within a farming system (crop, plant, pests organisms and factors influencing their development;

(b) Understanding of economical factors within a production system (infestation: loss ratio, market potential and product prices);

(c) Understanding of socio-cultural decision-making behavior of the farmers (traditional preferences, risk behavior);

(d) Involvement of the farmers in the analysis of the pest problems and their management

(e) Successive creation of a legislative and agricultural policy framework conducive to a sustainable IPM strategy (plant quarantine legislation, pesticides legislation, pesticide registration, price policy)

Due to drawbacks of reliance on pesticides, a crop protection approach (IPM) that is centred on local 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.

CHAPTER TWO: PEST MANAGEMENT POLICY AND LEGAL FRAMEWORK

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.

The 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 some considerable amount of pesticides as one way of combating pest problems. The pesticides that are used in Malawi include insecticides, fungicides, herbicides, fumigants, nematocides, Acaricide and rodenticides. To some extent, other products such as growth regulators, repellents, molluscicides and parasiticides are also used. Recently some scientists have initiated the testing of some botanical plants to regulate pests.

The major crops that are 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 the various pests and diseases that attack them. Table 2.1 illustrates the estimated use of pesticides in Malawi by crop.

Table 2.1 Pesticides use in Malawi for the Major Crops

CROP	ESTIMATED USE (% of total)
Tobacco	40-50
Coffee	15-20
Sugarcane	10-15
Cotton	10
Tea	5
Maize	4

Source: Pesticides Control Board, 2004

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

The major importers of pesticides in Malawi are:

(a) Farmers Organizations;
(b) Chemicals and Marketing;
(c) Agricultural Trading Company (A.T.C);
(d) Coffee / Tea Association of Malawi;
(e) Sugar Corporation of Malawi (SUCOMA); and
(f) Limbe Leaf

2.2 PEST MANAGEMENT (OPERATIONAL POLICY 4.09)

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 whole of 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 pesticide 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 (Geneva: WHO 1994-95). 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;

(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 Labeling 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 be 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. However, procurement of pesticides will not be financed until it can be demonstrated that local capacity exists to adequately manage their environmental and social impacts, in compliance with OP 4.09 as described above.

2.3 PRINCIPLES IN SELECTING PESTICIDES

Selection of pesticides, under the project implementation will be guided by the principle that requires the consideration of several pest management approaches of cultural, physical and biological measures before the application of chemical pesticides is considered necessary.

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. The 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) Approved list of pesticides, 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.

2.4 PESTICIDES TO BE ACCEPTABLE TO THE ASWAP - SP

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 Appendix 2.1 provide internationally accepted standards on pesticides to minimize the hazards associated with pesticide use.

The use of pesticides under the project will 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 Libelling Practice, Transportation and Disposal of Waste Pesticide and Pesticide Containers1985.

2.5 PESTICIDES MANAGEMENT: LEGISLATION AND REGISTRATION

2.5.1. International Policies

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

The Bank uses various means to assess pest management in the country and support integrated pest management (IPM) and the safe use of agricultural pesticides, 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 the Bank-financed agriculture operations, it 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.

2.5.1.2 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).

2.5.1.3 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, including 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; and promote concurrently, regional collaboration in plant pests and animal disease control and the widespread development and use of integrated pest management practices

2.5.1.3 National Policies

Previously, there was no regulatory body to control importation and consumption of pesticides in Malawi. Although the amount of pesticides used in Malawi is generally low as compared to other countries, there has been a lot of abuse of these toxic substances. In the absence of a regulatory body, chemicals were just imported by some organizations, as it deemed necessary. As a result, there were more chemicals than actually required. This resulted into the build-up of pesticides products that became obsolete.

The Ministry of Agriculture and Food Security 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.

2.5.1.1 The Pesticides Act, 2000

Upon realisation of the importance of having a Regulatory Body on the use 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 was 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 gives 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 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 formulation control in collaboration with the Malawi Bureau of Standards;

(g) Harmonization of pesticides registration through international bodies such as SEARCH;

(h) Labelling of pesticides containers according international standards; and

(i) Carrying out proper disposal of obsolete 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.

2.5.1.2 Pesticides Registration Process

As the process of pesticides registration in Malawi continues, it is proposed that the following factors be taken into account:

1. Quantity of pesticides to be considered for registration in Malawi;
2. A list of candidate pesticides (pesticides for registration consideration) in Malawi is provided in Appendix 2.2;
3. Priority list and importance of pesticides by crop as supplied by organizations;
4. Risk assessment of pesticides for registration consideration;
5. Harmonization with the list of registered chemicals in SEARCH countries;
6. For the Registration of a "New Active ingredients and formulations', Malawi will have to conduct at least one year of trials if product is registered in at least one SEARCH country.
7. If not registered in any SEARCH country, conduct trials for 2 years. Also include residue trials. Thereafter the test results must be submitted to the Malawi Agricultural Technology Clearing Committee (ATCC) for final assessment and recommendations to Pesticides Control Board for endorsement; and
8. The Malawi Bureau of Standards (MBS) must conduct pesticides residue and quality control tests on the formulations.

2.5.1.3 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. That is, they should follow the "safety" guidelines on pesticides transportation, distribution, application, storage and disposal of pesticides.

The Pesticides Control Board should 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 chemicals in all premises.

The PCB must advise the Malawi Government on how to dispose off obsolete stock. Disposal of obsolete stock will involve collecting all obsolete stock from all premises and may require arranging for incineration.

The PCB should 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 chemicals in all premises.

The PCB will advise the Malawi Government on how to dispose off obsolete stock. This will involve collecting all obsolete stock from all premises and arranging for incineration in properly assessed and designated sites.

2.6 USE OF NON-CHEMICAL PLANT PROTECTION METHODS

Some of the main features of IPM involve the non-chemical methods of pest control:

(a) Biological Controls: Biological controls are the use of natural enemies of crop pests, often called beneficials, which include parasites, predators and insect pathogens. Environmental friendly chemical interventions such as the use of semiochemicals; including pheromones and feeding attractants, biopesticides and specific and beneficial friendly insecticides are sometimes included among the biological controls;

(b) Cultural and Crop Management Controls: Tissue culture, disease-free seed, trap crops, cross protection, cultivation, refuge management, mulching, field sanitation, crop rotations, steam cleaning, trapping, freezing and intercropping are some of the cultural crop management controls that can be used;

(c) Strategic controls: Strategic controls include consideration of planting location, timing of planting and harvesting; and

(d) Genetically based controls: These include insect and disease resistant varieties/breeds and rootstock.

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.

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. Neem (*Azadirachta indica A. juss*) is also used to control root knot nematodes *Meloidogyne* species on bananas. Table 3.5 shows botanicals that are being tested for the control of various pests.

Table 3.5: Botanicals being tested for the control of various pests

Scientific Name	Local Name	Pest on which it is used
Combretum ternifolium	Kadale	Storage pests
Elephantorrhiza goetzei	Chiteta	Storage pests
Cassia spp.	Muwawani	Storage pests
Mucuna spp.	Dema	Storage pests
Tephrosia vogelli	Wombwe	Storage pests / cabbage pests
Neem	Nimu	Storage pests / vegetable pest
Lasiosiphon kraussianus	Katupe	Storage pests
-	Katswatswata	Storage pests
-	Kangaluche	Storage pests
Dicoma spp.	Somphole	Storage pests

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

(a) *Apoanagyrus lopezzi* on cassava mealy bug;

(b) *Teretrius nigrescens* on Larger Grain Borer (*Prostephamus 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*)

Advantages of the IPM: Integrated Pest Management (IPM) fundamentally differs from the traditional pest control programs in that it addresses more than just the symptoms of a pest problem. Non-integrated pest control programs tend to focus on killing pests while ignoring the reasons why pests are there in the first place, which doesn't do much to prevent recurring problems. By removing or altering the conditions that attract or are conducive to pest infestations, IPM practitioners can better cure existing infestations and prevent future ones.

Scheduled chemical treatments are not IPM. Many pest control plans call for routine pesticide applications whether pests are present or not. These applications are seen as "protective barriers" that will prevent infestations but they are not. Unnecessary applications may even lead to the development of pesticide resistance in target pest populations and increase

problem infestations instead of reducing them. Hence application of a pesticide on a regular schedule is not IPM.

IPM relies on routine inspection and monitoring for pest presence. Pesticides are considered only when there is clear evidence of pest presence (e.g., pest sightings, droppings or pest catches in monitoring traps, and when non-chemical approaches such as vacuuming, trapping and exclusion (i.e., physically blocking pests' entrance) have been unsuccessful or are inappropriate.

IPM techniques are less toxic and more targeted. Some pest controllers will apply pesticide to exposed areas far from where it is really needed and use more of it than necessary. IPM practitioners apply pesticides with precision and choose the least-toxic formulation to get the job done. IPM is not a one-person job. Long-term pest management solutions typically depend on daily pest monitoring and a variety of sanitation, breeding, tillage, management and appropriate agronomic practices. No one person can do it alone. Without cooperation from land owners, land occupiers, management and staff, the IPM model falls apart and chemical treatments will be difficult to avoid.

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

IPM is more effective in controlling pests over long periods. This is not surprising, since IPM combines many control techniques instead of relying on any one technique. IPM's efficacy advantage has been confirmed by research and in practice. IPM approach is recommended by pesticide management stakeholders.

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

IPM poses less risk than persistent use of chemical pesticides. Farm workers may have compromised immune, neurological, digestive and respiratory systems that put them at increased risk of suffering harmful effects from exposure to pesticides. Chemically sensitive individuals, pregnant women, infants, children and the elderly may be particularly vulnerable to the effects of pesticides. By reducing pesticide use, IPM helps reduce the potential for negative impacts on human health and the environment.

CHAPTER THREE: STEPS IN SETTING UP INTEGRATED PEST MANAGEMENT

3.1 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 Farm Group will be a member of this Committee. This arrangement is appropriate, because implementation of an IPM program can be tracked as a performance indicator. The leader of this team should be familiar with pests, pesticides and pesticide regulations.

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

3.2 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 ASWAp-SP 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.

3.3 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 accomplish 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 an IPM program;
- Number of calls related to pest problems and toxic chemical use reduction.

Furthermore, when the shift to IPM will occur is must be resolved 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 following must be calculated:

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 the practical insight.

