REPUBLIC OF GHANA

MINISTRY OF FOOD AND AGRICULTURE

West Africa Food System Resilience Program (FSRP2) – Phase 2 (P178132)

Integrated Pest Management Plan (IPMP)

February 2022

LIST OF ACRONYMS

AEAs	Agricultural Extension Agents	**KLBIP**	Kpong Left Bank Irrigation Project
AESA	Agro-Ecosystem Analysis	**LI**	Legislative Instrument
AgSSIP	Agriculture Services Sub-sector Investment Programme	**LVB**	Lower Volta Basin
APFOG	Apex Farmers Organisation of Ghana	**MESTI**	Ministry of Environment, Science, Technology and Innovation
ASDP	Agricultural Sector Development Program	**METASIP**	Medium Term Agriculture Sector Investment Plan
BP	Bank Procedure	**MoFA**	Ministry of Food and Agriculture
CAADP	Comprehensive Africa Agriculture Development Programme	**MoH**	Ministry of Health
CCMC	Chemicals Control and Management Centre	**MoTI**	Ministry of Trade and Industry
CMV	Cowpea Mosaic Virus	**MPA**	Multi-Phase Programmatic Approach
CPPs	Crop Protection Products	**MRL**	Maximum Residue Limits
CSIR	Council for Scientific and Industrial Research	**NDA**	Northern Development Authority
DAES	Directorate of Agricultural Extension Services	**NGO**	Non-Governmental Organisation
DCS	Directorate of Crop Services	**NNRI**	National Nuclear Research Institute
ECOWAS	Economic Community of West African States	**NSTL**	National Seed Testing Laboratory
EIA	Environmental Impact Assessment	**OFSP**	Orange-Fleshed Sweet Potato
EPA	Environmental Protection Agency	**OP**	Operational Policy
ESMF	Environmental and Social Management Framework	**PAD**	Project Appraisal Document
FAO	Food and Agriculture Organisation	**PCN**	Project Concept Notes
FASDEP	Food and Agriculture Sector Development Policy	**PIA**	Pesticides Importers Association
FBO	Farmer-Based Organisations	**PID**	Project Implementation Document
FDA	Food and Drugs Authority	**PIU**	Project Implementation Unit
GAEC	Ghana Atomic Energy Commission	**POPs**	Persistent Organic Pollutants
GAIDA	Ghana Agri Input Dealers Association	**PPE**	Personal Protective Equipment
GCAP	Ghana Commercial Agriculture Project	**PPME**	Policy Planning, Monitoring and Evaluation
GFAP	Ghana Federation of Agriculture Producers	**PPRSD**	Plant Protection and Regulatory Services Directorate
GIDA	Ghana Irrigation Development Authority	**PTC**	Pesticide Technical Committee
GIZ	German Development Cooperation	**RELC**	Research Extension Linkage Committee
GNAFF	Ghana National Association of Famers and Fishermen	**SARI**	Savannah Agricultural Research Institute
GoG	Government of Ghana	**SEEDPAG**	Seed Producers Association of Ghana
GRA	Ghana Revenue Authority	**ToT**	Training of Trainers
GSA	Ghana Standard Authority	**UNIDO**	United Nation Industrial Development Organisation
GSGDA	Ghana Shared Growth and Development Agenda	**USAID**	United States Agency for International Development
ICAT	Institut de Conseil d'Appui Technique	**VEPEAG**	Vegetable Producers Exporters Association of Ghana
IEC	Information-Education-Communication	**VSD**	Veterinary Services Department
IPMP	Integrated Pest Management Plan	**WAATP**	West African Agricultural Transformation Program

IPPC	International Plant Protection Convention	**FSRP2**	West Africa Food System Resilience Program – Phase Two
ISO	International Organization for Standardization	**WB**	World Bank
ISPM	International Standards for Phytosanitary Measures	**WIAD**	Women in Agricultural Development
ITRA	Institut Togolaise de Recherche Agronomique	**WRC**	Water Resources Commission
IUCN	World Conservation Union	**WVB**	White Volta Basin
KIS	Kpong (Right Bank) Irrigation Scheme		

EXECUTIVE SUMMARY

Background of the Second Phase of the Food System Resilience Program (FSRP2)

The Government of Ghana (GoG) through the Ministry of Food and Agriculture (MoFA) in collaboration with the Economic Community of West African States (ECOWAS) intend to participate in the second phase of the West Africa Food System Resilience Programme (FSRP2) under the World Bank Multi-Phase Programmatic Approach (MPA) to strengthen regional food system risk management, improve the sustainability of the productive base in targeted areas and to develop regional agricultural markets. The FSRP2 will contribute to enhancing the capacity of vulnerable households, families, communities, and food systems within the country to face uncertainty and the risk of shocks; to withstand and respond effectively to shocks; as well as to recover and adapt in a sustainable manner.

The Program includes three regional institutions: Economic Commission of West African States (ECOWAS), The Permanent Interstate Committee for Drought Control in the Sahel (CILSS), and the *West* and Central *African* Council for Agricultural Research and Development (CORAF). Phase 1 of FSRP countries include Burkina Faso, Mali, Niger, and Togo. Phase 2 countries include Chad, Ghana, and Sierra Leone. The Program is expected to end December 2030. Ghana will implement the program for 5 years (expected end date December 2026) with a financing envelope of US$100 Million.

Implementation of FSRP2 is particularly important for Ghana's food and nutrition security situation due to the uncertainty of the nature and severity of Covid-19 impacts across the agricultural value chain.

Overview of FSRP2 Components

The proposed programme would have five (5) components:

Component 1: Digital Advisory Services for Agriculture and Food Crisis Prevention & Management

- Sub-Component 1.1 Upgrading Food Crisis Prevention and Monitoring Systems
- Sub-Component 1.2 Strengthening Creation and Provision of Digital Advisory Services for Farmers

Component 2: Sustainability & Adaptive Capacity of the Food System's Productive Base

- Sub-Component 2.1: Adapting/Adopting Innovations and Technologies for Resilient Food Systems
- Sub-Component 2.2: Strengthen Food Security Through Sustainable Practices in Targeted Areas

Component 3: Market Integration and Trade

- Sub-component 3.1: Facilitate Trade Across Key Corridors and Consolidate Food Reserve System
- Sub-component 3.2: Support to Development of Strategic Value chains

Component 4: Contingent Emergency Response Component

Component 5: Project Management

Rationale of the Integrated Pest Management Plan (IPMP)

Component 2, which will support agro-sylvo-pastoral production systems and soil fertility management, is expected to cause an increase in the use of agro-chemicals including pesticides and fertilizers to boost agricultural productivity both in the crop and livestock sectors. However, unsupervised, and intensive application of these products could result in the reduction or elimination of bio-control agents or crop aids, thereby promoting the uncontrolled increase in pest populations and the occurrence of secondary pests as well as the development of pesticide resistance in pests. In addition, impacts on human and animal health, contamination of soil, surface and groundwater are some of the consequences that could compromise the achievement of the program objectives. Sub-component 3.2 is also to ensure an improvement in the standards and quality of products and is expected to minimize and monitor the safe application of these products.

The World Bank Environmental and Social Standard 3 – Resource Efficiency and Pollution Prevention is relevant for projects under which any procurement of pesticides (agricultural use, vector control, weed

control, etc.) either directly by the project, or indirectly through on-lending, co-financing, or government counterpart funding, projects and programs that are expected to introduce new pest management practices or expand or alter existing pest management practices and subsequent environmental and health risks.

In line with the World Bank ESS3, this standalone Integrated Pest Management Plan (IPMP) has been prepared to guide the project's pest management interventions and to complement the Environmental and Social Management Framework (ESMF) and other safeguards instruments relevant for the Programme.

Objectives of the IPMP

The specific objectives of the IPMP are to:

- develop an integrated pest management plan (IPMP) by using recommended best-practices;
- assess the current and anticipate pest problems in the programme areas;
- evaluate the capacity of the country's regulatory framework and institutions to promote and support safe, effective, socially and environmentally sound integrated pest management and to provide for appropriate institutional capacity support recommendations;
- ensure compliance with regional standards, laws and regulations; and
- develop monitoring and evaluation systems for the various pest management practices of the IPMP based on the government laws and the relevant World Bank environmental and social standards.

Policy, Regulatory and Legal Framework for Pest/Disease Management

Ghana has a number of laws, regulations, policies and institutional arrangements that promote environmentally sustainable pest management practices. Most of these policy and regulatory requirements lay emphasis on the adoption of integrated pest management methods in the agricultural production and processing sector. An assessment on the state of integration of pest management issues in different sectoral and cross-sectoral regulatory frameworks is given in Chapter 2 of this document.

The major national and international policies relevant to this program include the following:

- Ghana's Food and Agriculture Sector Development Policy (FASDEP);
- Ghana 's Medium Term Agriculture Sector Investment Plan (METASIP);
- National Irrigation Policy, Strategies and Regulatory Measures, June 2010;
- Guidelines for the National Plant Protection Policy, June 2004;
- National Land Policy, 1999;
- National Water Policy, June 2007;
- National Environment Policy;
- WB Environmental and Social Standards (ESS 3 – Resource Efficiency and Pollution Prevention);
- ECOWAS Regulation on the Harmonization of the Rules Governing Pesticides Registration.

The key laws and regulations relevant to this programme include the following:

- Environmental Protection Agency Act, 1994 (Act 490);
- Environmental Assessment Regulations, 1999 (LI 1652) and its Amendment of 2002, (LI1703);
- Plants and Fertilizer Act, 2010 (Act 803);
- Water Resources Commission Act, 1996 (Act 522);
- Food and Drugs Act 1992, (PNDCL 3058); and
- Irrigation Development Authority Act, 1977 (SMCD 85) and IDA Regulation of 1987.

Ghana is a signatory to many conventions on the protection of the environment, which have relevance to the IPMP under study. Some of these conventions ratified by Ghana pertaining to the FSRP2 project are listed in section 2.2.2 of this document. Additionally, Ghana has put in place the necessary national

framework for the control and management of pest and pesticides in the country with institutions such as the Environmental Protection Agency (EPA), Plant Protection and Regulatory Services Directorate (PPRSD), Ghana Standard Authority (GSA), Food and Drugs Authority (FDA) etc. as the leading coordinating bodies.

Environmental and Social Baseline Conditions

The Republic of Ghana is located between latitudes 4° and 12°N, and longitudes 4°W and 2°E. It has a total border of approximately 2,093 km, including 548 km with Burkina Faso to the north, 688 km with Côte d'Ivoire to the west, and 877 km with Togo to the east. It has a coastline on the Gulf of Guinea, part of the Atlantic Ocean, measuring 539 km. It has an area of 239,540 sq km. The country is divided into 16 administrative regions and 260 districts with Accra as the administrative capital.

Average rainfall over the country is about 1,260 mm/ year but ranges from 890 mm/year in the coastal zone near Accra to 2,030 mm/year in the south-western rainforests. The rainfall is bi-modal in the southwestern forest zone, giving a major and a minor growing season; elsewhere, a uni-modal distribution gives a single growing season from May to October. Except for the south-western zone, the reliability of the rainfall, particularly after crop germination, is a major factor affecting crop growth and agriculture in general.

Ghana is drained by three (3) main river systems comprising the Volta, South-Western and Coastal River Systems. The Volta in Ghana occupies nearly one third (30%) of the land area of Ghana, the south-western 22% and the minor coastal 8%. The areas covered by the respective river basins are described below. Global water resources are estimated at 53.2 km^3 per year, consisting of 30.3 km^3/year of internally produced water resource, and 22.9 km^3/year of runoff from other countries.

The farming system within the Lower Volta Basin area is basically crop-livestock. Crops grown include root and tubers, cereals, legumes, vegetables. Smallholder livestock rearing - cattle, small ruminants and household poultry also forms part of the mainstay of the communities. Cottage industries such as kente weaving (local fabric), harvesting of reeds for mat weaving, production of lime from oyster shells deposits and distillation of Akpeteshie (local gin) are also common in the area. The area falls within the lower Volta Basin, directly below the Akosombo and Kpong Hydro-electric Dams. A sizeable number of people are engaged in artisanal fishing due to the presence of network of creeks, lagoons within the Volta catchment area.

The people in the White Volta Basin area are typically involved in subsistence crop-livestock farming systems. The crops include millet, sorghum, fonio, potatoes, groundnuts, cowpea, onions, leafy vegetables. Livestock rearing is common to every household with small ruminants, poultry (guinea fowl and fowls) and to a small extent piggery. There is also production of mango in the area; and shea trees grow wild. Some fishing is done on the white Volta and its tributaries. Small cottage industries – weaving of basket and hats from grass; weaving of local fabric for sewing of traditional smocks and dresses for ladies. There is small scale gold mining in and around Nangondi and Talensi areas.

The farming systems of the Forest Transition and Guinea Savannah Areas is mainly crop-livestock farming with farmers engaged in the cultivation of varied crops such as vegetables (tomatoes, garden eggs, pepper, onions, ginger); grains (maize, rice); roots and tubers (yam, cassava, sweet potato); perennial and horticultural crops such as plantain, mangoes, cashew and cocoa. The area is also known for livestock (sheep, goats and cattle) and household poultry production. There are fisher-folk along the Volta and its major tributaries.

Existing and Anticipated Pest and Disease / Management Practices

There are two key categories of activities that will involve use of pesticides during implementation of the program

(i) Agricultural pesticides for the control of pests, diseases, nematodes and weeds; and
(ii) Prevention of invasive aquatic weeds in the case of using herbicides.

Some of the major crops targeted under FSRP2 are vegetables (tomatoes, garden eggs, pepper, onions, ginger); grains (maize, rice, millet, sorghum); roots and tubers (yam, cassava, sweet potato); perennial and horticultural crops such as plantain, mangoes, cashew and cocoa which involve the application of agro-chemicals and inputs such as fertilisers, herbicides, insecticides, nematicides and fungicides. Additionally, the application of veterinary products in the livestock (small ruminant) and poultry sectors will be regulated.
The major pests and diseases associated with the following commonly grown crops in the project regions are described in detail in chapter 4 of this document:

(a) Pulses/grain legumes (cowpea, groundnut, soya bean/soybean);
(b) Vegetables (cabbage, cucurbits (cucumber, melon, pumpkin and courgette), eggplant, lettuce, okra, onion, pepper and tomato);
(c) Cereals (maize, rice, millet, sorghum); and
(d) Roots and tubers (cassava, yam, sweet potato).

Some of the common pests envisaged in the project areas include: rodents and migratory pest outbreaks such as locusts, borers, caterpillar, nematode, aphid, mealy bug. IPM strategies are recommended and used by some farmers as long as it is possible because there is no one control practice that can provide acceptable control of the target pest.

The Veterinary Services Division (VSD) has used various strategies across the country to control and contain outbreaks of diseases. These included spatial strategies such as movement prohibition, quarantine, restriction, regulatory services, and encouragement of community participation and non-spatial strategies of animal health programs such as immunization and prophylactic treatments. Over the years, diseases such as *anthrax* in the northern and western regions; *African swine fever* on the western borders of the country (Brong Ahafo, Upper West Region and Western); *contagious bovine pleuropneumonia (CBPP)* and *small ruminant plague (PPR)* in all regions; *Brucellosis* in Brong Ahafo and in the Western Region have been detected and controlled effectively.

Pesticides to be used under FSRP2
The EPA has a list of approved and registered pesticides for use by farmers. Additionally, there is a list of banned pesticides. This list is updated periodically with the last update in 2020. These pesticides are tested to improve the quality of the pesticides used i.e., the reduction of the toxicity and the increase of the efficiency.

The integrated pest management is the adopted strategy for the fight against pests in Ghana. However, the use of the integrated combat is not widespread despite the efforts undertaken. The use of pesticides is increasing in spite of the high cost of the products relative to the purchasing power of majority of farmers. Research Institutions in Ghana have had some good results with regard to the efficient use of botanical products. The national IPM approaches developed for cereals, pulses and vegetables are largely based upon 15 principles, practices and what happens in each case. Both preventive and curative fight methods will be employed to manage pest attacks and invasions.

Over the years, efforts have been made particularly by the research institutions to develop alternative products to the use of agro-chemical products such as POPs (Persistent Organic Pollutants) with the aim of reducing the use of pesticides in agriculture and the areas of use of these pesticides. These alternatives include cultural control, physical control, genetic control, integrated pest management, biological control, the use of bio-pesticides, the use of pesticides of the organophosphorus family, carbamates, pyrethroids, etc.

Losses due to damage caused by the larger grain borer, weevils, rats/rodents, aflatoxins, and grain moths can be minimized through adoption of the appropriate IPM strategies.

Management and Use of Pesticides

The IPMP also discusses the following pesticide use and management activities in detail:

- Production and importation of pesticides;
- Selling and distribution practices;
- Use of pesticides by farmers;
- Management of pesticide containers; and
- Accidents resulting from pesticide use.

Potential Impacts and Challenges Associated with FSRP2 Interventions

The use of various agro-chemicals especially pesticides is more likely during the implementation stage of the FSRP2 irrigation and storage interventions. The potential risks/impacts associated with the procurement, transport, storage, use / handling and disposal of pesticides are summarised in the table below:

Activities		RISKS	
		Human Environment	*Biophysical Environment*
Transport	- Use of public transportation vehicles for people and goods	- Passenger contamination - Inhalation of product vapours - Inhalation of contaminated dust; - Skin burns from contact	Accidental spills; contamination of soil and groundwater resources through leaching in the event of a traffic accident
Storage	- Non-compliance with national regulations and FAO standards on pesticide storage and/or obsolete stocks; - Lack of training of pesticide traders.	- Odour nuisances; - Contact with the skin during handling; - Bioaccumulation of pesticides.	(In the event of an uncontrolled spill or leak) - Soil contamination - Surface Water Contamination - Impairment of ambient air quality
Handling / manipulation	- Insufficient training and awareness-raising activities for authorised distributors; - Lack of supervision of phytosanitary agents and producers.	- Inhalation of vapors; - Dermal contact by splash during preparation	- Contamination of water sources by washing containers; - Accidental spills and contamination of soil and groundwater resources
Elimination of Packaging/ containers	- Failure of the empty packaging management system (storage, collection, transport, rinsing and compaction) - Lack of appropriate equipment for the disposal of empty packaging.	- Health concerns related to the ingestion of pesticide residues when reusing empty containers (plastic cans and metal drums) that have not been properly cleaned; - Dermal and respiratory conditions - Chronic intoxication of personnel in the distribution chain	- Spill of product funds on soils; - Groundwater contamination
Washing containers	- Information and awareness system failure	- Low level of public awareness of the health risks associated with handling pesticides	- Acute poisoning of fish and other crustaceans - Pollution of points (wells) and water bodies (ponds). - Water contamination by runoff or by wind action;

Integrated Pest and Pesticide Management Action Plan

The main purpose of the plan is to protect the biophysical and human environment through the promotion of the use of integrated pest management methods, capacity building of farmers, destruction

of obsolete stocks, and environmental impact assessment of agricultural development projects likely to use a considerable quantity of pesticides, the management of empty containers and the provision to farmers of protection and spraying equipment. Various impacts and challenges are likely to be associated with the implementation of FSRP2 with regard to pest and pesticide management issues. The following areas of impacts are adequately addressed in the IPMP:

- Mycotoxin poisoning from poor maize drying;
- Improper use of pesticides by farmers and farm assistants;
- Pollution of water resources and aquatic life;
- Public health concerns from water-borne or water related diseases in project areas under irrigation;
- Poisoning from improper disposal of pesticide containers;
- Threat from other crop pests and diseases;
- Production and market losses from fruit fly pest and armyworm outbreaks;
- Abuses in pesticide supply and sales;
- Impact on post-harvest losses due to pests; and
- General health and safety of farmers/crops and environmental hazards.

Programme to Meet IPMP Requirements

The rationale behind the plan is illustrated in the matrix below which confirms the results expected from the development and implementation of the Integrated Pest Management Plan (IPMP).

Narrative summary	Expected results	Performance indicators	Assumptions/risks
Goal: Attract investors into commercial farming and empower small holder crop farmers to contribute significantly to household, local and national economies through environmentally friendly pest management practices.	• Food security enhanced • Environmental quality improved, • Crop productivity and farmers' income increased • Crop export improved • National foreign exchange improved	• Evidence of improvements in food availability, level of poverty, and environmental protection in project targeted areas • Evidence of crop export increased • Evidence of area under irrigation in the project targested areas increased	• Government policies continue to support food security and irrigation programme • Nation continues to pursue stable democratic governance
Purpose 1. To prevent losses caused by pests in order to increase profitability of agriculture. 2. In the longer term, strengthen national and local capacity to reduce environmental and health risks associated with pest management practices.	**Medium-term results/outcomes** • Farmers in project areas prioritize their pest problems and identify IPM opportunities to mitigate negative environmental and social impacts associated with pesticides. • Farmers in project areas adopt ecologically sound options to reduce crop losses with minimal personal and environmental health risks.	• Availability of sufficient and healthier food. • Perception of state agencies regarding the value of IPM in agriculture. • Level of compliance with World Bank policies etc. • Level of chemical control practices • Types and level of use of alternatives to	

Narrative summary	Expected results	Performance indicators	Assumptions/risks
	• FSRP2 decision makers and actors provided with clearer guidelines enabling them to promote IPM approaches and options in agriculture • National IPM policy supported and promoted in compliance with international conventions and guidelines on pesticide use	synthetic chemical pesticides	

IPM Strategies

FSRP2 will adopt the following specific strategies to achieve an effective pest and pesticide management process:

1. Formation of a Safeguard Team;
2. Registration and training of all interested pesticide distributors/resellers;
3. IPMP communication and orientation workshop;
4. Education and awareness creation;
5. Participatory pests inventory and monitoring measures;
6. Stakeholder and interest group consultation and involvement;
7. Prevention of new pest infestations;
8. Management of established pests;
9. IPM capacity building;
10. Institutional arrangements and training responsibilities;
11. Participatory monitoring and evaluation;
12. Reporting;
13. Management reviews; and
14. Institutional arrangements for the implementation and monitoring of the IPMP.

IPMP Implementation Budget

The costing for activities identified in the IPMP (during Ghana's 5-year participation in the FSRP2) is provided in Table 55 as a guide. It is estimated that an amount of about USD613,500 will be required to implement the IPMP over the 5-yr period, with an average yearly investment requirement of about **USD 122,700.00.**

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1.0 INTRODUCTION

1.1 Background of the FSRP2

The Government of Ghana (GoG) through the Ministry of Food and Agriculture (MoFA) in collaboration with ECOWAS intend to undertake the West Africa Food System Resilience Programme (FSRP2) under the World Bank (WB) Multi-Phase Programmatic Approach (MPA) to strengthen regional food system risk management, improve the sustainability of the productive base in targeted areas and to develop regional agricultural markets. The FSRP2 will contribute to enhancing the capacity of vulnerable households, families, communities and food systems within the country to face uncertainty and the risk of shocks; to withstand and respond effectively to shocks; as well as to recover and adapt in a sustainable manner. The Program which will be undertaken in 2 phases will be implemented in 9 West African countries namely: Sierra Leone, Mali, Niger, Togo, Chad, Burkina faso, Ghana, Gambia, and Liberia. FSRP2 Is expected to be effective in March 2021 and end in December 2030**.** However, Ghana will implement the program for 5 years, commencing July 2022 and ending June 2027 with a financing envelope of US$150 million.

The WAFRSP will focus on the investments in resilience creation, the necessary conditions to enable the food sector exploit its significant potential as an engine for poverty alleviation, job creation (notably in rural areas) and provider of healthy and nutritious food.

This program is expected to help solve the Africa food security challenges by implementing existing commitments on agriculture and food security with key priorities for food system adaptation to climate change, including the need to leverage science and digital technology and the scale-up of agriculture support including through strengthened collaboration among development partners. Implementation of FSRP2 is particularly important for Ghana's food and nutrition security situation due to the uncertainty of the nature and severity of Covid-19 impacts across the agricultural value chains.

The proposed programme would have five (5) components:

Component 1: Digital Advisory Services for Agriculture and Food Crisis Prevention & Management

- Sub-Component 1.1 Upgrading Food Crisis Prevention & Monitoring Systems
- Sub-Component 1.2 Strengthening Creation and Provision of Digital Advisory Services for Farmers

Component 2: Sustainability & Adaptive Capacity of the Food System's Productive Base

- Sub-Component 2.1: Adapting and adopting innovations and technologies for resilient food systems
- Sub-Component 2.2: Strengthen Food Security Through Sustainable Practices in Targeted Areas

Component 3: Market Integration & Trade

- Sub-component 3.1: Facilitate Trade Across Key Corridors and Consolidate Food Reserve System
- Sub-component 3.2: Support to Development of Strategic Value chains

Component 4: Contingent Emergency Response Component

Component 5: Project Management

Component 2, which will support agro-sylvo-pastoral production systems and soil fertility management, is expected to see an increase in the use of agrochemicals including pesticides and fertilizers to boost agricultural productivity both in the crop and livestock sectors. However, the unsupervised and intensive application of these products could result in the reduction or elimination of bio-control agents or crop aids, thereby promoting the uncontrolled increase in pest populations and the occurrence of secondary pests as well as the development of pesticide resistance in pests. In addition, contamination of soil, surface and groundwater is one of the consequences that could compromise the achievement of program

objectives. Sub-component 3.2 is also to ensure an improvement in the standards and quality of products and is expected to minimize and monitor the application of these pesticides.

As part of the implementation of the FSRP2, the Integrated Pest Management Plan (IPMP) is required to minimize potential harmful effects on human and animal health and on the environment particularly on aquatic life, soil etc., which may arise particularly in component 2 in the context of vector control, and to promote integrated pest management. The World Bank Environmental and Social Standard 3 – Resource Efficiency and Pollution Prevention is relevant for projects under which any procurement of pesticides (agricultural use, vector control, weed control, etc.) either directly by the project, or indirectly through on-lending, co-financing, or government counterpart funding, projects and programs that are expected to introduce new pest management practices or expand or alter existing pest management practices and subsequent environmental and health risks. As a result, MoFA is required to prepare an Integrated Pest Management Plan (IPMP) as a standalone document. The IPMP is to complement the Environmental and Social Management Framework (ESMF) and other safeguards instruments relevant to the Programme.

1.2 Objectives of the IPMP

The World Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides", and "in appraising a project that will involve pest management, the World Bank assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. As part of the requirements, the project will have to incorporate in the project components to strengthen such a capacity. Consequently, the purpose of preparing this IPMP for the FSRP2 is to standardize pest management practices during program implementation in line with national regulatory compliance requirements, along with environmental and health safety requirements of the World Bank. The safety issues for application of chemicals as a part of integrated pest management also will be highlighted.

The specific objectives of the IPMP are to:

- develop a pest management plan (IPMP) by using recommended best-practices;
- assess the current and anticipate pest problems in the programme areas;
- evaluate the capacity of the country's regulatory framework and institutions to promote and support safe, effective, socially, and environmentally sound integrated pest management and to provide for appropriate institutional capacity support recommendations;
- ensure compliance with regional standards, laws, and regulations; and
- develop monitoring and evaluation systems for the various pest management practices of the IPMP based on the government laws and any existing relevant projects (e.g. the World Bank, FAO, WHO, UNEP etc.).

1.3 Rationale of the IPMP

The essence of the IPMP is to address concerns of relevant stakeholders with regards to pests and pesticides. It stresses the need to monitor and mitigate negative environmental and social impacts of the Program including the use of pesticides and promote ecosystem management with the human health risk being the underlying principle from seed usage, through planting and growth stage and also post-harvest issues including safe crops for consumption. It emphasizes the need for an integrated approach to the management of pests in line with the nation's policy on IPMP as well as funding agency's requirements on pest management and makes provision for adequate measures to enable FSRP2 sustain the adoption of IPMP techniques.

1.4 General Approach

The application of pesticides during the FSRP2 is expected to be a major focus of project activity considering the land mass required for the cultivation, breeding and processing of the different agricultural commodities that are selected under this project. The design and environmental impact

screening of specific project options or interventions will consider in each case the likely pesticides to be used. An appropriate IPM technique will be incorporated into the project option or intervention to mitigate the need or demand for the use of chemical pesticides.

The FSRP2 will assist and train farmers to be able to develop IPM approaches to the management of pests and diseases. This will be done holistically from seed selection, land preparation, through planting and farm maintenance to harvesting and post harvesting issues. Farmers will be trained and encouraged to make detailed observations in their fields regularly so that they can detect early infestations and make the appropriate management through the digital advisory services to be developed under Component 1 and Agro-Ecosystem Analysis (AESA) as well. This will ensure that pest and disease problems do not escape notice and are not allowed to develop to the extent that they cause very severe damage and heavy crop losses. The decision to use chemical pesticides will be taken only as the very last resort.

Pesticide use in general and pest issues amongst downstream project actors or participants (such as farmers, farm assistants, agro-chemical dealers, resellers, Farmer-Based Organisations (FBOs), local communities) will be surveyed regularly by MoFA and environmental specialists.

Downstream program actors will be key in decision making processes with regards to pest management strategies and measures at the project implementation level. Institutions such as the Environmental Protection Agency (EPA), Plant Protection and Regulatory Services Directorate (PPRSD), MoFA - Directorate of Agricultural Extension Services (DAES)/regional officers, well known and trained Non-Governmental Organisations (NGOs) and Farmer-Based Organisations (FBOs) will provide expertise on pest management strategies or measures during the project implementation phase.

1.5 Methodology

In preparation of the Integrated Pest Management (IPM), both primary and secondary data were sourced. IPM has been defined in various ways but a more scientific definition describes it as, "the practical manipulation of pest populations using sound ecological principles to keep pest populations below a level causing economic injury". Consultations with different stakeholders were carried out to solicit information regarding pest management practices and pest problems for crop production and weed management as well as food storage. During the preparation of this report, the existing IPMP which was developed by the MoFA through the Ghana Commercial Agriculture Project (GCAP) and the West African Agricultural Transformation Program (WAATP) as well as specific reports on pesticides use on similar projects were used as key reference documents. The specific documents included:

1. Review of the World Bank project documents including the Project Concept Note (PCN), Project Implementation Document (PID), ESMF and Project Appraisal Document (PAD).
2. Government of Ghana - Ministry of Food & Agriculture, West African Agricultural Transformation Program (WAATP) Pest Management Plan Final Report, June, 2018.
3. Government of Ghana - Ministry of Food & Agriculture, Ghana Commercial Agriculture Project (GCAP) Pest Management Plan Draft Final Report, November 2011. SAL Consult Limited, P. O. Box GP20200, Accra-Ghana.
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2.0 POLICY, REGULATORY AND LEGAL FRAMEWORK FOR PEST/DISEASE MANAGEMENT

Ghana has a number of laws, regulations, policies and plans that promote environmentally friendly pest management practices. Most of these policy and regulatory requirements lay emphasis on the adoption of integrated pest management methods in the agricultural production and processing sector. An assessment on the state of integration of pest management issues in different sectoral and cross-sectoral regulatory frameworks is given in the next sections.

2.1 Policy Framework and Guidelines

Farming in Ghana relies heavly on rain for cultivation. However, there are a number of irrigation schemes developed by the Ghana Irrigation Development Authority (GIDA) across the country. Irrigation systems rely heavily on water and access to water is crucial for human development. The control of pests and the use of fertilizers are also critical to commercial agricultural production. A number of sectoral policies could impact on the performance and success of the FSRP2 and the key policies relate to agriculture, land, water, environmental protection, irrigation and pest/pesticide and other supporting activities.

The major national and international policies relevant to this program are captured in Table 1.

Table 1: Major national and international policies and guidelines

National Policies (Ghana)	International Policies
• Ghana's Food and Agriculture Sector Development Policy (FASDEP) • Ghana 's Medium Term Agriculture Sector Investment Plan (METASIP) • National Irrigation Policy, Strategies and Regulatory Measures, June 2010 • Guidelines for the National Plant Protection Policy, June 2004 • National Land Policy • National Water Policy, June 2007 • National Environment Policy	• World Bank Environmental and Social Standards (ESS 3 – Resource Efficiency and Pollution Prevention and Management) • ECOWAS Regulation on the Harmonization of the Rules Governing Pesticides Registration • Pest Management Guidelines of the US Agency for International Development (USAID)

Food and Agriculture Sector Development Policy (FASDEP)

The first FASDEP was developed in 2002 as a framework for the implementation of strategies for the modernization of the agricultural sector. The revised policy, FASDEP II emphasizes the sustainable utilization of all resources and commercialization of activities in the sector with market-driven growth in mind. Enhancement of productivity of the commodity value chain, through the application of science and technology, with emphasis on environmental sustainability. The policy contains policy objective on food security and emergency preparedness to guide the management of pest and disease incidences, and climate change related risks of hazards and disasters affecting agricultural production and productivity.

Ghana's Medium Term Agriculture Sector Investment Plan (METASIP)

The METASIP developed by GoG was to implement the Food and Agriculture Sector Development Policy (FASDEP II) over the medium term 2011-2015. The plan provides the framework for the agriculture sector to play its role in the national economy in the context of the Ghana Shared Growth and Development Agenda (GSGDA) which is the national programme of economic and social development policies coordinated by the National Development Planning Commission (NDPC). METASIP is also in fulfilment of Ghana's participation in agriculture related initiatives of the Economic Community of West African States (ECOWAS) and the Africa Union Commission (AUC) under the framework of the ECOWAS Agriculture Policy (ECOWAP) and the Comprehensive Africa Agriculture Development Programme (CAADP).

The METASIP comprises the following six programmes which correspond to the FASDEP II and represent Ghana's priorities within the four CAADP Pillars, within the period 2011 - 2015:

(a) Food security and emergency preparedness
(b) Improved growth in incomes
(c) Increased competitiveness and enhanced integration into domestic and international markets
(d) Sustainable management of land and environment
(e) Science and technology applied in food and agriculture development
(f) Enhanced institutional coordination

The Plan has made provision for environmental issues including sustainable management of land and environment under the fourth programme. Some of the interventions planned under the programme to improve the use of improved technology in agriculture include the introduction of improved crop varieties i.e., high yielding, short duration, disease and pest resistance, and nutrient-fortified, as well as advocate for development and enforcement of regulations on the Pesticides Act.

Ghana Irrigation Development Policy

The Ghana Irrigation Development Policy (National Irrigation Policy, Strategies and Regulatory Measures) was promulgated by the Parliament of Ghana in 2010. The policy addresses the problems, constraints, and opportunities, which cut across the whole irrigation sub-sector; and specifically, for informal, formal and commercial irrigation. It is complemented with a strategic framework, the National Irrigation Development Master Plan (NIDMAP) to specify how the strategies in the policy document will be implemented to put an area of 500,000ha under irrigation in the medium term.

Section 2 of the policy highlights "Specific Problems Addressed by the Policy" while subsection 2.3 deals with "Environmental Degradation Associated with Irrigated Production" i.e., degradation of land and water resources from the use of agricultural chemicals. Subsection 2.3 is reproduced below.

Irrigated agriculture's environmental "footprint" in Ghana is no larger-than that of any other sub-Saharan country, but concentration of intensive agriculture in a relatively narrow and densely populated coastal margin will exacerbate degradation of land and water resources. The management of agricultural chemicals and drainage across irrigation schemes will be of crucial importance in relieving these pressures and maintaining the productive services of the natural resource base. This is as much an economic opportunity as an environmental imperative. Also, human health has to be considered due to water-related diseases like malaria and as some parts of the informal sector have only access to marginal quality water for irrigation.

Section 5 of the policy provides insight into the "Policy Implementation Strategy". However, subsection 5.3 provides for the implementation strategy on one of the policy objectives ie. responsible production, which emphasizes the need to internalize agricultural impacts on environment and human health. Subsection 5.3 is reproduced below:

This policy thrust will ensure that the irrigated sub-sector is capable of environmentally responsible production that is both compliant with Ghana's environmental legislation and regulation and is also up to date with international norms and practices in minimizing the sub-sector's hydrological footprint on the environment and human health. The key implementing units will be GIDA, the EPA and Ministry of Health (MOH). Supporting regulations and guidelines which include stipulation of minimum stream flows and agricultural effluent with updated guidelines for the application of pesticides and fertilisers in irrigation practice.

Guidelines for the National Plant Protection Policy, June 2004

This policy was enacted in 2004 with the goal of achieving an efficient system that ensures that crop losses caused by biological, environmental and ecological factors are contained in a sustainable, and economical manner. The thirteen (13) principles underlying the policy include:

1. Capacity building at national, regional and district levels
2. Intra and inter-ministerial collaboration
3. Private sector involvement
4. Partnerships with international development partners
5. Regional and international cooperation
6. Legislation
7. Integrated pest management (IPM)
8. Coordination of IPM Activities
9. Contribute to IPM research
10. International trade
11. Planting materials production
12. Compliance
13. Participatory approaches and farmer empowerment

Principles 7, 8, and 9 provide for integrated pest management (IPM) issues. Principle 7 on IPM specifically states that: *promoting Integrated Pest Management (IPM) as the standard plant protection strategy for all crops to effectively reduce crop losses with minimum pesticide use.*

The Plant Protection and Regulatory Services Directorate, PPRSD is the national agency assigned the national mandate to organize, regulate, implement, monitor and coordinate plant protection services needed for sustainable agricultural growth and development.

The PPRSD has adopted the Food and Agriculture Organisation (FAO) definition of pest which is *any form of plant or animal life or any pathogenic organism that is injurious or potentially injurious to plants, plant products, livestock or people; pests include insects and other arthropods, nematodes, fungi, bacteria, viruses, vertebrates and weeds.*

National Land Policy

This policy provides for the protection of water bodies and the environment in the long term national interest under any form of land usage be it for human settlements, industry and commerce, agriculture, forestry and mining. Two key aspects of Section 4.4 (Ensuring Sustainable Land Use) of the Policy relevant to the FSRP2 is provided below:

(h) In general, land use involving mining, other extractive industries, mechanised agriculture, cattle ranching, dairy farming and manufacturing industry will have to conform to prescribed environmental conservation principles and guidelines.

(m) All land and water resources development activities must conform to the environmental laws in the country and where Environmental Impact Assessment report is required this must be provided. Environmental protection within the 'polluter pays' principle will be enforced.

National Water Policy, June 2007

This policy was approved in June 2007 with the aim of providing the framework for the sustainable development of water resources in Ghana. As captured in the policy, the overall goal of the policy is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations.

There are number of relevant sections of the policy that pertains to the FSRP2. Section 2.2.3 focus on Water for Food Security. The key objectives of the section are to:

- ensure availability of water in sufficient quantity and quality for cultivation of food crops, watering of livestock and sustainable freshwater fisheries to achieve sustainable food security for the country; and
- ensure availability of water in sufficient quantity and quality to support the functions of the eco-systems in providing alternative livelihoods.

Relevant policy measures to be undertaken which are in conformity with the FSRP2 include:

(a) Policy measure iii - Promote partnership between the public and the private sector in the provision of large commercial irrigation infrastructure taking into consideration effects on economy, culture, environment and health;
(b) Policy measure iv - encourage the efficient use of fertilizers to reduce pollution of water bodies and ensure conservation of water;
(c) Policy measure v - promote and encourage water use efficiency techniques in agriculture and reduce transmission losses of water in irrigation systems; and
(d) Policy measure vi - manage land use and control land degradation, including bush fires, to reduce soil loss and situation of water bodies.

Even though the policy is silent on the use of pests or pesticides, water quality concerns are cited in many instances in the policy document which could generally encompass pollution concerns not only from fertilizers but also from pesticides as well.

National Environment Policy/Action Plans

The main objective of this policy is to ensure sustainability by ensuring a sound management of resources and the environment, and to avoid any exploitation of these resources in a manner that might cause irreparable damage to the environment. The policy provides for maintenance of ecosystems and ecological processes essential for the functioning of the biosphere, sound management of natural resources and the environment, and protection of humans, animals and plants and their habitats. The policy objectives seem to be clearly in line with integrated pest management principles.

World Bank Environmental and Social Standards (ESSs)

The World Bank Environmental and Social Standards (ESS) set out the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts associated with projects supported by the Bank through Investment Project Financing. ESS1, Assessment and Management of Environmental and Social Risks and Impacts, requires environmental assessment of projects that are considered to have potential adverse impacts on the environment to help ensure that they are environmentally sound and sustainable. The following World Bank Environmental and Social Standards (ESSs) are relevant for the project:

- ESS1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS2: Labor and Working Conditions
- ESS3: Resource Efficiency and Pollution Prevention and Management
- ESS4: Community Health and Safety
- ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- ESS8: Cultural Heritage
- ESS10: Stakeholder Engagement and Information Disclosure

For this report, pest management (which is a requirement of ESS 3) is considered.

ESS 3 – Resource Efficiency and Pollution Prevention and Management

ESS3 recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services, and the environment at the local, regional, and global levels. The current and projected atmospheric concentration of greenhouse gases (GHG) threatens the welfare of current and future generations. At the same time, more efficient and effective resource use, pollution prevention, and GHG emission avoidance, and mitigation technologies and practices have become more accessible and achievable.

Where projects involve recourse to pest management measures, the Borrower will give preference to integrated pest management (IPM) or integrated vector management (IVM) approaches using combined or multiple tactics. This standard supports safe, effective, and environmentally sound pest management. It promotes the use of biological and environmental control methods. The policy aims at assisting proponents to manage pests that affect either agriculture or public health, supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. The standard calls for assessment of the nature and degree of associated risks, taking into account the proposed use and the intended users for procurement of any pesticide in Bank-financed projects. It is a requirement that pesticides that will be used, will be manufactured, packaged, labelled, handled, stored, disposed of, and applied according to standards acceptable to the Bank.
This standard will be relevant for the FSRP2 due to application of pesticides and herbicides to boost agricultural productivity in the project targeted areas.

2.2 Regulatory Framework

2.2.1 National Laws

The Government of Ghana (GoG) has over the years developed some legislations and institutional framework to govern environmental pollution, plant protection, irrigation, and pest and pesticide management. The aspects of the law that pertains to FSRP2 are provided in the table below:

Table 2: Legislations on environmental pollution, plant protection, irrigation, and pest and pesticide management

National Law	Relevancy to FSRP2
Environmental Protection Agency Act, 1994 (Act 490)	This Act specifies the guideline and rules guiding the dealing with distribution, use and disposal of pesticides in Ghana. The act aims at controlling the volumes, types, components, wastes effects or other sources of pollution elements or substances that are potentially dangerous for the quality of life, human health and the environment. Part II of the Act 490 specifically deals with pesticides control and management and this was formally an Act on its own (Pesticides Control and Management Act of 1996, Act 528). This section of Act 490 provides the rules for registration, pesticides classification, approval, clearance, using, disposing of and non- disclosure of confidential information, the granting of license, labelling and pesticides inspections.
Environmental Assessment Regulations, 1999 (LI 1652) and its Amendment of 2002, (LI1703)	The regulation makes an environmental assessment mandatory as part of project implementation and permit acquisition process. The Regulations describe the procedures to be followed to obtain permits for both existing and proposed undertakings through the conduct of environmental impact assessments and preparation of environmental management plans. The Environmental Assessment (Amendment) Regulations 2002, LI 1703 establishes the charges to be taken by the EPA for review and issuance of a Permit.
Plants and Fertilizer Act, 2010 (Act 803)	The Act combines the Seed Inspection and Certification Decree, NRCD 100 of 1972 and the Prevention & Control of Pests and Diseases of Plants Act of 1965, Act 307. The Act provides for the efficient conduct of plant protection to prevent the introduction and spread of pests and diseases to regulate imports and exports of plants and planting materials; the regulation and monitoring of the exports, imports and commercial transaction in seeds and related matters; and control and regulation of fertilizer trade.

National Law	Relevancy to FSRP2
Water Resources Commission Act, 1996 (Act 522)	The Act conferred on the Water Resource Commission (WRC) the mandate to regulate and control the use of water resources through granting of water rights and water use permits. The Water Use Regulations, (L.I.1692) provides the procedure for allocating permits for various water uses including domestic, commercial, municipal, industrial, agricultural, power generation, water transport, fisheries (aqua culture), and recreational.
Food and Drugs Act, 1996 (Act 523)	Section 13 of the Act deals with prohibition on disposal of chemical substances and it states that: *A person commits an offence if that person uses or disposes of a chemical substance in a manner likely to cause* (a) *contamination of food or water for human or animal consumption, or* (b) *injury to, or be dangerous to the health of a person or an animal.* The Act defines a chemical substance to include an insecticide, rodenticide and a pesticide. It stipulates that "chemical substance" means a substance or mixture of substances prepared, sold or represented for use as: (a) a germicide, (b) an antiseptic, (c) a disinfectant, (d) a pesticide, (e) an insecticide, (f) a rodenticide, (g) a vermicide, or (h)a detergent, or any other substance or mixture of substances declared by the Minister, after consultation with the Board, to be a chemical substance.
Irrigation Development Authority Act, 1977 (SMCD 85) and IDA Regulation of 1987	The Ghana Irrigation Development Authority (GIDA) Act of 1977 establishes the Irrigation Development Authority and provides for its functions and administrative framework. The Act mandates the GIDA to formulate plans for the development of irrigation, and to co-operate with any other agencies for safeguarding the health and safety of the population living within and around irrigation project areas among others. The Irrigation Development Authority Regulation, 1987 (L.I.1350) provides the procedure for managing irrigation projects including water management within such projects.

2.2.2 Some key International Conventions

Ghana is a signatory to many conventions on the protection of the environment, which have relevance to the IPMP under study. Some of these conventions ratified by Ghana pertaining to the FSRP2 include:

- International Code of Conduct for the distribution and use of FAO pesticides
- The Basel International Convention on the Transboundary Movement of Hazardous Waste of March 22, 1989;
- Convention concerning protection against the risks of poisoning due to benzene, adopted in Geneva in 1971;
- The Rotterdam Convention on Prior Information and Contentment Principle (PIC)
- Bamako Convention on the Prohibition of the Import into Africa of Hazardous Wastes and on the Control of Transboundary Movements and the Management of Hazardous Wastes Produced in Africa, adopted in Bamako on 31 January 1991;
- The Basel Convention on Persistent Organic Pollutants (POP's), adopted in Stockholm 22 May 2001;
- International Standards for Phytosanitary Measures (ISPM) FAO;
- The Montreal Protocol on Substances that Deplete the Ozone Layer, adopted on 16 September 1987;
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, adopted on 10 September 1998;

- Vienna Convention for the Protection of the Ozone Layer, adopted on 22 March 1985;
- International Plant Protection Convention adopted on 6 December 1951 and entered into force on 4 April 1991.
- Ramsar Convention on Wetlands for Wetlands of International Importance, adopted on February 2, 1971 and entered into force in 1972.

Regulatory Activities at ECOWAS level

Members of the ECOWAS countries joined the process of harmonization of the rules defining the accreditation of pesticides in the ECOWAS region in 2005. A regulation was subsequently issued in 2008 after several regional validation workshops. The purpose of this Common Regulatory C / REG.3 / 05/2008 harmonizing the rules governing the registration of pesticides in the ECOWAS region is, in particular, to:

- protect the people and the West African environment against the potential dangers of pesticide use;
- facilitate intra and inter-state trade in pesticides, through the establishment of mutually agreed rules and principles at the regional level to dismantle trade barriers;
- facilitate convenient and timely access to quality pesticides for farmers. This regulation applies to all activities involving experimentation, as well as authorization, trade, use and control of pesticides and bio-pesticides in the Member States.

Ghana, although a stakeholder in the consultations on the harmonization process, the country is yet to implement this common regulatory on pesticides registration.