Reduced pesticide use is the substantive yardstick in measuring an IPM's ability to create a safer environment. The IPM Committee will therefore design an information database that includes annual quantities of pesticides used 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.

3.4 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

3.5 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, and 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 annual inspections and audits.

3.6 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.

Correctly identifying the pest that has invaded the area before is key to an effective IPM. 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 ongoing monitoring of the problem will facilitate determination of supplemental treatment options if required.

3.7 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 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 ASWAp-SP of chemical treatments. They will also communicate with the maintenance team to make the necessary repairs.

3.8 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.

3.9 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
- Using these records, and the goals of the IPM program (increased efficacy, lower costs and reduced pesticide use), the IPM Committe 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
    - 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 IPM.

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

CHAPTER FOUR: 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 is closely related to reduction in 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 ASWAp-SP.

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.

4.1 POSITIVE IMPACTS OF CHEMICAL PESTICIDES

Chemical pesticides may improve yields in the short term. However, continued application of chemical pesticides results in long term negative impacts which are presented in Section 4.2

4.2 NEGATIVE IMPACTS OF CHEMICAL PESTICIDES

Depletion of organic soil nutrients
Practical experience has shown that in many areas of the country, soils lack the basic and necessary organic soil nutrients to sustain crop production yields due to chemical imbalance; as a result there is increasing dependence on chemical fertilizers whose impact is short lived.

Mitigation measures
Apply soil conditioning measures which include IPM

Poisoning of non target species including natural biological pesticides
Poisoning of non target 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
- Regularly maintain and clean the equipment.
- Use recommended and appropriate protective clothing.
- Conduct training seminars in integrated Pesticide Management
- Clean equipment and dispose old equipment as recommended by manufacturer.

Adulteration
Pesticides dealers may adulterate or dilute their chemical pesticides for financial gains

Mitigation measures
Conduct regular inspection, sampling and testing of chemical pesticides

Water soil and environmental pollution
Water, soil and environmental pollution may occur due to spillage during loading and offloading of vessels and during storage.

Mitigation measures

- Provide suitable warehouse
- Use of bio-beds, draining channels and draining dams.
- Use chemical remains to re-spray.
- Clean equipment in one place.
- Use plants such as water lilies to absorb waste pesticides.
- Take stock of pesticide containers
- Apply Integrated Pesticide Management
- Train farmers not to spray toxic chemicals close to water sources
- Train farmers to maintain spray equipment in safe operational order

Health and safety risks
Farmers and other persons around pesticides storage and handling areas may be exposed to hazardous chemicals. Stocks of obsolete pesticides are a serious health and environmental risk in many countries of Africa. Pesticides are often not stored correctly, resulting in corroded containers, lost labels and release of the chemicals into the environment. Pesticide stockpiles pose a very serious health and safety risks of contaminating drinking water, food or the air. The presence of compounds in the soil for up to five years since last application shows that chemical pesticides persist in soils. High levels of these chemicals become harmful to man and aquatic community as the chemicals are eventually washed as run off into water bodies.

Mitigation Measures
- Provide protective clothing to workers and ensure it is used.
- Train farmers in proper handling of chemical pesticides and conduct routine medical examination for workers.
- Promote IPM to replace harmful chemicals

Pesticide misuse, over / under application
Pesticides may be misused, underused or overused due to lack of appropriate knowledge of application rates. In response to the need to be prepared for initiating a control campaign at short notice, stockpiles of chemical pesticides are maintained in many of the countries using them. Stockpiles of chemical pesticide pose serious threats of contaminating drinking-water, food or the air.

Mitigation Measures
- Conduct training sessions and awareness campaigns on appropriate and approved chemical pesticides application.
- Purchase only enough stocks as required and destroy obsolete stocks of chemical pesticides

Intentional poisoning
Pesticides may be used for poisoning to kill intentionally or commit suicide due to social pressures and frustration.

Mitigation Measures
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.

Drug resistance in pests
Pests may develop resistance to pesticides due to lack of appropriate knowledge in pesticides application

Mitigation Measures
Train farmers in correct application of pesticides

4.3 POSITIVE IMPACTS OF NON CHEMICAL PESTICIDE

Non chemical pesticides, which include biological controls, manual and mechanical methods of managing pests; entails the use of environmentally and socially acceptable methods on the host, to eliminate pests or diseases.

4.3.1 Positive impacts of biological controls

Reduced environmental and health risks
In biological control of pests and diseases; insects, bacteria or fungi are applied on the host to eliminate the pest or disease. This is one of the better known environmentally friendly control methods as compared to other non chemical control methods. Biological control is applied carefully and selectively and since no chemicals are used, the method has no adverse effect on people's health and the environment.

Enhancement Measures
Establish and disseminate environmental and health benefits of biological controls to the communities for them to appreciate the advantages

Ease of application and integration with other control methods
Application of biological controls can be done easily through community participation and can be integrated in other IPM control methods. Some of the biological controls are known to the communities in some specific areas.

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

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 numerous environmental benefits. For example providing a reliable supply of improved seed will have important benefits on 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 tree cover include improving soil stability, reducing erosion, preventing desertification and stabilizing global climate. By increasing and sustaining the supply of timber, pressure on forests will be reduced on natural forests, helping to preserve valuable natural biodiversity and rare habitats.

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.

4.3.2 Positive impacts of mechanical methods

Very fast method
This method involves the use of automated machines and may be a fast way of weeding. However, this method is not suitable for the ASWAp – SP as it is highly costly and the small scale farming methods are not conducive to the method

4.3.3 Positive impacts of manual methods

No pollution on the environment
This method is environmentally friendly, as there is no pollution from the manual control. Methods basically imply of the use of labour with simple implements/tools. The method is friendly to the environment as there is no pollution of land, water or air when applied.

4.4 NEGATIVE IMPACTS OF NON CHEMICAL PESTICIDES

4.4.1 Negative impacts of biological controls

Limited knowledge of consequences of impacts
Farming communities often lack the appropriate knowledge of types and methods or times of application for biological pest control methods. Some of the biological controls for instance, may not be very selective on hosts and as a result, they may attack other unintended plants or crops when the target host is eliminated. This may create an imbalance in the ecosystem. In Lake Kyoga and Victoria for instance, after beetles were successfully used for control of water hyacinth in the late 1990's, new plants (ecological succession) which emerged pose problems on water transport water supply and fishing in the lake.

Mitigation Measure
Biological controls must be applied carefully with the full knowledge of the consequences. Hence farming communities must be appropriately trained and indigenous knowledge on natural biological controls must be harnessed from them.

Biological control agents are slow in action
Biological control agents are known to be slow in action and may take a longer period to generate results; and therefore cannot be used in emergency situations. The slowness of biological agents to act may frustrate IPM programmes as farmers are used to the rapid though unsustainable results of chemical pesticides.

Mitigation measures

- Educate farmers on the long term benefits of the biological methods to win their confidence and acceptance of the method.
- Phase transition from chemical to IPM methods to ensure no appreciable loss of production during transition

4.4.2 Negative impacts of mechanical methods

Impact: High cost of machines and environmental problems of weed disposal

This method involves the use of automated machines and may be expensive depending which machines are used. For example inter-cultivation is done using a tractor mounted inter-cultivator to control weeds in crops such as sugarcane and use of boom sprays.

Use of mechanical methods may be friendly or unfriendly to the environment depending on the operation carried out and the disposal technique of the waste weeds. For example when water hyacinth are chopped mechanically and left to rot, they result into accumulation of debris. This material impacts on biotic communities, the environment and socioeconomic activities. Safe operation of the machines is important especially if they are to be used in rural areas.

Mitigation measures

Mechanical methods may be appropriate for large scale operations but will not be appropriate for the case of ASWAp – SP. This method calls for the removal of the chopped materials from the site and their disposal in an environmentally friendly manner. Hence these methods are included only to highlight their availability and would not be appropriate for the ASWAp - SP. However, if they are to be used somewhere else, an integrated system of weed removal and utilization has to be developed to reduce the costs.

4.4.3 Negative impacts of manual methods

The major concern is often the high cost involved. For example weeding of tea is particularly expensive before the tea matures and completely covers the ground. This method is not applicable to small scale farmers who normally use the hoe which is more appropriate than manual picking of weeds

Health hazards

Manual control methods pose risks of snake bites, hippo or crocodile attacks, depending on which plant and where the operation is carried out.

4.5 POSITIVE IMPACTS OF IPM

Increase in agricultural yields

Increased agricultural productivity is a precondition for growth and development in agrarian economies such as Malawi and most African countries. Integrated pest management practices will contribute to an increase in agricultural yields through appropriate prevention of crop damage and preservation of produce.

Enhancement measures

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 crops from pest damage.

Contribution to Food Security
Application of pest management practices will result in increased yields and efficient preservation of produce, subsequently providing enhanced food security; and contributing to the overall national goals on food security

Enhancement measures

- 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 pest management options.

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

Enhancement measures

- 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 practices to reduce application of chemical pesticides; and
- Enforce regulation prohibiting importation of banned chemical pesticides

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 traizines which are harmful to the environment. It will also help reduce application of banned chemicals such as DDT and dieldrine, which are sometimes smuggled across the borders.