2.3 Administrative and Institutional Capacity

2.3.1 National Institutional Frameworks

Ghana has put in place the necessary national framework for the control and management of pest and pesticides in the country with institutions such as the Environmental Protection Agency (EPA), Plant Protection and Regulatory Services Directorate (PPRSD), Ghana Standard Authority (GSA), Food and Drugs Authority (FDA) etc. as the leading coordinating bodies. The EPA has the responsibility of monitoring and coordinating activities of all the institutions in pest management. However, this responsibility has been delegated to the PPRSD of MoFA. The need for institutions to collaborate is necessary for a successful implementation of the IPMP. It is imperative for the Project Implementation Unit (PIU) of the FSRP2 to collaborates with other supporting institutions, to appropriately utilize the capacity within the institutions to deploy or use the IPMP as an important portion of the ESMF, necessary for accomplishing environmental and pest management goals. Some of these key national institutions responsible for the safe management of agro-chemicals and its related matters are represented below:

Environmental Protection Agency (EPA)

The EPA is a regulatory body under the Ministry of Environment, Science, Technology and Innovation (MESTI) with the oversight responsibility for pest management and control and it has the following prerogatives:

- The registration of pesticides
- The limitation or banning of the use of a pesticide if necessary
- The granting of licences to all categories of pesticides' resellers
- The levying of penalties.

The Chemical Control and Management Centre (CCMC) of the EPA is responsible for pesticides control and management. It has offices in all regions as well as three district offices. The Agency periodically provides a list of registered pesticides and banned pesticides for public consumption. The recent list is provided in Annex 1**.** The list is periodically updated and there is the need to liaise with the agency for any updates during project implementation.

The Pesticide Technical Committee (PTC) is a committee of the EPA Board. It is the organ of approval of pesticides. The committee consists of 13 members drawn from relevant institutions with expertise in pesticide management. The institution includes:

- The Chemistry Department of the National Nuclear Research Institute (NNRI) of the Ghana Atomic Energy Commission (GAEC);
- Cocoa Services Division of the Ghana Cocoa Board;
- Plant Protection and Regulatory Services Dirtectorate of the Ministry of Food and Agriculture;
- Veterinary Services Department of the Ministry of Food and Agriculture;
- Ministry of Health;
- Ghana Standards Authority;
- Ghana Revenue Authority/Customs Division;
- Association of Ghana Industries;
- Ghana National Association of Farmers and Fishermen;
- Ministry of Lands and Forestry;
- Ministry of Environment, Science, Technology and Innovation (MESTI) through the Environmental Protection Agency (EPA).

The Ghana Standards Authority (GSA)

The GSA is a regulatory body under the Ministry of Trade and Industry (MoTI) with the full responsibility of ensuring the quality of the infrastructure including the Metrology, Standards, Assessment/Test and Quality control (MSTQ). It ensures goods and services are of acceptable quality for both local and international consumers. The Authority makes routine analyses of pesticides residues in fruits and vegetables in order to facilitate the exportations of these products and also protect the public health and ensure safety.

The GSA has offices across the country. GSA has been supported by the World Bank-funded Agriculture Services Sub-Sector Investment Programme (AgSSIP) and United Nation Industrial Development Organisation (UNIDO) to bring its Maximum Residue Limit (MRL) analysis capacity up to ISO 17025 requirements.

The Food and Drugs Authority (FDA)

The FDA is a regulatory agency under the Ministry of Health responsible for ensuring that any activity concerning chemicals be registered including, pesticides. Section 18 of law 3058 stipulates that no person will be allowed to manufacture, prepare, sell, export or import any type of chemical product unless the product has been primarily registered with the FDA. According to the above-mentioned provision (supply) no product can be imported into Ghana without its prior registration by the FDA, and the appropriate fees paid. The word “chemical product” is however, defined according to the law to include germicide, pesticide, insecticide, rodenticide among others. By this law, the FDA is authorized at any normal hour to inspect any container or package, and if they suspect it to contain any type of pesticide, they are also vested with the authority to seize such products. The FDA has offices across the country.

The Customs Division (CD) of the Ghana Revenue Authority (GRA)

The Customs Division (CD) of the Ghana Revenue Authority (GRA) is a regulatory body under the Ministry of Finance and Economic Planning and works in close collaboration with the EPA and PPRSD, and reviews the EPA documents, certificates and licences to make sure they concern the importation of approved chemicals, meat and agrochemical products. The importation reports of chemical products are submitted by the CD to the EPA on a quarterly basis. The CD staff are members to the various technical committees of the EPA including the hazardous waste committee, the pesticide technical committee and other related projects undertaken by the EPA. The Customs Excise and Preventive Services (CEPS) is a member of the national coordination team of the Convention of Stockholm on Persistent Organic Pollutants (POPs).

Ministry of Food and Agriculture (MoFA) - Plant Protection and Regulatory Services Directorate (PPRSD)

The Ministry of Food and Agriculture (MoFA) is the lead agency responsible for the agricultural sector within the context of a coordinated Government Programme. To carry out its function, plans and programmes are coordinated through policy and strategy frameworks. The Ministry is responsible for the regulation of pesticides use in the country. The Plant Protection and Regulatory Services Directorate (PPRSD) of MoFA was established in 1965 by an Act of Parliament: Prevention and Control of Pests and Diseases of Plants Act of 1965 (Act 307) now replaced by "Plants and Fertilizer Act, 2010 (Act 803).

The PPRSD as one of the Technical Directorates of MoFA, is the national institution with the mandate and capacity to organize, regulate, implement and coordinate the plant protection services (including pest management and pesticide use) needed for the country in support of sustainable growth and development of agriculture.

The PPRSD has its headquarters in Pokuase near Accra and there are also regional officers in all the regions of the country. It is also represented at the main entry and exit points throughout the country. It is not directly represented at the district level however, it collaborates with the district MoFA offices to carry out its functions at that level. The PPRSD is divided into four main Divisions and these include:

- ***Crop Pests & Disease Management Division:*** The division develops Good Agricultural Practices (GAPs), guidelines for Integrated Pest Management (IPM) of food crops. The division also provides information on pests and disease situation. The division also carries out training in GAPs and provides comprehensive diagnostic and identification services of plant pests and diseases for stakeholders, monitors the pest situation in the country, ensures effective control of plant pests, manages calamity pest outbreaks (e.g. armyworms, grasshoppers etc), and carries out classical bio-control measures (mass rearing and release of bio-agents), and serves as secretariat for National Fruit Fly Management Committee and National IPM programme.
- ***Pesticide and Fertilizer Regulatory Division:*** The Division supervises and trains Regulatory Inspectors, publishes information materials, registers and trains pesticides and fertilizer dealers and applicators, keeps records as well as statistics of pesticides and fertilizers and manages pesticide and fertilizer stocks in the country. It supervises bio-efficacy trials carried out by research.
- ***Ghana Seed Inspection Division:*** The division is responsible for seed certification. Services provided are indicated in the table below:

Table 3: Services provided by Ghana Seed Inspection Division

Type	Service
Seed growers	▪ Registration of Seed Growers ▪ Monitoring of seed and planting material production of crop species ▪ Certification of Foundation and Certified Seeds and also Primary and Secondary planting materials. ▪ Training of major stakeholders (Seed Inspectors, Registered Seed Growers, Seed Dealers, Extension Staff of MOFA and NGO's etc) ▪ Facilitation of promotional activities in the seed industry.
Seed dealers	▪ Registration of Seed Dealers ▪ Monitoring of Seed Dealers' outlets
Seed importers and exporters	▪ Registration of importers ▪ Monitoring of importers' outlets ▪ Registration of exporters ▪ Monitoring of exporters' outlets
Farmers	▪ Education and awareness creation on the benefits of utilization of certified seed/planting materials

National Seed Testing Laboratory (NSTL)

The facility carries out seed sampling and seed quality tests such as moisture, purity, germination and health before seeds are certified for distribution and marketing. The laboratory is yet to be accredited by the International Seed Testing Association (ISTA). The facility is located at Pokuase near Accra.

Table 4: Services provided by National Seed Testing Laboratory (NSTL)

Seed growers	Seed growers are expected to contact the nearest regional agricultural office and register with the regional/zonal seed coordinator. All the locations of seed fields must be declared at the time of registration for monitoring and field inspection. Registration of seed growers is for two years and renewed annually.
Seed dealers	Seed dealers are also registered at the nearest regional agricultural office by the regional/zonal seed coordinator to qualify as a seed dealer. All dealer outlets are expected to be declared at the time of registration for monitoring. Registration is for two years and renewed annually
Seed importer	Seed importers are also required to register with the regional/zonal seed coordinator at the nearest regional agricultural office. Registration is for two years and renewable annually. All outlets of the importer must be declared at the time of registration for monitoring. Seeds imported into the country must be declared to the quarantine officers at the entry point and must be accompanied with an international certificate such as ISTA certificate or its equivalent along with phytosanitary and other relevant certificates.
Seed exporters	To become a seed exporter in Ghana, one needs to register with the regional/zonal seed coordinator at the nearest regional agricultural office. Registration is for two years and renewable annually. All outlets of the exporter must be declared at the time of registration for monitoring. Seed exporters must obtain an international certificate (Orange International Certificate of ISTA) from the National Seed Testing Laboratory (NSTL) along with phytosanitary and other relevant certificates before exportation.

Central Veterinary Laboratory

The most important role of the veterinary diagnostic laboratories is the provision of diagnostic services as well as technical support for animal health extension staff and the livestock and poultry farmers. These include the following:

(1) Differential diagnosis, samples collection and submission to world reference laboratories.
(2) Serological surveillance and testing.
(3) Training in disease recognition and confirmation.
(4) Training in sample collection, processing and submission.
(5) Training of laboratory Technicians.
(6) Vaccine production: I-2 Newcastle disease vaccine for rural poultry; Anthrax spore vaccine; Blackleg vaccine.

Sheep and Goat Investigation Farm is located at Techiman in Brong Ahafo Region. The main activity is monitoring dynamics of endoparasites in the transitional ecosystem.

The laboratory in collaboration with the Animal Research Institute of the Council for Scientific and Industrial Research (CSIR) is developing a vaccine to protect sheep and goats against heart-water, a disease which causes high mortality amongst sheep and goats. Preliminary results are positive and very encouraging.

Plant Quarantine Division

This division works closely with the Customs Division of GRA at all the official entry points. It supervises and trains Phytosanitary Inspectors, develops and publishes information material, keeps records of plant imports and exports, identity of the importers and exporters, as well as the pests and diseases of

quarantine importance. It issues phytosanitary certificates and import permits according to the International Plant Protection Convention (IPPC) format. It inspects plant materials and makes sure they are free from pests. It also operates the National Sanitary and Phytosanitary Enquiry Point. The division also carries out inspection on marketing quality standards on fresh fruits and vegetables for export. The Division implements relevant International Standards for Phytosanitary Measures (ISPMs).

Directorate of Crop Services (DCS) of MoFA

The Directorate is responsible for the following among other things:

(a) Ensuring that there are planting materials (seeds) in adequate quantities at affordable prices and at appropriate times and places.
(b) Promoting the production of food, industrial and export crops in the country.
(c) Monitoring the development of the crop sub sector.
(d) Facilitating the capacity building of staff in the districts.
(e) Providing technical advice to the public on all crops within our mandate.
(f) Promoting the sustainable use of soil and water resources for agricultural production.
(g) Recommending issuance of permits and waivers for the importation of agricultural materials for the crops sub-sector/industry.
(h) Sourcing, soliciting, and analyzing information for the crop sub sector development.

The Environment, Land and Water Management Unit of the DCS is directly responsible for environmental management and monitoring issues.

Veterinary Services Directorate of MoFA

The vision of the Veterinary Services Directorate is to create an animal health system which provides quality animal health services to enhance livestock production and productivity. Its mission is to ensure a stable animal health situation through the provision of quality animal health care services by both public and private sector veterinary practitioners to enhance livestock, poultry and companion animals' production and productivity.

To accomplish its mission, the Veterinary Services Directorate (VSD) pursues the following objectives:

- provide animal health services for the national livestock in order to further the expansion of the livestock and poultry industries in the country.
- protect public health by controlling animal diseases communicable to human beings.
- alleviate suffering among animals.
- protect the health and safety of pet and zoological animals.

The directorate has offices across the 16 regions and field technicians in all the 260 districts. This notwithstanding the directorate still faces many logistical and human capacity challenges in its operations. For instance, with the expected number of 200 veterinarians countrywide, only 32 were reported to be at post in August 2017[1]. Again, there are challenges with inadequate quarantine facilities and veterinary laboratories (only one laboratory out of 13 is equipped and functioning properly). The situation affects the quality of service delivery to farmers as well as cross-border quarantine activities.

Under FSRP2, the Veterinary Services would be called upon to play a number of roles including:

- Improve quarantine stations to facilitate animal movements
- Investigate to control small ruminants
- Increase the production of vaccine to sustainable control of Newcastle disease in poultry

[1] https://citifmonline.com/2017/08/ghana-has-only-32-practicing-veterinary-doctors-council/

Directorate of Agricultural Extension Services (DAES) of MoFA

The DAES is responsible for overseeing agricultural technology diffusion through the management of an extension delivery service in the country. Its mission is to work with the regional and district Departments of Agriculture and other stakeholders to ensure that extension services are carried out in an effective and efficient way towards the social and economic development of Ghana.

DAES is tasked to perform the following functions:

- Extension policy formulation and planning.
- Review various extension approaches, framework document on Research Extension Linkage Committees (RELCs), FBOs and private service providers in extension to improve on extension service delivery.
- Facilitate human resource development at all levels in extension delivery.
- Coordinate extension activities.
- Collaborate with a range of organisations/ agencies including NGOs, private service providers and public organisations in providing extension service.
- Disseminate information on appropriate approaches to all extension service providers.
- Coordinate the establishment of community field demonstrations on released technologies responding to beneficiary needs.
- Develop efficient extension methodologies including Farmers Field Schools, Study tours for field officers and farmers, and Field Days.
- Promote released technologies through various information systems and communications media to improve awareness of technologies.

Ghana Irrigation Development Authority (GIDA)

The functions of the Authority are:

(a) to formulate plans for the development of irrigation infrastructure;
(b) to develop the water resources of the country for irrigated farming, livestock improvement and fish culture;
(c) to execute comprehensive programmes for the effective use of irrigated lands in co-operation with any other agencies involved in providing extension services to farmers;
(d) to carry out land-use planning in areas earmarked for development in order to conserve the soil and water resources in those areas;
(e) to layout the environs of each project area for housing purposes and for the provision of any other social amenities;
(f) to co-operate with any other agencies for safeguarding the health and safety of the population living within and around irrigation project areas;
(g) to undertake any other activities that are incidental or conductive to the performance of its functions under this Act.

GIDA Environment Desk

GIDA has an environment desk officer whose responsibility is to ensure that activities of GIDA are in consonance with national environmental management and protection requirements. However, the environment desk is largely unresourced, inadequate and lacks the requisite capacity to effectively carry out its functions.

Women in Agricultural Development (WIAD) - MoFA

This Directorate is one of the seven Technical Directorates of MoFA. Its functions are to promote:

(a) Food based nutrition education in relation to food production and diet improvement
(b) Value addition to agricultural produce, food processing and preservation
(c) Food safety
(d) Natural Resource management (farm, home, processing site)
(e) Gender mainstreaming of all agricultural policies, programs and projects

The National Information Centre on Poisons

The National Information Centre on Poisons is located at the Ridge Hospital in Accra and has the following functions:

(a) Help health professionals in making diagnostics and managing intoxications by chemicals (including POPs), toxins, venons and drugs.
(b) Provide information to health professionals on the toxic effects of poisons.
(c) Provide information to the public on prevention and the management of first aid in case of acute intoxication.
(d) Train the public on the devastating effects of chemicals on the environment.
(e) Provide toxicological surveillance through the collection of data on chemical induced incidents, exposure and poisoning.
(f) Organise training sessions on the prevention and management of cases of intoxication for public health inspectors and all authorized agents such as PPRSD.

Currently, Ghana has a one Poison Control Centre located at Ridge Hospital in Accra. However, the centre has only one well qualified staff. Furthermore, there is the need to establish a well-equipped laboratory and provide other logistical support such as computers and modern equipment to enhance their operations.

These laboratories operate according to different methodologies, in the search for residues, pests / disease and analysis of pesticides, at different levels of use, in water, soil and planting material / seed and animals.

Phytosanitary products manufacturing companies

Phytosanitary products marketed in Ghana are either imported or formulated or packaged by approved companies as distributors in Accra and other cities in the country (Bayer Cropscience SA, Winca Sunshine Agrochemicals, Calli Ghana, Louis Dreyfus Ghana Limited, etc.).

Agricultural Professional Organizations and Civil Society

These organizations are groups of cooperative farmers or Non-Governmental Organisations (NGOs) for the direct acquisition of pesticides from importers or distributors.

Ghana National Association of Famers and Fishermen (GNAFF)

The Ghana National Association of Farmers and Fishermen is the umbrella organization which seeks the welfare of all member farmers involved in rural agricultural production. It is made up of commodity groups (crops, livestock and fisheries. GNAFF was established in 1992 and has over 1,000 employees. Its mission is to:

(a) facilitate procurement of agricultural inputs (fertilizers, pesticides) and also marketing of members' agricultural produce,
(b) organize training programmes and commodity group visits for exposure among others.

Ecological Restorations Ghana

Ecological Restorations (ER) carries out advocacy, raises awareness and builds capacity on environmental issues including sound management of chemicals including pesticides. These organizations collaborate as part of their activities with a number of stakeholders including professionals in the phytosanitary sector.

Professionals in the Phytosanitary Sector

There are three (3) main professional pesticide associations in Ghana:

(1) CropLife Ghana;
(2) Ghana Agri Input Dealers Association (GAIDA); and
(3) Pesticides Importers Association.

Crop Life - Ghana is the association of agrochemical importers and distributors in Ghana. The association is affiliated with Crop Life Africa Middle East (CLAME). It is currently made up of 16 major agrochemical companies in Ghana and counting. Crop Life Ghana controls about 90% of the fertilizer market as well as about 75% of the pesticide market in Ghana (Annex 2; statistics on fertilizer imports and exports). It is committed to sustainable agriculture through innovative research and technology in the areas of crop protection, non-agricultural pest control, seeds, and plant biotechnology.

The key activities of Crop life Ghana:

(1) promoting responsible uses (RU) and effective handling of Crop Protection Products (CPPs) through effective stewardship programs;
(2) organizing training programs for both members and stakeholders in the industry; and
(3) supporting the regulatory agencies in the formulation of policies on pesticide usage, regulation and inspection.

Ghana Agri Input Dealers Association (GAIDA) and Pesticides Importers Association (PIA) are national bodies of agricultural input dealers in Ghana. Their mission is to provide services and training for Agri-Input Dealers in Ghana for the Development of competitive agri-input market. CropLife-Ghana, GAIDA and PIA are trade union chambers that aim to implement the FAO Code of Conduct.

In the context of Ghanaian law, they constitute effective professional groups with administrative and political authorities. CropLife-Ghana, GAIDA and PIA are considered by the Public Administration as the privileged interlocutors in the phytosanitary profession.

Beside these organisations, there are also various farmers' associations including the Ghana Federation of Agriculture Producers (GFAP), established in 2009. The federation operates with a council made up of representatives of four Farmer Based Organisations (FBOs) - the Apex Farmers Organisation of Ghana (APFOG), Farmers Organisation of Ghana (FONG), Peasant Farmers Association of Ghana (PFAG and the Ghana National Association of Farmers and Fishermen (GNAFF). Integration of these different groups under one federation is much better. Others such as the Vegetable Producers Exporters Association of Ghana (VEPEAG), Ghana Agricultural Associations' Business and Information Centre (GAABIC) and the Seed Producers Association of Ghana (SEEDPAG) also exist to take care of members' interest.

These organizations take care of members' interest and support members to meet the requirements of EPA/PPRSD. All institutions require training support and education of members on statutory obligations and requirements with regard to pesticide trading, use and control.

Distributors and Carriers

Carriers are involved in the distribution of pesticides in Ghana. Generally, these particular actors are found in the sector because of the financial benefits they can draw without being professionals in the sector of phytosanitary products.

Resellers or Distributors

This group is the intermediary between the manufacturing companies and the users who are farmers, a very important link in the sector because of their role in the transport of phytosanitary products, even in villages and camps.

Pesticide Users

It is the farmers who will benefit from the training actions of the national initiatives. These farmers are mainly men, but also women and young people. Users of pesticides include approved applicators who are part of the chain of professionals in the phytosanitary sector.

Agricultural Extension Dissemination
Technology dissemination at the district level is undertaken by trained Agricultural Extension Agents (AEAs) of MoFA at the district level. However, there are challenges with inadequate number of extension agents resulting in high extension-farmers ratio of 1:2192 (DAES, 2017).

There are also private initiatives and NGOs involved in agricultural advisory services and support to farmers under the private sector. Key among them include:

- CARE International;
- Agricultural Development and Value Chain Enhancement Program (ADVANCE);
- International Fertilizer Development Centre (IFDC); and
- Alliance for Green Revolution in Africa (AGRA).

Most of these private sector entities engage in the distribution of fertilizers and pesticides to farmers to enhance crop yields.

Research Institutions
Academic and research institutions in Ghana continuously play a vital role in developing IPM strategies on pests for several commodities including maize, cowpea, mangoes, lemon, rice, cucumber, cotton etc. In addition, development of alternative management systems for use in communities practicing urban related agriculture, IPM Kit development, demonstration and transfer of technology in IPM have been carried severally. Nevertheless, full adoption has not been very widespread despite the efforts undertaken. The use of pesticides is increasing in spite of the high cost of the products relative to the financial capacity of majority of farmers. One of such major research institutions is the Council for Scientific and Industrial Research (CSIR).

The CSIR is the foremost national science and technology institution in Ghana. It is mandated to carry out scientific and technological research for national development. The Council was established by NLC Decree 293 of 10th October 1968 and re-established by CSIR Act 521 of 26th November 1996. The Council, however, traces its ancestry to the erstwhile National Research Council (NRC), which was established by the Research Act 21 of August, 1958, a little over a year after independence, to organize and co-ordinate scientific research in Ghana and provides the necessary platform for Ghana's accelerated development.

The council is mandated to pursue, among others, the implementation of government policies on scientific research and development, coordinate Research and Development (R&D) activities and other Scientific & Technical (S&T) institutions nationwide and assist the government in the formulation of S&T policies for national development. The CSIR is further required to commercialize appropriate technologies, in partnership with the private sector and other stakeholders, and encourage in the national interest, scientific and industrial research of importance for the development of agriculture, health, medicine, environment, technology and other service sectors of the economy. The council has 13 institutes under its umbrella with offices across the regions in the country. The institutes which activities are directly linked to pesticide use and management in the agricultural sector include but not limited to the CSIR-Crops Research Institute (CRI), CSIR-Savannah Agricultural Research Institute (SARI) and the CSIR-Animal Research Institute, CSIR-Plant Genetic Resource Research Institute (PGRRI) etc.

2.2.3 Regulatory and Institutional Gap Analysis

2.2.3.1. Legislative and regulatory Gap
The enactment of laws and policies particularly the EPA Act 1994 (Act 490) by Government of Ghana shows government commitment towards the sound management of pesticides. Consequently, the EPA has established a pesticide management scheme, which involves the management of pesticides from cradle to grave. However, challenges still exist with regards to effective implementation of the established laws and policies. This has been attributed to the absence of a full complement of relevant

regulations to give effect to some of the provisions of the law. There is therefore the need to address the gap in the legal framework and other legislative inadequacies by reviewing and enacting the relevant regulations to enhance compliance.

2.2.3.2. Institutional Capacity Gaps

The implementation and enforcement of the established policies and laws have been hindered as a result of low human and institutional capacity. Institutions involved with pesticides regulation or management do have experts with the necessary qualifications. However, issues of institutional concerns include:

- Inadequate experts to handle the enormity of the task involved.
- Remuneration and motivation in most state institutions for experts are so poor while majority of these experts are often poached by foreign and private organisations to leave the government sector.
- Lack of personnel is exacerbated by the absence of other resources like logistics and funds to carry out post registration and licensing monitoring activities on pesticides. For instance, the EPA is in the process of establishing a pesticide quality control laboratory. The laboratory requires equipment and accreditation to be fully operational. The EPA has the limitations of both the financial and human resources to handle the demands of the laboratory. In effect, the EPA and all the identified institutions be it in research, regulation, awareness or others would require financial support and institutional capacity to be effective in dealing with pesticides. Thus, the FSRP2 should support the establishment and operation of an efficient working laboratory for pesticide, water quality and other environmental pollution analysis. There are also gaps with regards to the extension capacity of IPM approaches and methods. The current agricultural extension agent (AEA) to farmer ratio is high which makes difficult for farmers to access AEA for services. An extension officer resourced with the necessary transportation logistics and equipment, is responsible for over 2,000 farmers.

It is therefore imperative to work towards achieving the UN-recommended ratio of one extension officer to 500 farmers and to ensure adequate equipment of extension agents of technologies and good practices of integrated pest management. The GoG has made the necessary efforts to improve the situation through the supply motorbikes, pick-up vehicles and recruitment of extensionists to enhance visibility as well as lower the AEA to farmer ratio.

3.0 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

This section presents a description of the existing environment, comprising the bio-physical and socio-economic conditions of areas likely to benefit from interventions under the FSRP2.

3.1 Methodology and Data Collection

Various techniques were applied for collecting data on the project environment. These included document review, institutional consultations, field surveys of the existing environment. An account of the existing physical and biological environment and socio-economic conditions (ethnic groups, culture, economic activities, etc.) were assembled. This formed part of the baseline information and the information obtained used in the environmental analysis/assessment.

The description of baseline information relevant to the project covers:

- The project areas;
- Biophysical Environment;
- Socio-economic environment;

3.2 General Information of Ghana

The Republic of Ghana is located between latitudes 4° and 12°N, and longitudes 4°W and 2°E. It has a total border of 2,093 km, including 548 km with Burkina Faso to the north, 688 km with Côte d'Ivoire to the west, and 877 km with Togo to the east. It has a coastline on the Gulf of Guinea, part of the Atlantic Ocean, measuring 539 km. It has an area of 239,540 sq km. The country is divided into 16 administrative regions and 260 districts with Accra as the administrative capital.

The country is characterized by fairly low relief with few areas of moderate elevation in the north and east. The land is generally 600 meters above sea level. Physiographic regions include the coastal plains, the forest dissected plateau, and high hill tops which are important ecological subsystems in a generally undulating terrain. At the southern and northern margins of the Volta Basin, there are two prominent areas of highland – the Kwahu Plateau, and the Gambaga Escarpment. On the eastern margins of the Volta Basin is a relatively narrow zone of high mountains running in a south-west to north-east direction with the Akwapim, Buem, Togo Ranges registering the highest point (Mt. Afadjato) in the country.

Average rainfall over the country is about 1,260 mm/ year, but ranges from 890 mm/year in the coastal zone near Accra to 2,030 mm/year in the south-western rainforests. The rainfall is bi-modal in the southwestern forest zone, giving a major and a minor growing season; elsewhere, a uni-modal distribution gives a single growing season from May to October. Except for the south-western zone, the reliability of the rainfall, particularly after crop germination, is a major factor affecting crop growth and agriculture in general.

Ghana is drained by three (3) main river systems comprising the Volta, South western and Coastal River Systems. The Volta in Ghana occupies nearly one third (30%) of the land area of Ghana, the south western 22% and the minor coastal 8%. The areas covered by the respective river basins are described below. Global water resources are estimated at 53.2 km^3 per year, consisting of 30.3 km3/year of internally produced water resource, and 22.9 km^3/year of runoff from other countries.

3.2.1. The Lower Volta Basin

Geographical description

This area covers approximately 6,950 km/sq. with a total population of 565,330 (GSS, 2010 census). It encompasses eight (8) political districts within three (3) regions namely; *Agotime Ziope, Adaklu Anyingbe, Central Tongu, North Tongu, Ketu North* in the Volta Region; *Lower Manya Krobo* in the Eastern Region and *Shai Osudoku* in the Greater Accra Region. The area falls in the forest transition and coastal savannah agro-ecological zones.

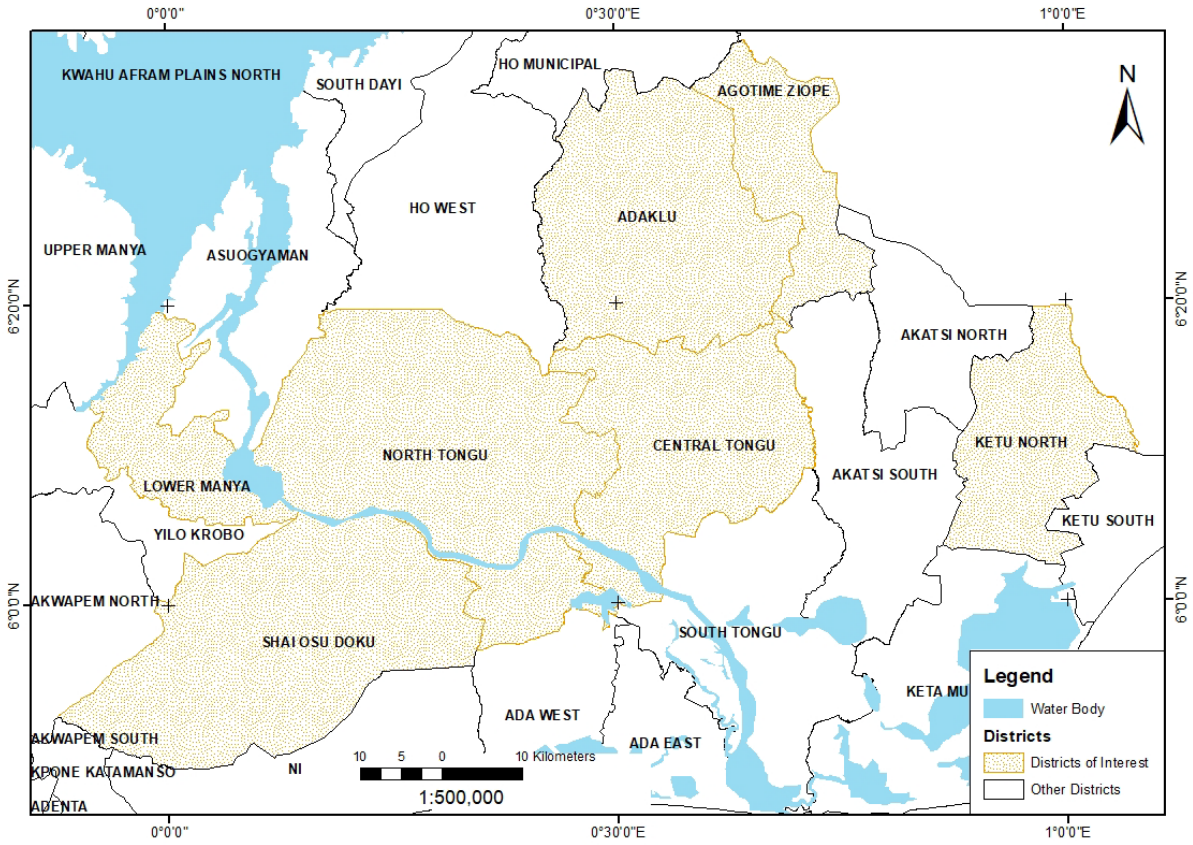

Figure 3. 1 Districts of Interest in the Lower Volta Basin (Source: Author)

Agriculture

The farming systems within the area is basically crop-livestock. Crops grown include cereals, legumes, root and tubers, vegetables. Smallholder livestock rearing - cattle, small ruminants and household poultry also forms part of the mainstay of the communities). Cottage industries such as kente weaving (local fabric), harvesting of reeds for mat weaving, Production of lime from oyster shells deposits and distillation of Akpeteshie (local gin) are also common in the area. The area falls within the lower Volta Basin, directly below the Akosombo and Kpong Hydro-electric Dams. A sizeable number of people are engaged in artisanal fishing due to the presence of network of creeks, lagoons within the Volta catchment area.

Apart from the activities of smallholders, the area has an appreciable number of large-scale public and private commercial investments, mostly in irrigation and aquaculture. Some notable public irrigation schemes in the area are Kpong Left Bank Irrigation Project (KLBIP) - 2,000ha; Kpong (right bank) Irrigation Scheme (KIS)- 3,200ha; Wheta Irrigation Scheme (880ha) and the Adidome Irrigation Project (potential 1,500ha). The GCAP, through GoG/WB funding has recently invested 58 million USD in rehabilitation and expansion of parts of the the two (2) schemes considered to be be among the two largest irrigation schemes in the country. The area also boasts of wholly private, commercial agro-investments such as Aveyime irrigation schemes, Global Agri-Development Company (GADCO) which produces and processes paddy rice; commercial production of banana and mangoes for export; large scale aqua culture for local consumption (over 80% of farmed fish produced in Ghana is from the target area).

Production within the enclave is targeted at markets within the Accra and Tema metropolis located as well as the Ho Municipality, the regional capital, (all of which are within 30 minutes to 2-hour drive).

Prior to the damming of the Volta River at Akosombo (1963) and Kpong (1982), the Lower Volta Basin (LVB) in Ghana had a very vibrant economy, which depended on the flood regime of the river and its subsidiary courses. The construction of the Akosombo Dam and later Kpong Dam triggered off drastic

changes in the hydrological conditions and physio-chemical parameters of the river and its waters, leading to collapse of a hitherto sustainable draw-down farming and lucrative fishing and clam (oyster) picking activities. The annual flood that occurred between July and November served as a permanent form of irrigation providing rich silt deposits, which fostered plant growth in the draw-down zone. This condition, coupled with the annual rainy season, made it possible for all-year round farming (T-Vieta, 1989), which contributed about 65% of the entire riparian crop production in the Lower Volta Basin (LVB). The contribution of agriculture to aggregate real income was estimated to be 70% (Lawson, 1972). Few riparian people owned cattle as a form of security and store of value (Lawson, 1972).

Challenges

Notwithstanding the enormous production and productivity potential within the target area, it continues to remain food deficient mainly because much attention has not been focused on the local residents and smallholders (both rainfed and irrigated ecology), and support provided for them to boost their farming activities. Other factors militating against productivity/production include: i) uncontrolled transhumance activity emanating from the Adaklu side of the Ghana Togo border, ii) low and erratic rainfall patterns, iii) dwindling fish stocks in the creeks and lagoons coupled with overfishing, pollution and invasive aquatic weeds in the case of fisheries and iv) low soil fertility (v) relatively low productivity at the irrigation sites due to a myriad of challenges – poor infrastructure, lack of appropriate agricultural machinery, lack of and/or expensive labour, lack of quality rice seed etc (vi) Aquaculture on the other hand is hampered by climate change impacts on Lake hydrology and changes in water quality. Difficulty in mechanised land preparation due to the presence of black cotton clay soils.

3.2.2. The White Volta Basin

Geographical description

This area, located in the northeastern tip of Ghana, falls within Sudan savannah and guinea savannah agro-ecological zones. The selected areas cover a total of 12,000sq km with a population of approximately 1.4million. The area has a very high population density relative to land and other resources available. It covers the Upper East Region and two districts in the North East Region. The target area is located in the White/Red Volta basin just south of the Burkina border and east of the Togo border. It is characterised by harsh weather conditions - with low mono-modal rainfall amounts of 900 – 1,100mm per annum, mean temperature ranging from 27.8 – 28.5^{0}C.

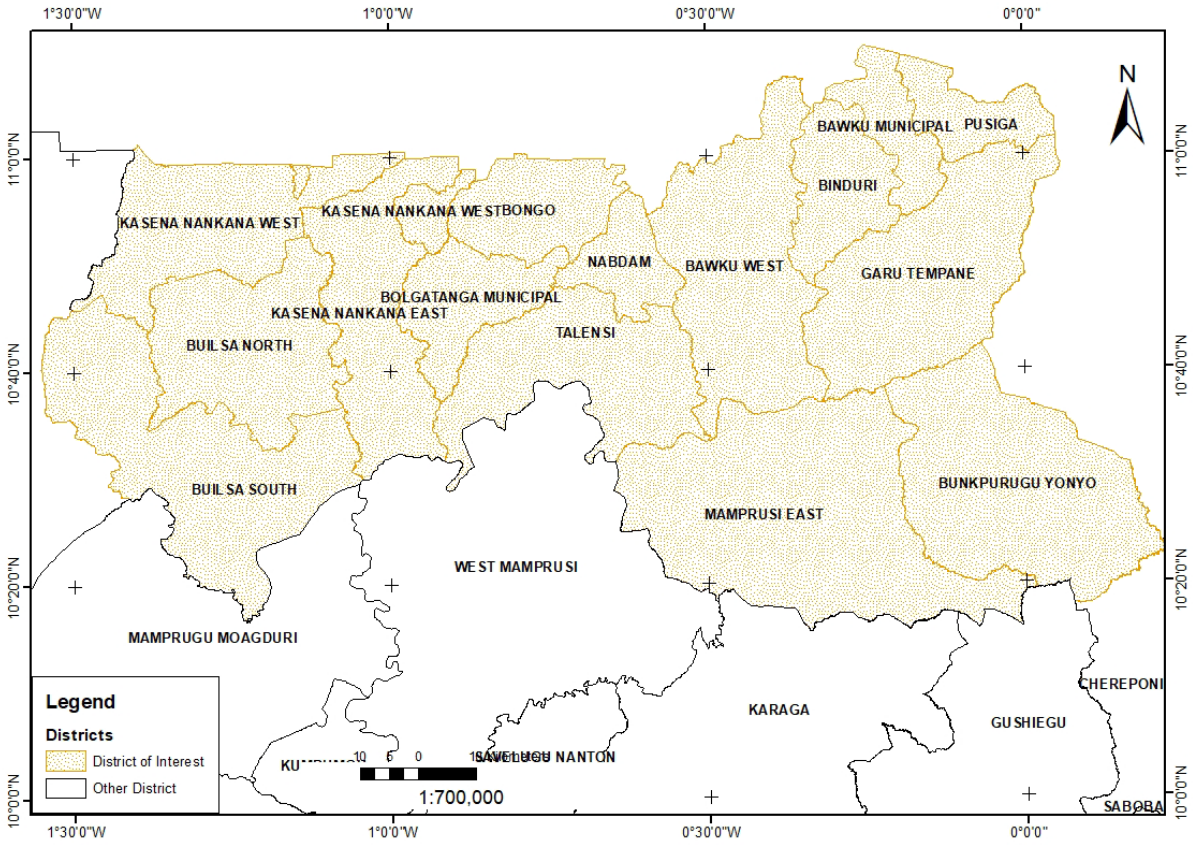

Figure 3. 2 Districts of Interest in the White Volta Basin (Source: Author)

Specifically, in the Sudan savannah enclave, the vegetation type is open grass with scattered short drought- and fire-resistant deciduous trees. In significant stretches, grass cover is very sparse, the land is bare and severely eroded. This agro-ecological zone is susceptible to desertification, and there is the fear that increased human activities could bring this about sooner than later (Biney 1990).

Agriculture

The people in the target area are typically involved in subsistence crop-livestock farming systems. The crops include millet, sorghum, fonio, potatoes, groundnuts, cowpea, onions, leafy vegetables. Livestock rearing is common to every household with small ruminants, poultry (guinea fowl and fowls) and to a small extent piggery. There is also production of mango in the area; and shea trees grow wild. Some fishing is done on the white Volta and its tributaries. Small cottage industries – weaving of basket and hats from grass; weaving of local fabric for sewing of traditional smocks and dresses for ladies. There is small scale gold mining in and around Nangondi and Talensi areas.

The produce of the area is marketed mainly in the big towns such as Bolgatanga, Navrongo and Bawku in the region; though cash crops like onions, parboiled rice, woven baskets and smocks are mainly sold in southern Ghana cities or exported in the case of the baskets and smocks.

Apart from the harsh and prolonged dry season, the area experiences excessive flooding from the white Volta basin, especially during spillage of the Bagre Dam just upstream in Burkina Faso. The construction of Pwalugu Dam, which is expected to hold back and contain the flash floods from the spillage of the Bagre Dam has barely commenced. There are 2 main public irrigation schemes in the area – Tono Irrigation Scheme (2,490ha) recently rehabilitated with funding from GoG/WB under GCAP and Vea Irrigation Scheme (880ha). In addition to these, there are numerous small dams/ *dug-outs* for community and livestock watering, though some have the potential for additional use for irrigation purposes.

There are extensive flood plains within the area, notable ones being the Fumbisi, Gbedimbilisi and Wiasi Valleys, all of which have received one form of intervention or other by way of land development (contour earth bunding, dykes) through donor funding. The irrigation schemes and flood plains are used for the cultivation of mainly rice, onions and leafy vegetables. Households have small hand-dug wells which they use for production of vegetables for domestic consumption. The rice is processed as parboilesd using local techniques.

Challenges

The constraints in this target area are numerous and include - dense population in certain areas leading to pressure on land which results in land degradation, inability of youth and women to have access to land, low soil fertility especially on the rocky slopes in Bongo area, soil erosion/ degradation from continuous cropping using inappropriate methods leading to loss of soil cover, inundation from flash floods, uncontrolled transhumance activity, nutrition deficient diet, increasingly poor and erratic rainfall patterns, bush burning. The above factors cause a lot of rural-urban migration. For example, the youth in the Bawku areas are noted for onion cultivation, but due to unavailability of land they are continuously on the move, throughout the country in search of land for production.

3.2.3. The Forest Transition and Guinea Savannah Areas

Geographical description

The area comprises districts including; Techiman North, Techiman South, Atebubu Amantin, Nkoranza North, Nkoranza South, Sene West all in Bono East Region; Ejura Sekyedumase, Sekyere Central, Sekyere Affram Plains, Asante Akyem North, Offinso North all in the Ashanti Region. This area falls in the Forest Transition and Guinea Savannah areas and covers a total land area of 27,810 sq/km and a population of 834,787 (GSS, 2010 census). It is located in the Lower Volta basin and drained by the Volta River with major tributaries such as Rivers Sene, Pru and Affram.

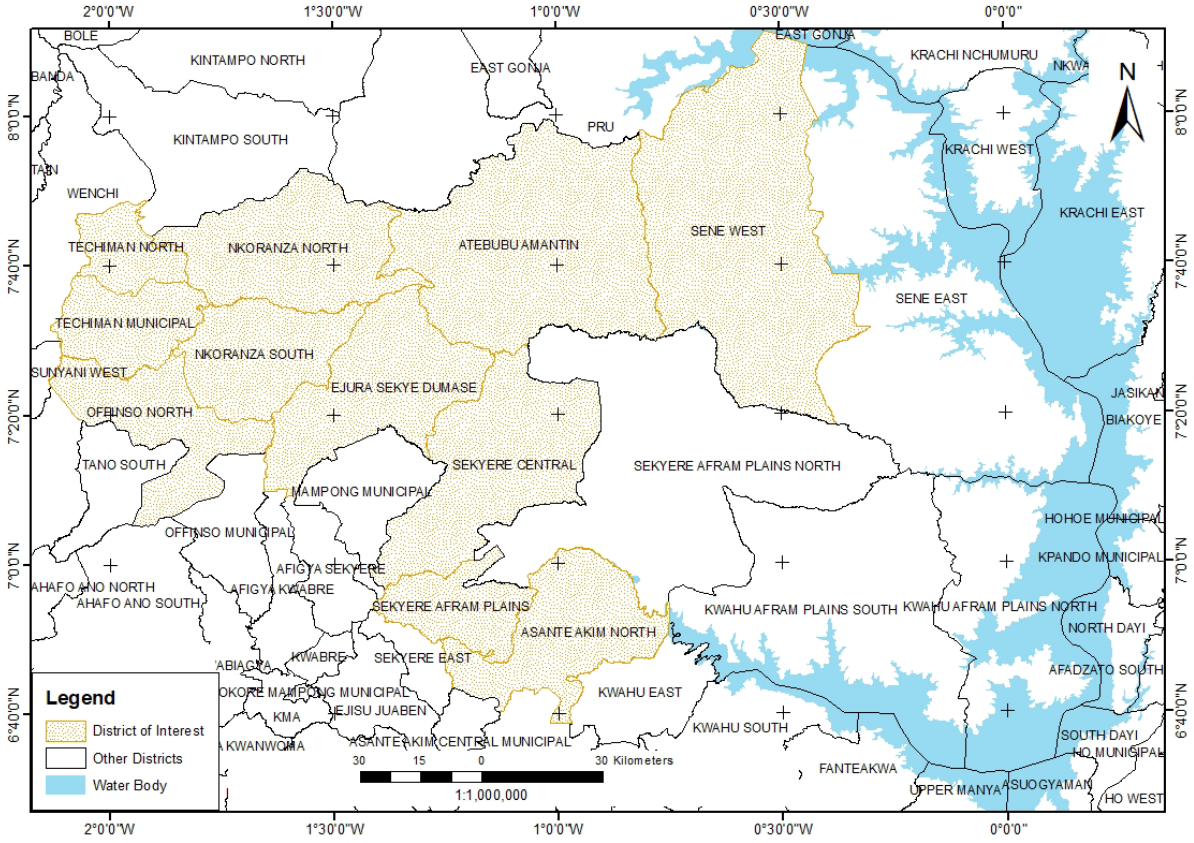

Figure 3. 3 Districts of Interest in the Forest Transition and Guinea Savannah Areas (Source: Author)

Agriculture

The farming systems is mainly crop-livestock farming with farmers engaged in the cultivation of varied crops such as vegetables (tomatoes, garden eggs, pepper, onions, ginger); grains (maize, rice); roots and tubers (yam, cassava, sweet potato); perennial and horticultural crops such as plantain, mangoes, cashew and cocoa. The area is also known for livestock (sheep, goats and cattle) and household poultry production. There are fisherfolk along the Volta and its major tributaries. It is considered as part of the bread basket of Ghana with large population of migrant/settler farmers who have migrated mostly from the Northern sector of the country as well as the Sahel Region. The rainfall regime is bi-modal with 1,400mm – 1,600mm in the major season and around 1,000mm in the minor season. The terrain lends itself to mechanisation, thus many farmers employ the use of tractors for land preparation with the attendant land degradation. The target area can also boast of several large markets from where exports of many commodities or trading with the Sahel region is done such as Techiman, Abofour, Ejura and Atebubu (grains, roots and tubers and livestock, cashew, mangoes); Atebubu, Akomadan, Agogo (vegetables, maize, livestock); Agogo (plantain, onions). There is the repetitive annual conflict between transhumant and the commercial plantain and smallholder farmers within the communities, especially at Agogo, Drobonso and Kumawu.

There are a few smallholder public irrigation schemes within the area - Tanoso, Techiman, Sata, New Longro Irrigation Schemes. Engineering designs and drawings for rehabilitation of the Tanoso Irrigation scheme have been completed by GCAP and awaiting funding.

Challenges

The enormous potential of this area is hampered mainly by poor bio resource management such as indiscriminate deforestation for farming; overgrazing and trespassing by transhumant, indiscriminate bush burning by farmers and herders, charcoal burning as a major economic activity, shifting cultivation/ fallowing, improper mechanisation practices. The above practices are now manifesting in increased erracticity in rainfall, soil erosion/ degradation, loss in soil fertility, loss in vegetative cover amongst others. With increasing pressure on land, the rapid expansion of the transitional zone at the expense of the deciduous forest zone is noticeable.

4.0 EXISTING AND ANTICIPATED PEST AND DISEASE / MANAGEMENT PRACTICES

There are two key categories of activities that will involve use of pesticides during implementation of the program and these will be the main focus of this chapter:

(iii) Agricultural pesticides for the control of pests, diseases, nematodes and weeds; and
(iv) Prevention of invasive aquatic weeds in the case of using herbicides.

Some of the major crops targeted under FSRP2 are vegetables (tomatoes, garden eggs, pepper, onions, etc.); grains (maize, rice, millet, sorghum); roots and tubers (yam, cassava, sweet potato); perennial and horticultural crops such as plantain, mangoes, cashew and cocoa which involve the application of agro-chemicals and inputs such as fertilisers, herbicides, insecticides, nematicides and fungicides. Additionally, activities related to livestock keeping (sheep, goats and cattle) and household poultry production would involve the use of pesticides and vaccines to avoid infestation and infection. The following crop calendar provides an overview of the time when most applications of agrochemicals occur.

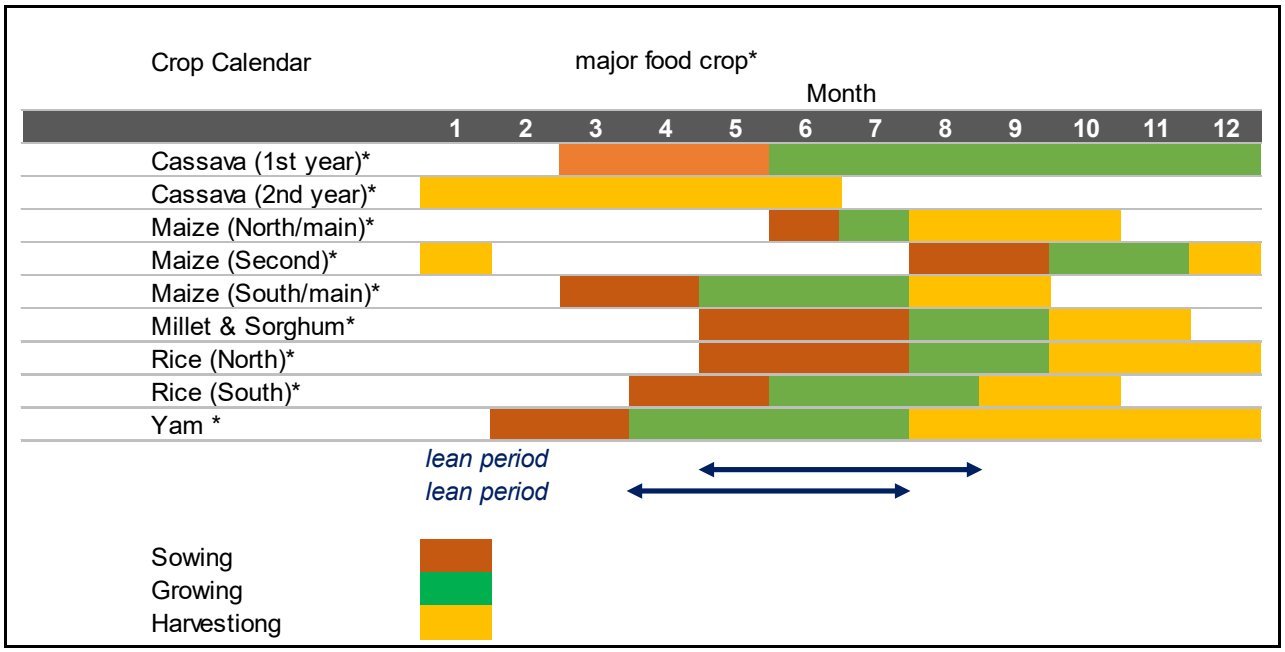

Figure 4. 1 Cropping calendar showing timing of different activities for FSRP2 targeted crops
(Source: FAO/GIEWS, FEWSNET)

4.1 Major Pests and Diseases

This section describes the major pests and diseases associated with the following commonly grown crops in the project regions:

(a) Pulses/grain legumes (cowpea, groundnut, soya bean/soybean)
(b) Vegetables (cabbage, cucurbits (cucumber, melon, pumpkin and courgette), eggplant, lettuce, okra, onion, pepper and tomato)
(c) Cereals (maize, rice, millet, sorghum)
(d) Roots and tubers (cassava, yam, sweet potato)

4.1.1 Major Pests and Diseases of Pulses/Grain Legumes

Table 5: Major Pests and Diseases of Soya bean

Pest		Comments
Insect	Aphids (*Aphis craccivora, A.gossypii and other species)*	Small, soft round, black or green insects that suck the sap of the young succulent green parts (leaves, stems and green pods) of the plant
	Storage mothss *(Ephestia cantella, Corcyra cephabonica)*	Two species of moths; attack soybean seeds in storage. The caterpillars of these moths feed on the grains, causing extensive damage by weaving threads around the grains, reducing their quality.
	Storage weevils (*Callosobruchus maculates)*	Storage weevils attack soybean during storage
	Sucking bugs (*Anoplocnemis spp., Clavigralla spp. and other species)*	Same group of six insect species that attack cowpea also attack soybean plants
Disease	Anthracnose disease (*Colletotrichum truncatum)*	Disease affects all the growth stages of soybean. Attacks from stem and later appears on pods and petioles as irregularly shaped brown areas. The infected areas then become covered with a black dust and necrosis occurs in the leaves.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 2

Table 6: Major Pests and Diseases of Cowpea

Pest		Comments
Insect	Aphids (*Aphis craccivora and other species)*	Small, round, black insects that suck the sap of the green parts (leaves, stems and green pods) of the plant
	Cowpea storage weevils *(Callosobruchus maculates)*	Is a major storage problem; Adult make holes in the cowpea grains and lay eggs inside. Recognized by visible holes (windows) on stored cowpea grains
	Flower thrips *(Megalurothrips sjoestedtii)*	Thrips are very small, very mobile, long black and brown insects that one can find in large numbers inside cowpea flowers. Suck the sap and cause many flowers to turn brown, die and drop off. Also feed on green pods.
	Pod borers (*Maruca vitrata, Euchrysops sp.)*	Pod borers are key pests of cowpea at the flowering and podding stages. Are small, whitish caterpillars that bore into the flowers and green pods and eat the entire contents.
	Sucking bugs (*Anoplocnemis spp., Clavigralla spp. And other species)*	Sucking bugs refer to a group of six insect species that attack cowpea at the podding stage. Are brown to black, with hard bugs and spiny outgrowths. Suck contents of pods and soft growing tips of stems.
Disease	Anthracnose disease (*Colletotrichum lindemuthianum)*	Disease attacks from stem showing dark brown areas which later join up to cover the entire stem, branches, peduncles and petioles. In severe infestations, stems die.
	Cowpea mosaic virus dieases	Cowpea mosaic virus (CMV) is transmitted by aphids. Attacked plants show mottling and poor formation of young leaves at tips of stems. CMV affects cowpea at the vegetative, pre-flowering, flowering and podding stages
	Cowpea wilt disease (*Fusarium oxysporum)*	Fungus disease that attacks cowpea causing rapid wilting and death. Older plants become stunted, their leaves turn yellow and drop off and dies
	Striga (witchweed) *(Striga gesnerioides)*	Parasitic weed can attack cowpea and prevents the crop from producing any pods. Unlike the *Striga* that occurs in cereals, cowpea striga is smaller and has whitish-pink flowers, and attacks

Pest		Comments
		only pulses. It grows into the roots of cowpea and interferes with plant development.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 2

Table 7: Major Pests and Diseases of Groundnut

Pest		Comments
Insect	Aphids (*Aphis craccivora and other species)*	Most common and important pests of groundunts. Small, round, black or green insects that suck the sap of the green parts (leaves, stems and green pods) of the plant and transmit groundnut rosette virus disease.
	Brown groundnut hopper (*Hilda patruelis)*	Is a small sucking insect about 5mm; The body is brown with white marks. Attack groundnuts at the base of stems, injecting poisonous sap into plants which then wither and turn yellow.
	Pod-sucking bugs (*Elasmolomus sordidus, Leptoglossus spp.)*	Two species of pod-sucking bugs attack groundnuts. These insects feed on groundnut pods that are harvested and left in the field to dry.
	Storage beetles *(Tribolium castaneum)* and storage caterpillars *(Trogoderma grenarium and othe species)*	Stored groundnuts are attacked by beetles, caterpillars and grubs. Beetles and their larvae (grubs) bore into and damage the groundnut seeds. Moths and their larvae (caterpillars) cause extensive webbing
Disease	Groundnut rosette virus diease	Most important disease of groundnuts, transmitted by aphids. Attacked plants show chlorotic (yellow) mosaic patterns with dark green areas on the veins of leaves. Stem internodes are shortened resulting in rosettes or witches broom-like growths.
	Leaf spot *(Cercospora spp.)*	Attacked plants show necrotic spots of various sizes on leaflets. Serious attack results in defoliation. The spots start as light tan, changing to reddish-brown, and then to black lesions on the lower surface and brown on the upper surface.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 2

4.1.2 Major Pests and Diseases of Vegetables

Table 8: Major Pests and Diseases of Egg plant (Aubergine)

Pest		Comments
Insect	Budworms (*Scrobipalpa blasigona)*	Small brown caterpillars of budworms bore into flower buds to feed inside flowers causing them to drop off and plant cannot produce many fruits
	Epilachna beetles (*Epilachna chrysomelina)*	Is a major pest that feed on leaves of egg plants by scraping surface and reducing leaves to skeletons
	Jassids (*Jacobiasca spp./Empoasca spp.)*	Are small, green and very mobile insects that live on lower side of upper leaves. Suck juice from leaves and inject poisonous substances that cause leaves to first turn yellow, then brown and dry, a condition known as 'hopper burn'
	Mole crickets (*Brachytrupes spp)*	Live in soil, and attach and feed on roots of many vegetables. Attack seedlings or young transplants especially at nigt. Are large brown insects found mainly in sandy areas
	Root-knot nematodes (*Meloidogyne spp)*	Are microscopically small, round worms that live in soil and in the roots of egg plants. Affected roots swell (gall) become malformed inhibiting plant growth.
	Stem and fruit borers *(Leucinodes orbonalis)*	Whit larvae or caterpillars of the pest bore into top sections of fruits and stem of egg plants. Tunnel through stems causing

Pest		Comments
		plants to grow poorly and sometimes die prematurely. Fruits change colour and taste
Disease	Damping-off disease (*Pythium spp)*	Major disease that affects young seedlings in the nursery. Seedlings become constricted near ground surface and then collapse and many die
	Wilt disease (*Fusarium semisectum)*	Soil fungus disease that causes egg plants to wilt. Leaves turn yellow and plant dies.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 9: Major Pests and Diseases of Cabbage

Pest		Comments
Insect	Diamond-back moth (DBM) (*Plutella xylostella)*	It is the most serious pest of cabbage. DBM female moth lays its eggs singly. Eggs are glued to the underside of leaves and hatch after 3-5 days into green larvae. Larvae creep to underside of leaf, pierce the epidermis and tunnel or bore through the leaf tissue. Progressively eat leaf from underneath leaving the upper cuticle intact creating a bizarre window, which later disintegrates.
	Webworms or cabbage borer (*Hellula undulalis)*	The light brown larvae or caterpillars of the cabbage webworm bore into the main veins of the leaves of cabbages and later into the centre of the stems, where they then feed. This makes these pests very difficult to control with pesticides.
	Cabbage aphids (*Brevicoryne brassicae)*	Usually occur in large numbers, mainly during dry spells. Sucking pests, grey or green with soft pear shaped bodies often in colonies on lower side of leaves. Suck sap causing stunting growth and honeydew excretes on leaves
	Root knot nematode *(Meloidogyne spp.)*	Nematodes invade roots causing swelling and deformation of roots (galls on roots). Stunted growth and chlorosis are above-ground symptoms
	Cutworm (*Agrotis sp)*	Dull coloured moths lay eggs in soil surface or on stems. Mature larvae hide during day and emerge at night to feed on crop causing damage by cutting young plant stems at the base and feeding on foliage. Larvae bend characteristically in an o-shaped when disturbed
Disease	Bacteria soft rot (*Erwinia carotovora)*	Is a major disease of cabbages; Attacks the leaves of cabbages and affected areas take on a water-soaked appearance and start to decay, emitting an unpleasant smell. Cabbage heads decay rapidly and turn dark
	Black rot	Chlorotic discoloration on leaves, which turn to dark brown or black. Black discoloration of the vascular bundles and internal tissue break down.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 10: Major Pests and Diseases of Okra

Pest		Comments
Insect	Aphids *(Aphis gossypii, Myzus persicae)*	Several species of aphids affect okra leaves and young fruits. Are very small, light to dark green, round insects that suck sap from okra leaves, causing leaves to turn yellow and become twisted; later plants may wilt and die
	Cotton stainers (*Dysdercus spp.)* and other sucking bugs (*Nezara viridula)*	Cotton stainer adults and nymphs are very common on okra plants at fruiting stage and abundant during dry season. When strainers attack mature fruits, they damage the seeds. The bugs are conspicuously red, with black bands. They pierce through both

Pest		Comments
		young and mature fruits and suck the seeds inside. Attacked fruits shrivel and then fall. Other bugs that attack okra plants are stink bugs and shield bugs. These bugs make feeding holes in okra fruits causing necrosis and these results in spotting, deformation and shedding of fruits.
	Flea beetles (*Nisotra spp., Podagrica spp.)*	Very common pest that occur on almost all okra plants. Feed on okra leaves and make many small holes in the leaves
	Root-knot nematodes (*Meloidogyne spp.)*	Several species of soil-living root-not nematodes are major pests of okra plants. These same species also attack egg plant, tomato, pepper, cabbage, carrot and other vegetables. Form swellings known as galls and other malformations on okra roots. Plant become stunted and may die
Disease	Anthracnose disease *(Colletotrichum spp.)*	Disease affects leaves of okra, on which dark necrotic spots will begin to appear; later leaves become badly wrinkled and are then completely destroyed. Sometimes affects petioles of okra flowers and fruits causing many to drop off.
	Leaf curl virus and mosaic virus	Okra suffers from these two major virus diseases. In affected plants, leaves become small, cup-shaped and/ or yellow (chlorotic), mottled and distorted; plants become stunted. Viruses transmitted by flea beetles, aphids and white flies.
	Wilt disease (*Fusarium pallidoroseum)*	This soil-borne disease is caused by two species of fungi that infect the roots, stems, leaves and fruiting stalks. Leaves initially show dark patches of mould on lower surface, then roll, wilt and drop off

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 11: Major Pests and Diseases of Lettuce

Pest		Comments
Insect	Cutworms (*Agrotis spp.)*	Large, brownish-black caterpillars of cutworms damage young lettuces by cutting through stems at ground level at night, causing plant to collapse and die. Hide in soil during daytime and emerge at night to feed on lettuce
Disease	Damping-off disease *(Pythium spp.)*	Fungus disease that is present in soil. It infects stems and roots of lettuce seedlings in the nursery or when just planted in the field.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 12: Major Pests and Diseases of Cucurbits (cucumber, melon, pumpkin and courgette)

Pest		Comments
Insect	Aphids *(Aphis gossypii)*	Are common on cucurbits. Occur in colonies of green to blackish aphids under leaves, where they suck the sap. Move from plant to plant in their winged form and transmit virus diseases.
	Melon flies	Very small black fly that pierces fruits of plants of cucurbit family and lay eggs in them. Eggs hatch into white maggots which feed inside fruits, causing sunken, discoloured patches and distortions and open cracks.
	White flies *(Bemisia tabaci)*	White fly adults are small, winged insects that fly off readily when disturbed. Attack cucurbits, sucking sap and secreting sticky honey dew on which black mould develops. Adult transmits various virus diseases which damage cucurbits
Disease	Cucumber mosaic virus disease (CMV)	Major disease of cucumber transmitted by aphids. Attacked plant leaves become mottled, distorted and stunted, and the leaf

Pest		Comments
		edges curl downwards. Fruits produced by these plants show pale green areas mixed with dark green spots
	Powdery mildew (*Erysiphe cichoracearum)*	Is a very serious fungus disease that affects leaves of cucurbits, causing them to dry up and die. Can be recognized by white powdery spots on upper and lower leaf surfaces and spread from older to younger leaves.
	Angular leaf spot (*Pseudomonas lachrymans)*	Is a major cucumber pest that attacks leaves, stems and fruits
	Downy mildew *(Pseudoperonospora cubensis)*	Is a major cucumber pest that attacks leaves

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 13: Major Pests and Diseases of Tomato

Pest		Comments
Insect	Aphids *(Aphis gossypii)*	Occasionally attack tomato heavily. Feed on the soft terminal shoots and on the underside of leaves. May also transmit virus disease during feeding. Honeydew produced by aphids causes unsightly black moulds on tomatoes which reduces their market value. Attacked plants may wilt and die
	Fruit borers (American bollworms *[Helicoverpa armigera]* and leaf-eating caterpillars (cotton leafworms *[Spodoptera littoralis]*)	Different kinds of caterpillars; attack developing and mature fruits of tomato. The American bollworm comes in various colours. A single caterpillar can bore into m ay tomato fruits in one night. Fungi and bacteria enter these fruits through the holes and cause the fruits to rot and become worthless. The cotton leaf worm feeds on leaves of tomato and bores into the fruits, especially those lower down the plant
	Fruit fly *(Rhagoletis ochraspis)*	It is an important pest of tomato at the fruiting stage. It pierces fruits and leaves rotten spots. Adult fly pierces fruit to lay eggs inside. The small white maggots or larvae develop in the fruit and pupation occurs in the soil below the host plant.
	Root-knot nematodes (*Meloidogyne spp.)*	Nematodes are one of the most important pests of tomato. These same species also attack egg plant, pepper, cabbage, carrot and other vegetables. They are microscopically small worms that live in the roots of their host and cause galls or root-knots. Some affected plants may show yellow leaves, poor growth and even wilting. Affected roots are short and have many swellings or galls. Plant become stunted and may die
	Tomato mirid bugs *(Cyrtopeltis teriuis)*	Adults and nymphs of slender, dark green mired bugs feed on tender terminal stems and flower stalks of tomato plants. Inject a toxic substance/saliva into the tissues, causing small, brown necrotic spots to develop. Adult female mirids pierce tomato stems to lay eggs resulting in major damage to stems.
	White flies *(Bemisia tabaci)*	White fly adults are small, white, winged insects that fly off readily when disturbed. They attack tomatoes from seedling stage to maturity. White fly adults and nymphs occur under tomato leaves, sucking the sap and secreting a sticky honeydew on which black mould develops. The adult transmits the leaf curl virus disease, which causes considerable damage to tomato plants.
Disease	Dumping-off disease *(Pythium spp.)*	A major disease that attacks tomato seedlings. Water-logging creates conditions that favour development and spread of

Pest		Comments
		disease. Is a soil fungus and attack causes young stems to rot; Affected seedlings wither and die.
	Early (or dry) tomato blight *(Alternaria solani)*	A major disease during the rainy season. It is caused by a soil-borne and air borne fungus. Symptoms are brownish-black angular spots with concentric circles on the leaflets. Black or brown sunken lesions develop on stems and fruits
	Late blight *(Phytophtora infestans)*	Symptoms show as necrotic spots on leaves which enlarge rapidly to become water-soaked areas on leaves and fruits. Infestation leads to defoliation and fruit blotches
	Rots and cankers *(Phoma spp., Phomopsis spp.)*	Rots and cankers are caused by fungi and bacteria that infect tomato stems and roots. Root and stem rot fungus is present in soil and attacks roots, causing collars to rot. The bacteria that attack plants cause blight and cankers of stems, leaves and fruits
	Tomato yellow leave curl virus (TYLCV)	It is the most serious disease of tomatoes. Transmitted by white flies feeding on tomato leaves. Plants infected by disease are stunted and turn yellow, and leaves curl. Affected flowers and fruits drop off.
	Wilts *(Fusarium oxysporum)*	Caused by a soil-borne fungus that attacks root through small wounds (made during transplanting or resulting from nematode attack). Plant wilt from lower leaves and leaves turn yellow and die; later whole plant wilts and dies

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 14: Major Pests and Diseases of Pepper (hot and sweet pepper)

Pest		Comments
Insect	Root-knot nematodes (*Meloidogyne spp)*	Are same nematodes that attack egg plant and okra. Affected roots develops gall become malformed inhibiting plant growth; leaves become yellow, then curl and drop off before they mature. Pepper plants attacked by nematodes are also easily infected by wilt diseases and attacked by termites
	White flies *(Bemisia tabaci)* and Aphids *(Ahis gossypii)*	White flies and aphids are important as vectors of virus diseases. Same aphids attack cabbage and same white flies attack tomatoes
Disease	Leaf spot *(Cercospora capsicii)*	Disease affects mainly leaves of pepper seedlings. Initial symptoms are small dark spots on leaves and these spots later enlarge to cover whole leaf, causing leaf to turn yellow and drop off.
	Pepper leaf curl mosaic virus	Virus disease infects pepper leaves, stems and fruits and is transmitted by white flies. Leaves become yellow, mottled, distorted, small and cup-shaped. Plants become stunted and fruits are malformed.
	Pepper mottle virus	Is transmitted by aphids. Leaves and fruits of infected plants are badly formed; become mottled, twisted, and curled. Plants are stunted, turn yellow, and finally die.
	Pepper wilt disease *(Fusarium oxysporum)*	Soil-borne disease caused by two species of fungi that infect roots, stems and leaves of pepper. Seedlings wilt and die and old leaves turn yellow

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 15: Major Pests and Diseases of Onion

Pest		Comments
Insect	Onion flies (*Delia antique)*	A major pest of onions. Small, white, headless larvae (maggots) feed just above base of seedlings. Attacked plants die. Larvae are also found in developing onion bulbs.
	Onion thrips (*Thrips tabaci)*	Are major pests of onions throughout Africa. In attacked onion plants, leaves show white and silvery patches, become distorted and may later wilt and die. Adult thrips are tiny, long, brownish-black insects that are very mobile and collect in large numbers at base of onion leaves, sucking the cells of leaves.
Disease	Bacterial soft rot (*Erwinia carotovora)*	In attacked plants, leaves rot and also the entire bulb rots. It is also a very serious disease in stored onions, if onions are not mature, mechanically damaged during harvest and there is poor aeration and high humidity in the store room.
	Downy mildew disease (*Peronospora destructor)*	Caused by a fungus that attacks onion leaves. Fungus bodies develop as purple areas on fully mature leaves. Affected leaves drop off and die
	Mould *(Aspergillus niger)*	Unlike bacterial rot, mould cause dry rot. Immature onions when harvested (still moist, and neck intact) and then stored without curing (sun drying) under poor conditions (without aeration and in humid conditions), black mould develops and onions become unfit for human consumption
	Purple blotch (*Alternaria porri)*	Disease affects all parts of onion plant. Infected leaves and flowers show small, sunken, white areas with purple centres which become enlarged and encircle entire leaves. Tips of leaves become dry and collapse

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

4.1.3 Major Pests and Diseases of Cereals

Table 16: Major Pests and Diseases of Sorghum

Pest		Comments
Insect	Armyworms (*Spodoptera exempta)*	Attack leaves
	Greater grain weevil (*Sitophilus spp.)*	Attack stored sorghum grains
	Sorghum shoot flies *(Atherigona soccata)*	Most important insect pest of sorghum seedlings. White larvae of sorghum shoot fly bore into the seedlings and feed inside. Result in 'deadhearts' phenomenon.
	Sorghum midges *(Contarinia sorghicola)*	Pest sucks developing seeds and removes all contents. Adults lay eggs inside flowering heads and small orange larvae that hatch feed on developing seeds.
	Stem borers *(Busseola fusca, Sesamia calamistis, Eldana saccharina)*	Destruction of leaves and boring into stems. Same species which attach maize, millet also attach sorghum.
Disease	Downy mildew (*Sclerospora sorghi)*	Fungus disease causes dwarfing or reduction of upper internodes. Results in 'crazy top' phenomenon.
	Striga (witchweed) (*Striga hermonthica, S. asiatica)*	Is a parasitic weed that grows on the roots of sorghum plants and prevents the crop from growing properly.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 2

Table 17: Major Pests and Diseases of Rice

Pest		Comments
Insect	Armyworms (*Spodoptera exempta)*	Cause serious defoliation in upland rice plants, leaving only the stems. Are regarded as occasional pests but when there is outbreak they completely devastate farms
	African gall midges (*Orseolina oryzivora)*	bore into stems and up to the apical or lateral buds, feeding on the tissues of the buds. Attack young rice plants.
	Stalked-eye shoot flies *(Diopsis spp)*	Dark brown fly. Lay eggs at the base of rice plants and hatched maggots feed on the stem tissues.
	Stem borers *(Chilo spp, Maliarpha separatella, Sesamia calamistis)*	Caterpillars bore into the stem of rice, attack rice at full tillering stage prevent the grains from filling up and ripening. (e.g white borer, striped borer, pink borer and yellow borer)
Disease	Rice blast (*Pyricularia oryzae)*	Most widespread and destructive disease. Affects all the leaves and stem of plant, starting with spots on leaves
	Rice brown leaf spot (*Helminthosporium oryzae)*	Fungus disease which starts as tiny brown spots on rice leaves. Attack seedlings more often.
	Rice yellow mottle virus (RYMV)	Attacked rice plants show yellow leaves and stunted growth

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 2

Table 18: Major Pests and Diseases of Maize

Pest		Comments
Insect	Armyworms (*Spodoptera exempta)*	Attack leaves
	Larger grain borers (*Prostephanus truncatus*)	Attack stored maize grain
	Greater grain weevil (*Sitophilus spp.)*	
	Stem borers *(Busseola fusca, Sesamia calamistis, Eldana saccharina)*	Destruction of leaves and boring into stems
Disease	Maize streak virus (virus transmitted by insects known as leaf hoppers)	Can be recognized by the long white streaks on maize leaves, interrupted by yellow and white sections
	Striga (witchweed) (*Striga hermonthica, S. asiatica)*	Is a parasitic weed that grows on the roots of maize and prevents the crop from growing properly

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 2

Table 19: Major Pests and Diseases of Millet

Pest		Comments
Insect	Armyworms (*Spodoptera exempta)*	Eat all the aerial parts of millet, leaving only the base
	Downy mildew (*Sclerospora graminicola)*	Most serious fungus disease of millet. Attacked plants show shorter internodes between leaves and plants.
	Stem borers *(Busseola fusca, Sesamia calamistis, Eldana saccharina, Coniesta spp)*	Stem borer caterpillars bore into stems and disrupt flow of nutrient fluid from roots to upper parts.
Disease	Ergot (*Claviceps sp./Sphacelia sp.)*	When the ergot fungus infects millet panicles, long and large black seed develop (known as 'sclerotia'). These seeds are poisonous to humans and to livestock
	Striga (witchweed) (*Striga hermonthica, S. asiatica)*	Is a parasitic weed that grows on the roots of millet plants and prevents the crop from growing properly

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 2

4.1.4 Major Pests and Diseases of Roots and Tubers

Table 20: Major Pests and Diseases of Cassava

Pest		Comments
Insect	Cassava green mites *(Mononychellus monihoti)*	Cause tiny yellow spots on the surface of cassava leaves. Leaves become small, shrivel and narrow and drops off from the shoot tip, a condition referred to as 'candelsticks'
	Cassava Mealybug (*Phenacoccus manihoti)*	Attack the growing points of the plant, later the leaves senesce and fall, sometimes accompanied by die bark of the shoot. Attack on stems results in stunted growth of shoots with highly reduced internodes possibly due to introduction of a toxin. Damage is greater in late planted crop than early planted because high pest infestation during the dry season occurs when the tubers have not yet formed. In early-planted cassava most of the tubers are formed before high pest abundance
	Variegated grasshopper *(Zonocerus variegatus and Z. elegans)*	Adults and nymphs defoliate and sometimes strip the bark of cassava completely. Tuber yield is reduced significantly by defoliation only towards the end of the dry season after natural leaf regeneration has begun. The damaging stages are from three instar nymph to adults. Defoliation of leaves of up to seven months old cassava can cause 60% reduction in yield but above nine months old cassava, little or no reduction in tuber yield occurs
	Termites (*Macrotermes spp.*)	They attack cassava plant late or during the dry season. They can destroy the whole rooting system
Disease	Cassava anthracnose disease *(Colletotrichum gleosporoides)*	It is caused by fungus that affects the stems and bases of the leaf petioles. It causes a complete death of the stem
	Cassava bacterial blight *(Xanthomonas compestris)*	Identified by angular patches on the stems and leaves. The leaves wilt and die and drop off from the stems. Young plants tend to suffer more the disease than older ones

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 3

Table 21: Major Pests and Diseases of Yam

Pest		Comments
Insect	Mealy bugs *(Forrisia virgata, Phenacoccus madeirensis)*	Feed on yam, suck sap from the leaves and stems. Attacked plant become weak and produce low yield
	Millipedes *(Myriapoda spp.)*	Underground pests which bore into yam tubers to feed. They cause secondary infections leading to rotting.
	Termites *(Microtermes spp., Odontotermes spp. And other species)*	They are occasionally serious pests of yam in Ghana. They burrow into the developing tubers and make a network of tunnels that are invisible until the tuber is cut.
	Yam nematodes *(Scutellonema spp., Meloidogyne spp.)*	Infections by above-ground yam nematodes are rarely noticed in the field, except occasionally as a general chlorosis and stunting of yam vines
	Yam tuber beetles *(Heteroligus spp.)*	In Ghana, yam tuber beetles can cause serious economic losses by making extensive feeding holes in the yam tubers, often only just before harvest
Disease	Anthracnose disease *(Colletotrichum gleosporoides)*	They cause total destruction to the leaves

Pest		Comments
	Dieback /wilt *(Colletotrichum gleosporoides, Rhizoctonia solani, Fusarium spp. and other species)*	It is caused by fungi and blacken the necrotic areas at the base of the vines. It spread quickly and causes the entire stem to wilt and die
	Storage dry rot (Penicillium spp., *Rhizoctonia spp., Fusarium spp)* soft rot *(Erwinia spp.)*	Plant is wounded. Fungi and bacteria enter the wounded area causing dry and soft rot
	Yam mottle virus disease	Aphids are known to transmit this virus and capable of spreading the disease from one plant to another. Chorosis and mosaic patterns in affected plants.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 3

Table 22: Major Pests and Diseases of Sweet potato

Pest		Comments
Insect	Sweet potato butterflies (*Acraea acerate)*	Feed in groups on the leaves. The chew and leaves transparent skin on the leaves. Causes pupation on the leaves or stems.
	Sweet potato weevils *(Cylas spp.)*	It is believed to cause crop losses of up to 70%. Adult weevils attack and feed on underground tubers, leaves and vines.
	White flies *(Bemisia tabaci)* and aphids *(Aphis gossypii and other species)*	Live under the leaves of the plant. Suck large quantities of sap from the leaves and stems causing the plant to develop badly.

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 3

Aphids (*Aphis craccivor) - soya bean*

Anthracnose disease (soyabean)

Cowpea storage weevils *(Callosobruchus maculatus)*

Cowpea wilt disease *(Fusarium oxysporum)*

Brown groundnut hopper *(Hilda patruelis)*

Groundnut chlorotic rosette *(Groundnut rosette virus)* disease

Mole crickets-egg plant *(Neoscapteriscus spp.)*

Damping-off disease – egg plant *(Pythium spp.)*

Cabbage aphids *(Brevicoryne brassicae)*	Bacteria soft rot – cabbage *(Pectobacterium carotovorum)*	Root-knot nematodes - okra *(Meloidogyne spp.)*	Leaf curl virus and mosaic virus – okra *(Okra enation leaf curl virus)*
			
Damping-off disease -lettuce *(Pythium spp.)*	Cutworms - lettuce *(Agrotis ipsilon; Feltia subterranean; Peridroma saucia)*	White flies -cucurbits *(Aleurodicus disperses)*	Powdery mildew-cucurbits *(Podosphaera xanthii)*
			
Fruit fly -tomato *(Neoceratitis cyanescens)*	Leaf curl *(Tomato yellow leave curl virus, TYLCV)*	Root-knot nematodes – pepper *(Meloidogyne spp.)*	Pepper leaf curl mosaic virus
			
Onion thrips *(Thrips tabaci)*	Purple blotch -onion *(Alternaria porri)*	Sorghum midges *(Stenodiplosis sorghicola)*	Downy mildew – sorghum *(Peronosclerospora sorghi)*
			
Rice brown leaf spot *(Cochliobolus miyabeanus)*	Armyworms (*Spodoptera exempta) -rice*	Larger grain borers -maize *(Prostephanus truncates)*	Streak disease of maize *(Maize streak virus)*
			
Stem borers – millet *(Acigona ignefusalis)*	Ergot (*Claviceps sp./Sphacelia sp.)-millet*	Cassava Mealybug (*Phenacoccus manihoti)*	Cassava bacterial blight *(Xanthomonas*

			axonopodis pv. Manihotis)
			
Yam tuber beetles (Heteroligus meles)	Storage dry rot – yam *(Pratylenchus coffeae)*	Sweet potato butterflies *(Acraea acerata Hew.)*	Sweet potato weevils *(Cylas formicarius)*

Figure 4. 2 Pests and Diseases associated with targeted crops

4.2 Pest Problems and Control Practices

4.2.1 General Pest Problems and their Management

Some of the common pests envisaged in the FSRP2 targeted areas include: rodents and migratory and outbreak pests such as locusts, borers, caterpillar, nematode, aphid, mealy bug. IPM strategies are recommended and used by some farmers as long as it is possible because there is no one control practice that can provide acceptable control of the target pest.

Rodents:

Rodents, particularly the field rats (rattus rattus), the small house mice (*Rattus norwegicus*) and multimammate shamba rat, (*Mastomys natalensis*) are key pests of food crops. The most affected crops are orange-fleshed sweet potato (OFSP), soybeans, pawpaw and cabbage. The damage caused by rodents starts at early booting and continues through the mature stage as well as the storage stage.

Maize is the most susceptible of all the crops. At the pre-harvest stage, maize is attacked at planting (the rodents retrieve sown seeds from the soil causing spatial germination). The rodents cut and eat the fresh stems and parts of the panicle. Farmers are strongly advised to do the following to reduce potential damage to crops and the environment:

- Weeding for clean bunds and fields regular surveillance. The earlier the presence of rodents is observed, the cheaper and simpler any subsequent action will be and losses will remain negligible
- Store Sanitation: It is much easier to notice the presence of rodents if the store is clean and tidy
- Proofing i.e. making the store rat-proof in order to discourage rodents from entering
- Trapping: Place the traps in strategic positions

Migratory and outbreak pests

The key migratory and outbreak pests of economic significance in Ghana are armyworm (*Spodoptera exempta*), birds, and the red locusts. With an exception of the elegant grasshopper, the management of the rest of the pests under this heading is co-ordinated by the PPRSD of the MoFA.

Locust: Locusts live and breed in numerous grassland plains/savanna zones. During periods with favourable weather, locusts multiply rapidly and form large swarms that can cause huge damage to plants in a very short period of time.

Grasshopper has become increasingly damaging on cereal crops (maize, wheat sorghum, rice and millets) in parts of the country. There being no research done on the management of the pest, farmers are forced to use any recommended insecticide whenever outbreaks occur.

Armyworm: The African armyworm (*Spodoptera exempta*) is a major threat to cereal production in a number of African countries. It is a major pest of cereal crops (maize, rice, sorghum and millets) as well as pasture (grass family) and therefore a threat to food security and livestock. The problem with

armyworms is that they are highly migratory so that larval outbreaks can appear suddenly at alarming densities, catching farmers unawares and unprepared.

Armyworm (*Spodoptere exempta*) outbreak has occurred in Ghana thrice in the last two decades. The first outbreak occurred in 2002, second in 2006 and the third in 2017. Large expanses of farmlands were destroyed in such instances.

The recent armyworm outbreak was in 2017 on maize fields in Ghana and quickly dispersed through to cover all the regions. In the 2002, the outbreak was largely concentrated in the Upper East Regions, and a total of 790 (Ha) were affected in four communities. In 2006, the outbreak occurred in five regions namely Brong Ahafo, Ashanti, Volta, Northern and Eastern regions.

The worms destroyed crops in the grass family like maize, rice and sugar cane etc. In addition, animals that fed on infested pasture got bloated and died. The caterpillar outbreak is a threat to 3, 13 and 15 of the Sustainable Development Goals (SDGs), health and environmental sustainability, both of which are among the 17 UN SDGs. According to the Sanitary and Phytosanitary of the Centre for Agriculture and Biosciences International, it was estimated that the Fall Armyworm (FAW) could cause damage worth about $3 billion to Africa's maize crop if proper measures are not put in place. The infestation was first reported in the Yilo Krobo district of the Eastern Region in 2016.

Due to its economic significance, management and control is centrally coordinated by PPRSD. Its control combines monitoring in identified breeding areas, forecasting and early warning of potential outbreaks. In the northern regions, insect traps are usually set in first week of May and monitored. In 2002 however, the trap could not register significant catches before the sudden outbreak of the Armyworm. This brings to the fore the need to adopt other surveillance methods in addition to the setting of the trap to enable early detection of pests and diseases as part of the early warning system. The weapon of choice is the use of pesticides for spraying using gang sprayers instead of aerial spray. This method was adopted for the 2006 outbreak. Farmers are advised to inspect their fields for signs of infestation. If the crop is attacked, farmers should spray with diazinon, fenitrothion or chlorpyrifos, whichever is available at the nearest pesticide store.

The information about potential outbreaks is passed to the regions and districts from where it is further passed to farming communities through the extension system. Both ULV (ultra-low-volume) and knapsack sprayers can be used depending on available formulation in the outbreak areas.

A different approach, a biological one using a virus fatal to armyworms, NPV (Nuclear Polyhedrosis Virus), is also being investigated in various countries, including the UK, Canada and Tanzania.

Invasive alien species

Invasive alien species have become a problem in diverse ecosystems in Ghana. They affect both savannahs and tropical forests and they are found on land, in fresh water systems and along the coast in the country. The World Conservation Union (IUCN) identified 26 invasive alien species in Ghana which include the following key pests:

- Siam weed, Chromolaena odorata;
- Water hyacinth, Eichornia crasspes;
- Cashew mealybug, Rastracoccus invadens; and
- Invasive fruit fly, Aleurodicus disperses.

These invasive alien species have had a huge adverse effect on the production of major food crops such as orange-fleshed-sweet potato (OFSP), vegetables and also on pawpaw and cashew. Climate change, trade liberalization, and agricultural intensification (introduction of increased fertilizer use, introduction of new crops and varieties, changes in land use and landscape etc) could cause the occurrence of new

pest problems. This requires frequent pest risk surveillance and continuous updating of the existing pest list. The EPA and the PPRSD are currently the lead institutions in managing invasive alien species.

Major Pests and disease in livestock production (small ruminants, poultry, cow)
The VSD has used various strategies across the country to control and contain outbreaks of diseases. These included spatial strategies such as movement prohibition, quarantine, restriction, regulatory services, and encouragement of community participation and non-spatial strategies of animal health programs such as immunization and prophylactic treatments. Over the years, diseases such as *anthrax* in the northern and western regions; *African swine fever* on the western borders of the country (Brong Ahafo, Upper West Region and Western); *contagious bovine pleuropneumonia (CBPP)* and *small ruminant plague (PPR)* in all regions; *Brucellosis* in Brong Ahafo and in the Western Region have been detected and controlled effectively.

The underlisted diseases are the most frequently observed diseases in the field of animal protection by the VSD:

Table 23: Common diseases in animal production

Disease	Causative agent	Description
Anthrax	Bacillus anthracis	It is a zoonosis especially ruminants that can be transmitted to humans in many ways, by spores (form of resistance of the bacteria) or by contaminated meat
Ovine and caprine brucellosis (excluding Brucella ovis infection)	B. melitensis	Brucellosis is transmitted to humans, in whom it causes an acute febrile syndrome (waving fever) that can progress to a more chronic form and induce serious joint, cardiovascular or neurological complications. Infection is often linked to occupational exposure: veterinarians, slaughterhouse staff and breeders handling infected animals and abortions or placentas are most at risk. In this case, the transmission is particularly by the oral, conjunctival or respiratory
Peste des Petits Ruminants (PPR), also known as sheep and goat plague	Genus Morbillivirus (Paramixoviridae)	A highly contagious viral disease of sheep and goats
Blackleg *(Clostridial myositis)*	Clostridium chauvoei	An infectious, non-contagious disease that affects small ruminants (sheep, goats), pigs and cattle. Infection occurs when animals ingest bacterial spores whiles grazing
Gumboro	Infectious bursal disease (IBD)	A contagious avian viral disease, and fowl pox that occurs in commercial poultry
Newcastle disease	Para-myxo virus	An infection of domestic poultry and other bird species with virulent Newcastle Disease Virus (NDV)
Contagious bovine pleuropneumonia (CBPP)	Mycoplasma mycoides subsp. Mycoides (m. mycoides)	This is an insidious pneumonic disease of cattle which is sometimes referred to as lung sickness.

4.2.2 Pesticides to be used in FSRP2

The EPA has a list of approved and registered pesticides for use by farmers (Annex 1). Additionally, there is a list of banned pesticides (Annex 1). This list is updated periodically with the last update in 2020. These pesticides are tested to improve the quality of the pesticides used i.e., the reduction of the toxicity and the increase of the efficiency.

Engagements with farmers in previous project areas revealed knowledge of farmers with regards to the banned pesticides. However, some of these banned agrochemicals still exist in some agro-shops for sale usually from neighbouring countries such as Côte d'Ivoire which indicates lack of enforcement by regulatory bodies. Indications from the Chemicals Control and Management Centre (CCMC) of the EPA point to the fact that the registered pesticides are popular at the level of producers of the targeted crops. Even though farmers are aware of the banned chemicals, some farmers continue to apply the banned chemicals for a number of reasons including the cost of the banned chemical compared to approved pesticides; availability in local markets and difficulty in accessing approved pesticides i.e. proximity.

Table 24: Summary of Register of Pesticides - February 2020

Category	Fully Registered Pesticides (FRE)	Provisionally Cleared Pesticides (PCL)	Banned	Total
Insecticides	173	85	32	290
Fungicides	62	30	0	92
Herbicides	162	110	0	272
Plant Growth Regulators	8	3	0	11
Molluscicide	0	0	0	0
Rodenticides	0	2	0	2
Nematicides	3	3	0	6
Adjuvants	2	0	0	2
Biocides	5	3	0	8
Bactericide	0	1	0	1
Repellents	0	3	0	3
Total	415	240	32	687

Source: EPA/CCMC, 2021

4.3 IPM Strategy for Pest Control

The integrated pest management is the adopted strategy for the fight against pests in Ghana. However, the use of the integrated combat is not widespread despite the efforts undertaken. The use of pesticides is increasing in spite of the high cost of the products relative to the financial capacity of majority of farmers. Research Institutions in Ghana have had some good results with regard to the efficient use of botanical products. In actual fact, several institutes including the Crops Research Institute, Faculty of Agriculture / Kwame Nkrumah University of Science and Technology (KNUST) University of Ghana, Legon, Savannah Agricultural Research Institute (SARI) have conducted projects concerning the integrated management of pests in several operations (soybeans, pawpaw, OFSP, cucumber, etc), the development of a control system for the use of pesticides for communities practicing rural related agriculture, IPM Kit development, demonstration and transfer of technology in IPM.

During consultation with the PPRSD of MoFA, the directorate indicated efforts being made to build the capacity of farmers in the application of pesticides on farms. Through the support of international development partners including the German Development Cooperation (GTZ) and the United States Agency for International Development (USAID), the directorate has developed separate booklets and manuals to serve as extension guides on integrated pest management practices for food production. These include:

Table 25: Manuals/booklets developed by PPRSD for IPM practices

Manual	Compiled by	Highlights
Manual for Safe Use of Pesticides (Annex 5)	PPRSD of MoFA	• This manual was developed by the PPRSD of MoFA under GCAP.

Manual	Compiled by	Highlights
		• It provides a guidance to farmers and stakeholders involved in pest management and related fields. • The manual offers a practical and informative guidance on how to comply with legislations and best practices regarding the use, transportation and storage of pesticides by stakeholders. • It provides insight into the disposal of obsolete pesticide stocks and empty pesticide containers. • This document promotes safe and healthy practices associated with the overall use of pesticides. • It seeks to contribute to minimizing the potential risks involved in handling and application of pesticides by suggestion precautionary measures.
Integrated Pest Management Practices for the Production of Cereals and Pulses	PPRSD of MoFA	• To recognize the most common pest, diseases and weeds that attack crops in the field and in storage; • Identify the damage done by particular pests and diseases at different growth stages of crops; • Know and understand the options that are available for effective IPM of major crop pests, diseases ad weeds; • Work with farmers on how to apply IPM methods to manage crop pests, diseases and weeds to achieve sustainable and environmentally sound crop production
Integrated Pest Management Practices for the Production of Vegetables		
Integrated Pest Management Practices for the Production of Roots and Tubers and Plantains		
Principles and practices of Integrated Crop and Pest Management (ICPM)	PPRSD of MoFA	See Table 26

The national IPM approaches developed for cereals, pulses and vegetables are largely based upon 15 principles, practices and what happens in each case. The principles are presented in the table below.

Table 26: IPM Approaches for Pulses and Vegetables

Principles	Cereals	Pulses/Legumes	Vegetables	Fruits
Principle 1	Obtain good seeds	Obtain good seeds	Obtain good seeds and other planting materials	Obtain good seeds
Principle 2	Select fertile soils and suitable planting sites	Select fertile soils	Select well-drained fertile soils for the nursery and the farm	Select well-drained fertile soils for the nursery and the farm
Principle 3	Plan crop rotation	Plan crop rotation	Adopt good nursery practises	Plan crop rotation with other crops
Principle 4	Adopt appropriate planting distances and planting patterns	Adopt appropriate planting distances and planting patterns	Practise rotation with appropriate crops	Adopt appropriate planting distances and planting patterns
Principle 5	Plant crops at appropriate times	Plant crops at appropriate times so that their	Adopt appropriate planting distances	Plant crops at appropriate times so that their growth

Principles	Cereals	Pulses/Legumes	Vegetables	Fruits
		growth coincides with low pest and disease incidence		coincides with low pest and disease incidence
Principle 6	Weed early and regularly	Weed early and carefully	Plant crops at the appropriate time	Weed early and carefully
Principle 7	Adopt good soil management practices	Adopt good soil management practices	Weed early and carefully	Adopt good soil management practices
Principle 8	Adopt suitable water management practices	Adopt suitable water management practices	Adopt good soil management practices	Adopt suitable water management practices
Principle 9	Visit fields regularly	Visit fields regularly	Adopt suitable water management practices	Visit fields regularly
Principle 10	Maintain high levels of sanitation in the field	Maintain high levels of sanitation in the field	Visit fields regularly	Maintain high levels of sanitation in the field
Principle 11	Manage pests and diseases efficiently	Manage pests, diseases and weeds efficiently	Maintain high levels of sanitation in the field	Manage pests, diseases and weeds efficiently and early
Principle 12	Enhance and protect the populations of natural enemies (e.g. predatory ants, spiders and parasitic wasps)	Enhance and protect the populations of natural enemies (e.g. predatory ants, hover flies, ladybirds, spiders, assassin bugs and parasitic wasps)	Manage pests and diseases efficiently	Enhance and protect the populations of natural enemies (e.g. predatory ants, hover flies, ladybirds, spiders, assassin bugs and parasitic wasps)
Principle 13	Minimize the application of chemical pesticides	Minimize the application of chemical pesticides	Enhance and protect the populations of natural enemies (e.g. predatory ants, spiders, ladybirds, hover flies, lacewings, ground beetles and parasitic wasps)	Minimize the application of chemical pesticides
Principle 14	Adopt good harvesting methods	Adopt good harvesting methods	Minimize the application of chemical pesticides	Harvest timely and adopt good harvesting methods
Principle 15	Adopt good, clean storage systems	Adopt appropriate and clean storage systems	Adopt good harvesting methods	Adopt good, clean storage systems

Sources: MoFA-PPRSD/GTZ: Integrated Pest Management Extension Guide 4/Integrated Pest Management Extension Guide 2

4.3.1: Preventive Fight Methods

This control is usually applied for pests such as locusts. Regulatory bodies collaborate with international partners during the indicated periods of the year in order to follow the evolution of the situation of the populations. Surveillance of other agricultural pests is the responsibility of farmers. However, plant protection services also identify pests to determine areas at risk of infestation that compromise food security. The use of drones for pest management is also a method the PPRSD is looking forward to using to make pest control/management easier and faster.

Some of the preventive control consist of the destruction of the causative agent in the fields of the target and surrounding crops. Some farmers also adopt the use of crushed neem grains with oil to prevent insect attack. The following methods as summarised in Table 27 can be used for preventive control.