Enhancement Measures

- Enforce regulation prohibiting importation of banned chemical pesticides
- Educate farmers on harmful consequences of banned chemical pesticides

4.2 COMMON MAIZE PEST PROBLEMS AND RECOMMENDED IPM PRACTICES

Maize is the most common staple in Malawi and is the target as well as the main focus of the ASWAp – PS, under the FISP. Major maize pest problems and recommended management practices are given in Table 5.1

Table 4.1 Major maize pest problems and recommended pest management

Pest	***Recommended management practices***
Stalk borers (*Busseola fusca*)	• Burry or burn Stalks to eliminate diapausing larvae • Plant early to reduces infestation • Intercrop with pulses (except rice) • Apply neem (arobani) powder (4-5 gm i.e. pinch of 3 fingers) per funnel • Apply neem seed cake (4 gm/hole) during planting • Use carbofuran and carbaryl as insecticides • Use extract of *Neuratanenia mitis*, a botanical pesticide • Apply ash in maize funnels. • Uproot and burn any infected crop
African armyworm (*Spodoptera exempta*)	• Scout the crop immediately the forecast warns of expected outbreak in the area • Apply recommended insecticide or botanical extract timely
Seedling weevils *(Tanymecus* spp. & *Mesokeuvus* spp)	• Plant timely to avoid damage • Scout the crop • Apply lambda cyhalothrin if necessary
Larger grain borer (LGB) Weevils Moths Red flour beetle Dried bean beetles	• Select tolerant varieties • Harvest timely, dry adequately and sorting and clean produce • Dehusking and shelling • Cleaning & repair storage facilities • Use rodent guards in areas with rat problems • Use improved granaries such as metallic silos. • Use appropriate natural grain protectants where applicable or, use recommended insecticides at recommended dosage • Keep the grain in air tight containers and store these in a • shady place, preferably in-doors • Carry out regular inspection of the store and produce for timely detection of damage to the grain and/or storage structure to minimize potential loss or damage • Promote biological control of LGB using Teretriosoma nigrescens (Tn) to minimize infestation from wild sources.
Red locust	• Planting early • Promote use of green muscle which include fungal formulation • Apply Fenitrothrom especially in extreme cases
Grey leaf spots (GLS)	• Practice crop rotation • Plant recommended resistant varieties • Observe recommended time of planting, • Remove infected plant debris by deep ploughing • Uproot and burn infected crops.
Maize streak virus	• Planting early • Plant recommended resistant varieties • Uproot and burn infected stalks after harvesting
Northern leaf blight	• Practice crop rotation • Deep plough crop residues

	• Plant recommended resistant varieties
Maize streak virus (MSV) (*Cicadulina mbila*)	• Observe recommended time of planting to avoid the diseases • Plant recommended tolerant varieties • Early planting
Leaf rusts (*Puccinia sorghi*)	• Planting timely, Crop rotation, Clean seeds, Reduce density, • Allow adequate aeration
Leaf blights (*Helminthosparium turcicum and maydis*)	• Crop rotation, Deep plough of crop residues
Common smut (*Ustilago maydis*)	• Clean seeds • Practice crop rotation • Uproot and burn any infected crops • Remove plant debris by deep ploughing
Weeds:Wild lettuce, Starber weeds (oxygonum sinuatum), Star grass, Wondering jew, Late weed, Digitaria spp.	• Practice crop rotation • Prepare land properly and weed timely • Use recommended herbicides when necessary • Hand pull and weed with hoe • Intercropping and use resistant/tolerant varieties • Improve soil fertility and weed timely
Witch weed (*Striga* spp)	• Hand pull weeds at flowering to avoid seed formation • Use of false host plants e.g. rotation of maize with cotton or legumes and apply manure

CHAPTER FIVE: PEST MANAGEMENT AND MONITORING PLANS

5.1 PEST MANAGEMENT PLAN

The Integrated Pest Management and Monitoring Plan (IPMMP) is developed from the impacts and mitigation measures identified in Chapter 4. The IPMMP 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 IPMMP 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 IPMMP also provides opportunities for the enhancement of positive impacts. The IPMMP gives details of the mitigation measures to be implemented for the impacts; and the responsible institutions to implement them.

Implementation of the IPMMP 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 IPMMP for the best results in pest management.

The IPMMP 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 IPMMP will however, provide guidance in the development of more detailed IPMMP'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 5.1 below is a generic or typical environmental management and monitoring plan, which would easily fit in the implementation of the ASWAp - SP.

5.2 PEST MONITORING PLAN

Successful implementation of the ASWAp – SP Integrated Pest Management Plan in the project district will require regular monitoring and evaluation of activities undertaken by the Farmer Groups. The focus of monitoring and evaluation will be to assess the build up of IPM capacity among the Farmer Groups 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 membership Farmer Groups formed for IPM capacity building in the project districts:
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 Numbers of Farmer Organizations that nominated members for IPM training
5 Number of women 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 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 IPMMP; activities that need improvement; and remedial actions required

Table 5.1: Integrated Pest Management and Monitoring Plan

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution	Standards/Regulation	Monitoring Institution	Monitoring Frequency
1.	**NEGATIVE IMPACTS OF CHEMICAL PESTICIDES**						
	Depletion of organic soil nutrients	Persistent use of chemical pesticides	Apply soil conditioning measures which include IPM	Farmers	IPMMP	IRLADP EMC	Quarterly
1.1	Poisoning of non target species including sprayers and consumers	Lack of knowledge of pesticide potency and negligence	Training Monitor use of pesticides to ensure that only approved and recommended chemicals are used	ASWAp - SP	Pesticides Act	-PCB -EAD	Annually
1.2	Adulteration	Lack of controls	Inspection, sampling and testing	Pesticides Transporters and Suppliers	-Packaging and storage standards -Product specifications -EMA -Pesticides Act	-MBS, PCB, - --ASWAp - SP EMC	Quarterly
1.3	Health and safety risks	Exposure to pesticides	-Provide protective clothing and ensure it is used. -Train farmers in proper pesticides handling. -Routine medical examination	Agro-dealers	Labour regulations, PCB regulations	-Min. of Labour. -PCB -DA -ASWAp - SP	Annually
1.4	Water, soil and Environmental pollution	-Inappropriate building for storage of pesticides. -Cleaning of equipment, -Disposal of remains of pesticides	-Construct suitable warehouse -Use of bio-beds, draining channels and draining dams. -Use chemical remains to re-spray. -Clean equipment in one place. -Use plants such as water lilies to absorb waste pesticides. -Take stock of pesticide containers -Integrated Pesticide Management	Pesticides Transporters and Suppliers Farmers	-Pesticides and equipment manufacturer's recommendations. -Water pollution standards.	PCB Environmental Affairs. -Water Resources Board	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution	Standards/Regulation	Monitoring Institution	Monitoring Frequency
		-Disposal of containers and equipment	-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	-PCB regulations, -Manufacturer's guidelines	-PCB -DA	Half yearly
		-Inadequate storage space. -Bad housekeeping -Multipurpose use of warehouse	-Provide adequate and separate storage space for pesticides	Agro-dealers	-PCB regulations, -Manufacturer's guidelines	-PCB	Half yearly
		Multi-purpose use of equipment or pesticides	Control use of equipment and pesticides -Thorough cleaning of equipment -Training -Integrated Pesticide Management	Farmers	Pesticides Act	-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 ASWAp - SP	EMA Pesticides Act	EAD EMC	Half yearly
		-Equipment malfunction -Wrong type of equipment. -Time and method of	-Regular maintenance of equipment. -Use recommended equipment. -Use approved methods of application. -Use recommended protective	Farmers ASWAp - SP	-Manufacturer's recommendations. -Equipment maintenance policy	-PCB -EMC	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution	Standards/Regulation	Monitoring Institution	Monitoring Frequency
		application (spraying)	clothing. -Training seminars -Integrated Pesticide Management				
		-Improper cleaning of equipment. -Improper disposal of cleaning water and old equipment	-Clean equipment and dispose equipment as recommended by manufacturer. -Use bio-beds and draining dams to dispose cleaning and drainage waters -Integrated Pesticide Management	Farmers	-Manufacturer's recommendations. -PCB regulations. Water resources regulations	-PCB -EMC -DA	Annually
		Over-stocking	Buying the required and approved quantities only	Agro-dealers	Pesticides Act	PCB	Quarterly
1.5	Pesticide misuse, over / under use	Lack of appropriate knowledge	-Training and awareness campaigns	ASWAp - SP	Pesticide manufacturers regulations	-PCB, -EAD	Annually
1.6	Intentional poisoning	Frustration, Social pressures	-Ensure responsible, mentally sound and mature persons are given charge and control of pesticides. -Restrict accessibility to pesticides. -Spot checking	Farmers Agro-dealers ASWAp - SP	Pesticides Act	-PCB -Min of Labour -DA	Annually
	Drug resistance in pests	Lack of appropriate knowledge in pesticides application	Train farmers in correct application of pesticides	Farmers ASWAp - SP	Pesticides Act	PCB	Half yearly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution	Standards/Regulation	Monitoring Institution	Monitoring Frequency
2.	**POSITIVE IMPACTS OF BIOLOGICAL CONTROLS**						
	Reduced environmental and health risks		Establish and disseminate environmental and health benefits of biological controls to the communities for them to appreciate the advantages	ASWAp - SP	EMA Water Resources Board	-EAD -Ministry of Labour -Ministry of Health	Quarterly
	Ease of application and integration with other control methods		Prepare an inventory of indigenous and established biological control methods and conduct community awareness seminars to enhance community knowledge base	ASWAp - SP	IPMMP	Department of Land Resources	Annually
	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	ASWAp - SP	IPMMP	MOAFS	Annually
3.	**POSITIVE IMPACTS OF MECHANICAL METHODS**						
	Very fast method	Not applicable to ASWAp -SP					
4.	**NEGATIVE IMPACTS OF BIOLOGICAL CONTROLS**						
	Limited knowledge of consequences of impacts	Wrong application of method by farmers	Biological controls must be applied carefully with the full knowledge of the consequences. Hence farming communities must be appropriately trained and indigenous knowledge on natural	Farmers	IPMMP	IRLADP	Annually

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution	Standards/Regulation	Monitoring Institution	Monitoring Frequency
			biological controls must be harnessed from them.				
	Biological control agents are slow in action	Frustration of farmers	Educate farmers on the long term benefits of the biological methods to win their confidence and acceptance of the method. Phase transition from chemical to IPM methods to ensure no appreciable loss of production during transition	IRLADP	IPMMP	EMC MOAFS	Annually
5.	**NEGATIVE IMPACTS OF MECHANICAL METHODS**						
	High cost	Not suitable method for smallholder farmer and the IRLADP	Mechanical methods may be appropriate for large scale operations but will not be appropriate for the case of ASWAp – SP. This method calls for choosing a method whereby the chopped materials are completely removed from the site and disposed in an environmentally friendly manner. Hence these methods are included to highlight their availability. However, if they are to be used anywhere else, an integrated system of weed removal and utilization has to be developed to reduce the costs.	N/A	N/A	N/A	N/A
6.	**NEGATIVE IMPACTS OF MANUAL METHODS**						
	Health hazards	Slow but suitable for	Use appropriate manual implements and tools	Farmers	IRLADP	Department of Land	Anuaaly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution	Standards/Regulation	Monitoring Institution	Monitoring Frequency
		smallholder farmers				Resources	
7.	**POSITIVE IMPACTS OF IPM**						
	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 crops from pest damage	IRLADP	IPMMP	MOAFS	Annually
	Contribution to Food Security	Non chemical methods are generally slow	• 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 pest management options.	IRLADP	IPMMP	MOAFS	Annually
	Saving in foreign exchange due to reduced application of chemical pesticides	Banned chemicals	• Train pesticides suppliers in selection of appropriate pesticides to be eligible for supplying to IRLADP; • Train farmers in the appropriate application of the various IPM practices to reduce application of chemical pesticides; and • Enforce regulation prohibiting importation of banned chemical	IRLADP	Pesticides Act	PCB	Quarterly

Item No	Potential Issues / Concerns	Cause of Concern	Control/Mitigation Measure	Responsible Person/Institution	Standards/Regulation	Monitoring Institution	Monitoring Frequency
			pesticides				
	Contribution to offsetting rural/ urban migration	Banned chemicals	• Enforce regulation prohibiting importation of banned chemical pesticides • Educate farmers on harmful consequences of banned chemical pesticides	Farmers IRLADP	Pesticides Act	PCB	Quarterly

CHAPTER 6: CAPACITY AND TRAINING NEEDS FOR SUCCESSFUL IMPLEMENTATION OF THE IPMP

6.1 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 the newly acquired knowledge to choose compatible methods to reduce production and post-harvest losses through frequent field visits, meetings, demonstrations,
(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 designed to build 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 MOAFS will provide logistical provide capacity and policy guidance and oversight for implementation of the IPM at National level. MOAFS will, through the IRLADP, provide the necessary budgetary support and overall monitoring of the IPM activities.