Table 27: Preventive Fight Methods

Method	Comments
Prophylactic measures	In many crops, seeds are used as propagation material. They can be contaminated (internally and externally) by fungi, bacteria, viruses, and nematodes. These parasites will develop with the germination and growth of plants. Prophylactic measures consist of: • use only seeds, seedlings, discards or tubers of known and certified origin produced by official bodies. The seeds can be disinfected, by fumigation or by coating; • choose soils with good natural drainage, suitable for planting; • destroy the residues of previous crops. Plant residues (stems, roots) or even fruits and tubers that remain in the plots after harvest often contain pests or diseases, thus constituting a source of infestation for the next crop. Indeed, parasites can survive during the dry season and infest the next crop. It is recommended to (i) burn stems and stubble, (ii) compost with residues; • rotate crops, ie plant crops that do not have any pests in common (rotation of cereals with root and tuber crops). Crop rotation prevents the proliferation of diseases and pests by breaking their development cycle; • make physical barriers by protecting crops from pest attack by nets. Vertical nets, insect-proof plastic films, silica-based inert powders with abrasive and drying properties.
Genetic control	This control technique is based on the use of resistant or disease tolerant varieties. The cultivation of resistant varieties is the simplest and often least costly solution for the farmer in his fight against plant diseases. In the absence of adequate resistance characteristics, the tolerance can be used, with the proviso that tolerant plants can be infected and serve as a reservoir of germs and therefore a source of contamination for sensitive varieties.
Cultural or agronomic control	This control is carried out by adopting favourable cultural techniques. These include: (i) ploughing; (ii) adequate cropping system; (iii) good date of planting or planting; (iv) cover crops; (v) weeding; (vi) associated crop;
Biological control	This is a method of pest control of crops (insects, mites, rodents, etc.), diseases (fungal, bacterial, viral, etc.) or weeds (weeds) by means of living organisms' antagonists, called biological control agents or auxiliaries of crops. Biological control ensures the preservation of fauna or flora useful (create environments favourable to the development of auxiliaries.).

Method	Comments
	An auxiliary is defined as a predatory or parasitic animal that, by its way of life, assists in the destruction of pests that are harmful to crops. Most of these auxiliaries are insects (usually wasps), and a small proportion of nematodes and mites. Auxiliary organisms have demographics related to those of the populations of their "hosts". They are dependent on the density of the pest populations (disease, pest and weed).
Environmental management practices	Planting hedges: predators need this resource to reach sexual maturity and thus reproduce, providing prey / replacement hosts, shelter during work or treatment on the plot. Grass strips: the implementation of grass strips is relatively simple, inexpensive and their impact is fast. Different and complementary devices can be set up according to the auxiliaries that one seeks to promote. Grass strips make it possible to meet the specific requirements (varieties of pollen, nectar) of many auxiliaries, to give them easier access to these resources, and to attract them to the immediate vicinity of crops

4.3.2: Curative Fight Methods

By this method, locust invasions are managed at the national or even sub-regional level. Farmers encountering pest problems usually rely on competent MoFA services to receive control advice that they will apply in the field. Additionally, the decentralization of the PPRSD offices across the country plays a very important advisory role at this level. Neem grains and other pesticide mixtures help control the diseases and pests identified in the target crops. Some of the curative fight control include:

Table 28: Curative Fight Control Methods

Control	Comments
Mechanical control	There are several physical processes that can reduce parasite populations or bio-aggressors when they are already installed in cultivated plots: • *Destruction of diseased or infested plants*: This method is particularly indicated in cases where there is a disease that can disperse quickly in the plots (fungi, viruses, nematodes, etc.). It is the case of fruit fly (*Rhagoletisochraspis*) for tomato crops. Plants affected by the disease should be isolated, desiccated and buried or incinerated; Plants affected by the disease should be isolated, desiccated and buried or incinerated; • *Trapping pests (insects and rodents)*: it is achieved by the installation of traps classic (trapping live animals) type box with a rocking input system. It is a very effective method but quite restrictive and time consuming (takes time). Trapping is also used to estimate a population of animals (rodents) on a plot; • *Pickup* • *Harvest or sanitary size*
Biological control	• *Inundative release of auxiliary or predatory insects, and parasitoid*: In all ecosystems, there are organisms called "auxiliaries" which are natural enemies of "pests". Biological control consists in favouring the populations of these auxiliaries by releases. This keeps the "pest" populations under control. An example is the Trichogram flood release to control sugar cane drillers. • *Plant extracts or biopesticides*: Many plants produce insecticidal substances that can be sprayed on crops after extraction. It is a preparation based on Neem, Tobacco and papaya leaf. In Ghana, very few programs are being developed to initiate experimentation with the use of biological pesticides
Reasonable chemical control:	The application of pesticides at effective doses during treatments that are as few as desirable, carried out at the most appropriate times and with the required treatment equipment. This control method has the advantage of: (i) effectively protecting its crop and harvest; (ii) respecting maximum pesticide residue limits (MRLs);

Control	Comments
	(iii) improving its income by reducing the use of inputs (fertilizer and especially pesticides)

Additionally, subregional initiatives led by Institut Togolaise de Recherche Agronomique (ITRA) and Institut de Conseil d'Appui Technique (ICAT) in Togo have led to convincing results. The use of chemical pesticides is being replaced by biocidal plant extracts such as "neem" (*Azadirachta indica*), *Lannea microcarpa*, red pepper, cow dung, etc., which are used as a natural pesticide.

ITRA has particularly initiated the experimentation of the use of biological pesticides (especially extracts of the leaves of "neem" or *Azadirachta indica*) on vegetable crops. However, certain constraints have been encountered in the purification of the molecule extracted from the "neem". The difficulties of using these approaches by farmers are related to the availability of neem leaves and grains and the influence of climatic conditions in coastal areas. Other promising tests have also made from papaya leaf extracts. These different results of proven initiatives could be capitalized as part of integrated pest management in Ghana.

4.4. Alternatives to Pesticides

Over the years, efforts have been made particularly by the research institutions to develop alternative products to the use of agro-chemical products such as POPs (Persistent Organic Pollutants) with the aim of reducing the use of pesticides in agriculture and the areas of use of these pesticides. These alternatives include cultural control, physical control, genetic control, integrated pest management, biological control, the use of bio-pesticides, the use of pesticides of the organophosphorus family, carbamates, pyrethroids, etc.

Some forms of control are being tested and are alternatives to POPs pesticides. Many other plants (garlic, pepper, onion, tobacco, pyrethrum, etc.) are also used as bio-pesticides and research is continuing. Additionally, research is ongoing to test bio-pesticides on cashew nuts. The results of this research will make it possible to propose actions of information and sensitization of the populations on the necessity to use these biopesticides.

During the consultation, farmers indicated knowledge and understanding of alternatives products to pesticides. They indicated practices such as the use of neem grains, or bark of cailcédrat as bio-pesticides in market gardening; the use of oxen or goats' excrement to protect crops against ruminants; sands, ashes, chilli powder for the preservation of corn, and others (powders of mahogany bark, neem leaves) as alternatives to pesticides application. Farmers are also aware of cultural techniques such as cultural association, crop rotation, transplanting, organic manure, etc. Nonetheless, they indicated their preference for chemical pesticides due to their efficacy, and accessibility to treat large areas as compared to the alternative approaches. Table 29 provides a list of alternative products to POPs pesticides by their area of use.

Table 29: List of alternatives to POP pesticides by area of use

Area of use	POPs pesticides formerly used	Alternative
Agriculture	Aldrine, Chlordane, Dieldrine, Endrine, Heptachlore, DDT, Hexachlorobenzène	• Practice of biological control (use of organismsnatural enemies to control crop pests and the use of conventional or repellent insecticides); • Use of bio-pesticides (neem seed porridge, fermented neem leaf solution, neem leaf powder, neem seed oil, papaya leaf, dried pepper, garlic and onion extracts); • Organophosphorus, pyrethroid, and other new generations of agricultural insecticides;

Area of use	POPs pesticides formerly used	Alternative
		• Cultural practices aimed at reducing the pest population and promoting the natural enemies of these pests (combination of crops, rotation and rotation in time and space, varietal choice, timing of the sowing period to make them less vulnerable to pest attack); • Practical physical control (burning of parasitic plants, disinfection of soil with water vapor, use of mechanical traps, sun drying of foodstuffs before storage, systematic destruction of products, highly infested or infected plants, weeding good time); • Practice of genetic control (use of resistant or tolerant varieties)
Animal health	Aldrine, Dieldrine, Endrine, DDT	• Hygiene measures to be observed and quarantined; - Use of plants with proven bio-activity; • Organophosphorus, pyrethroid, and other new generations of insecticides for veterinary use

4.5 Assessing knowledge and practices in pesticide management

During the preparation of this report, a number of stakeholder engagements were held with key agencies including the Directorate of Crop Services (DCS) - MoFA, Directorate of Agricultural Extension Services (DAES) - MoFA, Veterinary Services Directorate – MoFA, the Plant Protection and Regulatory Services Department (PPRSD) – MoFA, and the Environmental Protection Agency (EPA) of the Ministry of Environment, Science, Technology and Innovation (MESTI). Details are found in Annex 6.

In the case of the Chemicals Control and Management Centre (CCMC) of the EPA, it was observed that knowledge about IPM and good phytosanitary practices are relatively well mastered. Nonetheless, there is still the need for capacity building for users including agro-dealers, vegetable-gardeners, cereal, and legume and root tuber farmers on regulatory procedures, product characteristics and good practices. Table 30 below provides a summary of the engagement with various stakeholders:

Table 30: Summary of Engagements with Stakeholders

Stakeholder	Issues
Farmers	• Pesticides containers/packaging is either buried or thrown in the fields or is incinerated; • Some farmers store their pesticides at home; • Non-use of personal protective equipment (PPE); • Inadequate AEAs to provide farmers with extension services
Regulatory Bodies (MoFA, EPA, GSA, and FDA)	• No protective measures during preparation and application of pesticides; • Poor packaging management (abandonment, burning, reuse as container); • Lack of storage facilities for prohibited products seized; • Challenge of compliance with phytosanitary regulations; • Lack of adequate storage facilities for the seeds produced; • Insufficient human resources, equipment (high-performance laboratories), logistical and financial resources for monitoring in the field; • Need for capacity building
Chemical distributors	• Competition with sellers of expired or near-expired products at low prices • Presence of unauthorized dealer shops

It was also revealed that farmers and sellers continue to ignore the adequate and relevant use of pesticides and the different alternative methods. Implementation of safety measures is generally

inadequate and it is important and necessary to control the places of storage and sale of pesticides in order to avoid or at least reduce the exposure of the population to these products. Risks remain greater in the country where information and awareness are insufficient on the necessary safety arrangements for handling pesticides. In the framework of the FSRP2, it is necessary to provide information-education-communication (IEC) actions through local radios and posters.

Figure 4. 3 Consultation with the Michel Camp Farmers' Association

Based on the stakeholder consultation on pesticide management, a number of recommendations have been proposed including:

- build capacity on responsible use of pesticides given the low level of knowledge of farmers;
- encourage farmers into organic farming to minimize environmental degradation and reduce the increased use of plant protection products;
- strengthen agricultural advice around the popularization of integrated pest management (IPM) methods among farmers;
- enhance the capacity of health workers in the management of pesticide poisoning cases and the establishment of databases on the various cases treated;
- establish storage facilities for unregistered pesticide and empty packaging products and regulate the removal of such packaging by distributors; and
- resource technical platform of health centres for better management of cases of intoxication

4.6 Key Pests and Recommended Management Practices

4.6.1 Major Natural Enemies and Enhancing Natural Enemy Populations

One important aspect of the IPM approach is the role of natural enemies, or beneficials. Natural enemies are the predators and parasites, parasitoids and beneficial micro-organisms that attack crop pests and disease organisms. Predators are hunters that usually feed on a range of insects or other animals, while parasitoids are often very specific to a certain pest in which they develop. The table below shows the major natural enemies and the pests they feed upon.

Table 31: Major natural enemies and the pests they feed upon

Natural Enemy Groups	Examples	What they feed upon
	Predatory mites	Pest mites and thrips
	Spiders	A wide range of insects, such as flies, aphids, caterpillars, butterflies, moths, planthoppers
	Mantids	A wide range of insects, such as flies, aphids, moths, caterpillars

Predators	Assassin bugs	Other bugs, aphids, leafhoppers, maggots, caterpillars
	Predatory ants	Insect eggs, caterpillars, grubs, maggots, termites
	Ladybirds (larva and adult)	Aphids, scale insects, mealy bugs, white flies, mites
	Lacewings (Larvae only)	Aphids and other soft-bodied insects, as well as insect eggs and mites
	Ground beetles (larva and adult)	Caterpillars, grubs, bugs, beetles, maggots
	Hover fly (larvae only)	Aphids, thrips and other soft-bodied insects
	Robber fly	Caterpillars and small insects
Parasites	Parasitic wasps	Caterpillars, aphids, scale insects, maggots, mealy bugs, white flies, insect eggs, beetles
	Parasitic flies	Caterpillars

Source: Integrated Pest Management Extension Guide 1. Principles of Integrated Pest Management: Growing Healthy Crops, Anthony Youdeowei, MOFA/GTZ

Populations of natural enemies can be increased in the field so that they help to control crop pests. Simple techniques for doing this are based on creating a conducive environment for their development and on providing attractive substances to concentrate them on infested crops. Some things that can be done include:

- Minimise the use of chemical pesticides, as these will kill the natural enemies and thus destroy their populations; if it is absolutely necessary to spray crops with pesticides, use selective rather than broad-spectrum pesticides;
- Mulch your crops with dried leaves and other plant materials; mulch provides protected, cool and moist sites suitable for the breeding and resting of natural enemies such as predatory ants, spiders, centipedes and ground beetles;
- Predatory ants are attracted to sugar/water solutions; prepare a sugar solution by adding about 90kg of fine sugar to 1 litre of water; mix thoroughly until all the sugar dissolves, and then spray this solution on the leaves of the infested crop once a week or as needed; this solution will attract ants onto the crop plants where they will prey on thus eliminate the pests;
- Water solutions of the juices of ripe fruits (e.g. mango) can serve as a cheap substitute for sugar;
- Leave strips of flowering weeds around the crop field to serve as a refuge for natural enemies.

4.6.2 Recommended IPM Practices for Selected Vegetable Crop Pests/Diseases

Table 32: IPM Practices for Eggplant (Aubergine)

Pest		Recommended cultural practice and direct interventions
Insect	Budworms (*Scrobipalpa blasigona)* (Pre-harvest – flowering stage)	• Avoid growing eggplant 2 years in succession • Practice crop rotation • Rotate pesticides e.g. spray organophosphate (OP) and then pyrethroid pesticide. • No chemical control advocated in small populations and damages • Monitor pest
	Epilachna beetles (*Epilachna chrysomelina)* (Pre-harvest stage)	• Usually no control measures necessary • Spray with a short persistence synthetic insecticide if numbers are great.
	Jassids/leafhoppers (*Jacobiasca spp./Empoasca spp.)* (Pre-harvest – all stages)	• Avoid use of chemicals only use recommended pesticides if there is heavy infestation • Balance fertilizer do not over fertilize with nitrogen

Pest		Recommended cultural practice and direct interventions
	Mole crickets (*Brachytrupes spp)* (Pre-harvest – seedling stage)	• A most crumbly bait of approved pesticides with maize flour or wheat bran may be used in nursery. • Pick adults from their burrows and destroy or feed to animals • Sprinkle wood ash in nursery • Do deep ploughing to destroy burrows and expose insect to predators (e.g. birds) • Land preparation exposes crickets to predators
	Root-knot nematodes (*Meloidogyne spp)* (Pre-harvest stage – seedling to fruiting stage)	• Rotate crops for at least three years with non-susceptible crops e.g. maize, pulses or cassava to effect reduction in residual juvenile populations • Use non infected seedlings for planting. • Solarise soil (4-6 weeks) before sowing seeds in nursery • Grow resistant varieties, however continuous or frequent use of resistant varieties may result in resistance breaking races • Clean planting and cultivating equipment from contaminated soils before moving to un infested fields • Destroy alternative weed host plants • Use trap crops such as Tagetes sp. • Improve soil with manure and fertilizer • Add 1-2 tonnes/ha neem cake (if available) to the field to reduce nematode infestation
	Stem and fruit borers *(Leucinodes orbonalis)* (Pre-harvest – shoots and fruits)	• Use resistant variety • Avoid growing garden egg for 2 years in succession. • Fruit sanitation: remove and bury affected fruits. • Frequent harvesting and destruction of unwanted and fallen fruits. • Destroy damaged shoots on a community wide basis as part of an overall IPM strategy
Disease	Damping-off disease (*Pythium spp)* (Pre-harvest – nursery problem)	• Use certified disease free seed • Treat seed with hot water before planting • Sow seed thinly or thin seeding when they appear crowed • Do not apply too much nitrogen fertilizer or too much irrigation water • Practice solarisation (4-6 weeks) before sowing seeds. • Sterilize soil for seed boxes for nursing. • Drain off excess water • Improve aeration by stirring soil • Drench soil with approved copper fungicide follow instruction on the label • Burn diseased seedlings.
	Wilt disease (*Fusarium semisectum)* (Pre-harvest – seedling to fruiting stage)	• Do not locate seedbeds on a land with a previous history of fusarium wilt • Raise soil pH by liming where soil is acidic • Control root not nematodes • Avoid application of excessive nitrogen • Use resistant varieties if present • Treat seed with recommended fungicide • Spray the crop with fungicide will not control the disease once established • Plant in neutral soils for seedbed

Pest		Recommended cultural practice and direct interventions
		• Irrigate plants regularly • Undertake long rotation

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 33: IPM Practices for Cabbage

Pest		Recommended cultural practice and direct interventions
Insect	Diamond-back moth (DBM) (*Plutella xylostella)* (Pre-harvest stage: Vegetative to head formation)	• Embark on filed sanitation (uproot and burn stalks or feed to animals) • Plant during rainy season to wash off young larvae • Intercrop with repellent plants such as tomato or chilly pepper between rows 30 days before planting cabbage • Do no leave overgrown cabbage in the field • Scout weekly when plants are young and destroy eggs and caterpillars • Conserve and encourage natural enemies such as Trichogramma and Diadegma insulare. • Use microbial insecticides such as Bacillus thruringiensis (Bt) Biobit to control young larvae • Spray neem pesticide in the evenings – light sensitive • When Diamondback moth population builds up and natural control proves not to be sufficient, switch on to pesticides • Prevent pesticide resistance build up in DBM by rotating the pesticides • Observe the pre harvesting intervals of synthetic pesticides
	Webworms or cabbage borer (*Hellula undulalis)* (Pre-harvest- seedling to head formation)	• Embark on field sanitation (uproot and burn stalks or feed to animals) • Use bio pesticides, such as Bt and neem based insecticides • Use insect growth regulators (IGR) or other recommended pesticides
	Cabbage aphids (*Brevicoryne brassicae)* (Pre-harvest –vegetative phase to head formation)	• Avoid planting cabbage near an aphid infested crop or on land, which a recent infested crop has been removed • Conserve and encourage natural enemies (ladybird beetles, hoverfly maggots, lacewing larvae, parasitic wasps) by enhancing diversity and avoiding broad spectrum pesticides • Avoid application of too much nitrogen fertilizer as this makes the plant very soft, juicy and attractive to aphids but apply organic manures liberally • Rainfall and overhead irrigation washes aphids off. • Scout and monitor aphid infestation for early detection and control. • Control ants that protect aphids against attack to ensure the supply of honeydew, which they also feed on either with pesticide or by removing nesting sites such as old tree trunks, rock heaps, debris and weeds. • Prune/remove basal (lower) old leaves of head forming cabbages as may be a source of aphid infestation • Use water jet spray for the lower leaves to wash off aphids. • Plant solutions such as chilli, neem and garlic can also be applied on the crop. Spray with a soapy solution (local soap - *alata samuna)* to wash off aphids and disturb their breathing. Use soap solution as a spray by mixing together and stir well 30 ml liquid soap in 5 litres of water. Test a small area first to

Pest		Recommended cultural practice and direct interventions
		ensure that the soap preparation does not damage the crop plant. • Use chemical spray with recommended and approved insecticide only when heavy infestation occurs
	Cutworm (*Agrotis sp)* (Pre-harvest –Seedling stage)	• Timely weed control. • Plough to expose larvae (specially Egret birds) and to bury others and prevent them form reaching the surface • Replant severe losses • In severe cases, dust around the plant with a recommended insecticide such as an Organophosphate (OP). • Dried grounded red pepper sprinkled on dampened plants deters insect attacks. Spreading red pepper powder around the base of plants can repel cutworm such as Braconid wasp larvae (*Meteorus communis),* Ichneumonid wasp larvae (*Nepiera spp),* Green Lacewing larvae (*Chrysopidae).* • Flooding the soil before planting will expose caterpillars to predators
	Root knot nematode (*Meloidogyne spp.)* (Pre-harvest – all stages starting at nursery)	• Practice plant rotation with non host e.g. cereals, cassava, etc • Avoid infected soils, grown with host crops before e.g. tomato, garden eggs, okra, carrots, etc • Solarise (4-6 weeks) nursery soil before sowing • Use resistant variety if available • Improve soil fertility by increasing levels of organic matter to alleviate and suppress nematode of damage. • Uproot plants after harvesting and burn them • Flooding the soil for a few weeks will reduce nematode population
Disease	Bacteria soft rot (*Erwinia carotovora)* (Pre- and post-harvest – heading stage, leaves)	• Practice three-year rotation with non host crops such as cereals and pulses • Avoid water logged or heavy soils; do ridging • Avoid injury to plants near soil level • Avoid practices that transfer infested soil to non-infested areas (clean hoes and ploughs from soil) • Strict hygiene/ sanitation • Use resistant varies where available • Avoid planting in shaded area that keep plants wet from dews or rains • Space rows and plants adequately so that soil dries easily • Undertake early harvesting • Store only sound cabbages without blemish and not wet cabbages (no water on them)
	Black rot (*Xanthomonas campestris)* (Pre- and post harvest – heading stage, leaves)	• Deep plough • Practice seed bed/crop rotation at least for three years or more with non crucifers e.g. cereals and pulses. • Use resistant varieties where available • Ensure good sanitation practices (removal and disposal of diseased plants) • Over head irrigation may increase the rate of infection if other conditions are favourable for the disease. • Undertake early harvesting • Store only sound cabbages without blemish and not wet

Pest		Recommended cultural practice and direct interventions
		• Avoid practices that transfer infested areas

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 34: IPM Practices for Okra

Pest		Recommended cultural practice and direct interventions
Insect	Aphids *(Aphis gossypii, Myzus persicae)* (Pre-harvest – all stages)	• Conserve natural enemies such as lady bird beetles, hoverfly, lacewings, parasitic wasps like Aphidius spp (mummified-brown, dry and inflated as a result of having been parasitized by a small wasp). • Rain and overhead irrigation discourages aphides. • Spray with soap solution or neem
	Cotton stainers (*Dysdercus spp.)* and other sucking bugs (*Nezara viridula)* (Pre-harvest – reproductive stage)	• Usually no control • May be controlled biologically by chickens or birds • Neem seed extracts can be used in severe infestation • After AESA, use fast acting pesticide in case of heavy infestations. • Trap nymphs with split kapok or baobab seeds then destroy mechanically nymphs and reduce number
	Flea beetles (*Nisotra spp., Podagrica spp.)* (Pre-harvest – early vegetative stage)	• Ensure good agricultural practices (fertilization, irrigation, soil management) to allow okra to out grow damage • Stir around plants to expose eggs and grubs in the soil to predators, e.g. ants, birds. • Control only if it is damaging seedlings and young plants severely with soil treatment recommended systematic organo phosphorus insecticide
	Root-knot nematodes (*Meloidogyne spp.)* (Pre-harvest – seedling to reproductive stage)	• Use crop rotation with maize, groundnut, millet, cassava and other small grains. • Avoid planting on fields previously planted to nematode susceptible crops such as solanaceous plants, sweet potato, carrots, etc • Undertake alternative planting or intercrop with Tagetes spp (African/ French marigolds) or crotolaria and Indian mustard as trap crop. • Use indicator plants to monitor presence of nematodes. • Deep plough, expose nematode infected roots • Try solarisation to reduce nematode numbers (4-6 weeks). • Incorporate neem cake into the soil during land preparation • Fallow field for 3-4 years • Apply recommended nematicide in extreme case or if monitoring confirms necessary
Disease	Leaf curl virus and mosaic virus (Pre-harvest – vegetative to reproductive stage)	• Ensure strict sanitation by removal and destruction of disease plants. • Remove possible weed host plants. • Control vectors with recommended insecticide before disease spreads. • Avoid smoking when working in the field or handling seedlings
	Wilt disease (*Fusarium pallidoroseum)* (Pre-harvest – vegetative stage)	• Use certified disease free seeds. • Take seeds only from disease free plants. • Grow plants in well drained soils

Pest		Recommended cultural practice and direct interventions
		• Practice long rotation with non susceptible hosts (more than 5 years in severe infestations; rotate with cereals, pulses, root and tubers, etc). • Destroy diseased plants. • Plant on ridges. • Increase pH level by liming where soil pH is below the recommended level of 6.0-6.8. • Treat seeds with recommended fungicide before planting. • Plant in balanced fertile soils neither too acidic nor too alkaline. • Irrigate at regular intervals with potable water

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 35: IPM Practices for Cucurbits (cucumber, melon, pumpkin and courgette)

Pest		Recommended cultural practice and direct interventions
Insect	Aphids *(Aphis gossypii)* (Pre-harvest stage-vegetative stage)	• Observe build up of predators (ladybird beetles, lacewings, hoverflies) • Use appropriate pesticide or neem extracts if need arises (check for winged aphids as transmitters) • Observe build up of aphid populations and of natural enemies
	Melon flies (Pre-harvest and post harvest – fruit stage before and after harvest)	• Good sanitation practices are of paramount importance: frequent picking, destruction of infested fruits • Do not dispose of culied fruit with live melon fly larvae in areas close to the field • Pick all infested fruits and bury them deep to break their life cycle and prevent them from serving as field reservoirs. • Eliminate all alternate hosts that serve as reservoirs. • Periodically monitor melon fly populations through trapping • Bag fruits • Spray around the plants as bait • As a preventive measure in known high infestation areas spray with appropriate pesticides starting from flowering
Disease	Cucumber mosaic virus disease (CMV) (Pre-harvest – vegetative to fruiting stages)	• Eradicate infected plants in vegetative stage. • Select tolerant varieties where applicable • Control aphids (vectors) with insecticides before disease spreads • Try spraying with emulgated oil (e.g. milk powder) to keep winged aphids from flying. • Avoid transmission by tools and cultivation practices. • Plant during wet season when least likely to occur. • Wash and clean farm tools thoroughly. • Destroy alternate weedy hosts close to the field
	Powdery mildew (*Erysiphe cichoracearum)* (Pre-harvest stage)	• Control weeds and eliminate volunteer cucurbit crops around the field or in the field • Practice good sanitation • Try to spray with sodium bicarbonate and potassium silicate • Plant resistant varieties where applicable • Use EPA approved pesticides and strictly observe pre harvesting intervals.
	Angular leaf spot (*Pseudomonas lachrymans)*	• Practice a three-year crop rotation.

Pest		Recommended cultural practice and direct interventions
	(Pre-harvest – vegetative stage)	• Plant disease free seed (certified or selected) from selected disease free, ripe fruits • Plant resistant varieties where available • Eradicate all affected plants (uproot and burn or feed to animals). • Do not work in the field when foliage is wet. • Monitor disease • At first sight of disease in wet season, spray with copper or other registered and recommended fungicides and then repeat at 8-10 days interval and thereafter with copper fungicide, if there is a history of heavy attacks and favourable weather
	Downy mildew *(Pseudoperonospora cubensis)* (Pre-harvest – vegetative to generative stage)	• Grow young plants away from older plants • Ensure adequate spacing to lower humidity • Avoid overhead irrigation • Eradicate diseased plants • Monitor disease • At first sight of disease in wet season, spray with copper or other registered and recommended fungicides and then repeat at 8-10 days interval and thereafter with copper fungicide, if there is a history of heavy attacks and favourable weather

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 36: IPM Practices for Tomato

Pest		Recommended cultural practice and direct interventions
Insect	Aphids *(Aphis gossypii)* (Pre-harvest – vegetative to reproductive stages)	• Neem extract sprays recommended if populations are high, following AESA • When attacked in early growth, spray with quick acting, short persistent Organo-Phosphate insecticide following AESA • Spray solution of local soap (1-2%) if infestation is heavy)
	Fruit borers (American bollworms *[Helicoverpa armigera]* and (Pre-harvest –fruiting stage) leaf-eating caterpillars (cotton leafworms *[Spodoptera littoralis]*) (Pre-harvest –vegetative to reproductive stage	• Grow trap crops such as pigeon pea (Cajanus cajan) and Crotalaria in and around tomato fields • As soon as young caterpillars are seen, spray with Bacillus thuringiensis based bio-pesticides, neem seed extracts or short residual pyrethroid, after AESA • Predators and parasitoids usually control the pest • Use Bacillus thuringiensis products or neem extracts following AESA
	Fruit fly (Rhagoletis ochraspis) (Pre-harvest – fruiting stage)	• All infected fruits should be gathered and destroyed • Destroy wild host plants, e.g cherry tomatoes
	Root-knot nematodes (*Meloidogyne spp.)* (Pre-harvest – all stages, from seedling to fruiting)	• Crop rotation (at least 3 years) with non-host crops (e.g. cereals, pulses, cassava etc) • Plant Tagetes spp. (marigold) in alternate rows or as intercrop • Plant Tagetes spp. Or Crotalaria as fallow crop

Pest		Recommended cultural practice and direct interventions
		• Add organic matter to stimulate and encourage antagonistic organisms in soil • Flood field if water can be controlled
	Tomato mirid bugs *(Cyrtopeltis teriuis)* (Pre-harvest –vegetative stage)	• Usually no control necessary • Spray with a quick acting but ephemeral carbamate or organo-phosphate insecticide if damage is likely to be subnstantial after AESA
	White flies *(Bemisia tabaci)* (Pre-harvest – seedling to reproductive stages)	• Use yellow sticky traps to reduce populations but cannot prevent the spread of TYLCV • Spray solution of local soap (1-2%) if infestation is heavy
Disease	Dumping-off disease *(Pythium spp.)* (Pre-harvest –seedling stage)	• Use clean, hot water treated seeds • Use subsoil for nursery seedbed. Also apply solarization • Sterilize soil for seed boxes. Drain off excess water • Avoid overcrowding in nursery • Drench soil with copper fungicide
	Early (or dry) tomato blight *(Alternaria solani)* (Pre-harvest – vegetative to fruiting stages)	• Remove and burn affected leaves • Rotate crops and observe strict sanitation (no new plots alongside old ones) • Use clean, disinfected seeds • Practice staking and mulching • Spray with fungicides when environmental conditions are favourable for infection (cool and humid, for several days after rains), or at first sign of disease and every 7-10 days there after
	Late blight *(Phytophtora infestans)* (Pre-harvest – vegetative to fruiting stages)	• See early blight above • Grow resistant cultivars where available • Use copper fungicides after AESA in disease favoring weather • Remove and destroy infected plants detected early • Avoid wetting plants for protracted periods
	Rots and cankers *(Phoma spp., Phomopsis spp.)* (Pre-harvest – vegetative to reproductive stages)	• Remove and destroy infected debris • Avoid planting in infested fields for 3 years • Adequate spacing between rows and plants • Practice staking • Use seed from uninfected fields • Hot water treated seeds 30mins at 122oF • Spray with a copper fungicide after AESA
	Tomato yellow leave curl virus (TYLCV) (Pre-harvest – seedling to reproductive stages)	• Rotate crops (minimum 2 years) • Destroy weeds • Use resistant varieties • Control vector chemically with contact insecticide or 1-2% solution of local soap (*alata samina)* □ Rogue infested plants early, from seedbed on, and destroy □ Enhance nutrition to help plants recover
	Fusarium wilts *(Fusarium oxysporum)* (Pre-harvest – vegetative to reproductive stages)	• Destroy whole plant and roots after harvest • Use resistant varieties (e.g. Roma VF) • Follow strict field sanitation • Remove solanaceous weeds • Avoid infected fields • Use health seedlings

Pest		Recommended cultural practice and direct interventions
		• Controlled burning on fields • Use clean seed-beds (subsoil nurseries, solarization) • Avoid excessive use of nitrogen fertilizer, which encourages the fungus • Practice rotation with non solanaceous crops (minimum of 5 years)

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 37: IPM Practices for Pepper (hot and sweet pepper attacked by same pests and diseases)

Pest		Recommended cultural practice and direct interventions
Insect	Root-knot nematodes (*Meloidogyne spp)* (Pre-harvest – all stages, starting at nursery)	• Practice plant rotation with non host (e.g. cereals, cassava, pulses etc.) • Avoid infected soils, grown with host crops before (e.g. tomato, garden eggs, okra, carrots, etc) • Rotate one season with marigold (Tagetes spp.) or plant marigold alongside peppers (Tagetes patula or Tagetes erecta) • Solarise (4-6 weeks) nursery soil before sowing • Use resistant variety if available • Improve soil fertility by increasing levels of organic matter to alleviate and suppress nematode damage • Uproot plants after harvesting and burn them • Flooding the soil for a few weeks will reduce nematode population
	White flies *(Bemisia tabaci)* and Aphids *(Ahis gossypii)* (Pre-harvest – all stages)	• Encourage the presence of natural enemies (predators or parasites) by promotion of vegetation along field edges. • Moderate use of nitrogen fertilizer. • Use resistant varieties where available. • Controlled in nature by hymenopteran parasitoids Encarsia spp and Eretmocerus spp, by phytoseiid mites, Amblyseius spp and by Chrysopa spp (lace wings). • Use of repellents such as botanicals. • Spray with soap solution or neem extract • Use yellow sticky traps • Use trap crops and use sprinkler or over head irrigation. • African marigolds and masturtiums intercropped with pepper discourage whiteflies • Chemical spray is not necessary
Disease	Leaf spot *(Cercospora capsicii)* (Pre-harvest - vegetative stage)	• Use only certified disease free seeds • Practice a three-year rotation with non-host plants like cereals and pulses • Burn or plough deep crop debris after harvest • Hot water treatment of seed • Spray with a recommended fungicide after AESA
	Pepper leaf curl mosaic virus (Pre-harvest – all stages from vegetative stage)	• Strict sanitation by removal and destruction of diseased plants, especially before fruit set • Remove weed from within and around the field (solanaceous), which are alternate host • Ensure balance nutrition • Use sticky yellow traps to trap vector (white fly) • Use repellents such as botanicals

Pest		Recommended cultural practice and direct interventions
		• Spray with soap solution or neem extract or apply a fast acting chemical as soon as flying vectors are seen on young plants • Use resistant varieties where available • Do not smoke while working on the field
	Pepper mottle virus (Pre-harvest –vegetative stage)	• Plant only healthy virus free seed from a reliable source • Remove all weeds, which may act as host for aphids, particularly solanaceae
	Pepper wilt disease/stem and root rot *(Fusarium oxysporum, Fusarium solani)* (Pre-harvest stage)	• Use certified seeds (disease free seeds) • Practice crop rotation for at least three years with non host crops

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

Table 38: IPM Practices forOnion

Pest		Recommended cultural practice and direct interventions
Insect	Onion flies (*Delia antique)* (Pre-harvest – vegetative stage)	• Practice crop rotation with non host crop (not from onion family). Infested plants should be carefully uprooted and burnt or buried deeply. • Destroy crop debris after harvesting.
	Onion thrips (*Thrips tabaci)* (Pre-harvest – all stages, from seedling)	• Grow tolerant varieties. • Plant early to avoid pest attack or organize closed season. • Irrigate regularly (twice daily). • Apply appropriate insecticides approved by EPA as a last resort (>30 thrips scouted) after AESA. • Maintain weed free field and borders
Disease	Bacterial soft rot (*Erwinia carotovora)* (Post-harvest – storage)	• Cure onion bulbs before storage • Clean store before use • Create well aerated storage conditions • Check store regularly for rotting onions (weekly) and remove them • Remove infested bulbs • Store only onions that are fully mature with collapsed necks • Avoid harvesting onions during rainy day
	Downy mildew disease (*Peronospora destructor)* (Pre-harvest – vegetative stage)	• Burn plant debris • Plant only healthy disease free seeds • Keep field free from weeds • Plant in fields with well drained soils • Avoid over irrigation • Practice a four-year rotation • Excess nitrogen should be avoided • Rogue out affected plants • Plants that are to be used for seed production should be isolated from the main crop • Use resistant varieties • Spray with a appropriate fungicide approved by EPA every 7-10 days (add sticker spreader) after AESA • Select field with well drained soil
	Mould *(Aspergillus niger)*	• Cure onion bulbs before storage • Clean store before use

	(Post-harvest – storage)	• Create well aerated storage conditions • Check store regularly for mouldy onions (weekly) and remove them • Store only onions that are fully mature with collapsed necks
	Purple blotch (*Alternaria porri)* (Pre-harvest – from seedling stage on)	• Organism persists in crop residue so gather and burn all plant residues in the field • Use seeds only from disease free plots. • Practice long rotation (>5 years) with unrelated crops such as cabbage, tomato, maize or beans. • Treat seeds with appropriate chemical. • Use resistant varieties when available. • Spray with appropriate EPA approved fungicide during rainy season and strictly observe pre-harvest intervals

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

4.6.3 Recommended IPM Practices for Cereals and Pulses Crop Pests/Disease

Table 39: Recommended IPM Practices for Sorghum

Pest		Recommended management practices
Insect	Armyworms (*Spodoptera exempta)*	(see under maize)
	Greater grain weevil (*Sitophilus spp.)* (Post harvest stage)	(see Section 4.7.5)
	Sorghum shoot flies *(Atherigona soccata)* (Pre-harvest stage)	• Observe recommended time of planting to avoid the pest • Plant recommended varieties • Destroy infected crop residues by burying • Apply recommended insecticides if necessary e.g. endosulfan or fenitrothion
	Stem borers *(Busseola fusca, Sesamia calamistis, Eldana saccharina)* (Pre-harvest stage)	• Stalks are buried or burned to eliminate diapausing pupae • Early sowing reduces infestation • Intercropping with pulses such as cowpea and groundnut • Neem(arobani) powder (4-5 gm i.e., pinch of 3 fingers) per funnel • Neem seed cake (4 gm/hole) during planting • Use the extract of *Neuratanenia mitis*, a botanical pesticide • Use EPA approved insecticide
Disease	Downy mildew (*Sclerospora sorghi)* (Pre-harvest stage)	• Early sowing • Use of disease free seeds/certified seeds • Roughing of infected plants to avoid secondary infection
	Striga (witchweed) (*Striga hermonthica, S. asiatica)* and other weeds (Pre-harvest stage)	(see under maize)

Table 40: Recommended IPM Practices for Rice

Pest		Recommended management practices
Insect	Armyworms (*Spodoptera exempta)*	(see under maize)
	African gall midges (*Orseolina oryzivora)*	• Plant recommended early maturing varieties • Destruction of eggs in the seedbeds • Early planting • Proper fertilization
	Stalked-eye shoot flies *(Diopsis spp)*	

	Stem borers *(Chilo spp, Maliarpha separatella, Sesamia calamistis)*	• Use recommended plant spacing • Observe simultaneous planting • Destruction of stubble after harvest • Clean weeding • Biological control for *C. partellus* (already introduced and released) • Plough after harvest to expose the eggs to natural enemies
	Weeds (all type)	• Early clean weeding • Use recommended herbicides if necessary
	Birds, rats, rodents	• Scaring • Bush clearing • Early weeding and field sanitation • Early harvesting • Monitoring and management of outbreak flocks • Bird trapping • Farmers to scout potential breeding sites and destroy nests □ Monitoring and organise aerial spray based upon advice from PPRSD • Spot spraying, targeting roosting sites (carried out by PPRSD)
Disease	Rice blast (*Pyricularia oryzae)*	• Destruction of crop residues • Clean seeds • Avoid use of excessive nitrogen fertilizers • Use of wide spacing to avoid overcrowding • Use resistance varieties where available • Appropriate crop rotation • Timely planting • Burying crop debris
	Rice brown leaf spot (*Helminthosporium oryzae)*	
	Sheath rot (Acrocylindrium oryzae)	
	Rice yellow mottle virus (RYMV)	• Field sanitation including burning of crop residues and removal of volunteer plants • • Use of resistant varieties

Table 41: Recommended IPM Practices for Maize

Pest		Recommended management practices
Insect	Armyworms (*Spodoptera exempta)* (Pre-harvest stage)	• Use pheromone traps to detect when adult months are flying and preparing to lay eggs • During outbreaks immediately contact PPRSD / DAES • Use approved short-term persistence pesticides to spray young caterpillars
	Larger grain borers (*Prostephanus truncatus*) (Post-harvest)	• Use air tight and clean containers for storage • Store in clean, well-aerated stores with low relative humidity • Dehusk and thresh after harvest • Ensure grain in properly dried, cleaned before storage • Dust with recommended insecticide and/or botanical extracts
	Greater grain weevil (*Sitophilus spp.)*	
	Stem borers *(Busseola fusca, Sesamia calamistis, Eldana saccharina)* (Pre-harvest stage)	• Intercropping with pulses • Early sowing and early maturing varieties reduce infestation • Destroy (make compost, burn or feed livestock) crop residues • Apply neem seed cake during planting (4gm/hole)

Pest		Recommended management practices
		• Apply neem cake (a 50:50 mixture of neem and sawdust) at the rate of 1g per plant into the funnels in cereal stems • Use the extract botanical pesticides
Disease	Maize streak virus (virus transmitted by insects known as leaf hoppers) (Pre-harvest stage)	• Early planting • Observe recommended time of planting to avoid the diseases • Plant certified seeds/tolerant varieties (all certified maize varieties in West Africa are streak virus resistant)
	Striga (witchweed) (*Striga hermonthica, S. asiatica)* and all other weeds (Pre-harvest)	• Crop rotation • Proper land preparation • Timely weeding (at 2 and 5 weeks after planting) • Use recommended herbicides when necessary • Witch weed (*Striga* spp) - Hand pulling before flowering to avoid seed formation • Use of false host plants e.g. rotation of maize with legumes • Application of high quantities of farm yard manure

Table 42: Recommended IPM Practices for Millet

Pest		Recommended management practices
Insect	Armyworms (*Spodoptera exempta)* (Pre-harvest stage)	(see under maize)
	Downy mildew (*Sclerospora graminicola)* (Pre-harvest stage)	• Early sowing • Use of disease free seeds • Transplanting the crop suffers less from the disease • Roughing of infected plants to avoid • secondary infection
	Stem borers *(Busseola fusca, Sesamia calamistis, Eldana saccharina, Coniesta spp)* (Pre-harvest stage)	• Stalks are buried or burned to eliminate diapausing larvae • Early sowing reduces infestation • Intercropping with pulses such as cowpea and groundnut • Neem(arobani) powder (4-5 gm i.e. pinch of 3 fingers) per funnel • Neem seed cake (4 gm/hole) during planting • Biological control • • Use the extract of *Neuratanenia mitis*, a botanical pesticide
Disease	Striga (witchweed) (*Striga hermonthica, S. asiatica)* and other weeds (Pre-harvest stage)	(see under maize)

4.6.4: Recommended IPM Practices for Pulses/Grain Legumes

Table 43: Recommended IPM Practices for Beans (Cowpea, Soybean)

Pest		Recommended management practices
Insect	Aphids (*Aphis craccivora and other species)* (Pre-harvest stage)	• Promote build up of indigenous natural enemies • Observe recommended time of planting • Apply wood ash in case of a heavy attack • Carry our regular crop inspection to detect early attacks • • Apply recommended insecticide when necessary
	Storage weevils *(Callosobruchus maculates)*	• (see Section 4.7.6)

Pest		Recommended management practices
	(Post-harvest stage)	
	Flower thrips *(Megalurothrips sjoestedtii)* (Pre-harvest stage)	• Use resistant varieties if available • Adopt mixed cropping/intercropping system with cereals • Biological control • Practice crop rotation • Apply recommended selective insecticides if absolutely necessary • Apply botanical extracts (e.g. neem seed or leaf extracts in water)
	Pod borers (*Maruca vitrata, Euchrysops sp.)* (Pre-harvest stage)	• Apply recommended insecticides or botanical extracts • Promote build up of indigenous natural enemies • use resistant varieties if available • Biological control • Crop rotation
	Sucking bugs (*Anoplocnemis spp., Clavigralla spp. And other species)* (Pre-harvest stage)	• Use resistant varieties if available • Promote build up of indigenous natural enemies • Mixed cropping system • Biological control • Crop rotation
Disease	Anthracnose disease (*Colletotrichum lindemuthianum)* (Pre-harvest stage)	• Use of resistance varieties • Use of healthy seeds • Crop rotation • Seed dressing • Post harvest tillage • Field sanitation • Plant tolerant/resistant varieties
	Mosaic virus diseases (Pre-harvest stage)	• Plant tolerant/resistant varieties if available • Effect good control of aphids
	Striga (witchweed) *(Striga gesnerioides)* and other weeds (Pre-harvest stage)	• (see under maize) • Early and frequent weeding

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 4

4.6.4: Recommended IPM Practices for Roots and Tubers Crop Pests/Disease

Table 44: Recommended IPM Practices for Cassava

Pest		Recommended management practices
Insect	Cassava green mites *(Mononychellus monihoti)*	• Use predatory mites • Use mature healthy cassava stems • Avoid spraying of chemical pesticides • Use varieties that produce many branches and leaves
	Cassava Mealybug (*Phenacoccus manihoti)*	• Biological control • Use mature healthy cassava stems
	Variegated grasshopper *(Zonocerus variegatus and Z. elegans)*	• Biological control • Dig up the soil to expose laid eggs
	Termites (*Macrotermes spp.*)	• Use predatory mites • Encourage growth of weeds along the farm • Use mature healthy cassava stems • Avoid spraying of chemical pesticides

Disease	Cassava anthracnose disease *(Colletotrichum gleosporoides)*	• Avoid planting at the peak of the rain • Plant early in the season
	Cassava bacterial blight *(Xanthomonas compestris)*	• Plant early in the season • Avoid planting at the peak of the rain

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 3

Table 45: Recommended IPM Practices for Yam

Pest		Recommended management practices
Insect	Mealy bugs *(Forrisia virgata, Phenacoccus madeirensis)*	• Plant in land that is well away from forest and swamps
	Millipedes *(Myriapoda spp.)*	• Plant in land that is well away from forest and swamps
	Termites *(Microtermes spp., Odontotermes spp. And other species)*	• Ensure soil is not too dry
	Yam nematodes *(Scutellonema spp., Meloidogyne spp.)*	• Avoid infected soils • Solarise (4-6 weeks) nursery soil before sowing • Use resistant variety if available • Improve soil fertility by increasing levels of organic matter to alleviate and suppress nematode damage • Uproot plants after harvesting and burn them • Flooding the soil for a few weeks will reduce nematode population
	Yam tuber beetles *(Heteroligus spp.)*	• Plant in land that is well away from forest and swamps • Stake yam vines and pile soil around the base of the yam (earthing up)
Disease	Anthracnose disease *(Colletotrichum gleosporoides)*	• Use small whole yam tubers that are high value planting materials
	Dieback /wilt *(Colletotrichum gleosporoides, Rhizoctonia solani, Fusarium spp. and other species)*	• Clean whole tuber • Use small whole yam tubers that are high value planting materials • Store in well aerated barns or stores • Check regularly to remove infested tubers
	Storage dry rot (Penicillium spp., *Rhizoctonia spp., Fusarium spp)* soft rot *(Erwinia spp.)*	• Ensure storage area is always clean and dry

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 3

Table 46: Recommended IPM Practices for Sweet Potato

Pest		Recommended management practices
Insect	Sweet potato butterflies (*Acraea acerate)*	• Early planting recommended • Mechanically destroy butterflies Feed in groups on the leaves. The chew and leaves transparent skin on the leaves. Causes pupation on the leaves or stems.
	Sweet potato weevils *(Cylas spp.)*	• Re-ridge about 30-days after planting to close up soil cracks • Avoid late weeding • Clean farm fields clean • Close ridge after harvesting to cover any exposed tubers • Store harvested produce in ventilated areas • Encourage processing i.e., drying, boiling, making chips after harvesting

		It is believed to cause crop losses of up to 70%. Adult weevils attack and feed on underground tubers, leaves and vines.
	White flies *(Bemisia tabaci)* and aphids *(Aphis gossypii and other species)*	• Early planting preferred • Spray solution of local soap (1-2%) if infestation is heavy

Source: MoFA/PPRSD/GIZ: Integrated Pest Management Extension Guide 3

4.6.5 Management of post-harvest pests of cereal crops

Losses due to damage caused by the larger grain borer, weevils, rats/rodents, aflatoxins, and grain moths can be minimized through the following IPM strategies:

- Selection of tolerant varieties
- Timely harvest
- Dehusking and shelling
- Proper drying
- Sorting and cleaning of the produce before storage
- Cleaning & repair of storage facilities
- Use rodent guards in areas with rat problems
- Use improved granaries
- Use appropriate natural grain protectants where applicable
- Use recommended insecticides at recommended dosage
- Store grain in air tight containers. Where airtight containers are used store these in a shady place, preferably in-doors on raised platform to allow air circulations and prevent attack by mould.
- Carry out regular inspection of the store and produce. Timely detection of any damage to the grain and/or storage structure is essential to minimise potential loss or damage

Biological control of the Large Grain Borer (LGB) using *Teretriosoma nigrescens (Tn)* to minimise infestation from wild sources will be beneficial once appropriate strains of the *Tn* are identified and validated. This is a task of the national plant protection services (PPRSD) because the agents have to be reared and released in strategic sites.

4.6.6 Management of post-harvest pests of pulses

The most important post-harvest pest of pulses includes the storage weevil for cowpea and soybean and the storage beetle and grub for groundnuts. Losses due to damage caused by these pests can be minimized through the following IPM strategies:

- Dry seeds properly immediately after harvest and before storage to prevent attack by storage pests and diseases.
- Divide seeds into batches for short term (less than 3 months) and long-term storage, and treat only the long-term batch, if necessary, using neem oil at a rate of 2-4 ml/ kg of seed, or a recommended pesticide.
- Clean the store properly before storing pulses there; use containers that are airtight and clean, and do not allow humidity to build up.
- For storing cowpea and soybean, use triple bagging with polythene bags.
- Adopt solar disinfestations by heating cowpea and soybean grains between black and transparent plastic sheets.
- Treat small quantities of pulses for storage with wood ash, groundnut oil, neem oil or black pepper powder
- Use rodent guards in areas with rat/rodent problems

4.6.7 Pesticide applications - cereals, pulses and vegetables - in line with IPM approaches

The following considerations should be applied in the application of pesticides for cereals, pulses and vegetables:

(i) A decision to use chemical pesticides should be taken only as the very last resort and should also be based on conclusions reached from an agro-ecosystem analyses (AESA).
(ii) All pesticides should be EPA approved and PPRSD recommended.
(iii) If it is absolutely necessary to spray crops with pesticides, use selective rather than broad-spectrum pesticides.
(iv) All herbicides should be applied using knapsack sprayers.
(v) All the insecticides for storage pests of cereals/pulses are in dust form and therefore used as supplied without mixing with anything else.
(vi) The list of pesticides can change as new products are recommended and/or some of the chemicals are withdrawn. Therefore, always consult the retailer/stock list, the nearest PPRSD extension worker if in doubt and/read the label.

4.7 Controlling Pesticides used in Crop Protection

Every pesticide produced in Ghana and also imported is expected to be subjected to approval. This constitutes the primary barrier making it possible to filter the products entering the countries. In order to ensure that it is done, Phytosanitary Controls are stationed at the borders (sea ports, airports, and roads). It is done by the PPRSD and assisted by custom officials at the entry points also in charge of pesticides control.

The control of pesticides is also done in principle at the distribution level in the towns/villages through decentralized services, which see to it that distributors, dealers and resellers abide by the established texts (sales permit).

In order to ensure the efficient use of the pesticides for the fight against crop pests/diseases, the maximum residue limits (MRL) have been defined by European markets/EU standards, if not it is the Codex Alimentarius that is considered. Ghana is required to comply with sanitary and phytosanitary measures (SPS) and especially the pesticides residue values available in farm products that should not exceed the acceptable maximum residue limit, otherwise produce from Ghana will be banned. Currently, compliance with MRL is restricted to crops earmarked for export. There are no restrictions on MRL for crop products sold locally. It is an accepted fact by West African countries that the presence of residues in food stuff is a reality.

The Ghana Standard Authority laboratory is qualified for the analysis of the MRL. It is important both from an economic point of view (exports) and also from a sanitary/health point of view to systematically carry out the monitoring of MRL for crops sold in the local markets.

4.8 Management and Use of Pesticides

4.8.1 Production and importation of pesticides

In West Africa, there are no industrial units ensuring the synthesis of active materials through branded laboratories. Thus, production of pesticides in the proper way is not effective in the whole of these countries. Finished products are rather imported notably through mother companies represented at the national level or active matters for formulation purposes. In Ghana, the following can be cited among others – Abuakwa Formulation unit, Wienco, Dizengoff, CHEMICO, Reiss & Co., Calli Ghana. The volume of pesticide imports for the 2020 is provided in the table below (Table 47).

Table 47: Summary of pesticides import -2020

Chemical Type	Unit	Quantity
Insecticides	Mt	6,354.1
Herbicides	Mt	30.154.1
Fungicides	MT	1,105

Source: EPA/CCMC, 2021

4.8.2 Selling and distribution Practices

The distribution channel is entirely private. Suppliers who import the products feed the market through distributors, retailers who supply traders and they display for sale. Certain distribution spots – sales point- are well kept and abide by commercial rules; in general, the products are well displayed on shelves. However, at the level of many retailers and traders who display for sale there are great risks.

On account of the low financial capacity of local farmers/peasants and other buyers, some of the products are sold in retail. This practice is carried out without caution notably with decanting. Smaller retailers may decant products into smaller containers to meet farmers' purchasing ability, usually without proper labels, which should describe active ingredients and concentration, dosage, handling instructions and hazards, batch and date of expiry.

Some retailers are polyvalent and therefore engage in other types of commerce in the same premises. Distribution is also carried out sometimes without authorisation as required by the regulation and with the personnel not having received any training in the pesticides chemical products domain in general. In actual fact many of these actors do not have the requisite approvals/permits/license. Nevertheless, retailers affiliated to suppliers receive this type of training through the suppliers themselves.

Other challenges

The problems associated with the adulteration of pesticides by some pesticide dealers have created real concern for a wide variety of interest groups in recent times. Stakeholders from the Environmental Protection Agency (EPA), Ministry of Food and Agriculture (MOFA) as well as farmers have observed that some pesticide dealers adulterate and fake pesticides, using methods such as the alteration of expiry dates of pesticides, the change of labels on pesticide containers, and the preparation and bottling of mixtures in already used pesticide containers.

These criminal and unethical practices are attributed to the desire of bad dealers to make huge profits. These unscrupulous dealers exploit the low literacy levels and financial capacity of their customers, most of whom are smallholder farmers, who cannot tell the difference between fake and genuine products and the implications and sources of low-priced pesticides.

4.8.3 Use of pesticides by farmers

In most cases, farmers themselves or farm assistants spray the plant protection products. The protection of farmers and farm assistants against any type of contamination by pesticides is not guaranteed. Farmers use various types of applications and in most cases the appropriate personal protective equipment (PPEs) such as hand gloves, overalls etc are not worn. The time of spray during the day is sometimes not appropriate. Farmers have been observed spraying during hot afternoons when sunshine is at its peak and such farmers who are usually not in appropriate PPEs are exposed through inhalation and skin contacts.

As regards the bad use of pesticides, the treatments are done several times which leads to product waste but also to a lack of good judgement as regards their efficiency. The documents that allow to monitor product traceability are very scarce or even non-existent as well as the notification of product usage. All of this could lead to the availability of residues in the products with the associated difficulties to export these.

4.8.4 Management of pesticide containers

The management of pesticides containers is under the responsibility of resellers and farmers because of the retail sales system. They find themselves with the most important share of the empty containers which are differently managed.

- Sales to pesticides buyers who do not have empty containers and who straightforward reuse these containers;
- Sales for other uses

- Farmers/buyers reuse empty containers for storage purposes at household levels.

Littering of farms with empty pesticide containers
With big commercial farms or companies, management of pesticide containers is expected to be clearly stated in their environmental management plans (EMP) to the EPA. Usually, these companies indicated that they will liaise with the appropriate MoFA office to provide guidance on the disposal of the containers.

Facilities for the treatment of large empty containers are not known to be installed or in use in the country at the moment. Such facilities will be useful for the treatment of high-capacity drums for recycling or reuse. A collection and disposal system and cleaning of pesticide containers need to be put in place by PPRSD-MoFA and the EPA under the FSRP2. Currently there are few private companies recycling empty containers and other plastics. Farmers supported by the project should be linked to these companies for efficient disposal of empty containers.

4.8.5 Accidents resulting from pesticide use

As regards the sanitary consequences of the use of pesticides, there are often cases of death or intoxication. Indeed, cases of lethal intoxication have been recorded for human, and animals. PAN Africa keeps a database on the cases that occurred in Senegal and in some countries of the sub region. The Ghana Poison Control Centre is expected to keep records on pesticide poisoning and accidents. The existence of the Centre is not very popular among many Ghanaians. The Centre needs to be supported for the collection and keeping of accurate statistics on these events. Currently, the data on pesticide poisoning and accidents resulting from pesticides use or disposal must be fragmented and remains in the various newspapers that have reported such cases, and various hospital cases. There is the need to create awareness raising actions that will target the different pesticide users in order to avoid accidents and incidents.

4.9 General health problems and environmental hazards associated with pesticides

There are acute and chronic health effects, and these effects may manifest as local or systemic effects. They include skin irritations, such as itching, rashes, blisters, burns, wounds, irritation of throat leading to cough or difficulty in breathing with or without wheezing or choking, chest pain, burning mouth and throat with pain on swallowing, runny nose, sore throat, headache, dizziness, sudden collapse with or without unconsciousness.

Others include eye irritation, blurred vision, lots of tears or saliva or mucus secretion and sweating, nausea, vomiting, chest infections due to aspiration of vomits, fever, abdominal pain or discomfort, diarrhoea, uncontrolled urination and defaecation, slowing of heartbeat or rapid heartbeat, weakness including muscles for breathing, muscle twitching or pains, tremors, convulsion, coma, hallucinations, pain and numbness in legs, allergic reactions. Others are problems with liver, kidney, or nerves functions, improper functioning of the heart etc. The table below provides a summary of pesticide problems relating to human health, environment and crops.

Table 48: Pesticide problems relating to health, environment and crops

Hazards to health	Hazards to Environment	Hazards to crops
Acute poisoning: 3 million poisonings including 20,000 unintentional deaths occur annually (WHO). Symptoms of acute poisoning include severe headaches, nausea, depression vomiting, diarrhoea, eye irritation, severe fatigue and skin rashes.	Contamination of drinking water and ground water. Water contamination kills fish. Soil contamination. Wildlife and domestic animals can be killed by spray drift or drinking contaminated water.	Pesticide resistance: 520 species of insects and mites, 150 plant diseases; and 113 weeds are resistant to pesticides (FAO). Resistance can create treadmill syndrome, as farmers use increasing inputs to little effect, while elimination of beneficial insects Causes secondary pest outbreaks.

Hazards to health	Hazards to Environment	Hazards to crops
Chronic ill-health problems can affect women and men, girls and boys exposed to pesticides, whether because of their occupation or because they live near areas of use. Such problems can include neurological disorders, cancers, infertility and birth defects and other reproductive disorders.	Exposure may also cause infertility and behavioural disruption. Persistence in the environment and accumulation in the food chain leads to diverse environmental impacts. Loss of biodiversity in natural and agricultural environments	High cost of pesticides can lead to falling incomes for farmers: Newer products are often safer, but are more expensive. Farming communities lose knowledge of good horticultural practices and become dependent on expensive external inputs.

5.0 POTENTIAL IMPACTS AND CHALLENGES ASSOCIATED WITH FSRP2 INTERVENTIONS

The use of various agro-chemicals especially pesticides is a common feature of crop production activities across the country and is expected to be employed during the implementation of the FSRP2 interventions. This section assesses the potential risks/impacts associated with the procurement, transport, storage, use / handling and disposal of pesticides are summarised in the table below:

Table 49: Summary of the environmental and social risks of pesticide application

Activities		Risks	
		Human Environment	*Biophysical Environment*
Transport	- Use of public transportation vehicles for people and goods	- Passenger contamination - Inhalation of product vapours - Inhalation of contaminated dust; - Skin burns from contact.	Accidental spills; contamination of soil and groundwater resources through leaching in the event of a traffic accident
Storage	- Non-compliance with national regulations and FAO standards on pesticide storage and/or obsolete stocks; - Lack of training of pesticide traders.	- Odour nuisances; - Contact with the skin during handling; - Bioaccumulation of pesticides.	(In the event of an uncontrolled spill or leak) - Soil contamination - Surface Water Contamination - Impairment of ambient air quality
Handling / manipulation	- Insufficient training and awareness-raising activities for authorised distributors; - Lack of supervision of phytosanitary agents and producers.	- Inhalation of vapors; - Dermal contact by splash during preparation	- Contamination of water sources by washing containers; - Accidental spills and contamination of soil and groundwater resources
Elimination of Packaging/ containers	- Failure of the empty packaging management system (storage, collection, transport, rinsing and compaction) - Lack of appropriate equipment for the disposal of empty packaging.	- Health concerns related to the ingestion of pesticide residues when reusing empty containers (plastic cans and metal drums) that have not been properly cleaned; - Dermal and respiratory conditions - Chronic intoxication of personnel in the distribution chain	- Spill of product funds on soils; - Groundwater contamination
Washing containers	- Information and awareness system failure	- Low level of public awareness of the health risks associated with handling pesticides	- Acute poisoning of fish and other crustaceans - Pollution of points (wells) and water bodies (ponds). - Water contamination by runoff or by wind action;

5.1 Impact of pesticides on water bodies

The use of agro-chemicals on farms could affect the freshwater resources: the main water bodies and underground water. Apart from these, there are a number of seasonal rivers and creeks within the project zone. The excessive use of agro-chemicals such as herbicides can contaminate water bodies through run off especially during the rainy season and/or water logging, water pollution as well as pH modification of the water bodies. The ecological effects of pesticides (and other organic contaminants) are varied and are often inter-related. Effects at the organism or ecological level are usually considered to be an early warning indicator of potential human health impacts. The major types of effects including the following will vary depending on the organism under investigation and the type of pesticide: Death of the organism; Cancers, tumours and lesions on fish and animals; Reproductive inhibition or failure; Suppression of immune system; Disruption of endocrine (hormonal) system; Cellular and DNA damage; Teratogenic effects (physical deformities such as hooked beaks on birds); Poor fish health marked by low red to white blood cell ratio, excessive slime on fish scales and gills, etc; Intergenerational effects (effects are not apparent until subsequent generations of the organism); Other physiological effects such as egg shell thinning.

5.2 Impact of pesticides on aquatic fauna

Pollution from agrochemicals may also affect aquatic animals in water bodies. Continued usage of pesticides could threaten the survival of small aquatic organisms that form the basis of the food web. In the aquatic ecosystems, runoff of organochlorine insecticides following rain events in adjacent streams lead to severe fish kills and the eradication of the stream invertebrate fauna over stretches of several kilometres.

5.3 Public health concerns from water-borne or water-related diseases

Water-borne or water-related diseases are commonly associated with the introduction of irrigation. The diseases most directly linked with irrigation are malaria and intestinal (is mortal) and urinary (blood in urine) bilharzia (schistosomiasis), whose vectors proliferate in the irrigation waters.

Uncovered trenches, excavations and manholes to be developed during the construction phase and the use of irrigation infrastructure such as canals, reservoirs and drains are potential breeding grounds for female anopheles' mosquitoes that transmit malaria. If not managed properly, malaria cases are likely to increase in the project areas under irrigation schemes. The project could increase mosquito pests which cause malaria in human beings. This could necessitate the use of malaria control pesticides.

Bilharzia is an infection caused by parasitic worms or blood flukes of certain species of the genus *Schistosoma*. Adult parasites live in the blood of mammals, but their life cycle requires a phase of asexual multiplication within a fresh-water snail host. The flukes infect humans through exposed skin in water, usually through swimming, bathing or wading. Improved sanitation such as latrines and safe drinking water, as well as yearly treatment with praziquantel, will reduce the prevalence of bilharzia.

5.4 Mycotoxin poisoning from poor maize drying

This is closely linked with mould development because of inadequate and delayed drying of maize. A number of studies by the Food Research Institute have confirmed the presence of myco-toxins in maize and maize products at unsafe levels, varying from 20 to 355 µg/kg aflatoxin from silo-stored maize and from 0.7 to 313 µg/kg aflatoxin in fermented maize-dough collected from major processing sites. Ghana has adopted the Codex acceptable level of 15µg/kg (or 15ppb) for aflatoxin content in maize and products thereof, including fermented maize dough.

These high levels have carcinogenic effects (liver), stunt growth and cognitive behavior in children, and weakens the immune system. The exact impacts of these high levels of myco-toxins on human health in Ghana are not known and documented.

5.5 Improper pesticide use and disposal of pesticide containers

This is caused by poor knowledge, inadequate equipment and storage, application of unregistered and non-approved pesticides and the use of an excessive dosage. With an average annual use of 12,355 mt of pesticides over the period 2007 – 2010, pesticides use is relatively moderate in Ghana.

There are pockets of high use in vegetable cultivation, such as in tomatoes, cabbage, onion and okra. The inappropriate use of pesticides is reflected in the pesticide content on vegetables. A recent study by Yafetto *et al., 2019* indicate that vegetables produced by farmers in Ghana are significantly contaminated and have poor microbiological quality that could potentially result in outbreak of foodborne illnesses.

The production of cereals and pulses will increase under the FSRP2 and this will require proper storage to prevent pests from ravaging the grains. Improper use of pesticides during storage is also a concern as pesticide residues above the MRLs are more likely to occur with stored grains.

Pesticide containers have been found to be reused at homes. Improper washing or cleaning could lead to harmful consequences where containers are reused as food or drink containers. The population groups at risk include women, children, elderly and rural farmers who are mostly illiterate and principal users of empty containers without proper treatment. An increase in pesticide containers in the project area is expected during the implementation stage and proper collecting system and disposal is required to minimize reuse of containers for domestic activities.

5.6 Production and market losses from fruit fly attacks

Fruit flies affect fruits such as mango, citrus, guava and papaya, and vegetables, like tomato, egg plant and pepper**.** The fruit fly *(Bactrocera invadens)* was identified in Ghana in 2005. Both males and females are similar in appearance but damage is often caused by females. They pierce the fruit to lay eggs. The larvae live and feed inside the fruit and destroy the pulp. The losses because of the fruit fly are major, including a likely ban on fresh fruits and vegetables exports from Ghana with the consequent reduction in foreign exchange earnings, post-harvest losses for sale in the domestic market, loss of farmers' income, and increased risk of exposure of producers and consumers to pesticides. Good Agricultural Practices, treatment of the fruits/vegetables and eventually the establishment of pest free zones are some of the control measures available.

5.7 Production losses and food security concerns from Armyworm and other crop pests and disease outbreaks

Armyworms are occasional pests but when they occur, the devastation is alarming and disastrous. The project will put large tracts of land under cereal and pulse cultivation and this can easily be devoured within few days during armyworm outbreaks. Food security concerns will arise because an outbreak could wipe-off most if not all cereal/pulses farms at the Accra Plains and its environs within few days. Cereals and pulses are key staple foods of Ghanaians. Adequate armyworm surveillance is required to contain and eliminate any threat.

Though pests and diseases have been with mankind since farming began, the problem has been accentuated as a result of expanded farm sizes, intensive methods applied and the need to make adequate returns on investment. According to MOFA, crop losses due to pests in the fields in Ghana are estimated to be 30%. Horticultural production has always been a hot spot for both pests and disease losses and the sometimes excessive use of agrochemicals. Any form of production losses will impact negatively on crop prices in the local market.

5.8 Abuses in pesticide supply and sales

The abuses associated with the supply and sale of pesticides are likely to occur under the Project and these abuses include:

- Use of banned and or unregistered pesticides
- Decanting of pesticides into improper containers without appropriate labels and use information at the retail level and farm gate points
- Supply and sale by unauthorized persons /persons without EPA/PPRSD license and permits
- Supply and sale of adulterated and or expired pesticides

6.0 INTEGRATED PEST AND PESTICIDE MANAGEMENT ACTION PLAN

The main purpose of the plan is to protect the biophysical and human environment through the promotion of the use of integrated pest management methods, capacity building of farmers, destruction of obsolete stocks, and environmental impact assessment of agricultural development projects likely to use a considerable quantity of pesticides, the management of empty containers and the provision to farmers of protection and spraying equipment. Various impacts and challenges are likely to be associated with the implementation of FSRP2 with regard to pest and pesticide management issues. The impacts and challenges identified from previous sections of the report include:

- Lack of IPM sustenance measures even though national pest control strategy is IPM;
- Likely pollution of water resources and aquatic life from pesticide usage;
- Public health concerns from water-borne diseases such as malaria and bilharzia that can cause the use of pesticides in controlling their vectors;
- Poisoning from improper use of pesticides by farmers and farm assistants;
- Poisoning from improper disposal of pesticide containers;
- Impact of fruit fly;
- Production losses from threats from other crop pests and diseases;
- Abuses associated with pesticide supply and sales; and
- General health and safety of farmers and environmental hazards.

Appropriate mitigation measures and implementation tools as well as monitoring indicators are required to be instituted to contain any adverse occurrence. The key actors to be involved in the implementation of the mitigation and management need to be identified as well. Table 50 below provides the action plan for pest and pesticide management during the implementation of FSRP2.

6.1 Issues identified during consultations

During the stakeholder engagement, several issues were identified and prioritized by stakeholders to improve pest and pesticide management.

At the institutional, legislative and regulatory level, issues such as porosity of national borders which allow for the influx of banned chemicals into the country; non-compliance with the regulations; insufficient regulation; lack of database on diseases in animal production; lack of quarantine infrastructure (station); need for capacity building; lack of awareness / absence of confirmation of farm animal diseases by the VSD; inadequate human resources, equipment logistics and financial resources for the field monitoring of IPM approaches were identified as the main concerns.

Monitoring is also a major concern for stakeholders with issues such as lack of personnel and equipment in assessing the impacts of pesticides and insufficient control over the use of pesticides identified. Inaccessibility of approved pesticides near farmers, lack of efficient treatment and waste disposal systems at the farms and insufficient extension of alternative methods to pesticides and integrated pest management were also identified as concern by farmers.

Farmers also raised concerns on issues regarding lack of regular training for farmers on pesticide use and management of empty packaging, inadequate information on the dangers related to the use of pesticides and illiteracy of the populations.

Table 50: Integrated Pest and Pesticide Management Action Plan

Impact issue / Pest & pesticide threat/ risk	Mitigation Measures	Implementation tool	Expected result	Monitoring indicators	Responsibility/ Key implementing actors
Mycotoxin poisoning from poor maize drying	Ensure adequate and timely drying of maize	Mycotoxin Elimination Plan (education, equipment/facilities, international standards etc)	Mycotoxin levels in maize produced meets international standards	• Number of farmers trained and educated in the proper way of maize drying	PPRSD-MoFA; DAES-MoFA, FRI
	Provide proper maize drying facilities			• Number and condition of maize drying facilities available	MoFA; FRI
	Ensure maize storage facilities are adequate and meet acceptable standards				
	Monitor mycotoxin levels in maize produced under the project			• Mycotoxin levels	GSA/FRI
Improper use of pesticides by farmers and farm assistants	Educate farmers and farm assistants on proper use of pesticides and pesticide use hazards	Pesticide hazards and use guide manual or leaflet for the project (include simple pictorial presentations)	Proper use of pesticides by farmers and farm assistants	• Number of cases of pesticide poisoning occurring under the project	PPRSD-MoFA; GHS/local hospitals and clinics
	Control and supervise pesticide use on farms	Adoption of IPM approaches/ techniques	Farmers trained in IPM techniques	• Number of farmers trained, Training records	PPRSD-MoFA, DAES-MoFA and Regional officers
	Monitor pesticide residue in crops	Random sampling procedure for crops and storage products	Pesticide residue in crops within acceptable limit/MRL	• Levels and trend of pesticide residue in sampled crops • Number of times exported crops are rejected due to pesticide residues	Ghana Standards Authority (GSA) / PPRSD-MoFA
Pollution of water resources and aquatic life	Control and supervise pesticide use by farmers	Adoption of IPM approaches/ techniques	Farmers trained in IPM techniques	• Number of farmers trained, Training records	PPRSD-MoFA, DAES-MoFA and Regional officers

Impact issue / Pest & pesticide threat/ risk	Mitigation Measures	Implementation tool	Expected result	Monitoring indicators	Responsibility/ Key implementing actors
	Proper disposal of pesticide containers by resellers/farmers	Pesticide container collection and disposal plan	Pesticide container disposal plan developed and implemented	• Number of farmers/ resellers aware of pesticide container disposal plan	PIU/MoFA/EPA
	Monitor pesticides in water resources	Environmental quality monitoring plan (linkage with Project ESMP)	Pesticide concentration in water resources	• Levels of pesticides in water resources	GIDA Environment Desk/ EPA
Public health concerns from water-borne or water related diseases in project areas under irrigation	Design appropriate irrigation systems and ensure functional operation system (removing aquatic vegetation, lining canals with cement or plastic, regularly fluctuating water levels, periodic rapid drying of irrigation canals)	a) Adoption of environmentally friendly irrigation system designs; b) Selection of experienced and proven contractors and consultants for project designs and construction; c) Effective operational maintenance system	a) Well functioning and environmentally friendly irrigation system; b) infrequent breakdown of system	• Number of times system breakdown in a given year	GIDA
	Monitor malaria and bilharzias cases in project area	Hospital/clinical records of malaria cases in project area	Malaria/bilharzia cases before and during project implementation established	• Trend in malaria/bilharzia cases during project implementation	Ministry of Health (MoH)/Ghana Health Service (GHS); Hospitals and clinics in project areas
	Make Deltamethrin Impregnated mosquito bed nets available at affordable prices to farmers and local community members	Project malaria and bilharzia control plan	Non-significant increase in malaria/bilharzia cases under project	• Frequency of reported malaria/bilharzia cases among farmers and communities • Monitor the number of malaria and bilharzia cases in the irrigated project areas from existing health centers.	Ministry of Health (MoH)/Ghana Health Service (GHS); Hospitals and clinics in project areas

Impact issue / Pest & pesticide threat/ risk	Mitigation Measures	Implementation tool	Expected result	Monitoring indicators	Responsibility/ Key implementing actors
	Make latrines and safe drinking water available in farming communities and provide yearly treatment with Praziquantel to minimize the bilharzia prevalence.				
Poisoning from improper disposal of pesticide containers	1. Educate farmers, farm assistants and local communities on health hazards associated with use of pesticide containers	1. Pesticide hazards and use guide manual or leaflet for the project	Farmers, farm assistants, FBOs, local communities educated on pesticide health hazards	• Number of cases of pesticide poisoning through use of pesticide containers; • Number of farmers returning empty pesticide containers at collection points; • Number of farmers, FBOs, resellers trained in proper cleaning of pesticide containers	a) PPRSD-MoFA, b) GHS/local hospitals and clinics
	2. Properly dispose pesticide containers	2. Pesticide container cleaning and disposal plan	Pesticide container cleaning and disposal plan developed and implemented		PPRSD/EPA
Threat from other crop pests and diseases	Educate and train farmers to adopt good agricultural practices (GAP)	Adoption of IPM techniques/ approaches	Farmers trained in IPM techniques and GAP	• Number of farmers trained, Training records • Incidence of crop pests • Production losses from crop pests	PPRSD-MoFA/ MoFA-DAES/ Regional officers
	Apply EPA approved and PPRSD recommended pesticides if necessary	Inspection of pesticides at farm/storage gate prior to use (Project Policy)	Applied pesticides registered and approved by key stakeholders and in conformity with IPM principles	• Records of pesticides applied at each farm	PPRSD-MoFA; MoFA-DAES/ MoFA Regional Officers

Impact issue / Pest & pesticide threat/ risk	Mitigation Measures	Implementation tool	Expected result	Monitoring indicators	Responsibility/ Key implementing actors
Production and market losses from fruit fly pest and armyworm outbreaks	Educate and train farmers to adopt good agricultural practices (GAP)	Adoption of IPM techniques/ approaches	1. Farmers trained in IPM techniques and GAP	• Number of farmers trained, Training records • Number of times exported crops rejected due to fruit fly pest • Production losses from crop pests	PPRSD-MoFA/ MoFA-DAES/ Regional officers
	Establish pest surveillance system	Early detection and warning system in place	Zero or minimal fruit fly/ armyworm cases	• Incidence of fruit fly /armyworm cases recorded	PPRSD-MoFA; MoFA-DAES / Regional officers
	Apply EPA approved and PPRSD recommended pesticides if necessary	Inspection of pesticides at farm/storage gate prior to use (Project Policy)	Applied pesticides registered and approved by key stakeholders and in conformity with IPM principles	• Records of pesticides applied at each farm	PPRSD-MoFA; MoFA-DAES/ MoFA Regional Officers
Abuses in pesticide supply and sales	Identify all pesticide distributors and resellers interested in providing services and products to farmers under the Project	Registration policy for all interested distributors and resellers under project	Only approved and licensed dealers and resellers supply pesticides under project	• Company registration documents • Evidence of license/permit to operate in pesticides • Evidence of location and contacts of suppliers/resellers	PPRSD of MoFA/ CCMC of EPA
	Confirm status and integrity of pesticides supplied under project	a.) All pesticides are to be in the original well labeled pesticide containers prior to use b.) No decanting of pesticides under this project c) Inspection of pesticides at farm gate prior to use	a) Only approved and registered pesticides used under project b) Banned pesticides avoided c) Fake and expired pesticides avoided d)Integrity of pesticide guaranteed at farm gate level	• List of pesticides supplied and used in line with Ghana EPA and USEPA list of registered and approved pesticides • Cases of pesticides found in non-original containers • inspection records for pesticides at farm gate prior to use	PPRSD-MoFA; MoFA-DAES/ MoFA Regional Officers

Impact issue / Pest & pesticide threat/ risk	Mitigation Measures	Implementation tool	Expected result	Monitoring indicators	Responsibility/ Key implementing actors
	Ban big pesticide containers to minimize decanting cases	Decanting policy (No decanting of pesticides under project)	All pesticides delivered for use are in the original containers	• Cases of pesticides found in non-original containers	PPRSD-MoFA; MoFA-DAES/ MoFA Regional Officers
Impact on post harvest losses due to pests	1. Provide adequate and proper storage facilities	Post-harvest loss reduction plan based on IPM techniques in place	a.) Post harvest losses avoided or minimised b) Applied pesticides registered and approved by key stakeholders and in conformity with IPM principles	• Number of farmers trained in IPM techniques for post harvest storage; Number and condition of storage facilities in use	MoFA-DAES
	2. Monitor incidence of post harvest pests			• Number of cases of post harvest pests	PPRSD-MoFA
	3. Confirm status and integrity of pesticides at storage gate prior to use	Inspection of pesticides at farm/storage gate prior to use (Project Policy)		• Records of pesticides applied at storage sites/ rooms	PPRSD-MoFA; MoFA-DAES/ MoFA Regional Officers
General health and safety of farmers/crops and environmental hazards	Educate farmers to adopt GAP based upon IPM techniques; and do not use chemical pesticides unless advised by PPRSD	IPM techniques with emphasis on cultural and biological forms of pest control	Compliance with national IPM policy and WB policy on Pest/ pesticide management	• Number of farmers trained in IPM techniques; • Number of farmers implementing IPM on their farms • Frequency of chemical pesticides usage	MoFA-DAES/ MoFA Regional Officers
	Provide PPEs to farmers/ farm assistants for pesticide use in the fields	Health and safety policy for farm work	Farmers and accompanying dependants (children) protected against pesticide exposure in the fields	• Quantities and types of PPEs supplied or made available under the project	MoFA
	Educate farmers/ farm assistants in the	Pesticide hazards and use guide manual or leaflet for the project	Farmers know and use pesticides properly; pesticide	• Number of farmers trained in pesticide use;	MoFA/EPA

Impact issue / Pest & pesticide threat/ risk	Mitigation Measures	Implementation tool	Expected result	Monitoring indicators	Responsibility/ Key implementing actors
	proper use of pesticides	(include simple pictorial presentations)	hazards and use guide leaflet or flyers produced	• Number of farmers having copies of the pesticide hazard and use guide flyers;	
	Properly dispose obsolete and unused pesticides	Obsolete and unused pesticide disposal plan	Obsolete and unused pesticide disposal plan prepared and implemented. All obsolete pesticides to be taken back by the suppliers.	• Relationship between pesticide supply and usage	PPRSD-MoFA/CCMC-EPA
	Educate farmers to obtain or purchase quantities of pesticides required at a given time and to avoid long term storage of pesticides	Pesticide use policy/plan	Only pesticides needed are purchased; long term storage of pesticides by farmers avoided	• Relationship between pesticide supply and usage	PPRSD-MoFA/CCMC-EPA
	Provide emergency response to pesticide accidents and poisoning	Emergency response plan	Pesticide accidents and emergencies managed under the project	• Number of pesticide accidents and emergencies	PPRSD/GHS/National Poisoning Control Centre
	Educate farmers/ farm assistants in the proper use of pesticides	Pesticide hazards and use guide manual or leaflet for the project (include simple pictorial presentations)	Farmers know and use pesticides properly; pesticide hazards and use guide leaflet or flyers produced	• Number of farmers trained in pesticide use; • Number of farmers having copies of the pesticide hazard and use guide flyers;	MoFA/EPA

7.0 PROGRAMME TO MEET IPMP REQUIREMENTS

7.1 Rationale

The rationale behind the plan is illustrated in the matrix below (Table 51) which confirms the results expected from the development and implementation of the Integrated Pest Management Plan (IPMP).

Table 51: Planning Matrix

Narrative summary	Expected results	Performance indicators	Assumptions/risks
Goal: Attract investors into commercial farming and empower small holder crop farmers to contribute significantly to household, local and national economies through environmentally friendly pest management practices.	• Food security enhanced • Environmental quality improved, • Crop productivity and farmers' income increased • Crop export improved • National foreign exchange improved	• Evidence of improvements in food availability, level of poverty, and environmental protection in project targeted areas • Evidence of crop export increased • Evidence of area under irrigation in the project targeted areas increased	• Government policies continue to support food security and irrigation programme • Nation continues to pursue stable democratic governance
Purpose 1. To prevent losses caused by pests in order to increase profitability of agriculture. 2. In the longer term, strengthen national and local capacity to reduce environmental and health risks associated with pest management practices.	**Medium-term results/outcomes** • Farmers in the project targeted areas and other project areas prioritize their pest problems and identify IPM opportunities to mitigate negative environmental and social impacts associated with pesticides. • Farmers in project areas adopt ecologically sound options to reduce crop losses with minimal personal and environmental health risks. • FSRP2 decision makers and actors provided with clearer guidelines enabling then to promote IPM approaches and options in agriculture • National IPM policy supported and promoted in compliance with international conventions and guidelines on pesticide use	• Availability of sufficient food. • Perception of state agencies regarding the value of IPM in agriculture. • Level of compliance with World Bank policies etc. • Level of chemical control practices • Types and level of use of alternatives to synthetic chemical pesticides	

7.2 IPM Implementation Strategies

FSRP2 will adopt the following specific strategies to achieve an effective pest and pesticide management process:

7.2.1 Formation of a Safeguard Team

The Project Coordinator of the Project Implementation Unit (PIU), together with Environmental and Social Safeguards Specialists will form a Safeguard Team to oversee and ensure that the project complies with relevant safeguard policy documents prepared for the Project including this IPMP.

7.2.2 Registration and training of all interested pesticide distributors/resellers

Under the project, FSRP2 will notify pesticide distributors or publish in the national dailies that all interested pesticide distributors or resellers interested in providing services or products for the Project are to register with FSRP2 by providing specific requested information which will include but not limited to the following:

- Certificate of registration or incorporation with the Register General's Department of Ghana;
- License or permit to operate from EPA or PPRSD;
- Locations of company; and
- Types of activities or services or products to be provided.

The Project will organize an orientation workshop for all registered pesticide distributors/resellers under the Project on the following but not limited to these:

- EPA registered and banned pesticides; and
- EPA/PPRSD requirements on purchase, supply and safe distribution of pesticides.

7.2.3 IPMP Communication and Orientation Workshop

The PIU, represented by the Environmental and Social Safeguards (ESS) Specialist will communicate the content of the Integrated Pest Management Plan to all upstream project actors or participants such as the EPA, PPRSD, GIDA, MoFA at the national and relevant regional levels (i.e., within project beneficiary regions). It will establish on-going communication with both the national and relevant regional level pest and pesticide management representatives.

The PIU will also organize orientation workshops on IPM techniques as well as the IPMP for relevant primary communities, which will in fact be at the forefront in terms of use of pesticides and are likely to be exposed to its various and gradual risks.

7.2.4 Education and Awareness Creation

FSRP2/PIU will create awareness among downstream project actors / participants (pesticide distributors / resellers, farmers, farm assistants) of the importance of pest and pesticide management in the framework of this IPMP and the national IPM strategy; avenues created or available for obtaining appropriate pesticides among other things.

Availability of Information: The FSRP2 will ensure that all downstream actors or participants have access to information on relevant crop pests/diseases, MoFA-PPRSD IPM strategies regarding pest control, declared pest plants, current EPA list of registered and banned pesticides, USAID/USEPA list of registered and approved pesticides. Key information on crop pests/diseases, IPM strategies regarding pest control as well as pesticide use toolkits will be provided in easy to read and understand format /pictorial presentations and translated into at least two local languages for easy understanding and use by illiterate beneficiary communities. The awareness creation programme will be regular, every 3 or 6 months to enable communities become used to the schedule.

Education and Training: The FSRP2 Environment Specialist and implementers will incorporate pest management awareness issues into environmental training programs.

7.2.5 Participatory Pests Inventory and Monitoring Measures

The project will track and document all pest cases, be it minor or major in a pest inventory register through PPRSD. It will identify the types, abundance, location of pest plants, date of first spotted or seen and date reported. This information will be gathered from surveillance or monitoring system to be put in place, periodic surveys to be conducted and feedback from farmers/farm assistants. The data will be managed in a standardized way so that trends can be established.

7.2.6 Stakeholder and Interest Group Consultation and Involvement

The IPMP implementers will coordinate the pest management process with all relevant water resource regulators/users (WRC, VRA, Fisheries Commission) and other major land users in the project areas (such as traditional authorities/landowners, cattle rearers/herdsmen in the project targeted areas). Any activities that may have an impact on pest management will be identified and included in the pest management planning process. Contacts will be established with significant neighboring land managers and consult with them when appropriate and co-ordinate management activities with representatives of the identified government agencies and other land users when appropriate.

7.2.7 Prevention of new Pest Infestations

The FSRP2 will endeavour to treat and manage new pest infestations as soon as they are identified and this will be done through:

Surveillance, Early Detection and Eradication: A process for the reporting and identification of unusual plants, animals and pests will be established. Pest surveys will be conducted by PPRSD on a regular basis to detect new infestations and a rapid response process for the management of new infestations will be established.

Prevention of Spread: This IPMP establishes protocols for appropriately managing risks of all human assisted transport of declared pests.

7.2.8 Management of established Pests

The IPMP will ensure that established pest infestations are effectively managed. Priorities for pest management will be regularly reviewed. These will include the reduction of Class 3 pests (environmental weeds) where appropriate. The impact on non-target species, particularly those of environmental significance, will be minimized.

7.2.9 IPM Capacity Building

The purpose of the capacity building of farmers is to help farmers develop their IPM approaches to the management of pests and diseases under the Project. The success of IPM depends largely on developing and sustaining institutional and human capacity to facilitate informed decision making by farmers and farm assistants and empowering them to integrate scientific and traditional knowledge to solve location-specific problems and respond to market opportunities. Poor communication between farmers / farm assistants, extension agents and researchers has often led to poorly targeted research or to poor adoption of promising options generated by research. The full benefits of investments in agricultural research thereby remain untapped under these circumstances.

Farmer Field Schools (FFS), Farmer participatory research (FPR) and participatory learning (PL) approaches in capacity building efforts help to bridge this gap and make research results more understandable and useful to farmers and farm assistants. This is particularly the case in knowledge intensive disciplines such as IPM.

Farmers will have the capacity to accurately identify and diagnose pests and pest problems, understand trophic relationships that underpin biological control opportunities, and use such knowledge to guide pesticide and other kinds of interventions. Through the participatory approaches, the Project will build

local capacity to ensure rapid spread and adoption of ecologically sound and environmentally friendly management practices especially among smallholder farmers in the Accra Plains and SADA (now NDA) regions. The farmers will learn cultural, biological and ecological processes underpinning IPM options, and use the newly acquired knowledge to choose compatible methods to reduce losses in production and post-harvest storage.

A foundation element of the capacity building exercise is the accurate diagnosis of the pest problem and to provide baseline information that will enable stakeholder groups to develop a shared vision on felt needs and IPM strategies. Through informal interviews, field visits, and planning meetings, stakeholder groups will develop joint understanding of the key issues affecting production and develop a common IPM plan based on agreed concerns.

The IPMP implementation will be anchored at the MoFA regional level with field action by farmer groups which will receive training and advisory services from MoFA and appropriate NGOs, who would have graduated from Training of Trainers (ToT) sessions. Training at all levels will be based on participatory learning modules for capacity building in IPM information delivery. The participants will be equipped with skills in facilitation, group dynamics, and non-formal education methods to encourage adult learning. Farmer training will focus on farmers' group learning for informed decision making on IPM issues. Group learning will be experimental through farmer-led field trials and discussions on practical aspects of crop production and pest management including indigenous and traditional knowledge/technologies. Farmer group learning will be facilitated by ToT trained men and women extension agents.

Group decision making will be achieved through Agro-Ecosystem Analysis (AESA) involving a comparison of IPM practices with normal farmer practices. At each AESA, farmers observe, record and monitor changes in soil, crop and trophic relationships affecting crop growth. Farmers analyse and discuss their findings and recommend corrective action based on the results of their own analyses. Group learning helps to increase scientific literacy, ownership of biological and ecological information and knowledge, and informed decisions making habits in the communities. Also trained farmers and leaders of farmers' associations will be expected to promote secondary adoption of proven options. For example, leaders of farmers' associations trained will be expected to assist in training new farmers through demonstrations and farm visits. Additionally, the trained farmers will organize field days to train other farmers and explain new/improved IPM practices they have learnt. Field day participants will include representatives of the PIU, GIDA, local community leaders, NGOs, local community FM stations, researcher institutes, and national extension services.

7.2.10 Institutional Arrangements and Training Responsibilities

Annual work plans will be developed in consultation with participating farmers/investors and in line with their respective farm work plans to indicate institutions and networks that will be required to provide research and development support. The principal actors will include a number of local institutions directly involved in the implementation of the IPMP while other agencies/partners will include international and national institutions to provide technical and other support for implementation of the plan. These are explained in Table 52 below:

Table 52: Actors and Partners

Actors	Partners
The actors will collaborate with the project: • Contribute field staff to be trained as IPM Trainers. • Organize its members into farmer groups for training, learning experiences among farmers and promotion of IPM practices. • Facilitate extension and farmer training	The partners will be IPM experts who: • Serve as technical reviewers for IPM activities. • Provide technical support in pest and natural enemy identification • Assist to organize study tours and networking with international IPM groups. • Provide expertise in planning, training and field implementation of IPM

• Prepare and produce field guides and other relevant IPM information materials • Provide policy guidance/oversight for implementation of the IPMP • Monitor, supervise and coordinate IPM activities • Document user compliance on pesticide use Examples of actors: 1. MoFA/PIU 2. EPA (national and regional officers) 3. PPRSD (national and regional officers) 4. GIDA 5. Customs Division of the GRA (CD) 6. Ministry of Health/Ghana Health Service (for disease vector control) 7. Farmers and Farmers Associations (e.g. GFAP, GAABIC, SEEDPAG, VEPEAG, APFOG) 8. Agric-input dealers (e.g. GAIDA)	Examples of partners: 1. The CGIAR System-wide Program on Integrated Pest Management (SP-IPM) which is dedicated to breaking isolation barriers to the full realization of IPM research results 2. The Global IPM Facility which assists interested Governments and NGOs to initiate, develop and expand IPM programmes mostly through farmer field school training. 3. Research Institutes (Council for Scientific and Industrial Research, CSIR), and Universities. 4. NGOs

Training Responsibilities

The PIU/MoFA with input from PPRSD/EPA are to standardize training needs assessment across sites; and organize appropriate workshops to develop participatory learning modules. The PPRSD with input from the EPA, will liaise with appropriate farmers' associations to plan training implementation; provide technical support such as in preparing and delivering specific training materials, and evaluating resource materials; identify and select suitable local training resource persons and materials; and prepare training progress reports.

The MoFA (Regional/District Officers) will collaborate with farmers'/agriculture associations to identify and organize farmer groups for training (i.e. use of farmer field school to teach farmers on the efficient and responsible use of pesticides and chemical fertilizers and sound agricultural practices); prepare, organize and supervise training implementation plan; verify reports of persisting pest problems and farmers training needs; monitor performance of farmer trainers and post-training assignments; and prepare training progress reports.

Farmers/local communities as the principal beneficiaries, will be organized into farmer groups for training and adoption of IPM practices. The farmers will be facilitated to set up Community IPM Action Committees to coordinate IPM activities in their areas.

7.2.11 Participatory Monitoring and Evaluation

There will be regular monitoring and evaluation of control programs to determine the level of progress being made with regard to pest and pesticide management and control issues identified in the IPMP. Monitoring indicators are provided in the action plan under the previous section. The following performance indicators will be incorporated into a participatory monitoring and evaluation plan.

Table 53: Performance Indicators

No	Area	Indicators
1	Training and awareness creation	• Types and number of participatory learning modules (PLM) delivered; • Category and number of extension agents and farmers trained and reached with each PLM; • Category and number of participants reached beyond baseline figures;

No	Area	Indicators
		• Practical skills/techniques most frequently demanded by extension agents and farmers; and • Crop management practices preferred by farmers.
2	Technology acceptance/ field application	• Category and number of farmers who correctly apply the skills they had learnt; • New management practices adopted most by farmers; • Category and number of other farmers trained by project trained farmers; • Types of farmer-innovations implemented; • Level of pest damage and losses; • Rate of adoption of IPM practices; • Impact of the adoption of IPM on production performance of farmers
3	Project direct benefits	• Increase in crop production; • Increase in farm revenue; • Low incidence of pests and diseases • Social benefits: e.g., improvement in the health status of farmers; • Level of reduction of pesticide purchase and use; and • Number of projects co-families using preventive mechanisms against diseases.

7.2.12 Sustainability Issues

Scientific information, adapted into user-friendly format will strengthen training and extension delivery, and increase IPM literacy in project sites/communities.

Strategic alliances with international IPM groups will strengthen national capacities to integrate new IPM options in crop production. Farmer-educational activities will be central to the exit strategy which will feature increased roles and responsibilities of committed national and local farmers' associations and communities to take primary responsibilities in the development of action plans and expertise exchange for IPM development and promotion.