Agricultural sector departments have the national mandate in the implementation of crop protection and pest management research. They will provide technical support to ASWAp-SP, 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 pest.

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

The MOAFS 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.

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.

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 environmental pest management.

Partners in capacity building and training will include the following:

- ***Research and training institutions***: Agricultural research stations will formulate proposals for research and training programmes for the development of IPM protocols, and training modules for the IPM for ASWAp-SP.

- ***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.

IPMP training and capacity building is necessary for the key role players and stakeholders. It will ensure that they possess the appropriate skills for maximum IPMP implementation. Organizations and institutions to be trained are presented in Table 6.1

Table 6.1: Training programme for implementation of IPM

Institution to be trained	IPMP training objective	Area of concentration	Training duration
Farmers	• Acquire technical knowledge • Carry the message home to their peers • Engage in participatory learning	• biological and ecological control • Pest management (theoretical and practical) • Precautionary safety measures of pesticide use	3 days
IRLADP	• Building capacities of researchers to train farmers and community leaders • Promoting IPMP activities. • Conduct research and lessons learnt in related projects in Africa and elsewhere. • Learn about elements necessary to consider when preparing annual work plans and budgets. • To be fully abreast with ASWAp-SP's PMP, so they can be fully informed as they provide direction for SWAp-SP's pest management	• Agriculture research in areas of interest for IRLADP • Farmer/trainer coordination • Promotion of IPMP • Management of outbreak and migratory pests. • Leadership • Financial advice	Program duration
Ministry of Health	• set up databases on incidence of data on poisoning, effect of pesticides on human health and environmental contamination.	• IPMP scientific study data collection, analysis and storage • Assess pesticide use impact on the environment	• N/A

Institution to be trained	IPMP training objective	Area of concentration	Training duration
MOAFS:	• provide logistical and technical support to the ASWAp-SP training team. • provide staff within districts for training local farmers • Train IPM trainers. • provide capacity and policy guidance and/or oversight for implementation of the IPM • play major role with NGOs/CBOs in the public awareness campaign • monitor the prevalence of inputs supply by the dealers	• Play a secondary supportive role to IPMP implementation, and provide general oversight of the project	• N/A
Environmental Affairs Department (EAD):	• Collaborate with the district hospitals and natural resources management offices of the districts on training and beneficiary Farmer Groups in environmental and pest management.	• Training farmers in IPMP	• N/A
Land Resources and Conservation Department (LRCD)	• assist in training in non-pesticides management practices	• IPMP non pesticide management	• N/A
Pesticides Control Board (PCB)	• Regulate pesticide: o Imports o Transportation o Use o Disposal o registration	• Regulation	• N/A
WorldBank, FAO and Global IPM facility	• serve as a valuable source of technical information • provide technical support for training, planning and field implementation of IPM in Farmer Groups.	• Organization • support for research	• N/A
Agriculture Service Providers and NGOs	• Provide services and technical support to the field implementation of IPM and other pilot IPMP.	• Specialized leadership	• N/A

Institution to be trained	IPMP training objective	Area of concentration	Training duration
Marketers	Learn about: • safety and precautionary measures while handling pesticides • general information about pesticides (classification, directions, warning signs etc.)	• Theoretical pesticide general knowledge	3 Days

The IPMP training program (developed under ASWAp-SP) is a four facet initiative, as detailed below:

National level (ministries): A total of 30 representatives from the organizations listed in table 6.1 shall attend a three day training program in Lilongwe, with each member making a presentation on the specific areas of expertise, and how their technical know-how would be applied in the implementation of IPM.

Regional level: 50 participants shall be trained in IPM, to facilitate program inspection.

District level (extension workers): From the representative districts, 100 participants shall take part in a three day training program in pursuit of facilitating supervisory talent.

Community level (farmers): Being P Beneficiaries, 30 farmers from each of the five districts, shall be selected to participate in a three day IPM training program. Areas of concentration are discussed in table 6.2

The Summary budget for the training under ASWAp-SP is as tabulated in Table 6.2. Additional funding (US$100,000) has been budgeted under IRLADP AF II for additional training.

Table 6.2 Summary of budget for IPMP training

Capacity Building Program	Description	Cost $
National level (ministries)	Cost for 1 training = $16,354	16,354
ADD Level	Cost for 1 training = 9,784 Cost for 5 districts= $ 48,920	48,920
District level (extension workers)	Cost for 1 training = $8,064 Cost for 5 districts= $ 40,320	40,320
Community level (farmers)	Cost for 1 training = $18,356 Cost for 5 districts= $91,780	91,780

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APPENDICES

Appendix 2.1: Internationally accepted standards on pesticides

A. GUIDELINES ON USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

1. PPE must be kept separate (i.e. in different lockers) from personal clothing.

2. Protective clothing must be thoroughly washed after each application or spray operation before being worn again.

3. Contaminated protective clothing must under no circumstances be washed at home and should not be removed from the store area.

4. Durable, light-weight and comfortable protective clothing must be provided to workers handling pesticides.

5. Overalls can be two-piece (jacket with hood and trousers) or one-piece hooded garments.

6. Hood must close around gas mask.

7. Sleeves must close at wrists with elasticized cuffs and the trousers must have elasticized closures around waist and ankles.

8. Jackets of two-piece suits should seal on the hips.

9. Overalls should preferably be light in colour so that contamination with pesticides can be visible.

10. A clear transparent face shield, which is impervious to solvent and pesticide vapours; and which provides full face protection should be worn as indicated on the product label, when preparing and applying spray mixtures.

11. Safety goggles are an acceptable alternative to a face shield.

12. Non-slippery gloves made of nitrile rubber, PVC, neoprene or butyl rubber that are long enough to give cover to a minimum of 90 mm above the wrist must be used.

13. Lined gloves are not recommended as pesticides can accumulate in the lining material.

14. Gloves should preferably be light in colour so that contamination with pesticides can be visible.

15. Before contaminated gloves are removed from the hands after use, they must first be washed with soap and water. They should again be washed inside out after removal.

16. Unlined, rubber boots that are at least calf-high must be used.

17. To prevent pesticide from entering boots, trousers must be worn outside/over the boots.

18. At the end of each day's spraying boots should be washed inside and outside.

19. A cotton hat with brim should be used for protection against spray drift.

20. A waterproof hat and cape must be worn by operators during overhead spraying.

21. A hood that covers the head, neck and shoulders of workers should be worn for total skin protection during the application of irritant powders (e.g. sulphur).

22. Respirators should be worn when indicated on the product label.

23. Tractors with closed canopies and air conditioning are recommended for maximum safety and comfort during application. This could improve the productivity of operators and the quality of pesticide application and coverage.

Ablution facilities

24. Facilities must be provided for operators to wash or shower at the end of each spray operation or shift.

25. Contaminated washing water generated at the ablution facilities shall not be disposed of into any water source, including rivers, ground water sources and sewerage systems. This water can also be channelled into a mesh-covered evaporation pit like the one for the filling area.

B. GUIDELINES FOR SAFE USE AND HANDLING/APPLICATION OF PESTICIDES

Preparation and mixing of spray formulations

1. Application of pesticides should be selective and targeted (in space and time)

2. Pesticides must be prepared and used in the prescribed manner as indicated on the label(s). Any other way is a criminal offence and this must be communicated to workers as such.

3. Only prepare the amount of spray mixture required for one specific application.

4. If containers with concentrated formulation are transported to filling points further away from the agrochemical store, these containers must be locked into a secure metal or galvanized mesh trunk.

Filling points

5. The mixing and filling area for spray equipment must be well away from any water sources.

6. The floor of the filling point must be of non-porous material (e.g. cement with damp

coursing) and must be bunded (retaining wall).

7. Rinse liquid from measuring vessels must be added to the spray tank.

8. Soil and water sources may not be contaminated by run-off and/or spillage. Construct a non-permeable evaporation pit that is either filled with stones or covered with a metal grid, into which contaminated run-off water can be channelled. Add a handful of lime to increase the pH. Ultra-violet radiation from the sun, combined with the high pH will break down active ingredients and water will evaporate. Cover the pit when it rains, to prevent rainwater from filling up the pit. Alternatively, install a tank for contaminated water that can be emptied by a professional hazardous waste disposal company.

Worker health

9. Workers handling chemicals must be declared medically fit to work with pesticides. This examination must be done by an Occupational Health practitioner that is a general practitioner with a post-graduate diploma in occupational medicine, and not by a clinic nurse or ordinary general practitioner.

10. All workers exposed to and handling pesticides must undergo routine medical examinations (mostly involving a blood test) to test for signs of pesticide exposure. These should preferably be done annually at the end of the spraying season, but the interval between examinations may not exceed two years.

11. Any incident of exposure to pesticides must be documented according to occupational health and safety regulations and labour regulations.

12. All medical records and records of pesticide exposure must be kept for at least 30 years for every worker exposed to pesticides.