Short-term technical study visits (to other West African countries with proven experience in IPM development and implementation) for hands-on laboratory and field training, and farmer participatory learning will help to create favourable conditions for continuity of IPM processes and results. The tour will involve representatives from PIU, PPRSD, and selected farmers' associations.

7.2.13 Reporting

Annual report on the progress of pest and pesticide management at the project sites will be prepared by the Program Coordinating Unit of FSRP2. The reports will indicate the pest cases identified and treated using IPM approaches, location of pests, level of success of treatment, the amount and type of herbicide/pesticide used, level of corporation from farmers and other relevant information (e.g., training programmes organized, farmer field schools held etc).

7.2.14 Management Reviews

The PIU will undertake annual pest and pesticide control and management reviews to confirm the implementation of the various control measures or programmes or actions outlined in the IPMP. Recommendations from the reviews will help the PIU to refocus and plan effectively towards achieving planned targets. The management review team will include:

- Project Implementation Unit/Project Coordinators
- Representative of the Minister of Food and Agriculture (MoFA)
- Representatives of the EPA
- Representative of PPRSD

7.2.15 Institutional arrangements for the implementation and monitoring of the IPMP

The IPMP will be implemented under the coordination of the FSRP2 environmental unit with the institutions in the table below playing different roles.

Table 54: Institutions in the implementation of IPMP

Name of institution	Function
PPRSD	it will ensure the internal monitoring of the implementation of the environment and health component of the IPMP and will regularly report to the Project Implementation Union (PIU). It will intervene in the training of the regional agents of the Ministry in charge of Agriculture
EPA	It is responsible for the external monitoring of the "environment" component of the implementation of the IPMP as well as approved/registered agrochemicals.
Health Services	They will provide external monitoring of the implementation of the health component of the IPMP and will regularly report to the PIU.
Research and Analysis Laboratories	They will assist in the analysis of environmental components (analyzes of pesticide residues in water, soil, plants, agricultural harvest, fish, food, etc.) for determine the various parameters of pollution, contamination and toxicity related to pesticides
Farmers' Organizations	They must have and apply the procedures and good environmental practices concerning the use and the ecological and safe management of pesticides
Local communities (town halls)	They will participate in the sensitization of populations, social mobilization activities. They will also participate in the supervision and external monitoring of the implementation of the measures recommended under the IPMP
NGOs and civil society	NGOs and other environmental organizations of civil society can also participate in informing, educating and raising awareness among agricultural producers and the population on the environmental and social aspects related to the implementation of the IPMP, but also to monitoring of the implementation and monitoring of the environment.

8.0 IPMP IMPLEMENTATION BUDGET

A breakdown of the costing for activities identified in the IPMP (during Ghana's 5-year participation in the FSRP2) is provided in Table 55 as a guide. It is estimated that an amount of about USD613, 500.00 will be required to implement the IPMP over the 5-yr period, with an average yearly investment requirement of about USD122, 700.00.

Table 55: Budget Estimates for IPMP Implementatiion

	Activity/Programme	Budget (USD)					
		Year 1	Year 2	Year 3	Year 4	Year 5	Total
1.0	**Capacity Building**						
1.1	Orientation workshops (on IPM, and for project registered agro-input dealers)	3,000	2,500	2,000	-	-	7,500
1.2	Training of trainers	1,500	1,500	1,000	1,000	-	5,000
1.3	Farmer groups training	5,000	4,000	3,000	2,000	1,000	15,000
1.4	Study visits	2,000	2,000	2,000	2,000	2,000	10,000
	Sub total	**9,500**	**8,500**	**7,500**	**6,500**	**5,500**	**37,500**
2.0	**Support / Advisory services**						
2.1	Registration of pesticide suppliers	1,000	1,000	1,000	1,000	1,000	5,000
2.2	IPM problem diagnosis	4,000	4,000	4,000	4,000	2,000	18,000
2.3	Field guides/ IPM materials	5,000	-	-	-	-	5,000
2.4	Public awareness/ sensitization campaigns	3,000	-	3,000	-	-	6,000
2.5	Pest / vector surveillance	2,500	_-	2,500	-	2,000	7,000
2.6	Laboratory analysis support-MRLs	30,000	-	-	-	-	30,000
2.7	Emergency response support	5,000	5,000	5,000	5,000	5,000	25,000
	Sub total	**48,500**	**8,000**	**13,500**	**8,000**	**10,000**	**96,000**
3.0	**Environmental management**						
3.1	Pesticide monitoring in surface water bodies in or around project areas	5,000	10,000	10,000	10,000	5000-	40,000
3.2	Equipment, bed nets, chemicals	30,000	10,000	10,000	5,000	5,000	100,000
3.3	Support to IPM R&D	5,000	5,000	5,000	5,000	5,000	25,000
	Sub total	**36,000**	**11,000**	**11,000**	**11,000**	**11,000**	**165,000**
4.0	**Project management**						
4.1	PMP coordination	60,000	60,000	60,000	60,000	60,000	300,000
4.2	Monitoring and evaluation	2,000	2,000	2,000	2,000	2,000	10,000
4.3	Reviews and reporting	1,000	1,000	1,000	1,000	1,000	5,000
	Sub total	**63,000**	**63,000**	**63,000**	**63,000**	**63,000**	**315,000**
	GRAND TOTAL (USD)	**157,000**	**90,500**	**95,000**	**88,500**	**89,500**	**613,500**

Source: Consultant's Estimates, April 2021

Assumptions

This tentative budget has been prepared based on a number of assumptions and expectations as captured in Table 56.

Table 56: Assumptions underlining Budget Estimates for IPMP Implementation

	Activity/Programme	Assumptions / Comments
1.0	**Capacity Building**	

	Activity/Programme	Assumptions / Comments
1.1	Orientation workshops (on IPM, and for project registered agro-input dealers)	Orientation will be organised on a yearly basis during the lean seasons for an estimated number of 15 persons (at an average cost of US$100 per person) from the various agro-input dealers groupings
1.2	Training of trainers	10 selected persons from the project areas will be identified as trainers and given training annually at an estimated cost of US$100 per person
1.3	Farmer groups training	In collaboration with the Trainers, about 50 farmers participating in the programme will receive training on the IPMP in the 1st year at an average cost of US$100 per person. It is anticipated that the number of participating farmers requiring training will reduce over the 5-year implementation period. The Budget therefore makes provision for 40, 30, 20 and 10 more farmers in the 2nd, 3rd, 4th and 5th years respectively
1.4	Study visits	The PIU's Safeguards Team, with the support of a Pesticides/Pest Management Specialist will conduct periodic study visits of selected projects to evaluate the success of capacity building activities undertaken
2.0	**Support / Advisory services**	
2.1	Registration of pesticide suppliers	This will be an annual administrative activity that seeks to ensure that all suppliers on the project are conversant and compliant with the regulatory requirements in the sector.
2.2	IPM problem diagnosis	Diagnostic activities will be undertaken on an annual basis to identify and document pest management challenges on the project to enable the timely institution of remedial measures. A total budget of about US$10,000 has been devoted to this.
2.3	Field guides/ IPM materials	This item will cover production of materials and simple manuals with illustrations that would be relevant for onsite training of farmers and other farmhands. This would be a one-time expenditure
2.4	Public awareness/ sensitization campaigns	Public sensitisation will be an ongoing activity with major campaigns being organised in Years 1 and 3 with an average budget of about US$ 3,000 each.
2.5	Pest / vector surveillance	This will serve to provide a constant watch on the population dynamics of pests, its incidence and damage on each crop at fixed intervals to forewarn the farmers to take up timely crop protection measures. While this activity will continue throughout the 5-year period by the farmers themselves, the Agric Extension Agents will be charged with undertaking major surveillance exercises in the 1st, 3rd and 5th years at a total cost of US$ 7,000.00
2.6	Laboratory analysis support-MRLs	This would be a one-time expenditure of US$ 30,000 in the 1st year to procure the additional machinery required for conducting MRLs on this project. It is anticipated that internally generated funds would be raised to procure the consumables in order to enhance sustainability
2.7	Emergency response support	In addition to the provision where credit proceeds will be reallocated from other components to provide immediate emergency recovery support following an eligible crisis or emergency, a budget of about US$ 25,000 has been considered under this component over the full program period.
3.0	**Environmental management**	
3.1	Pesticide monitoring in surface water bodies in or around project areas	This significant activity will be conducted on an annual basis with an average annual cost of about US$ 1,000

	Activity/Programme	Assumptions / Comments
3.2	Equipment, bed nets, chemicals	A chunk of these items are expected to be procured before the commencement of the program, with a budget of about US$ 30,000. For subsequent years under FSRP2, a budget of about US$ 5,000 per year has been provisioned for maintenance and part replacement activities.
3.3	Support to IPM R&D	Research and development activities will be supported with a budget of US$ 25,000 during the implementation period. The relevant unit of the EPA or MOFA may receive this support.
4.0	**Project management**	
4.1	IPMP coordination	Implementing the IPMP will involve lots of administrative and project management activities, and anticipates the engagement of a Pest Management Specialist, hence the budgeted figure of US$ 300,000
4.2	Monitoring and evaluation	This item will form a major component of the work and will be useful for quantifying and reporting on the successes of the programme and an amount of US$ 10,000 has been devoted to this activity
4.3	Reviews and reporting	IPMP will require constant reviews and reporting and an amount of US$ 5,000 has been devoted to this activity

9.0 CONCLUSION

The implementation of FSRP2 activities in Ghana will have positive environmental and social impacts as well as some economic benefits for the rural farming populations of the targeted crops (cassava, yam, sweet potato, maize, rice, vegetable, small ruminants, and poultry) as well as research and development institutions.

With regards to animal production and agricultural productivity, these impacts will be manifested in terms of improving the quality and availability of seeds and planting material; use of sustainable agricultural technologies for the environment; maintaining fertility levels on agricultural land; extension of credible alternatives to chemical control and amendment.

However, there will be equally potential negative impacts on the biological and social environments. This will include mainly health risks related to pesticide use and a poor management of obsolete packaging and products; pollution of water resources and the irrational use of fertilizers and pesticides. The IPMP has been prepared as a tool to minimize and manage the environmental and health risks associated with the use of pesticides during FSRP2 implementation.

The consultations with relevant stakeholders during the IPMP preparation was key which made it possible to note that farmers in general, systematically resort to chemical pesticides to control pests. Famers do not master the techniques of identifying phytosanitary problems and pesticide use patterns well enough. Most farmers use unregistered pesticides.

Consequently, this IPMP pays special attention to issues such as information, awareness-raising, capacity building for the various actors in the target crops sector on methods of responsible and effective use of plant protection products in general, and integrated pest management approaches (IPM) in particular, appropriate equipment and infrastructural support and support/enforcement of certain regulatory provisions.

The implementation of the IPMP is expected to minimize impacts on the biophysical and human environment in the program area already affected by increased use of chemicals. The monitoring and evaluation of the activities planned in the IPMP will be carried out by the Project's Environmental Unit in collaboration with the PPRSD with strong backing from the key directorates or entities in charge of Agriculture, Environment (EPA), Health, Research, and other actors.

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LIST OF ANNEXES

ANNEX 1: Revised Register of Pesticides – January 2020

(A) Fully Registered Pesticides (FRE)
(A1a) Insecticides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Abalone 18 EC	FRE/2006/1583G January 2020	Abamectin (18g/l)	II	Insecticide for the control of red spider mite, two-spotted spider mite and tomatoes russet mite in tomatoes	Calli Ghana Limited, Accra
2.	Abamet	FRE/2099/1577G January 2020	Abamectin (92%)	II	Insecticide for the control of two-spotted mite in cotton and tomato	Rainbow AgroSciences Co. Ltd., Tema
3.	Aceta Star 46 EC	FRE/18100/1394 G August 2018	Bifenthrin (30g/l) + Acetamiprid (16g/l)	II	Insecticide for the control of capsids in cocoa	Adama West Africa Ltd., Accra
4.	Actara 240SC	FRE/18227/1407 G September 2018	Thiamethoxam (240g/kg)	III	Insecticide for the control of mirids in cocoa	Overseas Warehouse Ghana Ltd., Accra
5.	Agro-thoate 40EC	FRE/1710/1226G October 2017	Dimethoate (400g/l)	II	Insecticide for the control of insect pests in vegetables	Reiss & Co. Ghana Ltd., Accra
6.	Akape 20SC	FRE/1902/1518G October 2019	Imidacloprid (20%)	III	Insecticide for the control of insect pests in vegetables	Agrimat Ltd., Madina
7.	Akate Master	FRE/2005/1602G March 2020	Bifenthrin (27g/l)	II	Insecticide for the control of capsids in cocoa	Chemico Limited, Tema
8.	Alphacep 10 EC	FRE/1902/1488G June 2019	Alpha-cypermethrin (100g/l)	III	Insecticide for the control of insect pests in vegetables and fruits	Agrimat Ltd., Madina
9.	Ataka Super EC	FRE/1957/1559G October 2019	Emamectin Benzoate (19.2g/l)	III	Insecticide for the control of diamondback moth and cotton bollworm in cabbage and cotton	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra
10.	Attack 1.9 EC	FRE/1804/1304G February 2018	Emamectin-benzoate (1.9%)	II	Insecticide for the control of insect pests in vegetables	Agrimat Limited, Madina
11.	Aventall 300WG	FRE/18139/1420 G November 2018	Indoxacarb (300g/kg)	III	Insecticide for the control of insect pests in fruits, vegetables, rice and cotton	Jingbo Agrochemicals Tech. Gh. Co. Ltd., Accra.

12.	Bastion Extra	FRE/19202/1482 G March 2019	Imidacloprid (3%)	II	Insecticide for the control of rice hoppers, aphids, thrips, whiteflies, termites, beetles and soil borne insects in cereals, vegetables, fruits and cotton	Macrofertil Ghana Ltd., Accra
13.	Belt Expert 480SC	FRE/18185/1307 G April 2018	Flubendiamide (240g/l) + Thiacloprid (240g/l)	II	Insecticide for the control of insect pests in cotton	RMG Ghana Ltd., Accra
14.	Betallic Super	FRE/1825/1337G July 2018	Pirimiphos methyl (400g/l) + Permethrin (75g/l)	II	Insecticide for the control of insect pests in maize and cowpea	Bentronic Productions, Kumasi
15.	Bomec EC	FRE/19202/1455 G February 2019	Abamectin (18g/l)	II	Insecticide for the control of aphids, caterpillars, whiteflies, grasshoppers and bollworms in vegetables and fruits	Macrofertil Ghana Ltd., Tema
16.	Bonlambda 2.5 EC	FRE/19149/1458 G February 2019	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Bon Agro Co. Ltd., Kumasi
17.	Box 18EC+	FRE/20145/1598 G March 2020	Abamectin (1.8%)	II	Insecticide for the control of bollworms, red spider mites, cabbage worm, psyllas in soybean, cotton, and tangerine	Jubaili Agrotec Ltd., Kumasi
18.	Buffalo Supa 40EW	FRE/1723/1211G October 2017	Acetamiprid (400g/l)	III	Insecticide for the control of insect pests in vegetables and fruit crops	Thomhcof Company Limited, Kumasi
19.	Bypel 1	FRE/19133/1576 G November 2019	*Perisrapae Granulosis* virus + *Bacillus thuringiensis* (5%)	II	Bio-insecticide for the control of whiteflies and worms in vegetables and fruits	Abbnak Agro Services, Kumasi
20.	Callifan Super 200 EC	FRE/1906/1451G February 2019	Acetamiprid (100g/l) + Bifenthrin (100g/l)	II	Insecticide for the control of mirids in cocoa	Calli Ghana Co. Ltd., Accra
21.	Calthio Mix 485WS	FRE/1906/1445G February 2019	Imidacloprid (350g/kg) + Thiram (100g/kg) + Metalaxyl (35g/kg)	II	Insecticide/fungicide for the control of insect pests and fungal diseases in maize	Calli Ghana Co. Ltd., Accra

22.	Campaign	FRE/18185/1281 G January 2018	M*etharhizium anisoplae* (ICIPE 69)	U	Bio-insecticide for the control of thrips in pepper	RMG Ghana Ltd., Accra
23.	Carinho WP	FRE/18202/1377 GAugust 2018	Carbendazim (500g/kg)	II	Insecticide for the control of leaf spot, leaf mould and stem rot in vegetables	Macrofertil Gh. Ltd., Tema
24.	Chlorlet 48EC	FRE/18145/1430 G December 2018	Chlorpyrifos-ethyl (48%)	II	Insecticide for the control of insect pests in rice and cotton	Jubaili Agrotec Ltd., Kumasi
25.	Colam 247 ZC	FRE/1899/1311G April 2018	Thiamethoxam (141g/l) + Lambda-cyhalothrin (106g/l)	II	Insecticide for the control of insect pest in rice, tomato, cotton, beans, cabbage and watermelon	Rainbow Agrosciences Co. Ltd., Tema
26.	Condor SL	FRE/1825/1331G July 2018	Imidacloprid (20%)	II	Insecticide for the control of insect pests on vegetables	Bentronics Productions
27.	Condifor Super	FRE/1843/1352G July 2018	Imidacloprid (20%)	II	Insecticide for the control of insect pests in vegetables	Kumark Company Ltd, Kumasi
28.	Confidor 200 OD	FRE/20185/1518 G January 2020	Imidacloprid (200g/l)	III	Insecticide for the control of mirids in cocoa	RMG Ghana Limited, Accra
29.	Conti-halothrin 2.5EC	FRE/1978/1573G October 2019	Lambda-cyhalothrin (60%)	II	Insecticide for the control of insect pests in vegetables and pulses	Five Continents Imp. & Exp. Ltd., Accra
30.	Conti-zol	FRE/1978/1572G October 2019	Diazinon (25g/l)	II	Insecticide for the control of insect pests in vegetables	Five Continents Imp. & Exp. Ltd., Accra
31.	Control 5WDG	FRE/1804/1305G February 2018	Emamectin benzoate (5%)	II	Insecticide for the control of aphids, worms and borers in vegetables	Agrimat Limited, Madina
32.	Cydim Super EC	FRE/1802/1261G January 2018	Dimethoate (400g/l) + Cypermethrin (36g/l)	II	Insecticide for the control of aphids, caterpillars, whiteflies, grasshoppers and bollworms in vegetables	Agrimat Limited, Madina
33.	Cymethoate Super EC	FRE/1705/1144G July 2017	Dimethoate (400g/l) + Cypermethrin (36g/l)	II	Insecticide for control of aphids, caterpillars, whiteflies, grasshoppers, bollworms in vegetables and cotton	Chemico Ltd., Tema
34.	Cypadem 43.6EC	FRE/1957/1554G October 2019	Dimethoate (400g/l) + Cypermethrin (36g/l)	II	Insecticide for the control of insect pests in vegetables and field crops	Wynca Sunshine Agric Prod & Trading Co. Ltd., Accra

35.	Cypercal 50 EC	FRE/2006/1580G January 2020	Cypermethrin (50g/l)	II	Insecticide for the control of insect pests in cotton	Calli Ghana Company Ltd., Accra
36.	Cypersect Super EC	FRE/1825/1333G July 2018	Dimethoate (400g/l) + Cypermethrin (36g/l)	II	Insecticide for the control of aphids, caterpillars, whiteflies, grasshoppers and bollworms in vegetables	Bentronics Productions, Kumasi
37.	D-Ban Super 48 EC	FRE/1843/1350G July 2018	Chlorpyrifos (48%)	II	Insecticide for the control of insect pests in vegetables	Kumark Co. Ltd., Kumasi
38.	Dean 62 EC	FRE/19202/1462 G March 2019	Imidacloprid (50g/l) + Emamectin benzoate (12g/l)	II	Insecticide for the control of moth, caterpillars, whiteflies, aphids and ants in cereals, vegetables and sugarcane	Macrofertil Ghana Ltd., Tema
39.	Decis Forte 100 EC	FRE/17185/1161 G July 2017	Deltamethrin (100g/l)	II	Insecticide for the control of insect pests in vegetables	RMG Ghana Ltd., Accra
40.	Devaxam 25 WG	FRE/1710/1229G October 2017	Thiamethoxam (15%)	II	Insecticide for the control of insect pests in vegetables	Reiss & Co. Ghana Ltd., Accra
41.	Diazol 50 EW	FRE/17100/1235 G November 2017	Diazinon (500g/l)	II	Insecticide for the control of insect pests in vegetables	Adama West Africa Ltd., Accra
42.	Dimeking 400EC	FRE/1899/1435G December 2018	Dimethoate (400 g/l)	II	Insecticide for the control of insect pests in fruits, cotton and vegetables	Rainbow AgroSciences Company Limited, Accra
43.	Dimex 400 EC	FRE/17202/1204 G October 2017	Dimethoate (400g/l)	II	Insecticide for the control of aphids, fruit flies and leaf miners in vegetables, fruits and pineapples	Macrofertil Gh. Ltd., Tema
44.	Dimiprid 20 SL	FRE/1710/1228G October 2017	Imidacloprid (200g/l)	II	Insecticide for the control of insect pests in vegetables	Reiss & Co. Ghana Ltd., Accra
45.	Dursban 4E	FRE/1805/1383G August 2018	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of scale, borers, cockroaches and mosquitoes	Chemico Limited
46.	Ekuapa 2.5 EC	FRE/1823/1303G February 2018	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Thomas Fosu Enterprise, Kumasi

47.	Ema Star 112EC	FRE/19100/1542 G October 2019	Emamectin benzoate (48g/l) + Acetamiprid (64g/l)	II	Insecticide for the control of whiteflies, diamondback moth, aphids in okra and eggplant	Adama West Africa Ltd, Accra
48.	Eradicoat T GH	FRE/19125/1535 G October 2019	Maltodextrin (282g/l)	III	Insecticide for the control of insect pests in fruits, vegetables and Fall armyworm in maize	Positiveware Trading Company Limited, Accra
49.	Evict EC	FRE/1953/1476G March 2019	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests in vegetables and pulses	L'espoir Co. Ltd., Accra
50.	Evisect S50 SP	FRE/1906/1446G February 2019	Thiocyclam oxalate (500g/kg)	II	Insecticide for the control of leaf miner in oil palm	Calli Ghana Co. Ltd., Accra
51.	Evite 340WP	FRE/18139/1418 G November 2018	Tebufenozide (300g/kg) + Emamectin benzoate (40g/kg)	II	Insecticide for the control of armyworms, bollworms, corn borers, plutella of cabbage and cereals	Jingbo Agro. Tech. Gh. Co. Ltd., Accra.
52.	Fastrack 10 SC	FRE/1902/1487G June 2019	Alpha-cypermethrin (100g/l)	III	Insecticide for the control of insect pests in vegetables and fruits	Agrimat Ltd., Madina
53.	Fipro 50EC	FRE/1908/15322 G October 2019	Fipronil (500g/l)	II	Insecticide for the control of insect pests in vegetables and cereals	Dizengoff (Ghana) Limited, Accra
54.	Fixe 50 SC	FRE/18202/1376 G August 2018	Fipronil (50g/l)	II	Insecticide for the control of caterpillars, weevils, fire ants, termites in vegetables	Macrofertil Gh. Ltd., Tema
55.	Flash Akate	FRE/2005/1603G March 2020	Sulfoxaflor (20g/l)	II	Insecticide for the control of mirids in cocoa	Chemico Limited, Tema
56.	Frankocylon 2.5 EC	FRE/1739/1178G September 2017	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Frankatson Limited, Accra
57.	Frankofen 20 EC	FRE/1939/1490G June 2019	Fenvalerate (200g/l)	II	Insecticide for the control of insect pests in vegetables	Frankatson Ltd., Accra
58.	Furadan 3G	FRE/1805/1384G August 2018	Carbofuran (3%)	II	Insecticide for the control of insect pests in rice, vegetables and oil palm	Chemico Ltd., Tema
59.	Galil 300SC	FRE/19100/1543 G October 2019	Imidacloprid (250g/l) + Bifenthrin (50g/l)	II	Insecticide for the control of mirids in cocoa	Adama West Africa Ltd, Accra
60.	Golan 20SL	FRE/1908/1531G October 2019	Acetamiprid (200g/l)	II	Insecticide for the control of insect pests in vegetables, citrus, cotton, coffee and maize	Dizengoff (Ghana) Limited, Accra

61.	Hitcel	FRE/1810/1299G February 2018	Profenofos (40%) + Cypermethrin (4%)	III	Insecticide for the control of insect pests in field crops	Reiss & Co (Ghana), Accra
62.	Hoprole 30 WG	FRE/1899/1324G May 2018	Indoxacarb (95%)	II	Insecticide for the control of diamondback moth, beetles, caterpillars and cabbage moth in cabbage, tomatoes and cowpea	Rainbow Agrosciences Co. Ltd., Tema
63.	Insector T 45	FRE/19202/1467 G March 2019	Imidacloprid (350g/kg) + Thiram (100g/kg)	III	Insecticide/fungicide for the control of aphids, leafhoppers, insect pests anf fungal diseases in cereals	Macrofertil Ghana Ltd., Tema
64.	Inspire 30EC	FRE/1806/1371G August 2018	Etofenprox (303.68g/l)	III	Insecticide for the control of mirids in cocoa	Calli Ghana Co. Ltd., Accra
65.	Karto 2.5 EC	FRE/1710/1227G October 2017	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Reiss & Co. Ghana Ltd., Accra
66.	K D 415 EC	FRE/1805/1382G August 2018	Chlorpyrifos (400g/l) + Lambda-cyhalothrin (15g/l)	II	Insecticide for the control of scale and borers in cereals and vegetables	Chemico Limited
67.	Kilsect 2.5 EC	FRE/1825/1330G July 2018	Lambda-cyhalothrin (25g/l)	II	Insecticide for control of insect pests in vegetables	Bentronics Productions
68.	K-Lambda	FRE/1786/1157G July 2017	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Joyful Agro Services, Kumasi
69.	K-Optimal EC	FRE/17202/1205 G October 2017	Acetamiprid (20g/l) + Lambda-cyhalothrin (16g/l)	II	Insecticide for the control of insect pests in vegetables	Macrofertil Gh. Ltd., Tema
70.	Klopar 24 SC	FRE/18133/1316 G April 2018	Chlorfenapyr (240g/l)	II	Insecticide for the control of mites, armyworm, diamondback moth and cotton bollworm in vegetables	Abnark Agro Services Enterprise, Kumasi
71.	Lambda-M 2.5% EC	FRE/1927/1526G October 2019	Lambda-cyhalothrin (25g/l)	III	Insecticide for control of pests in vegetables and flowers	Multivet Ghana Limited, Accra
72.	Lambad 2.5 EC	FRE/1881/1408G August 2018	Lambda-cyhalothrin (25g/l)	III	Insecticide for the control of insect pests in cereals and vegetables	B. Kaakyire Agrochemical Co. Ltd., Kumasi
73.	Lambdacot EC	FRE/1758/1255G November 2017	Lambda-cyhalothrin	II	Insecticide for the control of	Afcott Ghana Ltd., Accra

			(25g/l)		insect pests in vegetables and pulses	
74.	Lambda Master 2.5 EC	FRE/1782/1164G August 2017	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Cropstar Enterprise, Kumasi
75.	Lambda Plus	FRE/1930/1477G March 2019	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests in vegetables and pulses	Natosh Enterprise, Kumasi
76.	Lambda Power	FRE/17166/1183 G September 2017	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Dasimah Enterprise, Adum-Kumasi
77.	Lambdaking 2.5EC	FRE/1899/1423G December 2018	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests in vegetables	Rainbow AgroSciences Company Limited, Tema
78.	Lambda Super 2.5 EC	FRE/1843/1349G July 2018	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in stored cereals, cowpea and soybean	Kumark Company Limited, Kumasi
79.	Lamsate EC	FRE/20145/1600 G March 2020	Dimethoate (300g/l) + Lambda-cyhalothrin (15g/l)	III	Insecticide for the control of aphids, thrips, planthoppers, whiteflies in cowpea, soybean, cotton, maize, sorghum, millet, melons and yams	Jubaili Agrotec Ltd., Kumasi
80.	Levo 2.4SL	FRE/1908/1529G October 2019	Oxymatrin (2.4%)	III	Insecticide for the control of insect pest in vegetables and fruit crops	Dizengoff Ghana Ltd., Accra
81.	Lufu 150SC	FRE/2043/1589G January 2020	Thiamethoxam (100g/l) + Deltamethrin (50g/l)	II	Insecticide for the control of capsids in cocoa	Kumark Co. Ltd., Kumasi
82.	Master 2.5EC	FRE/1822/1412G October 2018	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Annoh & Sons Enterprise, Accra
83.	Marshal 480 EC	FRE/1805/1385G August 2018	Carbosulfan (480g/l)	II	Insecticide for the control of scale, nematodes and symphilids in pineapple	Chemico Limited, Tema
84.	Mectin 1.8EC	FRE/1908/1530G October 2019	Abamectin (18g/l)	II	Insecticide for the control of leafminers, spidermites, caterpillars and thrips in citrus, cotton, vegetables and maize	Dizengoff Ghana Ltd., Accra
85.	Methoate 40EC	FRE/1825/1332G July 2018	Dimethoate (400g/l)	III	Insecticide for the control of insect pests in vegetables and fruit crops	Bentronics Productions. Kumasi

86.	M-Fos 48 EC	FRE/1927/1481G March 2019	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in vegetables and outdoor public health purposes	Multivet (Gh) Ltd., Accra
87.	Monceren GT 390 FS	FRE/18185/1309 G April 2018	Imidacloprid (233g/l) + Thiram (107g/l) + Pencycuron (50g/l)	II	Insecticide/fungicide for the control of insect pests, rhizoctonia and fusarium in cotton and for seed treatment	RMG Ghana Ltd., Accra
88.	Movento 100 SC	FRE/17185/1156 G July 2017	Spirotetramat (100g/l)	III	Insecticide for the control of insect pests in fruits and vegetables	RMG Ghana Ltd., Accra
89.	Nemaran 3GR	FRE/1899/1313R April 2018	Carbofuran (3%)	II	Insecticide for the control of insect pests in vegetables, sugarcane, cotton, rice and groundnut	Rainbow Agrosciences Co. Ltd., Tema
90.	Pawa 2.5 EC	FRE/1805/1381G August 2018	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Chemico Limited. Tema
91.	Perfecto 175 SC	FRE/1910/1485G June 2019	Imidacloprid (125g/l) + Lambda-cyhalothrin (50g/l)	II	Insecticide for the control insect pests in vegetables and cereals	Reiss & Co (Gh) Ltd., Accra
92.	Plan D 2.5 EC	FRE/1802/1400G August 2018	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Agrimat Limited, Madina
93.	Polytrin 50 EC	FRE/1825/1290G January 2018	Cypermethrin (50%)	II	Insecticide for the control of insect pests in vegetables	Bentronic Productions, Kumasi
94.	Porselen 5 SG	FRE/1899/1366G August 2018	Emamectin Benzoate (5%)	III	Insecticide for the control of worms and other insect pest in cabbage	Rainbow Agrosciences Co. Ltd., Tema
95.	Protect 1.9EC	FRE/1908/1528G October 2019	Emamectin-benzoate (1.9%)	III	Insecticide for the control of insect pests in cotton, vegetables and maize	Dizengoff (Ghana) Limited, Accra
96.	Protecta CCA-Oxide Type	FRE/17132/1146 R July 2017	Chromium trioxide (27.9%) Arsenic acid (24.6%) + Cupric oxide (11.3%)	II	Insecticide for wood treatment	Byes & Ways Co. Ltd., Accra
97.	Proteus 170 O-TEG	FRE/18185/1308 G April 2018	Thiacloprid (150g/l + Deltamethrin (20g/l)	II	Systemic insecticide for the control of mirids in cocoa	RMG Ghana Limited, Accra
98.	Punto SL	FRE/1899/1427G December 2018	Imidacloprid (200g/l)	II	Insecticide for the control of aphids and whiteflies in egg-plant,	Rainbow AgroSciences

					tomatoes and sweetpotatoes	Company Limited, Accra
99.	Pyperfos Plus	FRE/17166/1188 G September 2017	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in cereals and vegetables	Dasimah Enterprise, Adum-Kumasi
100	Pyrical 5G	FRE/1906/1447G February 2019	Chlorpyrifos-ethyl (50g/kg)	II	Insecticide for the control of insect pests in vegetables	Calli Ghana Company Ltd., Accra
101	Pyrical 480 EC	FRE/1706/1244G November 2017	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in pineapples	Calli Ghana Co. Ltd., Tema
102	Chlorfox 480 EC	FRE/1799/1162G August 2017	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in vegetables and field crops	Rainbow Agrosciences, Tema
103	Rainlambda 2.5 EC	FRE/1799/1147G July 2017	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Rainbow Agrosciences Co. Ltd., Tema
104	Rainlambda Plus EC	FRE/1899/1426 G December 2018	Dimethoate (300g/l) + Lambda-cyhalothrin (15g/l)	II	Insecticide for the control of leaf feeding beetles, leaf sucking bugs, pod sucking bugs and pod borers in cowpea and soybean	Rainbow Agrosciences Co. Ltd., Tema
105	Raintham 350 SC	FRE/1799/1173G September 2017	Thiamethoxam (350g/l)	III	Insecticide for the control of insect pests in vegetables and fruit crops	Rainbow AgroSciences Co. Ltd., Tema
106	Rimon 10 EC	FRE/17100/1239 G November 2017	Novaluron (100g/l)	III	Insecticide for the control of insect pests in cabbage, tomato and pepper	Adama West Africa Ltd., Accra
107	Sanitox 20EC	FRE/1822/1411G October 2018	Fenvalerate (200g/l)	II	Insecticide for the control of insect pests in vegetables and cowpea	Annoh and Sons, Accra
108	Savahaler WP	FRE/18202/1376 G August 2018	Methomyl (250g/kg)	II	Insecticide for the control of insect pests in vegetables, fruits, cotton and soybean	Macrofertil Gh. Ltd., Tema
109	Seed Power 44 WS	FRE/1708/1180G September 2017	Imidacloprid (200g/kg) + Metalaxyl (200g/kg) + Anthraquinone (40g/kg)	II	Insecticide/fungicide for the control of insect pest, downy mildew and damping off diseases in cereals, soybean and seed treatment	Dizengoff (Ghana) Limited, Accra
110	Seed Shield	FRE/1957/1552G October 2019	Imidacloprid (350g/l)	III	Insecticide for the control of insect pests in field crops	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.

111	Select Plus 315EC	FRE/1710/1233G October 2017	Profenofos (300g/l) + Lambda-cyhalothrin (15g/l)	II	Insecticide for the control of aphids, bollworms, leafworms and armyworms in cotton, vegetables and cereals	Reiss & Co. Ghana Ltd., Accra
112	Shocker 20 EC	FRE/18226/1363 G July 2018	Bifenthrin (200g/l)	II	Insecticide for the control of insect pests in vegetables and pulses	Rapid Lion Gh. Ltd., Kumasi
113	Sinoban EC	FRE/1822/1410G October 2018	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in vegetables	Annoh and Sons, Accra
114	Sivanto Energy 085 EC	FRE/18185/1310 G April 2018	Flupyradifurone (75g/l) + Deltamethrin (10 g/l)	II	Insecticide for the control of mirids in cocoa	RMG Ghana Ltd., Accra
115	Striker 2.5 EC	FRE/19202/1462 G March 2019	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of aphids, bollworms and diamondback moth in cereals and vegetables	Macrofertil Ghana Ltd., Tema
116	Success Appat	FRE/1705/1167G September 2017	Spinosad (0.24g/l)	U	Insecticide for the control of fruit flies in fruits and vegetables	Chemico Ltd, Tema
117	Sumico 20 EC	FRE/1843/1346G July 2018	Fenvalerate (200g/l)	II	Insecticide for the control of insect pests in vegetables	Kumark Company Limited, Kumasi
118	Sumitox 20 EC	FRE/18226/1362 G July 2018	Fenvalerate (200g/l)	II	Insecticide for the control of insect pests in vegetables and cowpea	Rapid Lion Gh. Ltd., Kumasi
119	Sumitex 40 EC	FRE/1843/1351G July 2018	Dimethoate (400g/l)	II	Insecticide for the control of mealybugs, mites, thrips, greenflies and borer larvae in vegetables and pineapples	Kumark Company Limited, Kumasi
120	Sunhalothrin 2.5EC	FRE/2057/1586G January 2020	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables and pulses	Wynca Sunshine Agric Products & Trading Co., Ltd, Accra
121	Sun-Lambda EC	FRE/1957/1557G October 2019	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of diamondback moth and cotton bollworms in cabbage and cotton	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
122	Sunpyram 20WG	FRE/2057/1584G January 2020	Nitenpyram (20%)	II	Insecticide for the control of chewing and	Wynca Sunshine Agric

					sucking insect pests in tree crops	Prdt & Trad. Co. Ltd, Accra
123	Sunpyrifos 48 EC	FRE/1957/1555G October 2019	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in crops	Wynca Sunshine Agric Prod & Trading Co., Ltd., Accra
124	Sun-Thiame WDG	FRE/1957/1558G October 2019	Thiamethoxam (25%)	II	Insecticide for the control of planthoppers and aphids in rice and cotton	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
125	Tanalith c 3310	FRE/1843/1372G August 2018	Cupricoxide (11.29%) +Arsenic pentoxide (17.3%) + Chromium trioxide (30.29%)	II	Insecticide for wood treatment	Du Paul Wood Treatment Gh. Limited, Takoradi
126	Termikill 20EC	FRE/1710/1234G October 2017	Chlorpyrifos ethyl (200g/l)	II	Insecticides for the control of insect pest in vegetables	Reiss & Co. Ghana Ltd., Accra
127	Termiking 480EC	FRE/1899/1428G December 2018	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests of vegetables and field crops	Rainbow AgroSciences Co. Ltd., Accra
128	Thodan Super 35SC	FRE/1810/1297G February 2018	Acetamiprid (2%) + Lambda-cyhalothrin (1.5%)	IV	Insecticide for the control of mirids in cocoa	Reiss & Co (Ghana), Accra
129	Thunder 145 OD O-TEQ	FRE/18185/1431 G December 2018	Imidacloprid (100g/l) + Beta-cyfluthrin (45g/l)	II	Insecticide for the control of leaf eating insects and bollworms in cotton	RMG Ghana Limited, Accra
130	Tihan 175-OD-TEQ	FRE/18185/1432 G December 2018	Flubendiamide (100g/l) + Spirotetramat (75g/l)	III	Insecticide for the control of lepidoptera and sucking pest in cotton and vegetables	RMG Ghana Limited, Accra
131	Tornado EC	FRE/20145/1596 G March 2020	Dimethoate (40%)	III	Insecticide for the control of insect pest in rice, cotton, citrus and vegetables	Jubaili Agrotec Ltd., Kumasi
132	Tricel 48 EC	FRE/1910/1483G June 2019	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of cutworms and aphids in cereals and cotton	Reiss & Co (Gh) Ltd., Accra
133	Trigger 10 CS	FRE/1708/1179G September 2017	Lambda-cyhalothrin (100g/kg)	II	Insecticide for the control of insect pest in vegetables	Dizengoff (Ghana) Limited, Accra

134	Verate 200 EC	FRE/1999/1501G June 2019	Fenvalerate (200g/l)	II	Insecticide for the control of stalkborer, bollworms, cotton stainers in cotton, maize and sorghum	Rainbow AgroSciences Co. Ltd., Tema
135	Vigilant 25 EC	FRE/1910/1484G June 2019	Bifenthrin (25g/l)	II	Insecticide for the control of aphids, bollworm, jassids, whiteflies, mites and hoppers in cotton and mango	Reiss & Co (Gh) Ltd., Accra
136	Viper 46EC	FRE/1906/1441G February 2019	Acetamiprid (16g/l) + Indoxacarb (30g/l)	II	Insecticide for the control of lepidoptera, sucking and biting insects	Calli Ghana Co. Ltd., Accra
137	Viper Super 80EC	FRE/1806/1370G August 2018	Indoxacarb (60g/l) + Acetamiprid (20g/l)	II	Insecticide for control of cocoa mirids	Calli Ghana Co. Ltd., Accra
138	Wonder 2.5 EC	FRE/18147/1294 G January 2018	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests of vegetables	Errands4u, C4 - 68, DTD, Madina, Accra
139	Zerofly Screen	FRE17125/1214G October 2017	Deltamethrin (4g/kg)	II	Insecticide for the control of insect pests on livestock	Vestergaard Frandsen West Africa, Accra

(A) Fully Registered Pesticides (FRE)
(A1b) Insecticides for Public Health Purposes

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Actellic 300 CS	FRE/1706/1251G November 2017	Pirimiphos-methyl (300g/l)	III	Insecticide for public health purposes	Calli Ghana Co. Ltd., Tema
2.	Actellic 300 CS	FRE/1906/1439G February 2019	Pirimiphos-methyl (300g/l)	III	Insecticide for public health purposes	Calli Ghana Co. Ltd., Accra
3.	Cypex Maxi Smoke Generator	FRE/1802/1402G August 2018	Potassium Chlorate (20% w/w) + Cypermethrin (13.5% w/w)	II	For general indoor disinfection	Agrimat Limited, Madina
4.	Dusfos 480 EC	FRE/1825/1285G January 2018	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for outdoor public health purposes	Bentronic Productions, Kumasi
5.	Fendona 5SC	FRE/18206/1268G January 2018	Alpha-cypermethrin (50g/kg)	III	Insecticide for public health purposes	Josann Agro Consult (J.A.C) Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
6.	Ficam VC 80WP	FRE/19183/1569G October 2019	Bendiocarb (80%)	II	Insecticide for public health purposes	Bayer West-Central Africa S.A, Accra
7.	Goliath Gel	FRE/19206/1454G February 2019	Fipronil (0.05%)	III	Insecticide for the control mosquitoes, housefly and cockroaches	Josann Agro Consult Ltd., Accra
8.	Hercules Extra 20 SC	FRE/1802/1401G August 2018	Fipronil (200g/l)	II	Insecticide for public health purposes	Agrimat Limited, Madina
9.	Hercules 50 SC	FRE/1802/1260G January 2018	Fipronil (50g/l)	II	Insecticide for public health purposes	Agrimat Ltd., Madina
10.	Inesfly SP Coating	FRE/17104/1216G October 2017	Alpha-cypermethrin (0.7%) + D-Allethrin (1%) + Pyriproxyfen (0.063%)	IV	Insecticide coating for public health purposes	Inesfly Africa Ltd., Accra
11.	Inesfly Floor Cleaner	FRE/17104/1217G October 2017	Alpha-cypermethrin (1.0%) + D-Allethrin (1.0%) + Pyriproxyfen (0.01%)	IV	Insecticide for public health purposes	Inesfly Africa Ltd., Accra
12.	Inesfly Body Repellent	FRE/18154/1406G August 2018	Pyrethrum extract (1.2%) + Piperonyl butoxide (0.3%) + Ethanol (7.5%)	III	Insecticide for repelling mosquitoes	Inestfly Africa Ltd., Accra
13.	Inesfly 5A IGR	FRE/17143/1138G April 2017	Diazinon (1.5%) + Chlorpyrifos (1.5%) + Pyriproxifen (0.063%)	II	Insecticide for public health purposes	Inesfly Africa Limited, Accra
14.	KD 215EC	FRE/1705/1168G September 2017	Chlorpyrifos (200g/l) + Lambda-cyhalothrin (15g/l)	II	Insecticide for outdoor public health purposes	Chemico Limited, Tema
15.	K-Othrine Moustiquaire 1% SC	FRE/1702/1158G July 2017	Deltamethrin (1%w/w)	III	Insecticide for public health purposes	Agrimat Ltd., Madina
16.	K-Othrine 250WG	FRE/19183/1568G October 2019	Deltamethrin (250g/kg)	II	Insecticide for public health purposes for the control of mosquitoes	Bayer West-Central Africa S.A, Accra
17.	Pyriforce 480 EC	FRE/17202/1210G October 2017	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for outdoor public health purposes	Macrofertil Gh. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
18.	Pyrinex 48 EC	FRE/17100/1238G November 2017	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for outdoor public health	Adama West Africa Ltd., Accra
19.	Suncombi 30EC	FRE/1957/1553G October 2019	Fenitrothion (25%) + Fenvalerate (5%)	II	Insecticide for public health purposes	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
20.	Supercare SC	PCL/19173/1435G August 2019	Beta-cyfluthrin (12.5%)	II	Insecticide for the control of mosquitoes, houseflies, ants, cockroaches and fleas	Agromonti Co. Ltd., Accra
21.	Terminus 480 EC	FRE/1816/1269G January 2018	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for outdoor public health	Kurama Company Limited, Accra
22.	Total Flying/ Crawling insecticide	FRE/1898/1405G August 2018	Parallethrin (0.1%) + Cyphenothrin (0.14%) + Deltamethrin (0.17%) + Tetramethrin (0.3%)	II	Insecticide for public health	Total Gh. Ltd., Accra
23.	Vectobac G	FRE/1802/1264G January 2018	*Bacillus thuringiensis*, serotype H-14, 3000 *Units/mg*	IV	Insecticide for the control of mosquito larvae	Agrimat Limited, Madina
24.	VectoBac WG	FRE/1780/1145G July 2017	*Bacillus thuringiensis* subsp. *Israelensis* 3000 ITU/mg	IV	Insecticide for the control of larvae of mosquitoes	Challux Ltd., Accra
25.	VectoBac 12AS	FRE/1802/1262G January 2018	*Bacillus thuringiensis, serotype H-14, 3000 Units/mg*	IV	Insecticide for the control of mosquito larvae	Agrimat Limited, Madina
26.	Vectolex WG	FRE/1802/1263G January 2018	*Bacillus sphaericus (3000 ITU/mg)*	IV	Insecticide for the control of mosquito larvae	Agrimat Limited, Madina

(A) Fully Registered Pesticides (FRE)
(A1c) Insecticides for Stored Produce

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor

1.	Agro Blaster	FRE/1876/1283G January 2018	Pyrethrum (1%)	II	Insecticide for the control of insect pests in stored grains	Equatorial Healthcare Services Ltd., Accra
2.	Ateco Super 25 EC	FRE/1843/1348G July 2018	Pirimiphos-methyl (250g/l)	II	Insecticide for the control of insect pests in stored cereals, cowpea and soybean	Kumark Company Limited, Kumasi
3.	Dastoxion T	FRE/17166/1192R October 2017	Aluminium phosphide (57%)	Ib	Insecticide for the control of insect pests in stored produce	Dasimah Enterprise, Kumasi
4.	Degesch Plate	FRE/17185/1152R July 2017	Magnesium phosphide (56%)	Ib	Insecticide for the control of insect pests in stored grains	RMG Ghana Ltd., Accra
5.	Protex 57TB	FRE/1826/1279R January 2018	Aluminium phosphide (57%)	Ib	Insecticide for the control of insect pests in stored produce	The Candel Ltd., Accra
6.	Super Agro Blaster	FRE/1876/1282G January 2018	Pyrethrum (10%)	II	Insecticide for the control of insect pests in stored grains	Equatorial Healthcare Services Ltd., Accra
7.	Thomaxin P	FRE/1890/1302R February 2018	Aluminium phosphide (57%)	Ib	Insecticide for the control of insect pests in stored produce	Thomas Fosu Ent., Kumasi
8.	Zerofly Storage Bag	FRE/17125/1214G October 2017	Deltamethrin (3g/kg)	III	Insecticide for the control of insect pests in stored grains	Vestergaard Frandsen West Africa, Accra