Training

13. All farm workers shall undergo training in the meaning of the signs, warning and labels on containers of pesticides.

14. Formal training (i.e. certificates awarded) in the meaning of signs, warning notices and labels on chemical containers, as well as on the interpretation of written instructions must be provided to all workers handling pesticides.

15. Spray operators must receive formal practical training in the safe handling and application of pesticides and must understand the risks involved and precautions to be taken.

C. GUIDELINES ON FORMULATION AND REPACKAGING OF PESTICIDES

1. Distribution and use of pesticides may require local formulation and/or repackaging. In such cases, IRLADP should ensure that, packaging or repackaging material conforms to FAO pesticide management guidelines, and is carried out only on permissible premises.

2. IRLADP should ensure that; (a) the staff working in such premises are adequately

protected against toxic hazards; (b) That the resulting pesticide products will be properly packaged and labelled, and that the contents will conform to the relevant quality standards.

3. Pesticide regulations should be strictly enforced in all ASWAp-SP projects.

D. GUIDELINES ON GOOD LABELLING PRACTICE FOR PESTICIDES

1. Label content:

The purpose of the label is to provide the user with all the essential information about the product and how to use it safely and effectively. The minimum information on the label should therefore tell the user:

What is in the container;

The hazard it represents; and

Associated safety information Instructions for use.

2. What is in the container?

The following information identifying the contents of the container should appear on all labels:

(a) Product or Trade name, associated with the product category (e.g. herbicide, insecticide, fungicide, etc.).

(b) Type of formulation -name and code, as per International Formulation Coding System.

(c) Active ingredient, name (ISO) or other locally used common name or in the absence of either the chemical name as used by IUPAC and content. This should normally be expressed as "contains x g ai per kg" (for solids, viscous liquids, aerosols or volatile liquids) or "contains x g a.i. per liter" (for other liquids), or just "y%".

(d) Net contents of the pack. This should be expressed in metric units (e.g. liter, gram, kilogram, which can be abbreviated to l, g and kg.

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3. Safety information

There should be a clear warning on the label in relation to:

* Reading the safety instructions before opening the pack.

* Handling, transport and storage warning symbols.

* Hazard classification/symbol. There may be a necessity to classify the product with relation to its toxicity.

2.3 The following safety precautions should appear on all labels - preferably in black print on a white background:

4. **Safety Precautions**

The safety text must cover the following product specific advice:

Good agricultural practice;

Relevant protective clothing;

Precautions when handling the concentrate (if applicable);

Precautions during and after application;

Environmental safety during and after application;

Safe storage;

Safe disposal of product and used container; and

How to clean equipment (if a potential risk exists)

5. **Safety Pictograms**

Safety pictograms reinforcing the safety text should be included.

6. **Warning**

The following must appear on all labels: Keep locked up and out of reach of children

Other warning phrases may be aimed at good agricultural practice and/or steps which need to be taken to avoid adverse environmental effects.

7. **First Aid Advice and Medical Treatment**

Most labels should carry first aid and medical advice, where relevant. Additional information regarding symptoms, special tests and antidotal measures may be added, where appropriate, for particular products.

8. **Leaflets**

Any safety text on the label must also appear on any leaflets associated with it.

E. GUIDELINES ON STORAGE AND TRANSPORTATION OF PESTICIDES

1. ASWAp-SP is obliged to promulgate, update and enforce rules and regulations for safe, responsible storage and transport. Areas covered by these rules include maintenance of the original product labels, spill prevention, container adequacy, proper marking in storage, facility specifications, product separation, protection from moisture and contamination by other products, restriction of access, and other measures to ensure product integrity and safety.

2. Pesticide stores must be located away from areas where people or animals are housed and away from water sources, wells, and canals.

3. Pesticide stores should be located on high ground and fenced, with access only for authorized persons.

4. There should be easy access for pesticide delivery vehicles and – ideally – access on at least three sides of the building for fire-fighting vehicles and equipment in case of emergency.

5. Pesticides must not be kept where they would be exposed to sunlight, water, or moisture, which could affect their stability.

6. Storehouses should be secure and well ventilated.

7. Pesticide stocks should be arranged such that the oldest are used first ("first in first out" [FIFO] principle), to avoid the accumulation of obsolete stock.

8. Containers should be arranged to minimize handling and thus avoid mechanical damage which could give rise to leaks

9. Containers and cartons should be stacked safely, with the height of stacks limited to ensure stability.

10. Pesticides should not be transported in the same vehicle as items such as agricultural produce, food, clothing, drugs, toys, and cosmetics that could become hazardous if contaminated.

11. Pesticide containers should be loaded in such a way that they will not be damaged during transport, their labels will not be rubbed off, and they will not shift and fall off the transport vehicle onto rough road surfaces.

12. Vehicles transporting pesticides should carry prominently displayed warning notices.

13. Pesticides should not be carried in the passenger compartments of transport vehicles and should be kept tightly secured and covered at all times during transport.

14. The pesticide load should be checked at intervals during transportation, and any leaks, spills, or other contamination should be cleaned up immediately using accepted standard procedures.

15. In the event of leakage while the transport vehicle is moving, the vehicle should be brought to a halt immediately so that the leak can be stopped and the leaked product cleaned up.

16. Containers should be inspected upon arrival at the receiving station.

17. WHO/FAO guidelines (FAO, 1995a) should be followed for handling pesticide-related products during storage, transport, fires, and spills;

18. There should be official reports to ASWAp-SP and follow-up enquiries in the event of fires, spills, poisonings, and other hazardous events; and

19. Rules and regulations laid down in the Recommendations on the transport of dangerous goods: model regulations (United Nations, 2002) and by international organizations concerned with the specific modes of transport and ASWAp-SP should be respected.

F. GUIDELINES ON DISTRIBUTION OF PESTICIDES

1. Distribution of pesticides should be carried by trained personnel or under proper supervision. Misdirection or mishandling can result in the product falling into the hands of uninformed recipients or causing human or environmental risk.

2. Proper packaging is also important to ensure the confinement of the product and its safe handling.

3. The original package is intended to ensure safe distribution; when repacking is necessary, the new packing should meet the specifications of the original packaging as well as complying with the FAO pest management guidelines

4. Packaging (original or repackaging) should conform to FAO pest management guidelines requirements to ensure safety in distribution and prevent unauthorized sale or distribution of vector control pesticides.

5. The distributor should be aware that the shipment is a hazardous product.

6. The distributor must provide a timely service to ensure that products are available on an agreed date that takes into consideration the time of the original order and other related shipment matters.

7. The procurement process should anticipate shipment and distribution schedules.

8. A distribution scheme for pesticide products should be developed that reduces hazards associated with multiple handling and transportation.

9. The distribution of pesticide products to the point(s) of storage by the supplier should therefore be included in tender documents; and

10. All distributors of pesticides should be licensed.

G. GUIDELINES ON DISPOSAL OF PESTICIDES

1. When pesticides have passed their expiry date, specific methods of disposal must follow FAO pest management guidelines for safe disposal of hazardous materials.

2. Similarly, any equipment that is no longer serviceable should be removed from inventory, decontaminated and disassembled to ensure that it will not be subsequently diverted to other uses.

4. Avoid accumulation of obsolete pesticides by provision for phasing-out when pesticides are to be banned or deregistered, refusal of donations in excess of requirement; and spelling out of product specifications, including required packaging and labelling (long-life label).

5. Adherence to WHO/FAO guidelines for handling pesticide-related products during storage, transport, fires, spills and disposal.

6. Consultation with ASWAp-SP for disposal of obsolete pesticides.

7. Prevention of risk to human and environmental health from emptied packaging and containers, rinsates, and outdated products.

8. Ensure provision of instructions for disposal of pesticide containers as label requirements.

9. Leftover agrochemical formulations must not end up in rivers, streams, ditches, storage dams, etc. and should not be emptied out on the ground.

10. Empty pesticide containers must not be re-used and must be disposed of in a manner that avoids exposure to humans and contamination of the environment.

11. Relevant guidelines appearing on the label(s) should be followed.

12. Empty containers may not be burnt/ incinerated on the farm.

13. Empty containers must be rinsed with integrated pressure rinsing devices on the sprayer, or triple-rinsed (rinsed at least three times) with water, and the rinsate added to the spray/race tank/ Diptank or kept secure until disposal is possible.

14. Triple-rinsed containers can be punctured (in the case of plastics), shattered (in the case of glass) or otherwise rendered unserviceable so as to prevent reuse, whereafter it may be disposed of in a registered hazardous waste landfill site (operated by a registered hazardous waste removal company).

15. Empty triple-rinsed plastic containers can also be collected and removed for recycling by a registered recycler.

16. Obsolete or unwanted chemicals should preferably be sent back to local suppliers or alternatively be removed by certified or approved chemical waste
disposal companies.

17. Leftover formulations should never be combined or mixed while being stored for later removal /disposal.

Appendix 2.2: Pesticides for Registration Consideration in Malawi

INSECTICIDES

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Alphacypermethrin	Fastac (Ripcord Super)	EC	100g/LT
Acephate	Acephate, Orthene	SP	750g/KG
	Ace	SP	750g/KG
	Lancer	DF	970g/KG
	Lancer	SP	750g/KG
	Asafet	SP	750g/KG
	Novatheren TM	SC	750g/KG
Acetamiprid	Novacetam	SL	222g/KG
	Spear	SP	200g/KG
Aldicarb	Sanacarb	GR	150g/KG
	Temik	GR	150g/KG
Amitraz	Mitac	EC	200g/LT
Azinphos-methyl	Gusathion	SC	350g/LT
Azocyclotin	Peropal	SC	500g/LT
	Peropal	WP	250g/KG
Benfuracarb	Oncol	EC	200g/LT
	Oncol	CS	400g/LT
	Oncol	LS	900g/LT
Betacyfluthrin	Bulldoc 050RC	EC	50g/LT
	Bulldock 0.050g	GR	5g/LT
Bifenthrin	Talstar	EC	100g/LT
	Bisect	EC	100g/LT
Buprofezin	Applaud	WP	500g/KG
Carbaryl	Karbaspray	WP	850g/KG
	Sevin	WP	850g/KG
	Carbaryl	WP	850g/KG
Carbofuran	Karbadust	DP	50g/KG
	Curaterr	GR	100g/KG
	Carbosan	GR	100g/KG
	Carbofuran	GR	100g/KG
	Furadan	GR	100g/KG
Carbosulfan	Marshal	EC	250g/LT
	Marshals suscon	GR	100g/LT
	CMF	EC	250g/LT
	Carbosulfan	EC	250g/LT
Chinomethionat	Morestan	WP	250g/KG
Chlordane	Chlordane	EC	600g/LT
	Termidan	EC	600g/LT
Chlorpyrifos	Dursban	EC	480g/LT
	Dursban	WG	750g/KG
	Lirifos	SC	500g/LT/480g/LT
	Apollo	SC	500g/LT