(A) Fully Registered Pesticides (FRE)
(A2) Fungicides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Acticide EPW	FRE/1920/1493G June 2019	Diuron (20%) + Carbendazim (9%) + 2-octyl-2H-isothiazol-3-one (2.8%)	II	Fungal and algal paint preservative	BBC Industrials Company Ltd., Accra
2.	Agrithane 80WP	FRE/1802/1399G August 2018	Mancozeb (800g/kg)	III	Fungicides for the control of leaf spots, mildew, leaf blight and scab in vegetables	Agrimat Limited, Madina
3.	Agro Comet 72 WP	FRE/1810/1298G February 2018	Copper (I) oxide (60%) + Metalaxyl (12%)	III	Fungicide for the control of *Phytophthora spp.* in cocoa	Reiss & Co (Ghana), Accra
4.	Antracol 70 WP	FRE/17185/1160G July 2017	Propineb (700g/kg)	III	Fungicide for the control of fungal diseases in vegetables	RMG Ghana Ltd., Accra
5.	Athlete 80WP	FRE/19202/1464G March 2019	Fosetyl-aluminium (800g/kg)	III	Fungicide for the control of mildew and *Phytophtora sp.,*	Macrofertil Ghana Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					Pythium plasmopara and *Bremia sp.* in pineapples and fruit trees	
6.	Banjo Forte 400SC	FRE/19100/1541G October 2019	Fluazinam (200g/l) + Dimethorph (200g/l)	III	Fungicide for the control of *Phytophthora megakarya* in cocoa	Adama West Africa Ltd., Accra
7.	Benco 80 WP	FRE/1825/1336G July 2018	Mancozeb (800g/kg)	III	Fungicide for control of leaf spots, mildew, leaf blight and in vegetables, fruits and ornamentals	Bentronics Productions. Kumasi
8.	Bosun 300SC	FRE/18139/1419G November 2018	Boscalid (20%) + Kresoxim-methyl (10%)	III	Fungicide for the control of powdery mildew, anthracnose, mould, rust and leaf spots in vegetables and fruits	Jingbo Agrochemicals Tech. Gh. Co., Ltd., Accra.
9.	Caldo Bordeles Valles 20WP	FRE/18137/1436G December 2018	Bordeaux mixture (Copper (II) Sulphate + Ca (OH_2) (200g/kg)	III	Fungicide for the control of diseases in vegetables and fruits	Miqdadi Company Limited, Accra
10.	Callet 50WP	FRE/20145/1599G March 2020	Carbendazim (50%)	III	Fungicide for the control of *Pyricularia oryzae* in paddy rice	Jubaili Agrotec Ltd., Kumasi
11.	Calliete 80 WP	FRE/1706/1246G November 2017	Fosetyl-aluminium (800g/kg)	III	Systemic fungicide for the control of *phytophtor*a in pineapple	Calli Ghana Co. Ltd., Accra
12.	Callis 400 OL	FRE/1706/1245G November 2017	Thiophanate-methyl (400g/l)	III	Fungicide for the control of yellow and black sigatoka in bananas	Calli Ghana Co. Ltd., Accra
13.	Champion WP	FRE/2005/1606G March 2020	Copper Hydroxide (77%)	III	Fungicide for the control of fungal diseases in cocoa and coffee	Chemico Limited, Accra
14.	Chemoliette 80 WP	FRE/1705/1141G July 2017	Fosetyl-aluminium (800g/kg)	III	Systemic fungicide for the control of *phytophtora* diseases in pineapple	Chemico Ltd., Tema
15.	Conti-Zeb	FRE/1978/1571G October 2019	Mancozeb (800g/kg)	III	Fungicide for the control of leafspots, mildew, leafblight and scab in vegetables and fruits	Five Continents Imports & Exports Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
16.	Cuprofix 30 Disperss	FRE/1705/1142G July 2017	Mancozeb (30%) + Metallic copper (12%)	II	Fungicide for the control of powdery mildew, anthracnose, leaf and fruit spots in vegetables	Chemico Ltd., Tema
17.	Cuprozin 35WP	FRE/2008/1587G January 2020	Copper oxychloride (35%)	II	Fungicide for the control of diseases in vegetables	Dizengoff Ghana Ltd., Accra
18.	Curenox 50WP	FRE/18137/1437G December 2018	Copper Oxychloride (50%)	III	Fungicide for the control of diseases in fruits and vegetables	Miqdadi Company Limited, Accra
19.	Daszeb 80 WP	FRE/17166/1185G September 2017	Mancozeb (800g/kg)	III	Fungicide for the control of fungal diseases in cereals, cotton, sweetpotato and vegetables	Dasimah Enterprise, Adum-Kumasi
20.	Dizole 250 EC	FRE/1899/1364G August 2018	Difenoconazole (250g/l)	III	Fungicide for the control of leaf blight and leaf spot in banana, carrots and tomatoes	Rainbow Agro Sciences Co. Ltd., Tema
21.	Delco 75WP	FRE/1843/1373G July 2018	Copper Hydroxide (75%)	III	Fungicide for the control of blackpod disease in cocoa	Kumark Company Limited, Kumasi
22.	Fantic Plus 69WP	FRE/1906/1448G February 2019	Cuprous oxide (60%) + Benalaxyl-M (9%)	III	Fungicide for the control of *Phytophtora megakarya* in cocoa	Calli Ghana Co. Ltd., Accra
23.	Five Star 325 SC	FRE/1899/1329G May 2018	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	III	Fungicide for the control of brown spot, blackspot, rust and white mould in cabbage, cowpea, soybean, bulb vegetables, groundnut and sweetpotatoes	Rainbow Agroosciences Co. Ltd., Tema
24.	Folicur 250 EW	FRE/19185/1473G March 2019	Tebuconazole (250g/l)	II	Fungicide for the control of black and yellow sigatoka in plantain and banana	RMG Ghana Limited, Accra
25.	Goldazim 500 SC	FRE/1816/1272G January 2018	Carbendazim (500g/l)	III	Systemic fungicide for the control of diseases in fruits and vegetables	Kurama Company Limited, Accra
26.	Impulse 800 EC	FRE/19185/1471G March 2019	Spiroxamine (800g/l)	II	Fungicide for the control of black and yellow sigatoka in plantain and banana	RMG Ghana Limited, Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
27.	Ivory 80WP	FRE/1906/1440G February 2019	Mancozeb (800g/kg)	III	Fungicide for the control of diseases in vegetables and fruits	Calli Ghana Co. Ltd., Accra
28.	Kabazeb 80 WG	FRE/1781/1139G April 2017	Mancozeb (800g/kg)	III	Fungicide for the control of blight, leafspot, rust, downy mildew and scab	B. Kaakyire Agrochemical, Kumasi
29.	Kentan 40WG	FRE/2006/1581G January 2020	Copper Hydroxide (400g/kg)	III	Fungicide for the control of blackpod disease in cocoa	Calli Ghana Company Limited, Accra
30.	Kilazeb 80 WP	FRE/1843/1355G July 2018	Mancozeb (800g/kg)	III	Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables and fruits	Kumark Co. Ltd., Kumasi
31.	Kocide 2000 WP	FRE/1706/1248G November 2017	Cupric hydroxide (53.8%)	III	Fungicide for the control of diseases in cocoa	Calli Ghana Co. Ltd., Accra
32.	Mancozan 80 WP	FRE/17202/1193G October 2017	Mancozeb (640g/kg) + Metalaxyl (80g/kg)	III	Fungicide for the control of blight, leafspot and scab in vegetables	Macrofertil Gh. Ltd., Tema
33.	Mancozan Super WP	FRE/19202/1465G March 2019	Mancozeb (640g/kg) + Metalaxyl (80g/kg)	II	Fungicide for the control of blight, leafspot and scab in fruits and vegetables	Macrofertil Gh. Ltd., Tema
34.	Mandazim WP	FRE/20145/1595G March 2020	Mancozeb (63%) + Carbendazim (12.5%)	III	Fungicide for the control of late leaf spot and peanut rust in groundnuts	Jubaili Agrotec Ltd., Kumasi
35.	Maneb 80 WP	FRE/1822/1413G November 2018	Maneb (80%)	III	Fungicide for control of fungal diseases in vegetables, cereals, citrus, avocados and mangoes	Annoh & Sons Enterprise, Achimota-Accra
36.	Manlax	FRE/1899/1424G December 2018	Mancozeb (64%) + Metalaxy (8%)	III	Fungicide for the control of downy mildew, late and early blight in lettuce, onions and sweetpotatoes	Rainbow AgroSciences Company Limited, Tema
37.	Metalm 72WP	FRE/1816/1273G January 2018	Cuprous oxide (60%) + Metalaxyl (12%)	III	Fungicide for the control of black pod disease in cocoa	Kurama Company Limited, Accra
38.	Nativo 300 SC	FRE/19185/1427G March 2019	Tebuconazole (200g/l) + Trifloxystrobin (100g/l)	III	Fungicide for the control of fungal diseases in vegetables	RMG Ghana Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
39.	Nordox Super 75 WG	FRE/17185/1151G July 2017	Cuprous oxide (86%)	III	Fungicide for the control of *P. palmivora* and *P. megakarya* in cocoa	RMG Ghana Ltd., Accra
40.	Ortiva Top	FRE/2006/1581G January 2020	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	III	Fungicide for control of leaf spot and *Anthracnose* of tomatoes	Calli Ghana Co. Ltd., Accra
41.	Prozole 250 EC	FRE/1999/1494G June 2019	Propiconazole (250g/l)	III	Fungicide for the control of diseases in rice and pineapple	Rainbow Agrosciences Company Limited, Tema
42.	Raintebzol 75 WG	FRE/1799/1174G September 2017	Tebuconazole (75%)	III	Fungicide for the control of leaf spots, mildew, leaf blight, scab in fruits and vegetables	Rainbow AgroSciences Co. Ltd., Tema
43.	Raintebzol 430 SC	FRE/1799/1172G September 2017	Tebuconazole (430g/l)	III	Fungicide for the control of rust, leaf spots, mildew, leaf blight in fruits and vegetables	Rainbow AgroSciences Co. Ltd., Tema
44.	Ridomil Gold Plus 66 WP	FRE/17185/1150G July 2017	Cuprous oxide (60%) +Metalaxyl-M (6%)	III	Fungicide for the control of *P. palmivora* and *P. megakarya* in cocoa	RMG Ghana Ltd., Accra
45.	Royal Cop 77 WP	FRE/1843/1372G July 2018	Copper Hydroxide (77%)	III	Fungicide for the control of blackpod disease in cocoa	Kumark Company Limited, Kumasi
46.	Shavit F 715 WP	FRE/18100/1275G January 2018	Folpet (700g/kg) + Triadimenol (15g/kg)	III	Fungicide for the control of diseases in vegetables	Adama West Africa Ltd., Accra
47.	Skystar 280SC	FRE/1899/1434G December 2018	Azoxystrobin (20%) + Propiconazole (8%)	III	Fungicide for the control of leaf spots, mildew, leaf blight, scab and anthracnose in vegetables	Rainbow AgroSciences Company Limited, Tema
48.	Skyrobin 50 WG	FRE/1705/1171G September 2017	Azoxystrobin (500g/kg)	III	Fungicide for the control of mildew, leaf blight, scab and anthracnose in vegetables	Rainbow AgroSciences Company Limited, Tema
49.	Sphinx star 480WDG	FRE/18100/1315G April 2018	Chlorothalonil (400g/l) + Dimethomorph (80g/l)	III	Fungicide for the control of diseases in vegetables	Adama West Africa Ltd, Accra
50.	Sun-Anil SC	FRE/1957/1549G October 2019	Pyrimethanil (50g/l)	III	Contact fungicide for the control of downy	Wynca Sunshine Agric.

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					mildew of tomatoes and cucumber	Products & Trading Co. Ltd., Accra.
51.	Suncozeb 80WP	FRE/1957/1557G October 2019	Mancozeb (800kg/kg)	III	Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables	Wynca Sunshine Agric Products & Trading Co Ltd, Accra
52.	Sun-Vege	FRE/2057/1579G January 2020	Dimethorph (50%)	III	Fungicide for the control of downy mildew and early blight in cucumber	Wynca Sunshine Agric Products & Trading Co Ltd, Accra
53.	Sustain	FRE/18185/1280G January 2018	*Trichoderma asperellum* TRC (900)	U	Bio-fungicide for the control of RKN in beans	RMG Ghana Ltd., Accra
54.	Thiopsin 70WP	FRE/1781/1137G April 2017	Thiophanate-methyl (700g/kg)	III	Fungicide for the control of leaf spot, mildew leaf blight and scab in vegetables and fruits	B. Kaakyire Agrochemicals, Kumasi
55.	Top Cop	FRE/1805/1387G August 2018	Sulphur (50%) + Copper (8%)	III	Fungicide / miticide for the control of diseases in vegetables	Chemico Limited, Tema
56.	Topsect 70WP	FRE/1825/1296G January 2018	Thiophanate-methyl (70%)	III	Fungicide for the control of fungal diseases in crops	Bentronic Productions, Kumasi
57.	Trimangol 80WP	FRE/1805/1388G August 2018	Maneb (80%)	III	Fungicide for the control of leaf spots, downy mildew, fruit rot in cereals and vegetables	Chemico Limited. Tema
58.	Trustar 85WG	FRE/1899/1328G May 2018	Azoxystrobin (49%) + Tebuconazole (36%)	IV	Fungicide for the control of diseases in rice, soybean, tomato and banana	Rainbow Agroosciences Co. Ltd., Tema
59.	Vamos 500SC	FRE/19100/1540G October 2019	Fluazinam (500g/l)	III	Fungicide for the control of *Phytophthora megakarya* in cocoa	Adama West Africa Ltd., Accra
60.	Victory 72WP	FRE/1708/1148G July 2017	Mancozeb (64%) + Metalaxyl (8%)	III	Fungicide for the control of fungal diseases in vegetables and fruits	Dizengoff (Ghana) Ltd., Accra
61.	Volley 88 OL	FRE/19206/1453G February 2019	Fenpropimorph (880g/l)	II	Fungicide for the control of *Mycosphaerella musicola and Mycosphaerella fijiensis* in banana	Josann Agro Consult Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
62.	Zeb-care 80WP	FRE/20145/1597G March 2020	Mancozeb (80%)	III	Fungicide for the control of fungal diseases in fruits and vegetables	Jubaili Agrotec Ltd., Kumasi

(A) Fully Registered Pesticides (FRE)

(A3) Herbicides

Note: For this project, Glyphosate, even though it is approved by the Ghana EPA, will not be used due to the associated adverse environmental, soil life and human health impacts.

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Adom 48 SL	FRE/1767/1258G December 2017	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Jakess Agro Company Ltd, Kumasi
2.	Adupa Wura SL	FRE/1825/1288G January 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Bentronic Productions, Kumasi
3.	Adwumade n Ye	FRE/17166/1182G September 2017	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Dasimah Enterprise, Adum-Kumasi
4.	Adwumapa SL	FRE/1771/1191G September 2017	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broad-leaf weeds and grasses in cereals and vegetables	Chinese Woman Agrochemical, Kumasi
5.	Adwumamu Hene 41SL	FRE/1930/1478G March 2019	Glyphosate (41%)	II	Herbicide for the control of annual, perennial broad-leaf weeds and grasses in cereals and vegetables	Natosh Enterprise, Kumasi
6.	Adwuma Wura 480 SL	FRE/1843/1344G July 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
7.	Agil 100 EC	FRE/17100/1236G November 2017	Propaquizafop (100g/l)	III	Herbicide for the control of grasses in pineapple, cotton, groundnut, soybean, vegetables and yam	Adama West Africa Ltd., Accra
8.	Agro 2,4-D 72 SL	FRE/1710/1230G October 2017	2, 4-D Amine (720g/l)	II	Selective herbicide for the control of	Reiss & Co. Ghana Ltd.,

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					broadleaf weeds and sedges in cereals and sugarcane	Accra
9.	Agro-Ametryn 500SC	FRE/1710/1234G October 2017	Ametryn (500g/l)	II	Herbicide for the control of annual broadleaf weeds and grasses in fruits and sugarcane	Reiss & Co. Ghana Ltd., Accra
10.	Alligator 400 EC	FRE/17202/1195G October 2017	Pendimethalin (400g/l)	III	Herbicide for the control of grasses in rice	Macrofertil Gh. Ltd., Tema
11.	Amazone 10 WP	FRE/1906/1452G February 2019	Pyrazosulfuron-ethyl (100g/kg)	U	Herbicide for the control of grasses and broadleaf weeds in rice	Calli Ghana Co. Ltd., Accra
12.	Amino 72 SL	FRE/1805/1380G August 2018	2, 4-D Amine (720g/l)	III	Selective herbicide for the control of broad-leaved weeds and sedges in cereals and sugarcane	Chemico Limited, Tema
13.	Aminespray 720SL	FRE/1899/1433G December 2018	2,4-D Amine (720g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds in cereals, sugarcane and citrus	Rainbow AgroSciences Co. Ltd., Tema
14.	Aminoforce 72SL	FRE/18145/1320G May 2018	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds and sedges in cereals and tree crops	Jubaili Agrotec Ltd., Kumasi
15.	Anna	FRE/ 1822/1414G November 2018	2,4-D Amine (720g/l)	II	Selective herbicide for control of weeds in rice, maize, sorghum	Annoh and Sons Enterprise, Accra
16.	Anigramo Super 20 SL	FRE/18122/1278R January 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses	Asantepon Farms, Kade
17.	Aniphosate 41 SL	FRE/18122/1277G January 2018	Glyphosate (410g/l)	III	Herbicide for annual, perennial broadleaf weeds and grasses in cereals and vegetables	Asantepon Farms, Kade
18.	Arsenal Gen 2SL	FRE/18206/1266G January 2018	Imazapyr (250g/l)	II	Selective post emergence herbicide for the control of grasses in cereals	Josann Agro Consult (J.A.C) Ltd., Accra
19.	Baccara 435 EC	FRE/1906/1444G February 2019	Propanil (260g/l) + 2,4 D Amine (175g/l)	II	Herbicide for the control of broadleaf weeds and grasses in rice	Calli Ghana Company Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
20.	Basagran 480 SL	FRE/18206/1265G January 2018	Bentazon (480g/l)	II	Herbicide for the control of broadleaf weeds in beans, groundnut and maize	Josann Agro Consult (J.A.C) Ltd., Accra
21.	Bastnate 200 SL	FRE/1999/1500G June 2019	Glufosinate-ammonium (200g/l)	II	Herbicide for the control of annual and perennial broadleaf weeds in banana, plantain, mango and pineapple	Rainbow AgroSciences Company Limited, Tema
22.	Benapa 460 SL	FRE/1899/1326G May 2018	Bentazone (400g/l) + MCPA (60g/l)	II	Contact and selective post-emergence herbicide for the control of grasses in rice, maize, sorghum and sugarcane	Rainbow Agrosciences Co. Ltd., Tema
23.	Benaxone	FRE/1825/1334G July 2018	Paraquat (276g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Bentronics Productions, Kumasi
24.	Bextra 72SL	FRE/1825/1289G January 2018	2, 4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in maize, rice and sorghum	Bentronic Productions, Kumasi
25.	Bisonrice 400SC	FRE/1899/1375G August 2018	Bispyribac sodium (400g/l)	III	Selective herbicide for the control of grasses and broadleaf weeds in rice	Rainbow Agro Sciences Co. Ltd., Tema
26.	Bonamine 720 SL	FRE/19149/1459G February 2019	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds and grasses in rice and maize	Bon Agro Co. Ltd., Kumasi
27.	Bonsate 480 SL	FRE/19149/1459G February 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual and perennial weeds on non-crop lands	Bon Agro Co. Ltd., Kumasi
28.	Butaforce EC	FRE/18145/1322G May 2018	Butachlor (500g/l)	III	Pre-emergent herbicide for the control of grasses and broadleaf weeds in rice, soybean, cotton and vegetables	Jubaili Agrotec Ltd., Kumasi
29.	Butaplus EC	FRE/1843/1354G July 2018	Butachlor (50%)	II	Pre-emergence herbicide for soyabean, cotton, rice, groundnuts and vegetable	Kumark Co. Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
30.	Calliherbe 720 SL	FRE/1906/1443G February 2019	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds in cereals and tree crops	Calli Ghana Co. Ltd, Accra
31.	Canphosate SL	FRE/18147/1292G January 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Errands4u, C4 - 68, DTD, Madina, Accra
32.	Canquat Super SL	FRE/18147/1293R January 2018	Paraquat dichloride (20%)	II	Herbicide for control of grasses and broadleaf weeds in cereals and vegetables	Errands4u, C4 - 68, DTD, Madina, Accra
33.	Capizad EC	FRE/17202/1209G October 2017	Haloxyfop-R-methyl (104g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema
34.	Chemosate Super EC	FRE/1705/1143G July 2017	Glyphosate (360g/l)	III	Herbicide for the control of annual and perennial weeds in crops	Chemico Ltd., Tema
35.	Chemopax 500 SC	FRE/2005/1605G March 2020	Ametryn (485g/l) + Trazine (15g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Chemico Limited, Tema
36.	Chemostor m 500EC	FRE/2905/1604G March 2020	Pendimethalin (500g/l)	III	Pre-emergent herbicide for the control of weeds in cereals, cotton and soybean	Chemico Limited, Tema
37.	Chemoxone SL	FRE/1805/1391G August 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Chemico Limited, Tema
38.	Chemuron 80 WP	FRE/1805/1392G August 2018	Diuron (800g/kg)	III	Herbicide for the control of grasses in pineapples, citrus and mangoes	Chemico Limited, Tema
39.	Chemovar 80 WP	FRE/1805/1393G August 2018	Bromacil (800g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in pineapples	Chemico Limited, Tema
40.	Cleanspray 80 SG	FRE/1999/1499G June 2019	2,4-D Amine (800g/kg)	II	Herbicide for the control of annual broadleaf weeds and grasses in millet	Rainbow AgroSciences Co. Ltd., Tema
41.	Condax WP	FRE/1978/1570G October 2019	Bensulfuron-methyl (30%)	III	Systemic herbicide for the control of annual and perennial broadleaf weeds in rice	Five Continents Imp. & Exp. Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
42.	Conti-quat	FRE/1978/1574R October 2019	Paraquat dichloride (276g/l)	II	Herbicide for the control of annual, perennial broad-leaf weeds and grasses in field crops	Five Continents Imp. & Exp. Ltd., Accra
43.	Corta 480 EC	FRE/19202/1468G March 2019	Triclopyr (480g/l)	III	Herbicide for the control of broadleaf weeds in oil palm, rice and sugarcane	Macrofertil Ghana Ltd., Tema
44.	Cotbond 560 SL	FRE/1758/1256G November 2017	Propanil (360g/l) + 2, 4-D Amine salt (200g/l)	II	Herbicide for the control of grasses and weeds in rice	Afcott Ghana Ltd., Accra
45.	Conti-sul WP	FRE/1865/1274G January 2018	Acetolachlor (25%) + Bensulfuron-methyl (5%)	III	Herbicide for the control of annual, perennial weeds in rice	Five Continents Imports & Exports, Accra
46.	Dekel 170 EC	FRE/19100/1548G October 2019	Propaquizafop (50g/l) + Oxyfluorfen (120g/l)	III	Herbicide for the control of grasses and broadleaf weeds in onion, legume and cotton	Adama West Africa Ltd. Accra
47.	Diuron Plus	FRE/1843/1356G July 2018	Diuron (80%)	III	Herbicide for the control of annual and perennial grasses and broadleaf weeds in pineapples, citrus and mangoes	Kumark Co. Ltd
48.	Eduodzi 480 SL	FRE/1999/1505G June 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in vegetables and cereals	Rainbow AgroSciences Co. Ltd., Tema
49.	Eduodzi 757 SG	FRE/1999/1506G June 2019	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Rainbow AgroSciences Co. Ltd., Tema
50.	Ervextra 720 SL	FRE/19202//1469 G March 2019	2, 4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in rice, maize, oil palm, coconut, rubber and sugarcane	Macrofertil Ghana Ltd., Tema
51.	Fenfen 240 EC	FRE/1999/1498G June 2019	Oxyfluorfen (240g/l)	IV	Herbicide for the control of annual, perennial broadleaf weeds and grasses in groundnut, fruit trees, onion and cotton	Rainbow AgroSciences Company Limited, Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
52.	ForceUp SL	FRE/18145/1319G May 2018	Glyphosate (41%)	III	Herbicide for the control of weeds	Jubaili Agrotec Ltd., Kumasi
53.	Forpine 80 WP	FRE/1899/1364G August 2018	Bromacil (80%)	III	Herbicide for the control of weeds in pineapples and citrus	Rainbow Agro Sciences Co.Ltd., Tema
54.	Fos-lade Super 15 EC	FRE/1890/1300G February 2018	Fluazifop-p-butyl (150g/l)	III	Selective herbicide for the control of annual, perennial grasses in broadleaf crops	Thomas Fosu Enterprise, Kumasi
55.	Franko 2, 4-D	FRE/1739/1177G September 2017	2,4-D Amine salts (720g/l)	II	Herbicide for the control of broadleaf weeds and sedges in rice, maize, sorghum, millet and sugarcane	Frankatson Limited, Accra
56.	Frankosate 41 SL	FRE/1739/1175G September 2017	Glyphosate (410g/l)	III	Herbicide for the control of broadleaf weeds, sedges and grasses in orchards	Frankatson Limited, Accra
57.	Frankosulfuron	FRE/1939/1489G June 2019	Nicosulfuron (40g/l)	III	Herbicide for the control of grasses in maize	Frankatson Limited, Accra
58.	Gallant Super	FRE/1805/1390G August 2018	Haloxyfop (108g/l)	III	Post emergence herbicide for the control of broadleaf weeds in vegetables	Chemico Limited
59.	Garlon 4E	FRE/1905/1575G November 2019	Triclopyr (480g/l)	III	Herbicide for use as tree killer and the control of broadleaf weeds	Chemico Limited. Tema
60.	Glycel 41SL	FRE/1910/1515G July 2019	Glyphosate (410g/l)	II	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Reiss & Co. (Ghana) Ltd., Accra
61.	Glycot 41 SL	FRE/1758/1253G November 2017	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals	Afcott Ghana Limited, Accra
62.	Glyking 480 SL	FRE/1999/1502G June 2019	Glyphosate (480g/l)	III	Herbicide for the control annual, perennial grasses and broadleaf weeds on non-crop and farm lands	Rainbow AgroSciences Co. Ltd., Tema
63.	Glyphader 75 SG	FRE/17202/1197G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
64.	Glyphader 480 SC	FRE/17202/1202G October 2017	Glyphosate (480g/l)	III	Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Macrofertil Gh. Ltd., Tema
65.	Glyphapat	FRE/17166/1190G September 2017	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial broad-leaf weeds and grasses in soybean, cotton	Dasimah Enterprise, Adum-Kumasi
66.	Glyfos 41SL	FRE/1802/1403G August 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Agrimat Limited, Madina
67.	Glygold 41 SL	FRE/1953/1475G March 2019	Glyphosate (410g/l)	III	Herbicide for the control of perennial grasses, broadleaf weeds, sedges and aquatic weeds in arable crops	L'espoir Co. Ltd., Accra
68.	Glyphosate 95% Technical	FRE/1857/1397G August 2018	Glyphosate Ammonium Salt (95 % Min)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric Products & Trading, Accra
69.	Glyphosate 88% Technical	FRE/1857/1398G August 2018	Glyphosate Ammonium Salt (88 % Min)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric Products &Trading, Accra
70.	Guardforce OD	FRE/18145/1429G December 2018	Nicosulfuron (4%)	III	Herbicide for the control of annual grass weeds	Jubaili Agrotec Ltd, Kumasi
71.	Halaxy 108 EC	FRE/1899/1314G April 2018	Haloxyfop-P-Methyl (108g/l)	IV	Herbicide for the control of annual and perennial weeds in cereals, leafy vegetables, pineapple, soybean and cowpea	Rainbow AgroSciences Co. Ltd., Tema
72.	Herbaking 720 SL	FRE/1999/1497G June 2019	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds and grasses in sorghum, maize, coffee and citrus	Rainbow AgroSciences Company Limited, Tema
73.	Herbazol	FRE/1945/1507G June 2019	2,4-D Amine (760g/l)	II	Herbicide for the control of broadleaf weeds and sedges in cereals and tree crops	J. K Duku Enterprise, Kumasi
74.	Herbextra 72 SL	FRE/1843/1340G July 2018	2,4-D Amine (720g/l)	II	Selective herbicide for the control of	Kumark Co. Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					broadleaf weeds in rice, maize, sorghum, millet and sugarcane	
75.	Herbimais WG	FRE/17202/1198R October 2017	Atrazine (750g/kg) Nicosulfuron (40g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Macrofertil Gh. Ltd., Tema
76.	Herbisuper S	FRE/17202/1199G October 2017	Acetachlor (300g/l) + Simazine (200g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Macrofertil Gh. Ltd., Tema
77.	Hero Super 108 EC	FRE/1843/1373G August 2018	Haloxyfop methyl (108g/l)	III	Herbicide for the control of annual grasses in vegetables and pulses	Kumark Co. Ltd., Kumasi
78.	Kabaherb SL	FRE/1881/1409G October 2018	2,4-D Amine Salts (720g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in rice	B. Kaakyire Agrochemical Co. Ltd., Kumasi
79.	Kabasate 41SL	FRE/1881/1416G October 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	B. Kaakyire Agrochemical Co. Ltd., Kumasi
80.	Kalach 360 SL	FRE/1706/1249G November 2017	Glyphosate (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Calli Ghana Co. Ltd., Accra
81.	Kalach Extra 70SG	FRE/1706/1250G November 2017	Glyphosate (700g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Calli Ghana Co. Ltd., Accra
82.	Komanda	FRE/1927/1480G March 2019	Glyphosate (410g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize, sugarcane and fruit trees	Multivet (Gh) Ltd., Accra
83.	Kumnwura SL	FRE/1825/1284G January 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Bentronic Productions, Kumasi
84.	Kurasate 360 SL	FRE/1816/1271G January 2018	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Kurama Company Limited, Accra
85.	Kwatrikwa 20 SL	FRE/1802/1404G August 2018	Paraquat (20%)	II	Herbicide for the control of annual,	Agrimat Limited, Madina

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					perennial grass and broadleaf weeds	
86.	Ladaba 75 SG	FRE/17202/1200G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals, vegetables and plantation crops	Macrofertil Gh. Ltd., Tema
87.	Lagon 575SC	FRE/19185/1474G March 2019	Aclonifen (500g/l) + Isoxaflutole (75g/l)	III	Pre-emergent herbicide for the control of grasses and broadleaf weeds in maize	RMG Ghana Limited, Accra
88.	Landlord 360 SL	FRE/18185/1317G April 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in crops	RMG Ghana Ltd., Accra
89.	Maestro 960 EC	FRE/1999/1496G June 2019	Metolachlor (960g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize	Rainbow AgroSciences Company Limited, Tema
90.	Multi 2, 4-D SL	FRE/1927/1479G March 2019	2,4-D Amine Salt (720g/l)	II	Herbicide for the control of annual broadleaf weeds in maize and rice	Multivet (Gh.) Ltd., Accra
91.	Nico 40OD	FRE/18139/1421G November 2018	Nicosulfuron (40g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals	Jingbo Agrochemicals Tech. Gh. Co. Ltd., Accra.
92.	Nico Plus OD	FRE/1843/1353G July 2018	Nicosulfuron (4%)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
93.	Nicocal 40 OD	FRE/1825/1338G July 2018	Nicosulfuron (400g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Bentronic Productions. Kumasi
94.	Nicoherb 40 OD	FRE/1945/1461G February 2019	Nicosulfuron (40g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	J. K Duku Enterprise, Kumasi
95.	Nicoking 75WG	FRE/1899/1326G August 2018	Nicosulfuron (750g/kg)	III	Herbicide for the control of annual, perennial grasses and	Rainbow AgroSciences Co. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					broadleaf weeds in maize	
96.	Nicopat Super	FRE/17166/1187G September 2017	Nicosulfuron (40g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds	Dasimah Enterprise, Adum-Kumasi
97.	Nnoboa 41 SL	FRE/1945/1457G February 2019	Glyphosate (41%)	III	Herbicide for the control of annual, perennial grasses and broadleaf in cereals and vegetables	J. K Duku Enterprise, Kumasi
98.	Nwura Wura 360SL	FRE//1757/1218G October 2017	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Wynca Sunshine Agric Prod & Trading Co. Ltd., Accra
99.	Oboafo 480 SL	FRE/17202/1208G October 2017	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema
100.	Ogyefo 72 SL	FRE/1890/1301G February 2018	2,4-D Amine (720g/l)	II	Herbicide for the control of post emergent annual weeds in rice	Thomas Fosu Enterprise, Kumasi
101.	Oyeadieyie 41 SL	FRE/1739/1176G September 2017	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Frankatson Limited, Accra
102.	Orizo Plus SL	FRE/1826/1323G May 2018	Propanil (360g/l) + 2,4-D Amine salts (200g/l)	II	Selective herbicide for the control of grasses and broadleaf weeds in rice	The Candel Company Limited, Accra
103.	Panicumma x Cleaner 100EC	FRE/18139/1422G November 2018	Quizalofop-P-Ethyl (100g/l)	II	Systemic herbicides for control of *Panicum maximum,* annual and perennial weeds	Jingbo Agrochemical s Technology, Gh. Ltd., Accra
104.	Paracot SL	FRE/1758/1254R November 2017	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of grasses and broadleaf weeds in maize, sorghum, yam, cassava and sugarcane	Afcott Ghana Ltd., Accra
105.	Pencal 500 EC	FRE/1906/1449G February 2019	Pendimethalin (500g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice and maize	Calli Ghana Co. Ltd., Accra
106.	Pendico 50 EC	FRE/1910/1486G June 2019	Pendimethalin (500g/l)	III	Herbicide for the control of broadleaf	Reiss & Co (Gh) Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					weeds in cereals, cotton and soybean	
107.	Pendigan 400 CS	FRE/18100/1276G January 2018	Pendimethalin (400g/l)	II	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Adama West Africa Ltd., Accra
108.	Pendipax	FRE/2099/1588G January 2020	Pendimethalin (500g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in maize and sugarcane plantation	Rainbow AgroSciences Co. Ltd., Tema
109.	Pendi Plus 400 EC	FRE/2043/1590G January 2020	Pendimethalin (40%)	III	Herbicide for the control of annual grasses and broadleaf weeds in maize, onion, cotton and rice	Kumark Co. Ltd., Kumasi
110.	Power 41 SL	FRE/1945/1456G February 2019	Glyphosate (41%)	III	Herbicide for the control of annual, perennial grasses and broadleaf in cereals and vegetables	J. K Duku Enterprise, Kumasi
111.	Pronil Plus SL	FRE/1825/1335G July 2018	Propanil (360g/l) + 2, 4 D Amine Salt (200g/l)	III	Selective herbicide for the control of annual and perennial grasses and broadleaf weeds in rice	Bentronics Productions. Kumasi
112.	Propacal-Plus 480EC	FRE/1843/1342G July 2018	Propanil (240g/l) + 2, 4-D isobutylate (240g/l)	II	Selective herbicide for the control of annual and perennial grasses and broadleaf weeds in rice	Kumark Co. Ltd., Kumasi
113.	Propaforce Plus EC	FRE/18145/1321G May 2018	Propanil (36%) + 2, 4-D Isobutyl Ester (20%)	III	Herbicide for the control of weeds in rice	Jubaili Agrotec Ltd., Kumasi
114.	Propapat Plus	FRE/17166/1186G September 2017	Propanil (360g/l) + 2, 4-D Amine (200g/l)	III	Herbicide for the control of annual, perennial weeds in arable crops	Dasimah Enterprise, Adum-Kumasi
115.	Ricetop	FRE/1899/1425G December 2018	Propanil (360g/l) + 2,4 D Amine (200g/l)	III	Herbicide for the control of *Amaranthus retroflexus, Digitaria spp., Echinochloa spp., Panicum spp.* in rice	Rainbow AgroSciences Company Limited, Tema
116.	Ricecare 240 SC	FRE/1899/1327G May 2018	Penoxsulam (240g/l)	IV	Herbicide for the control of broadleaf weeds and sedges in field crops	Rainbow Agrosciences Co. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
117.	Ricenice 360 EC	FRE/1999/1495G June 2019	Propanil (360g/l)	III	Herbicide for the control of *Amaranthus retroflexus, Digitaria spp.,* and *Echinochloa spp.*in rice	Rainbow AgroSciences Co. Ltd., Tema
118.	Ricestar 300 WP	FRE/1705/1170G September 2017	Bensulfuron-methyl (120g/kg) + Bispyribac-sodium (180g/kg)	III	Herbicide for the control of annual grasses, broadleaf weeds and sedges in rice	Chemico Limited, Tema
119.	Ridmax 510 SL	FRE/1899/1325G May 2018	Glyphosate IPA (300g/l) + 2,4-D IPA (210g/l)	III	Herbicide for the control of annual, perennial weeds in field crops	Rainbow Agrosciences Co. Ltd., Tema
120.	Rid Out 480 SL	FRE/1999/1503G June 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds on non-crop and farm lands	Rainbow AgroSciences Co. Ltd., Tema
121.	Rid Over 757 SG	FRE/1999/1504G June 2019	Glyphosate ammonium (75.7%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable and plantation crops	Rainbow AgroSciences Co. Ltd., Tema
122.	Rigold 432 EC	FRE/17202/1207G October 2017	Propanil (360g/l) + Triclopyr (72g/l)	III	Herbicide for the control of grasses and broad leaf weeds in rice	Macrofertil Gh. Ltd., Tema
123.	Rondo 48SL	FRE/1710/1232G October 2017	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Reiss & Co. Ghana Ltd., Accra
124.	Rondo 75.7SG	FRE/1710/1231G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in vegetables and cereals	Reiss & Co. Ghana Ltd., Accra
125.	Roundup 450 Turbo	FRE/17202/1201G October 2017	Glyphosate (450g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema
126.	Sharp 480 SL	FRE/1843/1341G July 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual and perennial grasses and	Kumark Co. Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					broadleaf weeds in cereals	
127.	Shye Nwura SL	FRE/1825/1287G January 2018	Glyphosate (41%)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Bentronic Productions, Kumasi
128.	Sikosto 360 SL	FRE/1816/1270G January 2018	Glyphosate (360g/l)	III	Non-selective herbicide for the control of annual, perennial grasses and broadleaf weeds	Kurama Company Limited, Accra
129.	Sinosate 41 SL	FRE/1825/1291G January 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses	Natosh Enterprise, Kumasi
130.	Special 30 WP	FRE/17202/1206G October 2017	Diuron (560g/kg) + Bromacil (240g/kg)	II	Herbicide for control of weeds in pineapple	Macrofertil Gh. Ltd., Tema
131.	Squad	FRE/1906/1450G February 2019	Pendimethalin (300g/l) + Clomazone (150g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice	Calli Ghana Co. Ltd., Accra
132.	Stomp 445 CS	FRE/18206/1267G January 2018	Pendimethalin (445g/l)	II	Herbicide for the control of broadleaf weeds and grasses in maize, cotton and tomatoes	Josann Agro Consult (J.A.C) Ltd., Accra
133.	Sun Agogo 33EC	FRE/1957/1561G October 2019	Pendimethalin (33%)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
134.	Sun-Anico OF	FRE/1957/1551R October 2019	Atrazine (20%) + Nicosulfuron (3%)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
135.	Sun 2,4-D Amine 72SL	FRE/2057/1578G January 2020	2, 4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds, grasses and sedges in cereals and sugarcane	Wynca Sunshine Agric Products & Trading Co. Ltd., Accra
136.	Sun 2,4-D PRO 560 EC	FRE/1757/1222G October 2017	2, 4-D Amine (360g/l) + Propanil (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
137.	Sun-Bromacil 80WP	FRE/1857/1359G July 2018	Bromacil (800g/kg)	III	Herbicide for the control of broadleaf weeds and grasses in pineapples	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
138.	Sunbuzin 70WP	FRE/1957/1566G October 2019	Metribuzin (700g/kg)	III	Herbicide for the control of broadleaf weeds in soybean	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
139.	Sun- Diuron 80WP	FRE/1857/1360G July 2018	Diuron (800g/kg)	III	Herbicide for the control of weeds in pineapples, mangoes and cashew	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
140.	Sunfuron 40OD	FRE/1957/1565G October 2019	Nicosulfuron (40g/l)	III	Herbicide for the control of broadleaf weeds in maize	Wynca Sunshine Agric Prdts & Trading Co. Ltd, Accra
141.	Sunfuron 75WDG	FRE/1757/1224G October 2017	Nicosulfuron (750g/kg)	III	Herbicide for the control of broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
142.	Sunfuron 80WP	FRE/1757/1223G October 2017	Nicosulfuron (800g/kg)	III	Herbicide for the control of broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
143.	Sun-Gallop	FRE/1957/1564G October 2019	Haloxyfop-P-methyl (108g/l)	III	Pre-emergence herbicide for the control of annual broadleaf weeds in cereals and beans	Wynca Sunshine Agric Prdts & Trading Co. Ltd, Accra
144.	Sunphocate 360SL	FRE/1957/1562G October 2019	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses in onion, garlic, tulips and cotton	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
145.	Sunphosate 360 SL	FRE/1757/1220G October 2017	Glyphosate (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
146.	Sunphosate 757 G	FRE/1757/1221G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of broadleaf weeds and grasses in ceteals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
147.	Sunphosate Plus	FRE/1957/1560G October 2019	Glyphosate (30%) + MCPA (6%)	III	Herbicide for the control of broadleaf weeds and grasses in rubber and citrus plantations	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
148.	Sunphosate Ultra SL	FRE/1957/1563G October 2019	Glufosinate Ammonium (200g/l)	III	Non-selective systemic herbicide for the control of weeds in rubber and citrus plantations	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
149.	Sun-Ameso	PCL/1957/1369R August 2019	Atrazine (500g/l) + Mesotrione (50g/l)	II	Herbicide for the control of broadleaf weeds ad grasses in maize	Wynca Sunshine Agric. Pdts & Trading Co. Ltd., Accra
150.	Sun-Atrazine 80 WP	PCL/1957/1384R August 2019	Atrazine (800g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in pineapple, maize and cereals	Wynca Sunshine Agric. Pdts & Trading Co. Ltd., Accra
151.	Sun-Atrazine 80 WP	PCL/1957/1383R August 2019	Atrazine (800g/kg)	II	Herbicide for the control of annual grasses and broadleaf weeds in pineapple, maize and cereals	Wynca Sunshine Agric. Pdts & Trading Co. Ltd., Accra
152.	Sun-Paraquat G	PCL/1957/1385R August 2019	Paraquat dichloride (200g/kg)	II	Herbicide for the control of annual grasses and broadleaf weeds in fruit trees, plantation crops and maize	Wynca Sunshine Agric. Pdts & Trading Co. Ltd., Accra
153.	Target 240 SL	FRE/1899/1312G April 2018	Imazethapyr (240g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in soybean and cowpea	Rainbow Agrosciences Co. Ltd., Tema
154.	Topstar 400SC	FRE/19183/1567G October 2019	Oxadiargyl (400g/l)	III	Pre-emergent herbicide for the control of annual, perennial grasses and broadleaf weeds in rice	Bayer West-Central Africa S.A, Accra
155.	Voila EC	FRE/18202/1378G August 2018	Pretilachlor (225g/l) + Pyribenzoxim (15g/l)	III	Herbicide for the control of grasses and broadleaf weeds and sedges in rice	Macrofertil Gh. Ltd., Tema
156.	Weedcot SL	FRE/1758/1257G November 2017	2, 4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in cereals	Afcott Ghana Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
157.	Weed Magic 41 SL	FRE/1825/1295G January 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Bentronic Productions, Kumasi
158.	Weed Out SL	FRE/1825/1286G January 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Bentronic Productions, Kumasi
159.	Weed Up	FRE/1822/1415G November 2018	Glyphosate (41%)	III	Herbicide for the control of annual and perennial grasses and broadleaved weeds	Annoh and Sons Agro-chem, Accra
160.	Weed Well SL	FRE/1843/1343G July 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
161.	Wynna 360 SL	FRE/1857/1318G April 2018	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading, Accra
162.	Zoomer 390 SC	FRE/18100/1394G August 2018	Glyphosate (360g/l) + Oxyfluorfen (300g/l)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Adama West Africa Ltd., Accra

(A) Fully Registered Pesticides (FRE)
(A4) Plant Growth Regulators

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Callel 480 SL	FRE/1706/1247G November 2017	Ethephon (280g/l)	III	Plant Growth Regulator for degreening of pineapple	Calli Ghana Co. Ltd., Accra
2.	Callel 480 SL	FRE/1906/1442G February 2019	Ethephon (280g/l)	III	Plant Growth Regulator for degreening of pineapple	Calli Ghana Co. Ltd., Accra
3.	Chemophon 480 SL	FRE/1805/1386G August 2018	Ethephon (480g/l)	III	Plant growth regulator for degreening of pineapples	Chemico Limited, Tema
4.	Ethemax 480 SL	FRE/1799/1225G October 2017	Ethephon (480g/l)	III	Plant Growth Regulator for degreening of vegetables	Rainbow AgroSciences Co. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
5.	Flower up 40SL	FRE/1857/1396G August 2018	Ethephon (40%)	III	For the acceleration of maturation in tomatoes and banana	Wynca Sunshine Agric Products & Trading Co. Ltd., Accra
6.	Hevetex	FRE/19202/1466G March 2019	Ethephon (5%)	III	Ethylene generator for stimulation of latex production	Macrofertil Ghana Ltd., Tema
7.	Mat 480 SL	FRE/17202/1194G October 2017	Ethephon (480g/l)	III	Plant growth regulator for de-greening of pineapples	Macrofertil Gh. Ltd., Tema
8.	RyzUp 40 SG	FRE/1780/1252G November 2017	Gibberellic acid 1.279 billion ITU/l	U	Plant growth regulator for banana	Challux Ltd., Accra

(A) Fully Registered Pesticides (FRE)

(A5) Molluscicide

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor

(A) Fully Registered Pesticides (FRE)
(A6) Nematicides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Agrocelhone NE	FRE/17136/1149G July 2017	Dichloropropene (60.8%) + Chloropicrin (33.3%)	II	Nematicide for the control of nematodes	Spica Ghana Ltd., Accra
2.	Carbodan 3G	FRE/1843/1347G July 2018	Carbofuran (3%)	II	Nematicide/ Insecticide for the control of nematodes in vegetables	Kumark Company Limited, Kumasi
3.	Velum Prime 400 SC	FRE/19185/1470G March 2019	Fluopyram (400g/l)	III	Nematicide for the control of nematodes in pepper, tomatoes and okro	RMG Ghana, Limited, Accra

(A) Fully Registered Pesticides (FRE)
(A7) Adjuvants

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Break-thru S240	FRE/17157/1213G October 2017	Polyether-polymethylsiloxane-copolymer (1000g/l)	U	Surfactant to improve the spreading, wetting and penetration of water-based pesticide formulations on leaves of vegetables, fruits and arable crops	Evonik West Africa, Accra
2.	EOS	FRE/17100/1237G November 2017	White summer spray oil (800g/l)	U	Adjuvant for public health use	Adama West Africa Ltd., Accra

(A) Fully Registered Pesticides (FRE)
(A8) Biocides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Nalco 303MC	FRE/20200/1591G January 2020	1-(2-hydroxyethyl)-2-alkyl (C-18)-2-imidazoline	U	Diesel biocide	Nalco Champion, Gh., Ltd, Accra
2.	PermaClean PC-11	FRE/20200/1593G January 2020	2,2 Dibromo-3-nitrilopropionamide	U	Control bacteria fouling of ultrafiltration units, non potable reverse osmosis membranes and peripheral systems	Nalco Champion, Gh., Ltd, Accra
3.	PermaClean PC-56	FRE/20200/1592G January 2020	5-Chloro-2-methyl-4-isothiazoline-3-one + 2-Methyl-4-isothiazoline-3-one	U	For controlling bacteria fouling of ultrafiltration units, non potable reverse osmosis membranes and peripheral systems	Nalco Champion, Gh., Ltd, Accra
4.	Promex CHS-3	FRE/1920/1491G June 2019	Dihydroxy-2, 5-dioxahexane 20% + 5- chloro-2-methyl-4-isothiazolin-3-one (1%)	II	For controlling bacteria and fungi in aqueous solution	BBC Industrials Company Ltd., Accra
5.	Promex DB-20	FRE/1920/1492G June 2019	2, 2-Dibromo-3-nitrilopropionamide (20%)	II	For controlling bacteria and fungi in aqueous solution	BBC Industrials Company Ltd., Accra