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Cyfluthrin	Baythroid	EC	50g/LT
	Baysol	AE/NF	50g/LT
	Sneak	WE	50g/LT
Cyhexatin	Cyhexatin	SC	600g/LT
Cypermethrin	Cypennethrin	EC	200g/LT
	Cypersan	EC	200g/LT
	Cyrux	EC	200g/LT
	Kemprin	EC	200g/LT
	Sherpa	EC	200g/LT
	Cymbush	EC	200g/LT
	Ripcord	EC	200g/LT
	Novacord TM	EC	200g/LT
Cypennethrin + Profenofos	Polytrin C	EC	40 + 400g/LT
Deltamethrin	Bitam	SC	50g/LT
	Deltabak	SC	50g/LT
	K-O Gard	SC	50g/LT
	Crackdown	SC	10g/LT
	Cislin	TB	10g/LT
	Decitab	Tablet	25g/LT
	Deltamethrin	EC	0.5g/KG
	Decis	SC	50g/LT
	K-Otab	Tablet	25g/LT
	Decis forte	EC	100g/LT
Deltamethrin+Endosulfan	Kracker	EC	2.5g + 475g/LT
Deltamethrin+Fenitrothion	Shumba Supper	DP	1.3g + 10g/KG
Deltamethrin+Piperonyl Butoxide	K-Biol	EC	25g + 250g/LT
Demeton-Methyl	Metaxystox (I)	EC	250g/LT
	Demeton-S-Methyl	SC	250g/LT
Diazinon	Diazinon	EC	275g/LT
Dichlorvos	DDVP	EC	1000g/LT
	Dedevap	EC	1000g/LT
	Dichlorvos	EC	1000g/LT
	DDVP 100	EC	100g/LT
	Doom	M/V	100g/LT
Dicofol	Kelthane	EC	185g/LT
Dimethoate	Cygon	EC	400g/LT
	Dimethoate	EC	400g/LT
	Rogor, Perfethion	EC	400g/LT
	Dimet	EC	400g/LT
	Dimethoate 20 WP	WP	200g/KG
	Nugor	EC	400g/LT
Disulfoton	Disyston 5g	GR	50g/KG
	Solvirex	GR	50g/KG
	Disulfoton	GR	50g/KG

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Disulfoton + Triadimenol	Repulse 5.75g	GR	50g + 7.5g/KG
Endosulfan	Thiodan	EC	350g/LT
	Endosulfan	SC	350g/LT
		MO	350g/LT
		EC	350g/LT
		SC	475g/LT
		WP	475g/LT
		SC	350g/LT
	Endflo	MO	350g/LT
	Agrisulfan dust	DP	50g/KG
	Thioflo	SC	475g/LT
	Thionex	WP	500g/KG
		EC	350g/LT
	Thiokill	EC	350g/LT
Fenitrothion	Sumition	EC	500g/LT
Fenitrothion	Sumithion	ULV	1000g/LT
	Fenitrothion	ULV	1000g/LT
		EC	500g/LT
	Folithion	EC	600g/LT
	Tracker Garden Insecticide	EC	600g/LT
Fenitrothion + Fenvalerate	Sumicombi 3D	DP	25g + 5g/KG
Fenpropathrin	Meothrin	EC	200g/LT
Fenthion	Labaycid	EC	500g/LT
		WP	500g/KG
Fenvalernte	Fenkill	EC	200g/LT; 500g/LT
	Felecid	EC	200g/LT
Fenvalernte	Sumicidin	EC	200g/LT; 500g/LT
	Fenvalernte/	EC	200g/LT; 500g/LT
	Sanvalerate	EC	200g/LT
	Novacidin TM	EC	200g/LT
Fipronil	Regent	GR	30g/KG
	Fipronil	GR	30g/KG
Furfural	Crop Guard	EC	900g/LT
Gamma BHC	Bexadust	DP	6.0g/KG
Imidachloprid	Confidor	SL	100g/LT, 200g/LT
	Confidor 70	WG	700g/KG
	Gaucho 70 WS	WS	700g/KG 45 WS
	Imidachlorprid	WS	700g/LT
	Gaucho 600 FS	FS	600g/LT
	Gaucho 390 FS	FS	390g/LT
	Protect 200 SL	SL	200g/LT
	Protect 700 WS	WS	700g/LT
Imidachloprid 233g/LT	Monceren GT	FS	390g/LT
Imidachloprid/Thiram	Gaucho T	WS	45 WS

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
	Gaucho 275FS	FS	175g/LT + 100g/LT
	Novacot Dress	FS	350g/LT
Isofenphos	Peril turfgrass Insecticide	SC	500g/LT
Lambda-Cyhalothrin	Karate	EC	50g/LT
		WG	37.5g/LT
		CS	50g/LT
	Vajra	EC	50g/LT
	Lambda-Cyhalothrin	EC	50g/LT
	Novathrin	EC	50g/LT
Lufenuron	Match	EC	50g/LT
Mercaptothion	Malathion	WP	250g/KG
		EC	250g/LT
	Mercaptothion	WP	250g/KG
Methamidophos	Tamaron, Methaphos Sniper, Methamidophos	EC	585g/LT
Methomyl	Methomyl, Lannate	SL	200g/LT
	Methomyl, Lannate	SP	900g/KG
	Methosan, Methomex	SP	900g/KG
Methoprene	Kabat	AE	41.3g/LT
Mevinphos	mevinphos	EC	20g/LT
Mineral oil	Summer oil	EC	-
	Bacoil	EC	835g/LT
Monocrotophos	Nuvacron	WSC	400g/LT
	Monocron	WSC	400g/LT
	Monocrotophos	WSC	400g/LT
	Monostem	WSC	400g/LT
	Azodrin	WSC	400g/LT
	Novacrotophos TM	SL	400g/LT
	Phoskill	SL	400g/LT
Oxydemeton-Methyl	Metasystox ®	EC	250g/LT
Parathion	Folidol	EC	500g/LT
Pamthion	Pamthion	EC	500g/LT
	Novaper	EC	500g/LT
Pamthion-Methyl	Pamthion-Methyl	EC	500g/LT
Permethrin	Coopex TC	TC	250g/LT
	Tobacco guard	EC	50g/LT
	Tabakskern	EC	5.0g/LT
	Permethrin	EC	100g/LT
Phenthoate	Elsan	EC	500g/LT
Phoxin	Baythion Ant killer	EC	500g/LT
	Turmoil soil insecticide	EC	500g/LT
	Whack	EC	500g/LT
Pirimiphos-Methyl	Actellic EC	EC	500g/LT

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
	Actellic dust Actellic smoke generator	DP EU	20g/KG -
Pirimiphos-Methyl + Permethrin	Actellic Super EC Actellic Super dust	EC DP	500g/LT 16g + 3g/KG
Plus Pencycuron 50 EC	Plus Pencycuron 50EC	EC	50g/LT
Plus Thiram 107EC	Plus Thiram 107EC	EC	107g/LT
Profenophos	Selecron	EC	500g/LT
Propargite	Propargite	EC	570g/LT 720g/LT 790g/LT
Prothiophos	Tokuthion	EC	960g/LT
Terbufox	Terrafos Counter	GR GR	100g/KG 100g/KG
Terbufos	Hunter	GR	150g/LT
Tetradifon	Tedion V8	EC	81g/LT
Thiachloprid	Calypso	SC	480g/LT
Thiodicarb	Larvin	FW	375g/LT
Thiophanate-Methyl	Topsin	WP	500g/KG
Triazophos	Hostathion	EC	420g/LT
Trichlorfon	Dipterex Trichlorfon	SP GR SP GR	950g/KG 25g/KG 950g/KG 25g/KG
Triflumuron	Alsystin	SC	480g/LT
Thiamethoxam	Actara	WG	250g/kg

HERBICIDES

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Acetochlor	Sprint Wenner Curagrass, Crocodile Trophy S Bullet Har-I-cane	EC EC EC EC	900g/LT 700g/LT 750g/Lt 700g/LT
Acetochlor + Atrazine + Propazine	Tuff-E-Nuff	SC	96g + 202g + 202g/LT
Acetochlor + Atrazine + Simazine	Robust	SC	160g + 165g + 165g/LT
Acetochlor + Atrazine + Terbuthylazine	Acetrazine	SC	125g + 187.5g + 187.5g/LT

COMMON NAME	TRADE NAME	FORMULATIO N	CONCENTRATION
Alachlor	Alachlor 384, Eland Alachlor 480 Sanachlor 384 Lasso 480 & 384 Lasso MT	EC EC EC EC CS	384g/LT 480g/LT 384g/LT 480g/LT 480g/LT
Ametryn	Gesapax Ametryn Ametryn	SC SC WP	500g/LT 500g/LT 800g/KG
Ametryn + Atrazine	Ametra	SC	250g + 250g/LT
Asulam (Na-Salt)	Asulox	SL	331g/LT
Asulam	Asulam	SL	400g/LT
Atrazine	Atrazine Gesaprim Gesaprim	SC, WP, WG WG SC	500g/LT,800g/KG,900g/k 900g/LT 500g/LT
Atrazine + Terbuthylazine	Suprazine, Eliminator	SC	600g/LT, 500g/LT
Atrazine + Terbuthylazine + Metolachlor	Gadomil	SC	262.5g +262.5g +175g/LT
Bendioxide	Basagran	SL	480g/LT
Bromacil	Bromacil Hyvar-X80	WP WP	800g/KG 800g/KG
Bromoxynil	Bromox Buctril DS	EC EC	225g/LT, 450g/LT 450g/LT
Chlorimuron-Ethyl	Classic	WG	250g/KG
Chlorimuron-Ethyl + Metribuzin	Canopy	WG	107g + 643g/KG
Clomazone EC	Novazone	EC	450g/LT
Cyanazine	Cyanazine Bladex	SC SC	500g/LT 500g/LT
Cyanazine + Atrazine	Blazine Bladex Plus	SC SC	250g +250g/LT 333g +167g/LT
2-4 -D (Amine)	Embamine 2-4 -D Amine	EC SL	480g/LT 480g/LT
2-4 -D (Ester)	2,4 -D Ester	EC	500g/LT
2-4 -DB	2,4 -DB	AS	480g/LT, 500g/LT
2,4 -D Dicamba	Spotaxe	SL	240g +80g/LT
2,4 -D MCPA	Rampant Turfgrass Herbicide	WSC	360g + 315g/LT
2,4-D + Picloram	Tordon 101	SL	240g + 65g/LT
Dalapon	Dalapon	SP	850g/KG
Dicamba	Banvel	EC SL	480g/LT 480g/LT
Diuron	Diuron	WP	800g/KG

COMMON NAME	TRADE NAME	FORMULATIO N	CONCENTRATION
	Diuron	SC	500g/LT, 800g/LT
Diuron + Paraquat	Gramuron	SC	300g + 100g/LT
EPTC	EPTAM	EC	720g/LT
EPTC (+Safener for Maize)	EPTAM super	EC	720g/LT
Ethidimuron	Ustilan Ustilan	GR WP	100g/KG 700g/KG
Fluazifop-P-Butyl	Fusilade super, Forte	EC	150g/LT
Fluazifop-R-Methyl	Gallant Super	EC	108g/LT
Flufenacet	Tiara	SC	500g/LT
Flumetsulam	Broadstrike	WG	800g/LT
Fluometuron	Cottonex	FW	500g/LT
Flazafulfuron	Kantana	WP	100g/KG
Oxyfluorfen	Goal	EC	240g/LT
Glufosinate ammonium	Basta	WSC	200g/LT
Glyphosate	Mamba/Springbo k Ridder weed killer Roundup Cobra + Duiker Shaikdown Turbo	SL SL SL SL	360g/LT 360g/LT 360g/LT 180g/LT 480g/LT 500g/LT
Haloxyfob-R-Methyl-Ester	Gallant Super	EC	104g/LT
Halusulfuron	Servian	WG	750g/LT
Hexazinone	Ransom	SL	240g/LT
Hexazionone	Hexazinone, Hexsan Velpar L Velpar SP	SC, SL SC SP	240g/LT 750 DF 240g/LT 900g/LT
Ioxynil +2,4 -D	Actril D.S.	EC	100g +600g/LTD
Isoxatlutole	Merlin	WG	750g/LT
MCPA (K-salt)	MCPA	SL	400g/LT
MCPB	MCPB	AS	400g/LT
Mesotrione	Callisto	SC	480g/LT
Metazachlor	Pree Butisan S	EC SC	400g/LT 400g/LT, 500g/LT
Metolachlor	Dual Magnum + Falcon Gold	EC	960g/LT
Metribuzin	Veto Sencor Contrast Turfgrass	SC SC SC	480g/LT 480g/LT 480g/LT

COMMON NAME	TRADE NAME	FORMULATIO N	CONCENTRATION
	herbicide Sencor WP Metribuzin	WP SC	480g/KG 480g/LT
Metribuzin + Chlorimuron Ethyl	Extreme plus	WP	107 + 643g/KG
MSMA	MSMA MSMA	SL EC	720g/LT 720g/LT
Nicosulfuron	Sanson	SC	40g/LT
Oxadiazon	Ronstar	EC	250g/LT
Oxyfluorfen	Goal	EC	240g/LT
Paraquat	Paraquat Gramoxone	SL EC	200g/LT 200g/LT
Paraquat Dichloride	Uniquat	SL	200g/LT
Pebulate	Tillam 6E	EC	720g/LT
Pendimethalin + Ametryne + Atrazine	Paragon Plus	WP	350g + 200g + 200g/KG
Pendimethalin + Chlorimuron-Ethyl + Metribuzin	Paragon Extra	WP	437 + 31g + 200g/KG
Prometryn	Gesagard	FW	500g/KG
Sethoxydim	Nabu	EC	186g/LT
Simazine	Simazine	WP	800g/KG
S-Metolachlor	Dual Magnum Falcon Gold	EC EC	960g/LT 960g/LT
S.Metolachlor/Flumetsula n	Bateleur gold	EC	630 + 20g/LT
Tebuthiuron	Tebusan	SC,WP	500g/LT, 500g& 800g/KG
Terbumeton	Terbumeton Terbumeton	SC WP	500g/LT 800g/KG
Terbuthylazine + S-Metolachlor	Sorgomil Gold	SC	600g/LT
Terbuthyn	Terbuthyn	WP	800g/KG
Terbuthyn	Igran	SC	490g/LT
Terbuthyn + S-Metolachlor	Igran +Combi Gold	SC	450g +10g/LT
	Trifluralin Trifluralin	EC SC	480g/LT 500g/LT

FUNGICIDES

COMMON NAME	**TRADE NAME**	**FORMULATION**	**CONCENTRATION**
Acibensolar-S-Metlyl	Bion 50WG	WG	500g/KG
Acibanzolar-S-Metlyl	Bion	WG	50g/KG
Anilazine	Dyrene	WP	750g/KG
Azoxystrobin	Ortiva 250SC	SC	250g/KG
Benomyl	Benlate	SC WP	480g/LT 500g/KG

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
		FW	500g/LT
	Fundazol	WP	500g/KG
Bitertanol	Baycor	EC	300g/LT
Captab	Captab	WP, SC	500g/KG, 500g/LT
Carbendazim	Derosol	SC	510g/LT
Chlorothalonil	Chloronil	SC	500g/LT
	Daconil	WP	750g/KG
	Bravo	FW	500g/LT, 720g/LT
		SC	500g/LT
Copper Ammonium Nitrate	Copper Count N	SL	316g/LT
Copper oxychloride	Cupravit	WP	850g/KG
	Demildex	WP	850g/KG
	Copper oxychloride	WP	850g/KG
		FW	600g/LT
Copper Hydroxide	Cung FU 538SC	SC	Copper Equiv. 350g/LT
Cupric hydroxide	Funguran – OH	WP	770g/KG
	Cupric hydroxide	WP	770g/KG
	Kocide 101	WP	770g/KG
	Kocide DF	WG	614g/KG
Cymoxanil +Mancozeb	Rimit 50.6 WP	WP	500g +60g/KG
Cyproconazole	ALTO 100 SL	SL	100g/LT
	ALTO G34	GR	34g/KG
Cyproconazole +Disulfoton	Alto mix	GR	2.5g +75g/KG
Difenoconazole	Score	EC	250g/LT
Difolatan	Captafol	WP	800g/KG
Dimethomorph + Mancozeb	Acrobat MZ	WP	90g +600g/KG
Dinocap	Karathane	WP	200g/KG
Fenarimol	Rubigan	EC	120g/LT
Fosetyl - Aluminium	Alliette	WP	800g/KG
Hexaconazole	Anvil	SC	50g/LT
Iprodione	Rovral	SC	250g/LT
	Rovral flo	FW	255g/LT
	Iprodione	SL	255g/LT
	Iprodione	SL	255g/LT
Iprodione + Mancozeb	Rovral M	-	-
Mancozeb	Pennozeb	WG	800g/KG
	Sancozeb	WP	800g/KG
	Dithane M45	WP	800g/KG
	Mancozeb	WG	800g/KG
Mancozeb + Oxadixyl	Sandofan M8	WP	560g + 80g/KG
Maneb	Manager Sc	SC	435g + 4.7g/LT

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
(Dithiocarbamete) + Zinc Oxide			
Maneb + Fentin Acetate	Brestan	WP	180g + 540g/KG
Metalaxyl + Mancozeb	Ridomil MZ 70 WP	WP	100g + 600g/KG
Oruface + Mancozeb	Patafol plus	WP	60g + 640g/ KG
Pencycuron	Monceren	SC	250g/LT
Prochloraz + Carbendazim	Sportac alpha	EC SC	300g + 80g/LT 300g + 80g/LT
Prochloraz + Mangane Chloride	Sporgon	WP	295g/KG
Propamocarb - HCL	Previcurn	SC	722g/LT
Propamocarb Hydrochloride	Propamocarb	SL	722g/LT
Propiconazole	Propiconazole	EC	100g/LT, 200g/LT
Propiconazole	Tilt	EC	250g/LT
Propineb	Antracol	WP	700g/KG
Pyrazophos	Afugan	EC	295g/LT
Sulphur	Wettable Sulphur Kumulus, Triovit	WP WP	800g/KG 800g/KG
Azoxystrobin	Ortiva 250 SC	SC	250g/LT
Acibensolar-S-Methyl	Bion 50 WG	WG	500g/KG
Difenoconazole	Score	EC	250g/LT
Cyproconazole/ Thiamethaxam	Verdadero	GR	10 + 10g/KG
Tebuconazole	Raxil 015 ES Folicur	ES EW EC	15g/LT 250g/LT 250g/LT
Thiram	Thiram Thiulin 50 DS	WP DS	750g/KG 500g/KG
Tolcofox Methyl	Rizolex 50	WP	500g/KG
Tolyfluanid	Euparen Multi	WP WP	500g/KG 500g/KG
Tolyfluanid Sulphur E	Euparen multi sulphur dust	DP	75g + 920g/KG
Triadimefon	Bayleton	WP	50g/KG
Triadimefon	Bounce turfgrass fungicide	EC	250g/LT
	Shavit Bayfidan EC Bayfidan G Baytan DS Baytan FS	EC EC GR DS FS	250g/LT 250g/LT 10g/KG 150g/KG 150g/LT
Triadimefon + Propineb	Bayleton A	DS	50g + 700g/KG
Triadimenol +	Repulse 5.75g	GR	7.5 + 50g/KG

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Disulfoton			
Trichoderma	Trichoderma	WP	-
Tridemorph	Calixin	EC	750g/LT
Zineb	Zineb 70 WP	WP	700g/KG

FUMIGANTS

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Aluminium phosphide	Gastoxin Phostoxin Alphos + Aluminium Phosphide	TB TB, Pellets	560g/KG 560g/KG
Magnesium phosphide	Degesch plates Degesch strips	FU (plates) FU (strips)	607g/KG 607g/KG
Methyl Bromide + Chloropicrin	Methyl Bromide	GA	980 + 20g/KG
	Metabrom Curabrom	GA GA	980 + 20g/KG 980 + 20g/KG

NEMATICIDES

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Cadusafos	Rugby	GR	100g/KG
Ethoprop	MOCAP	GR	100g/KG
Ethylene Dibromide (EDB)	Ethylene Dibromide (EDB)	EC, MO	1800g/LT
Fernamiphos	Nemacur Nemacur	EC GR	400g/LT 100g/KG
Metham Sodium	Herbifum Metam Sodium	Liquid Concentration SC	510g/LT 510g/LT
Methyl bromide + Chloropicrin	Methyl brimide	GA	980 + 20g/KG
Oxamyl	Vydate	SL	240g/LT, 310g/LT
1,3 Dichloropropene	Telone II	Liquid concentrate	1110g/LT
Metham-Sodium	Herbifume	Liquid concentrate	510g/LT

MOLLUSCICIDES

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Carbaryl + Metaldehyde	Snailban	RB	20 + 30g/Kg
Methiocarb	Mesurol	WP RB (Pellets)	800g/Kg 800g/Kg
Methiocarb	Draza Byluscide Metason	RB EC, WP RB	50g/Kg 250g/L; 700g/Kg 50g/Kg

PUBLIC HEALTH (ENVIRONMENTAL) PESTICIDES

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Alphacypermethin	Fendona	SC WP	58g/Kg 50g/Kg
Betacyflutrhin	Tempo	SC	125g/LT

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Brodifacoum	Finale (Rodenticide)	RB	0.02g/Kg
			0.05g/Kg; 0.75g/Kg
		BB	0.05g/Kg; 0.75g/Kg
			0.02g/Kg
		CB	0.05g/Kg; 0.75g/Kg
			0.02g/Kg
		CB	0.05g?kg; 0.75g/Kg
			0.02g/Kg
	Klerat	BB	0.5g/Kg
Chlorpyrifox	Baygon roach bait	DB	-
Coumatetralyl	Racumin rat bait	RB	3.75g/Kg
	Racumin rat poison	FW	8g/LT
Cyfluthrin	Baythroid H	WP	100g/kg
	Responsar	EW	50g/LT
Cyfluthrin + Propuxur	Blattanex	AE	2.5g/Kg + 10g/Kg
Cyfluthrin + Tetramethrin	Baygon spray	AE	-
D-Allethrin	Baygon mosquito coils	FU (coils)	2g/Kg
D-Allethrin + Piperonyl	Baygon mosquito mats	FU (mats)	50g + 2-g/Kg
Butoxide			
DDVP	Fly bait	RB	5g/Kg
Deltamethrin	Glossinex	SC	200g/LT
	Crackdonw	SC	10g/LT
	K-Ogard	SC	10g/LT
	K-Othrine	SC	10g/LT
	K-Othrine 15	E.C	15g/LT
	Deltabak	SC	50g/LT
	Super	SC	25g/LT
	crackdown/Cislin	WP	25g/Kg; 50g/Kg
	K-Othrine	DP	2g/Kg
	K-Othrine		
Deltamethrin + Bednet	K-Onet	TB + Bednet	-
Diazion	PCO diazinon	EC	880g/LT
Dichlorvos	Super doom	AE	-
Dichlorvos + Tetremethrin	Baygon fumigator	AE	10g + 2g + 10g/Kg
Fenitrothion	Reskol 64	EC	600g/LT
Fipronil	Fipronil	SC	200g/LT
	Regent	SC	200g/Lt
Flumethrin	Bayricol aerosol	AE	2g/Kg
Lambda-Cyhalothrin	Icon 10 WP	WP	100g/Kg
	Icon 2.5 CS	Cs	25g/LT
Mercaptothion	Kopthion 50 DP	DP	50g/Kg
Methomyl	Dy-fly	RB	10g/Kg

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Naled DBM	Dibron	SL	344.9g/LT
Permethrin	Coopex Dust Coopex WP Cooper WP Peripel 55 Temephosmostop Tobacco Cuard Imperator Coopex smoke generator	DP TC WP SC EC EC SC FU	5g/Kg 250g/LT 250g/Kg 550g/LT 500g/LT 50g/Kg 100g/LT 135g/Kg
Pemethrin + Piperonyl	Pybuthrin 44	FU	0.39% + 0.382% + 0.206%
Pipperonyl butoxide	Baygon knockdown spray	AE	10g + 2g + 1-g/Kg
Butoxide + D-Allethrin Butoxide + D-Allethrin	Pulvex fly smear	-	0.206% + 0382% + 0.205%
Phoxim + Honey	Baygon ant bait	RB	0.8G/Kg
Propuxur	Propuxur Baygon dust Baygon fly bait	GA DP RB	0.5 – 2.0% 10g/Kg 10g/Kg
Propuxur + Cyfluthrin	Baygon surface spray	AE	-
Pyrethrins + Piperonyl	Coopermatic fly killer	CB	9g/LT
Butoxide	Flip mosquito larvacide Mosquito larvacide oil Kontakil	- - -	- -

RODENTICIDES

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Brodifacoum	Finale Klerat	SL BB BB	0.05g/LT; 0.025g/LT 0.05g/Kg; 0.02g/kg 0.05g/Kg
Coumatetralyl	Racumin	FW Liquid BB Tracking powder	8g/LT 3.75g/Kg
Flocoumafen	Storm Supakill	BB -	0.05g/Kg -

PLANT GROWTH REGULATORS

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Alkylated phenol-ethylene condensate	Agal 90 Agripon Super	Surfactant Surfactant	940g/LT 940g/LT

	Agrowett Armoblen Astrozon green turf dye Compement Curabuff G-49 Wetter Kynobuff BB5, Insure	Nontonic Surfactant Nontonic Surfactant Dye Surfactant Buffer + Spreader Surfactant (Wetter) Ajuvant -	- SL Various SL Various - - - - -
Aminofit	Amino Acid Complex	Essential Amino acids for plant growth	
Butralin	Tabamex Tobago	EC EC	360g/LT 360g/LT
Chlorthal-Dimethyl	Razor, Erasor	SC	360g/LT
CU-Max	Copper	Liquid Complex	Copper 50g/LT
Cytokinins + Auxins	Kelpak	SL	0.031mg/LT + 11mg/LT
Ethephon	Ethephon Ethrel Ethrel Latex stimulant	SL SL SL	480g/LT; 217g/LT 480g/LT; 217g/LT 480g/LT; 217g/LT
Heptamethyltrisiloxane	Silwet L77	Adjuvant	1000g/LT
Modified phthalic – Glycerol alkyd resin	Latron B-1956	Speader/sticker	-
Magnesium	Magmax	WP	65g/KG
Multifeed	N,P,K, Micronutrients	Water Soluble Foliar Fertilizer concentrate	19:8:16
N-Decanol	Antak, Decasuckeride Royaltac Suckerkil N-Decanol	EC EC EC	690g/LT; 785g/LT 690g/LT; 785g/LT 690g/LT; 785g/LT
N'Decanol + Octanol	C85 Fair 85	EC EC	400 + 300g/LT 400 + 300g/Lt
Nonylphenol polyglycol ester	Sanawett 90	Wetter/Sticker	945g/LT
NPK + Cronutrient	Green gold plus	-	-
NPK (Plus micronutrients)	Bayfolan, Nitrophoska Turfolan	GR GR	3-2-1 (22) 3-2-1 (22)
Nitrophoska	GR Turfolan	GR 3-2-1(22)	3-2-1(22)
Pendimethalin	Accotab Bacstop Novatop Pendimethalin	EC EC EC EC	330g/LT 330g/LT 330g/Lt 330g/LT

Polyethylene wax	Tax wax Teepol Detergent Teepol disinfectant	Wax (fruit polish) - -	- - -
Polyvinyl Polymer	Mist Control	Adjuvant	20g/LT
Sodium borate	Solubor	WP	20.5%m/m
Sodium molybdate	Sodium molybdate	WP	38.8%m/m
Zinc oxide	Zinc oxide	WP	78.5%m/m
Zinc-Max	Zinc	Liquid Zinc complex	1130g/LT

ANIMAL HEALTH (PARASITICIDES)

COMMON NAME	TRADE NAME	FORMULATION	CONCENTRATION
Alphamethrin	Paracide	EC	70g/Lt
Amitrnz	Milbitrnz	EC	237.5g/kg
Amitrnz	Triatix stock spray Triatix TR	EC	125g/LT
Cargaryl	Pulvex dog shampoo	EC	50g/LT
Chlorfenvinphos	Chlorfenvinphos SUPONA Supona Super	EC EC EC	200g/LT; 300g/LT 200g/LT; 300g/LT 1000g/LT
Chlorfenvinphos + Dioxathion	Tic grease	-	4g + 4g/LT
Chlorpyrifos	Barrier Pulvex dog dip Pulvex dog powder	EC EC DP	480g/LT 150g/LT 10.7g/Kg
Closantel	Prantel	L	25g/LT
Cyfluthrin	Cylence	NF (pour-on)	10g/LT
Cypermethrin	Pouracide	NF	-
Deltamethrin	Decatix Spotton	NF (pour-on)	50g/LT
Febantel + Pyrantel Pamoate	Welpan	TB	1.6% + 1.44%m/v
Febantel + Pyrantel emboate + Praziquantel	Drontal	TB	-
Fenbendazole	Rintal	FW	100g/LT
Fenthion-methyl	Bayopet spotton Ticuvon spotton	L L	100g/LT; 200g/LT 200g/LT
Flumethrin Flumethrin + Piperonyl	Bayopet tick rinse Bayticol Drastic deadline Bacdip plus	EC EC L (pour-on) EC	20g/LT 20g/LT 10g/LT 20 + 100g/LT
Ivomectin	Ivomec	L (injecticable) (Endectoparasiticide)	1% M/V
Levamisole Hydrochloride/ Oxychlozanide	Levisan	Flowable concentrate	25 + 34 g/LT
Praziquantel	Cestocur	FW	25g/LT

Propuxur	Bayopet tic + Flea powder Bayopet dog colar Bayopet cat collar	 DP - -	 10g/Kg 94g/Kg 94g/Kg
Propuxur + Cyfluthrin	Bayopet surface spray	AE	-
Quainthiophos	Bacdip Bayopet dog and cat shampoo & conditioner	AE EC -	2g/Kg 500g/LT -
Rafoxanide	Ranide	FW	-
Thiabendazole	Thibenzole	FW	-
Toltrazuril	Baycox Systamex	SL FW	25g/LT -
Tetrachlorvinphos			
Piperonyl Butoxide			