(B) Provisionally Cleared Pesticides (PCL)

(B1) Insecticides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Acati Power SL	PCL/19228/1455G October 2019	Thiamethoxam (200g/l)	II	Insecticide for the control of mirids in cocoa	Alive Industries, Accra
2.	Actaladiz 240SC	PCL/2008/1541G January 2020	Thiamethoxam (200g/l)	II	Insecticide for the control of mirids in cocoa	Dizengoff Ghana Ltd., Accra
3.	Adepa Agro Organic Pesticide	PCL/19193/1332G May 2019	Ethyl palmitate	U	Insecticide for the control of mites, ticks, caterpillars, mealybugs and bacteria blight in vegetables, cashew, mango and citrus	Kwadutsa and Joam Co. Ltd., Suame-Kumasi
4.	Afford 50 WG	PCL/1999/1358G July 2019	Pymetrozine (500g/kg)	II	Insecticide for the control of aphids and whiteflies in cucumber, tomato, and vegetables	Rainbow Agrosciences Co. Ltd., Tema
5.	Agropy 5 EW	PCL/19197/1075G January 2019	Pyrethrum (50g/l)	II	Insecticide for the control of mirids in cocoa	Yayra Glover Ltd., Suhum
6.	Akate Aduro 27 EC	PCL/2008/1549G January 2020	Bifenthrin (27g/l)	II	Insecticide for the control of capsid bugs in cocoa	Dizengoff Ghana Ltd., Accra
7.	Akate Asa	PCL/19196/1459G October, 2019	Bifenthrin (3%)	II	Insecticide for the control of mirids in cocoa	Pear River Co. Ltd., Accra
8.	Akate Brafo 40 EC	PCL/2006/1510G January, 2020	Acetamiprid (20g/l) + Bifenthrin (20g/l)	II	Insecticide for the control of mirids in cocoa	Calli Ghana Company Limited, Accra
9.	Akate Kaptain	PCL/19207/1313G April 2019	Etofenprox (300g/l)	II	Insecticide for the control of mirids on cocoa	Soiless Limited, Accra
10.	Akate Star 3.5EC	PCL/19232/1454G October 2019	Bifenthrin (3.5g/l)	II	Insecticide for the control of mirirds in cocoa	Alu Africa Ltd., Accra
11.	AF Confidence	PCL/20245/1604G March 2020	Bifenthrin (15g/l)	II	Insecticide for the control of mirids on cocoa	New Okaff Industries Ltd., Kumasi
12.	Alti-Lambda 2.5 EC	PCL/19121/1334G July 2019	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests in vegetables and pulses	Altimate Agrochemicals Ltd., Somanya
13.	Alti-Pyrifos 48 EC	PCL/19121/1341G July 2019	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the insect pests in field crops and outdoor public health purposes	Altimate Agrochemicals Ltd., Somanya

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
14.	Alti-Sulphur WP	PCL/19121/1338G July 2019	Carbendazim (5%) + Imidacloprid (2%) + Lambda-cyhalothrin (2%) + Sulphur (3%)	II	Insecticide/fungicide for the controlof insect pests and fungi in vegetables, banana, citrus, food and floral crops	Altimate Agrochemicals Ltd., Somanya
15.	Ba-Pyrifos 48%EC	PCL/2081/1535G January 2020	Chlorpyrifos (480g/l)	II	Insecticide for the control of coleoptera, diptera, homoptera and lepidoptera in rice and vegetables	B. Kaakyire Agrochemicals , Kumasi
16.	Bif 30 ULV	PCL/19177/1458G October 2019	Bifenthrin (3.0 ± 0.3%)	II	Insecticide for the control of insect pests of cocoa	Spenshell Co, Ltd., Accra
17.	Centrole 20SG	PCL/2099/1540G January 2020	Dinotefuran (200g/kg)	II	Insecticide for the control of brown planthopper and rice planthopper in rice	Rainbow AgroSciences Co. Ltd., Tema
18.	Chemaprid Super 60EC	PCL/1905/1470G November 2019	Acetamiprid (30g/l) + Lambda-cyhalothrin (30g/l)	II	Insecticide for the control of insect pests in vegetables	Chemico Limited, Tema
19.	Chemomectin 50SG	PCL/1905/1471G November 2019	Emamectin-benzoate (50g/kg)	II	Insecticide for the control of Fall armyworm in maize	Chemico Limited, Tema
20.	Cisthrin	PCL/1999/1479G November 2019	Deltamethrin (12.5g/l)	II	Insecticide for the control of borers, aphids, bollworm, cutworm, mango weevil and strainers in maize, cassava, yam, sorghum, groundnuts and vegetables	Rainbow AgroSciences Co. Ltd., Tema
21.	Crownpyrifos 48EC	PCL/19229/1495G January 2020	Chlorpyrifos (480g/l)	II	Insecticide for the control of leafminers, thrips, caterpillars, beetles, flies, bugs and moth in vegetables	Agro Crown West Africa Co. Ltd., Kumasi
22.	Defiance 48 ME	PCL/1908/1434G August 2019	Beta-cyfluthrin (4.5%) + Emamectin-benzoate (0.3%)	II	Insecticide for the control of insect pests and spidermites in vegetables	Dizengoff Ghana Ltd., Accra
23.	Deltaplan 12.5EC	PCL/1816/1270G December 2019	Deltamethrin (12.5%)	II	Insecticide for the control of insect pests in vegetables and cereals	Kurama Company Ltd., Accra
24.	Diz-Lambda 2.5EC	PCL/2008/1546G January 2020	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Dizengoff Ghana Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
25.	Diz-Pyrifos 480 EC	PCL/2008/1545G January 2020	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in vegetables	Dizengoff Ghana Ltd., Accra
26.	D-Lion Akate Global 4000	PCL/19208/1428G August 2019	Thiamethoxam (350g/l)	II	Insecticide for the control of mirids in cocoa	Desert Lion International Ltd., Kumasi
27.	D-Lion Desband	PCL/19208/1431G August 2019	Chlorpyrifos (480g/l)	II	Insecticide for the control of aphids, thrips, fruitflies and stem borers in arable crops	Desert Lion International Ltd., Kumasi
28.	DimeCrown 400 EC	PCL/19229/1496G January 2020	Dimethoate (400g/l)	II	Insecticide for the control of insect pests in vegetables`	Agro Crown West Africa Co. Ltd., Kumasi
29.	EmaCare	PCL/1945/1439G October 2019	Emamectin-benzoate (1.92%)	II	Insecticide for the control of Fall Armyworm in maize	Jubaili Agrotec Limited, Kumasi
30.	Ex-icute/Rapid-O SL	PCL/20262/1502G January 2020	Clove oil (6%) + Sesame oil (5%) + Rosemary oil (3%)		Insecticide for the control of Fall Army worm in maize	Nanam Ventures, Tema
31.	FreeDome Bait	PCL/19252/1366G July 2019	Spinosad (0.05%)	II	Insecticide for the control of fruitfly in mango	Home of Quality Products, Accra
32.	Furabak 3%G	PCL/2081/1528R January 2020	Carbofuran (3%)	II	Insecticide/ nematicide for the control of cane beetles, aphids, rice stem borers and nematodes	B. Kaakyire Agrochemicals , Kumasi
33.	Imunit	PCL/20206/1520G January 2020	Alpha-cypermethrin (75g/l) +Teflubenzuron (75g/l)	II	Insecticide for the control of Fall Armyworm in maize	Josann Agro Consult Ltd., Accra
34.	Kilambda 25EC	PCL/19249/1412G August 2019	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of diamondback moth, cabbage, bollworm and leaf miner in cabbage	Karida Agro Trading Co. Ltd., Accra
35.	Konmidor 200SL	PCL/19249/1409G August 2019	Imidacloprid (200g/l)	II	Insecticide for the control of insect pests in cereals and vegetables	Karida Agro Trading Co. Ltd., Kumasi
36.	Lagano 2.5EC	PCL/19184/1380G August 2019	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of aphids, beetles, thrips and larvae of lepidoptera in cotton and vegetables	Ganorma Agrochemicals Ltd., Tamale

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
37.	Lambdacrown	PCL/19229/1398G August 2019	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables and fruits	Agro Crown Co. Ltd., Kumasi
38.	Leadrole 80 WG	PCL/1999/1352G July 2019	Ethiprole (40%) + Imidacloprid (40%)	II	Insecticide for the control of aphids, brown plant hopper and whiteflies in cotton, vegetables and rice	Rainbow AgroSciences Co. Ltd., Tema
39.	Leopard 20 SL	PCL/19137/1473G November 2019	Imidacloprid (200g/l)	II	Insecticide for the control of mango hopper, aphids, leafminers, jassids in mango, okra and groundnut	Miqdadi Co. Ltd., Accra
40.	Magicforce Gold	PCL/19145/1438G October 2019	Lambda-cyhalothrin (15g/l) + Acetamiprid (20g/l)	II	Insecticicide for the control of beet army worm, aphids, stem borers, beetles, leafhoppers, bollworm, leaf miner, diamond backmoth in cabbage, cucumber, okra, pepper, maize, sorghum, rice, legumes, mango and citrus	Jubaili Agrotec Ltd., Kumasi
41.	Nova BTK	PCL/1905/1464G October 2019	*Bacillus thuriengensis* (32000iu/mg)	III	Insecticide for the control of fall armyworm in maize	Chemico Ltd., Tema
42.	Organic Bug Buster	PCL/19247/1314G April 2019	*Metarhizium anisopliae* + *Beauveria bassiana*	II	Insecticide for the ontrol of Fall Armyworm and aphids in maize and okra	GWorld Gh. Ltd., Accra
43.	Organic JMS Stylet Oil	PCL/2008/1547G January 2020	White Mineral Oil	U	Insecticide/ fungicide for the control of aphids, mites, thrips, powdery mildew, botrytis and rust in vegetables and fruits	Dizengoff Ghana Ltd., Accra
44.	Orizon 120 SC	PCL/2008/1544G January 2020	Acetamiprid (100g/l) + Abamectin (20g/l)	II	Insecticide for the control of insect pests and soil nematodes in vegetables and citrus	Dizengoff Ghana Ltd., Accra
45.	Ozoneem 1EC	PCL/19216/1460G October 2019	Azadirachtin (1%)	II	Insecticide for the control of fall armyworm, diamondback moth in maize, okra and cabbage	Karsam Macro Ltd., Kumasi
46.	Protocol EC	PCL/19121/1339G July 2019	Acetamiprid (15g/l) +	II	Insecticide for the control of insect pests in	Altimate Agrochemicals

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
			Lambda-cyhalothrin (20g/l)		rice, maize, cotton, beans and leafy vegetables	Co. Ltd., Somanya
47.	Pyrethrum 5EW	PCL/19257/1469G November 2019	Pyrethrum (50g/l)	II	Insecticide for the control of chewing and sucking insect pests in outdoor and protected crops	Nkye Kya Ltd., Accra
48.	Rocket 20EC	PCL/20145/1600G March 2020	Chlorpyrifos-ethyl (20%)	II	Insecticide for the control of insect pest in cotton, citrus and vegetables	Jubaili Agrotec Ltd., Kumasi
49.	Rockot Extra 75 WG	PCL/1999/1482G November, 2019	Thiamethoxam (750g/kg)	III	Insecticide for the control of insect pests in rice, cotton, vegetables and sugarcane	Rainbow AgroSciences Co. Ltd., Tema
50.	Rockstar 2.5 EC	PCL/19213/1315G May 2019	Bifenthrin (2.5%)	II	Insecticide for the control of mirids in cocoa	Crop Doctor, Kumasi
51.	Ronfos 550 EC	PCL/1999/1353G July 2019	Profenofos (500g/l) + Lufenuron (50g/l)	III	Insecticide for the control of podborers, bollworm, beet armyworm, leafmoths in kidney bean, tomato and cabbage	Rainbow AgroSciences Co. Ltd., Tema
52.	Sauveur 62EC	PCL/1906/1333G May 2019	Acetamiprid (32g/l) + Lambda-cyhalothrin (30g/l)	II	Insecticide for the control of Fall Armyworm in maize	Calli Ghana Co. Ltd., Accra
53.	Seizer EC	PCL/19100/1311G April 2019	Bifenthrin (100g/l)	II	Insecticide for the control of mirids in cocoa	Adama West Africa Ltd., Accra
54.	Spartan 300 OD	PCL/1999/1360G July 2019	Imidacloprid (210g/l) + Beta-cyfluthrin (90g/l)	II	Insecticide for the control of armyworm, stem borer and bollworms in rice and maize	Rainbow AgroSciences Company Ltd., Tema
55.	Spur 19.6 EC	PCL/19249/1415G August 2019	Emamectin-benzoate (19.6g/l)	II	Insecticide for the control of caterpillars and aphids in tomato, garden eggs and onion	Karida Agro Trading Co. Ltd., Kumasi
56.	Stink EC	PCL/2081/1529G January 2020	Dimethoate (30%) + Lambda-cyhalothrin (1.5%)	II	Insecticide for the control of aphids, leafhoppers, borers and weevils in vegetables, cotton and sweet potato	B. Kaakyire Agrochemicals, Kumasi
57.	Strike 1.9EC	PCL/2081/1532G January 2020	Emamectin-benzoate (19.2g/l)	II	Insecticide for the control of leaf-eating beetle, spiny bollworm	B. Kaakyire Agrochemicals, Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					and pink bollworm in okro	
58.	Striker Super 70 EC	PCL/2081/1533G January 2020	Acetamiprid (50g/l) + Emamectin-benzoate (20g/l)	II	Insecticide for the control of Fall Armyworm in maize	B. Kaakyire Agrochemicals, Kumasi
59.	Sultan 400SL	PCL/2099/1539G January 2020	Bisultap (400g/l)	II	Insecticide for the control of armyworm and stem borers in maize and rice	Rainbow AgroSciences Co. Ltd., Tema
60.	Superkill 150 SL	PCL/19219/1308G April 2019	Acetamiprid (100g/l) + Cypermethrin (50g/l)	II	Insecticide for the control of mirids in cocoa	Kugyam Enterprise, Accra
61.	Supertop EC	PCL/2043/1525G January 2020	Acetamiprid (20g/l) + Lambda-cyhalothrin (15g/l)	II	Insecticide for the control of insect pests in tomato	Kumark Co. Ltd., Kumasi
62.	Sunpri-Lam 25EC	PCL/1957/1449G October 2019	Cypermethrin (2.5%) + Chlorpyrifos (22.5%)	II	Insecticide for the control of aphids, jassids, thrips, whiteflies, bollworms and cutworm in eggplant, cotton, tomatoes and lettuce	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
63.	Sun-Prida	PCL/1957/1452G October 2019	Imidacloprid (200g/l)	II	Insecticide for the control of aphids in cowpea and tomato	Wynca Sunshine Agric. Prod & Trading Co. Ltd., Accra
64.	Termidor SC	PCL/19206/1393G August 2019	Fipronil (25g/l)	II	Insecticide for the control of termites in cabbage, onion, eggplant and maize	Josann Agro Consult Ltd., Accra
65.	Termifos 48 EC	PCL/19249/1494G December 2019	Chlorpyrifos (480g/l)	II	Insecticide for the control of mealybugs, thrips, leafminers and aphids in vegetables and for wood treatment	Karida Agro Trading Co. Ltd., Kumasi
66.	Termichem 5SC	PCL/1905/1426G August 2019	Fipronil (50g/l)	II	Insecticide for the control of termites on wood	Chemico Limited, Tema
67.	Transform Akate	PCL/19251/1349G July 2019	Isoclast (240g/l)	U	Insecticide fir the control of mirids and shield bugs in cocoa	Agri Plus Horizon Farms Ltd., Accra
68.	Trika Expert G	PCL/1808/1261G December 2018	Lambda-cyhalothrin (25%)	II	Insecticide for the control of insect pests in vegetables	Dizengoff (Ghana) Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
69.	Trivor 310 DC	PCL/20100/1516G January 2020	Acetamiprid (186g/l) + Pyriproxyfen (124g/l)	II	Insecticide for the control of mirids in cocoa	Adama West Africa Ltd., Accra
70.	Uphold 360SC	PCL/1905/1465G October 2019	Methoxyfenozide (300g/l) + Spinetoram (60g/l)	III	Insecticide for the control of fall armyworm in maize	Chemico Limited, Tema
71.	Warrior Super 26EC	PCL/2081/1534G January 2020	Sophora flavescen plant extract (25%) + Emamectin-benzoate (1%)	III	Insecticide for the control of fall armyworm in maize	B. Kaakyire Agrochemicals, Kumasi
72.	Withoate 40EC	PCL/19137/1474G November 2019	Dimethoate (400g/l)	II	Insecticide for the control of aphids, jassids and beetles in sweet potato and vegetables	Miqdadi Co. Ltd., Accra
73.	WormAtak EC	PCL/1914/1364G July 2019	Teflubenzuron (50g/l) + Cypermethrin (20g/l)	III	Insecticide for the control of Fall Armyworm (FAW) in maize	Afropa Gh. Ltd., Accra
74.	Zinda 50EC	PCL/19249/1405G August 2019	Diazinon (50%)	II	Insecticide for the control of insect pests in cereals, groundnut and vegetables	Karida Agro Trading Co. Ltd., Kumasi
75.	Zukadoc 46 EC	PCL/19213/1328G May 2019	Indoxacarb (30g/l) + Acetamiprid (16g/1)	III	Insecticide for the control of insect pests in okro	Crop Doctor, Kumasi

(B) Provisionally Cleared Pesticides (PCL)

(B1a) Insecticides for public health purposes

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Agrifog Maxi Smoke Generator	PCL/19173/1467G November 2019	Deltamethrin (14%)	III	Insecticide for the control of household insect pests	Agromonti Co. Ltd., Accra
2.	Bacto Power	PCL/19248/1322G May 2019	*Bacillus thuringiensis israelensis* (BTI)	II	Insecticide for the control of mosquito larvae	Comforter Gh. Business Ltd., Accra
3.	D-Lion Bedbug	PCL/19208/1374G August 2019	Thiamethoxam (12.6%) + Lambda-cyhalothrin (9.4%)	II	Insecticide for the control of bedbugs	Desert Lion International Limited, Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
4.	Dulux Mosquito Protect	PCL/19115/1456G October 2019	Deltamethrin (0.1w/w)	II	Insecticide for the control of mosquitoes and other public health purposes	M & K Co., Ltd., Accra
5.	Fludora Fusion	PCL/19183/1443G October 2019	Clothianidin (500g/kg) + Deltamethrin (62.5g/kg)	II	Insecticide for indoor and outdoor spray of mosquitoes	Bayer West-Central Africa S.A, Accra
6.	Heaven Insecticide Spray	PCL/19230/1404G August 2019	Tetrafluthrin (0.10%) + Beta-cypermethrin (0.05%)	II	Insecticide for public health purposes	Menkish Impex Ltd., Accra
7.	Heaven Black Mosquito Coil	PCL/19230/1390G August 2019	Tetrafluthrin (0.03%)	II	Insecticide coil for the control of mosquitoes	Menkish Impex Ltd., Accra
8.	SumiShield 50WG	PCL/19209/1302G March 2019	Clothianidin (500g/kg)	III	Insecticide for public health purposes for the control of anopheles mosquitoes	Worldwide Healthcare Ltd., Accra

(B) Provisionally Cleared Pesticides (PCL)

(B1b) Insecticides for stored produce

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Devathrin 10 SC	PCL/1910/1320G July 2019	Alpha-cypermethrin (100g/l)	II	Insecticide for the control of storage insect pests in cocoa	Reiss & Co. (Gh) Ltd., Accra
2.	Storecare	PCL/19145/1346G July 2019	Malathion (2%)	III	Insecticide for the control of *Sitophilus zeamais* in stored rice and maize	Jubaili AgroTec Ltd., Kumasi

(B) Provisionally Cleared Pesticides (PCL)

(B2) Fungicides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Aflasafe GH02	PCL/19217/1303G May 2019	Four atoxigenic *Aspergiluss flavus* strains (0.0005%)	U	Fungicide for the control of aflatoxins in maize, groundnuts and sorghum	International Institute of Tropical Agriculture (IITA), Accra
2.	AgroSar 70WP	PCL/19179/1453G October 2019	Copper Hydroxide (70%)	III	Fungicide for the control of blackpod disease in cocoa	Moor Co. Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
3.	Arrest 325SC	PCL/19189/1468G November 2019	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	III	Fungicide for the control of leafspot, leaf blight, blast, black spot, rust and brown spot in cereals and vegetables	Matrix Innovation Ltd., Accra
4.	Banko D 450 SC	PCL/2006/1511G January 2020	Chlorothalonil (400g/l) + Difenoconazole (50g/l)	III	Fungicide for the control of *Alternaria sp*., *Phytophthora* and Anthracnose in vegetables and mango	Calli Ghana Co. Ltd., Accra
5.	Cabrio Duo	PCL/19206/1391G August 2019	Dimethomorph (72g/l) + Pyraclostrobin (40g/l)	II	Fungicide for the control of blackpod disease in cocoa	Josann Agro Consult Ltd., Accra
6.	Comet Plus 475EC	PCL/20206/1522G January 2020	Fenpropimorph (375g/l) + Pyraclostrobin (100g/l)	III	Fungicide for the control of black and yellow sigatoka in banana	Josann Agro Consult Ltd., Accra
7.	D-Lion Fungicide 2020 WP	PCL/19208/1429G August 2019	Copper (77%)	III	Fungicide for the control of spot, citrus canker and blackspot disease in vegetables, watermelon and citrus	Desert Lion International Ltd., Kumasi
8.	Fomestop IGR	PCL/19256/1457G October 2019	Triadimenol	II	Fungicide for the control of white rot in rubber plants	Ghana Rubber Estates Ltd., Takoradi
9.	Forum R	PCL/20206/1601G March 2020	Copper oxychloride (67.2%w/w) + Dimethomorph (6.0%w/w)	II	Fungicide for the control of *Phytophthora palmivora*, *Phytophthora megakarya* in cocoa	Josann Agro Consult (J.AC.) Ltd., Accra
10.	Fungus Fighter Plus	PCL/19133/1402G August 2019	Mancozeb (800g/kg)	III	Fungicide for the control of downy mildew in fruits and vegetables	Abbnak Agro Services, Kumasi
11.	Germ Kill 50WP	PCL/19249/1408G August 2019	Copper oxychloride (350g/kg) + Metalaxyl (150g/kg)	III	Fungicide for the control of diseases in fruits and vegetables	Karida Agro Trading Co. Ltd., Kumasi
12.	Guardian Xtra WP	PCL/1999/1478G November 2019	Carbendazim (80%)	II	Fungicide for control of *Botrytis, sclerotinia* and blue mould in beans,	Rainbow AgroSciences Co. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					onions, tomatoes and citrus	
13.	Kabendazim 50WP	PCL/2081/1530G January 2020	Carbendazim (50%)	III	Fungicide for the control of anthracnose, leaf spots and other fungal diseases in vegetables and cereals	B. Kaakyire Agrochemicals, Kumasi
14.	Manco-care	PCL/19145/1348G July 2019	Mancozeb (800g/kg)	III	Fungicide for the control of early and late blight, buck eye rot, leafspot, blast, sigatoka and tip rot in vegetables, tomato and plantain	Jubaili Agro. Tec Ltd., Kumasi
15.	Mangoda 10WG	PCL/19249/1406G August 2019	Difenoconazole (100g/kg)	II	Fungicide for the control of fungal diseases in fruits and vegetables	Karida Agro Trading Co. Ltd., Kumasi
16.	Mirage 450 EC	PCL/20100/1515G January 2020	Prochloraz (450g/l)	III	Fungicide for the control of fusarium wilt in cowpea	Adama West Africa Ltd., Accra
17.	Orvego	PCL/20206/1521G January 2020	Ametoctradin (300g/l) + Dimethomorph (225g/l)	II	Fungicide for the control of blackpod disease in cocoa	Josann Agro Consult Ltd., Accra
18.	Rescue 76WP	PCL/2008/1550G January 2020	Propineb (70g/l) + Cymoxanil (6g/l)	II	Fungicide for the control of fungal diseases in crops	Dizengoff Ghana Ltd., Accra
19.	Rover	PCL/1908/1433G August 2019	Chlorothalonil (500g/l)	III	Fungicide for the control of diseases in vegetables	Dizengoff Ghana Ltd., Accra
20.	Seed Care	PCL/20145/1553G March 2020	Imidacloprid 95%, Thiram	II	For rice blast, rice plant hopper in rice	Jubaili Agro. Tec Ltd., Kumasi
21.	Shaolin 62.5WG	PCL/1999/1480G November 2019	Cyprodinil (37.5%) + Fludioxonil (25%)	II	Fungicide for the control of fungal diseases in tomato, mango, green pepper, carrot and pawpaw	Rainbow AgroSciences Co. Ltd., Tema
22.	Skope 370 WP	PCL/19213/1327G May 2019	Mancozeb (320g/kg) + Azoxystrobin (50g/kg)	III	Fungicide for the control of leafspot in tomato	Crop Doctor, Kumasi
23.	Splendid 800 EC	PCL/1999/1359G July 2019	Spiroxamine (800g/l	U	Fungicide for the control of black sigatoka in banana	Rainbow AgroSciences Co. Ltd., Tema
24.	Sun-Azodi	PCL/1957/1450G October 2019	Azoxystrobin (250g/kg)	II	Fungicide for the control of downy mildew and white mould in tomato	Wynca Sunshine Agric Products & Trading Co. Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
25.	Sun-Cotala WP	PCL/1957/1445G October 2019	Copper hydroxide (770g/kg)	III	Fungicide for the control of angular leaf spot in cucumber	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
26.	Sunkopper 77WP	PCL/1957/1446G October 2019	Mancozeb (480g/kg) + Metalaxyl (100g/kg)	III	Fungicide for the control of downy mildew in cucumber	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
27.	Sun-Lonil WP	FRE/2057/1585G January 2020	Chlorothalonil (75%)	III	Fungicde for the control of downy mildew and early blight in cucumber and tomatoes	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
28.	Supreme 325 SC	PCL/1910/1317G May 2019	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	U	Fungicide for the control of leaf blight, powdery mildew, early and late blight, blast, downy mildew in vegetables and cereals	Reiss and Co (Gh) Ltd., Accra
29.	Top Pro	PCL/19249/1416G August 2019	Chlorothalonil (75%)	II	Fungicide for the control of early blight, downy mildew in cucumber	Karida Agro Trading Co. Ltd. Kumasi
30.	X-Glider	PCL/19137/1475G November 2019	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	III	Fungicide for the control of anthracnose in watermelon	Miqdadi Co. Ltd., Accra

(B) Provisionally Cleared Pesticides (PCL)

(B3) Herbicides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	AB-Xtra 72SL	PCL/20233/1552G January 2020	2, 4-D Amine Salt (720g/l)	II	Herbicide for the control of broadleaf weeds in rice	AB Benaldo Trading Co., Kumasi
2.	Adwuma Boss 48 SL	PCL/19249/1418G August 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in field crops	Karida Agro Trading Co. Ltd., Kumasi
3.	Adwuma Boss-G	PCL/19249/1344G December 2019	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in citrus	Karida Agro Trading Co. Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
4.	Adwuma Super 48 SL	PCL/1943/1372G August 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual broadleaf weeds and grasses in arable crops	Kumark Co. Ltd., Kumasi
5.	Agronil 36 EC	PCL/1910/1318G May 2019	Propanil (360g/l)	III	Herbicide for the control of annual grasses in rice	Reiss and Co. (Gh) Ltd., Accra
6.	Altibroma 80 WP	PCL/19121/1340G July 2019	Bromacil (800g/kg)	III	Herbicide for the control of annual, perennial roadleaf weeds in arable crops	Altimate Agrochemicals Ltd., Somanya
7.	Altisate 41 SL	PCL/19121/1335G July 2019	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in arable crops	Altimate Agrochemicals Ltd., Somanya
8.	Amega 360 SL	PCL/2043/1524G January 2020	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Kumark Co. Ltd., Kumasi
9.	AminoForce	PCL/19145/1441G October 2019	2, 4-D Amine Salt (720g/l)	III	Herbicide for the control of broadleaf weeds in maize	Jubaili Agrotec Limited, Kumasi
10.	AtraCrown	PCL/19229/1497R January 2020	Atrazine (800g/kg)	II	Herbicide for the control of annual grasses and broadleaf weeds in maize	Agro Crown West Africa Co. Ltd., Kumasi
11.	Atraforce 50SC	PCL/20145/1558R March 2020	Atrazine (500g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize, yam, sugarcane, orchards, oil palm and citrus	Jubaili Agrotec Ltd., Kumasi
12.	Atraforce 80WP	PCL/20145/1557R March 2020	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize and sugarcane	Jubaili Agrotec Ltd., Kumasi
13.	Atraking 80 WP	PCL/1999/1422R August 2019	Atrazine (800g/kg)	II	Herbicide for the control of annual broadleaf weeds and grasses in maize, sorghum, sugarcane and yam	Rainbow AgroSciences Co. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
14.	Atraking 500SC	PCL/1999/1423R August 20019	Atrazine (800g/l)	II	Herbicide for the control of annual broadleaf weeds and grasses in maize, sorghum, sugarcane and yam	Rainbow AgroSciences Co. Ltd., Tema
15.	Atraplus 600SC	PCL/1999/1476R November 2019	Atrazine (300g/l) + Terbutylazine (300g/l)	II	Herbicie for the control of annual broadleaf weeds and grasses in maize and sorghum	Rainbow AgroSciences Co. Ltd., Tema
16.	Atrazila 80 WP	PCL/2043/1526R January 2020	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Kumark Co. Ltd., Kumasi
17.	Atrazila 500 SC	PCL/2043/1527R January 2020	Atrazine (500g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Kumark Co. Ltd., Kumasi
18.	Barizaa 360SL	PCL/19184/1381G August 2019	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Ganorma Agrochemicals Ltd., Tamale
19.	Batrazine 80WP	PCL/2081/1531R January 2020	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize and sugarcane	B. Kaakyire Agrochemicals, Kumasi
20.	Bellazine 500SC	PCL/1905/1466R October 2019	Atrazine (250g/l) + Cyanazine (250g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in maize and sugarcane	Chemico Limited, Tema
21.	Bencinate 53 WP	PCL/1910/1319G May 2019	Mefenacet (500g/kg) + Bensulfuron-methyl (30g/kg)	U	Herbicide for the control of grasses, sedges and broadleaf weeds in paddy rice	Reiss and Co. (Gh) Ltd., Accra
22.	ButaCrown 50 EC	PCL/19229/1498G January 2020	Butachlor (500g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in rice	Agro Crown West Africa Co. Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
23.	Comot 41 SL	PCL/19121/1336G July 2019	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in arable crops	Altimate Agrochemicals Ltd., Somanya
24.	Council Activ 30 WG	PCL/20183/1514G January 2020	Triafamone (15%) + Ethoxysulfuron (15%)	II	Herbicide for the control of grasses, sedges and broadleaf weeds in rice	Bayer West-Central Africa SA., Accra
25.	BonNico	PCL/20149/1508G January 2020	Nicosulfuron (40g/l)	III	Herbicide for control of annual, perennial grasses and broadleaf weeds in maize	Bon Agro Co. Ltd., Kumasi
26.	Bonquat 276 SL	PCL/20149/1507R January 2020	Paraquat (276g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Bon Agro Co. Ltd., Kumasi
27. B	Bonzine 80WP	PCL/20149/1508R January 2020	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals	Bon Agro Co. Ltd., Kumasi
28.	ButaClear 50EC	PCL/19184/1378G August 2019	Butachlor (50%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in paddy rice, soybean, cotton, groundnut and vegetables	Ganorma Agrochemicals Ltd., Tamale
29.	Bylor 500EC	PCL/1999/1354G July 2019	Butachlor (500g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds in groundnut and rice	Rainbow AgroSciences Co. Ltd., Tema
30.	Conti-sate SL	PCL/2078/1501G January 2020	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Five Continents Import & Export Co. Ltd., Accra
31.	Crownquat	PCL/19229/1401R August 2019	Paraquat dichloride (276g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in field crops	Agro Crown Co. Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
32.	Crownsate	PCL/19229/1399G August 2019	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in field crops	Agro Crown Co. Ltd., Kumasi
33.	Diuron Super 80WP	PCL/19249/1410G August 2019	Diuron (80%)	II	Herbicide for the control of broadleaf weeds in sugarcane	Karida Agro Trading Company Ltd. Kumasi
34.	Diz-Paraquat 20SL	PCL/2008/1548R January 2020	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial weeds and grasses in cereals and fruits	Dizengoff Ghana Ltd., Accra
35.	D-Lion Glyphosate	PCL/19208/1361G July 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial weeds in arable crops	Desert Lion Int. Ltd., Accra
36.	Dzokpata 276SL	PCL/1999/1477R November 2019	Paraquat dichloride (276g/l)	II	Herbicide for the control of broadleaf weeds and grasses in plantation and tree crops	Rainbow AgroSciences Co. Ltd., Tema
37.	Erase 480 SL	PCL/19213/1310G April 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Crop Doctor, Kumasi
38.	Eserewura	PCL/1908/1420G August 2019	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial weeds in non-crop lands	Dizengoff Ghana Ltd., Accra
39.	Faaba Soja 10 SL	PCL/1943/1371G August 2019	Imazethapyr (10g/l)	II	Herbicide for the control of annual, perennial weeds in maize	Kumark Co. Ltd., Kumasi
40.	Fastherb 720SL	PCL/19249/1411G August 2019	2,4-D Amine (720g/l)	III	Herbicide for the control of broadleaf weeds in rice	Karida Agro Trading Company Ltd. Kumasi
41.	Flysate	PCL/20145/1601G March 2020	Glyphosate (41%)	III	Herbicide for the control of annual, perennial weeds in cereals and vegetables	Jubaili Agrotec Ltd., Kumasi
42.	ForceUp Granular	PCL/19145/1284G February 2019	Glyphosate Mono-ammonium salt (757g/kg)	III	Herbicide for the control of annual, perennial weeds in citrus	Jubaili Agrotec Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
43.	Ganico 40SC	PCL/19184/1379G August 2019	Nicosulfuron (40g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in maize, sorghum and millet	Ganorma Agrochemicals Ltd., Tamale
44.	Ganoquat Super	PCL/1930/1463R October 2019	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize and other crops	Natosh Enterprise, Kumasi
45.	Ganorherb SL	PCL/19184/1382G August 2019	2,4-D Amine Salt (720g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in cereals	Ganorma Agrochemicals Ltd., Tamale
46.	Ganorsate 360 SL	PCL/19184/1376G August 2019	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Ganorma Agrochemicals Ltd., Tamale
47.	Ganorzine 80WP	PCL/19184/1377R August 2019	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds in maize, sugarcane, pineapple, sorghum and yam	Ganorma Agrochemicals Ltd., Tamale
48.	Gramoda Super	PCL/19249/1345R July 2019	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Karida Agro Trading Company Ltd. Kumasi
49.	Gramoking 276 SL	PCL/1999/1425R August 2019	Paraquat dichloride (276g/l)	II	Herbicide for the control of grasses and broadleaf weeds in tree crops, maize, cowpea, cotton and pineapple	Rainbow AgroSciences Co. Ltd., Tema
50.	Gramofox Super	PCL/20260/1523G January 2020	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Placenta Agrochemicals & Trading Enterprise, Kumasi
51.	Gramoquin Super	PCL/20237/1519R January 2020	Paraquat dichloride (276g/l)	II	Herbicide for the control of broadleaf weeds and grasses in arable crops	K.K Rich Enterprise, Kumasi
52.	Groquat Super 27.6 SL	PCL/19175/1395R August 2019	Paraquat dichloride (20%)	II	Herbicide for the control of broadleaf weed and grasses in	Wamwus Agropham Ltd, Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					cereals, vegetables and fruit trees	
53.	Hadop	PCL/19249/1493G December 2019	Haloxyfop-methyl (108g/l)		Herbicide for the control of annual and perennial grass weeds in watermelon, onions, cabbage, groundnut and soybean	Karida Agro Trading Co. Ltd., Kumasi
54.	Hao Nico	PCL/19258/1492G December 2019	Nicosulfuron (40g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Agrohao Ghana Co. Ltd., Kumasi
55.	Haoquat 276 SL	PCL/19258/1491R December 2019	Paraquat (276g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize and non-crop lands	Agrohao Ghana Co. Ltd., Kumasi
56.	Haosate	PCL/19258/1487G December 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual and perennial weeds in non-crop lands	Agrohao Ghana Co. Ltd., Kumasi
57.	Haothapyr	PCL/19258/1489G December 2019	Imazethapyr (240g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in soybean	Agrohao Ghana Co. Ltd., Kumasi
58.	Hao 2, 4-D	PCL/19258/1488G December 2019	2,4-D Amine (720g/l)	III	Herbicide for the control of broadleaf weeds and grasses in rice and maize	Agrohao Ghana Co. Ltd., Kumasi
59.	Herbamine	PCL/20237/1518G January 2020	2,4-D Amine (720g/l)	III	Herbicide for the control of broadleaf weeds in cereals and sugarcane	K.K Rich Enterprise, Kumasi
60.	Herbacrown	PCL/19229/1400G August 2019	2, 4-Dimethyl Amine Salt (720g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in field crops	Agro Crown Co. Ltd., Kumasi
61.	Herbtryn SC	PCL/1999/1481G November 2019	Ametryn (500g/l)	II	Herbicide for the control of grasses and broadleaf weeds in banana, pineapple, plantain and sugarcane	Rainbow AgroSciences Co. Ltd., Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
62.	Legumeforce 70WP	PCL/19145/1437G October 2019	Imazethapyr (70%)	II	Herbicide for the control of broadleaf weeds and grasses in leguminous crops	Jubaili Agrotec Co. Ltd., Kumasi
63.	Intter 75WDG	PCL/20234/1517G January 2020	Glyphosate (75%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in eucalyptus	Miro Forestry (Ghana) Ltd., Agogo
64.	Kingforce	PCL/19258/1490G December 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals, vegetables and fruit trees	Agrohao Ghana Co. Ltd., Kumasi
65.	King Kong	PCL/19149/1486G December 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial weeds and grasses in cereals, vegetables and fruit trees	Bon Agro Co. Ltd., Kumasi
66.	Liberator 500 SC	PCL/20183/1513G January 2020	Flufenacet (400g/l) + Diflufenican (100g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and sedges in cotton	Bayer West-Central Africa S.A, Accra
67.	Megazine 3030	PCL/19208/1427R August 2019	Atrazine (250g/l) + Cyanazine (250g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in weeds	Desert Lion International Ltd., Kumasi
68.	Mofarno 160EC	PCL/2008/1543G January 2020	Quizalofop-p-methyl (35g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds in soybean	Dizengoff Ghana Ltd., Accra
69.	Multisate 41 SL	PCL/1927/1350G July 2019	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Multivet (Gh) Ltd., Accra
70.	M-Quat 20 SL	PCL/1927/1351R July 2019	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops and non-cropland	Multivet (Gh) Ltd., Accra
71.	NicoCrown 40 OD	PCL/19229/1499G January 2020	Nicosulfuron (40g/l)	III	Herbicide for the control of annual grasses and	Agro Crown West Africa

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					broadleaf weeds in maize	Co. Ltd., Kumasi
72.	Nicoda 40 OD	PCL/19249/1413G August 2019	Nicosulfuron (40g/l)	III	Herbicide for the control of weeds in maize	Karida Agro Trading Company Ltd. Kumasi
73.	Nicoking Super 230 OD	PCL/1999/1329G May 2019	Atrazine (200g/l) + Nicosulfuron (30g/l)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Rainbow Agrosciences Co. Ltd., Tema
74.	Nicotop 4% OD	PCL/19213/1309G April 2019	Nicosulfuron (40g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in maize	Crop Doctor, Kumasi
75.	Nico Master	PCL/1935/1330G May 2019	Nicosulfuron (4%)	III	Herbicide for the control of annual and perennial grasses in maize	K. Badu Agrochemicals, Kumasi
76.	Ohyew 55 EC	PCL/19213/1325G May 2019	Clethodim (55g/l)	III	Herbicide for the control of broadleaf weeds and grasses in cassava	Crop Doctor, Kumasi
77.	Ogyama	PCL/19213/1324G May 2019	Haloxyfop-R-Methyl (70g/l)	II	Herbicide for the control of annual and perennial grass weeds in casava	Crop Doctor, Kumasi
78.	Pantera 40EC	PCL/2006/1512G January 2020	Quizalofop-P-Tefuryl (40g/l)	III	Herbicide for the control of annual and perennial grasses in vegetables and beans	Calli Ghana Company Limited, Accra
79.	Parakin 276 SL	PCL/1999/1424R August 2019	Paraquat dichloride (276g/l)	II	Herbicide for the control of grasses and broadleaf weeds in tree crops, maize, cowpea, cotton and pineapple	Rainbow AgroSciences Co. Ltd., Tema
80.	Penox 8 OD	PCL/19213/1326G May 2019	Penoxsulam (8g/l)	U	Herbicide for the control of broadleaf weeds, sedges and grasses in rice	Crop Doctor, Kumasi
81.	PropaCrown EC	PCL/19229/1500G January 2020	Propanil (300g/l) + 2, 4-D Amine Salt (200g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in rice	Agro Crown West Africa Co. Ltd., Kumasi
82.	Raptor	PCL/19206/1392G August 2019	Imazamox (40g/l)	U	Herbicide for the control of annual broadleaf weeds and	Josann Agro Consult Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					grasses in groundnut and soybean	
83.	Rezim 80 WP	PCL/1999/1421R August 2019	Atrazine (800g/kg)	II	Herbicide for the control of annual broadleaf weeds and grasses in maize, sorghum, sugarcane and yam	Rainbow AgroSciences Co. Ltd., Tema
84.	Rezim Max 90 WG	PCL/1999/1484R November 2019	Atrazine (900g/kg)	II	Herbicide for the control of annual broadleaf weeds and grasses in maize, sorghum, sugarcane and yam	Rainbow AgroSciences Co. Ltd., Tema
85.	Rice-Adwuma	PCL/1957/1367G August 2019	Bispyribac-sodium (400g/l)	III	Herbicide for the control of annual, perennial grasses, broadleaf weeds and sedges in direct-seeded rice	Wynca Sunshine Agric. Pdts & Trading Co. Ltd., Accra
86.	Ricecare Super 60 OD	PCL/1999/1357G July 2019	Cyhalofop-butyl (60g/l) + Penoxsulam (10g/l)	IV	Herbicide for the control of annual broadleaf weeds in transplanting and direct seeding rice fields	Rainbow AgroSciences Company Ltd., Tema
87.	Ricestar 320 EC	PCL/1999/1356G July 2019	Pretilachlor (300g/l) + Pyribenzoxim (20g/l)	II	Herbicide for the control of annual weeds in paddy rice and transplanting rice fields	Rainbow AgroSciences Company Ltd., Tema
88.	Rice Mega 400SC	PCL/19249/1414G August 2019	Bispyribac-sodium (400g/l)	III	Herbicide of rthe control of grass weeds in rice	Karida Agro Trading Company Ltd. Kumasi
89.	Ridmax 75SG	PCL/1999/1355G July 2019	Glyphosate (750g/kg)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in field crops	Rainbow AgroSciences Company Ltd., Tema
90.	Riz-Diz 100SC	PCL/2008/1542G January 2020	Bispyribac-sodium (100g/l)	III	Herbicide for the control of annual broadleaf weeds and grasses in rice	Dizengoff Ghana Ltd., Accra
91.	Russel 260 OD	PCL/1908/1432G August 2019	Terbuthylazine (200g/l) + Mesotrione (40g/l) + Nicosulfuron (20g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds in arable crops	Dizengoff Ghana Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
92.	Sasa 48%	PCL/1943/1370G August 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Co. Ltd., Kumasi
93.	Sidal 2, 4-D	PCL/2066/1551G January 2020	2, 4-D Amine Salt (720g/l)	II	Herbicide for the control of broadleaf weeds in rice	Sidalco Gh. Ltd., Accra
94.	Sun-Aceto EC	PCL/1957/1447G October 2019	Acetochlor (900g/l)	III	Herbicide for the control of annual and perennial weeds in maize, soybean, cotton and peanut	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
95.	Super Nicogan 800 WDG	PCL/19100/1312G April 2019	Mesotrione (570g/kg) +Nicosulfuron (230g/kg)	III	Herbicide for the control of weeds in maize	Adama West Africa Ltd., Accra
96.	Supreme 48 SL	PCL/19121/1337G July 2019	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in arable crops	Altimate Agrochemicals Ltd., Somanya
97.	Supremo	PCL/20149/1506G January 2020	Imazethapyr (240g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in soybean	Bon Agro Co. Ltd., Kumasi
98.	Sunsate 41SL	PCL/1825/1274G December 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize, soybean and tomatoes	Bentronic Productions Kumasi
99.	Supercrown	PCL/19229/1461G October 2019	Bispyribac-sodium (400g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice	Agro Crown Co. Ltd., Kumasi
100.	Traceforce	PCL/19145/1436G October 2019	Acetochlor (250g/l) + Prometryn (150g/l)	III	Herbicide for the control of annual weeds in groundnuts, maize and soyabean	Jubaili Agrotec Ltd. Kumasi
101.	Tradazine 80WP	PCL/19249/1417R August 2019	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Karida Agro Trading Company Ltd. Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
102.	Trazine 80 WP	PCL/1925/1363R July 2019	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Bentronic Productions, Kumasi
103.	Trazine 500 SC	PCL/1925/1362R July 2019	Atrazine (500g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Bentronic Productions, Kumasi
104.	Tropica EC	PCL/1999/1483G November 2019	Acetochlor (900g/l)	III	Herbicide for the control of grasses and broadleaf weeds in maize, cotton, groundnut and sugarcane	Rainbow AgroSciences Co. Ltd., Tema
105.	United Force 360 SL	PCL/19145/1279G February 2019	Glyphosate isopropylamine (240g/l) + 2,4-D Amine (120g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in maize, yam, sugarcane, oil palm and citrus plantations	Jubaili Agrotec Ltd., Kumasi
106.	Wadwumanie	PCL/19175/1394G August 2019	Glyphosate (410g/l)	III	Herbicide for the control of annual and perennial weeds in citrus, pear and paddy rice	Wamwus Agrochemical Ltd., Kumasi
107.	WeedBlock 62.5 ME	PCL/19100/1323G May 2019	Imazethapyr (37.5g/l) + Propaquizafop (25g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cowpea	Adama West Africa Ltd., Accra
108.	Weedcut 20 SL	PCL/20145/1603R March 2020	Paraquat dichloride (200g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice and vegetables	Jubaili Agrotec Ltd., Kumasi
109.	Xtra Force SC	PCL/19145/1342G July 2019	Atrazine (250g/l) + Metolachlor (250g/l)	II	Herbicide for control of annual, perennial broadleaf weeds and grasses in maize, yam, sugarcane, oil palm and citrus plantations	Jubaili Agrotec Ltd., Kumasi
110.	Xtrariz 100 SC	PCL/1910/1321G May 2019	Bispyribac-sodium (100g/l)	III	Herbicide for the control of post-emergent weeds in rice	Reiss and Co. (Gh) Ltd., Accra

(B) Provisionally Cleared Pesticides (PCL)

(B4) Plant Growth Regulator

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Atonik SL	PCL/1906/1472 G November 2019	Sodium 0nitrophenolat e (2g/l) + Sodium p-nitrophenolate (3g/l) + Sodium snitroguaiacola te (1g/l)	III	Plant Growth Regulator to improve crop development in ric	Calli Ghana Co. Ltd., Accra
2.	Great Paclo	PCL/19190/133 1G May, 2019	Paclobutrazol (50%)	II	Plant Gowth Regulator to Regulates growth of treetops in mango	Matrix Innovation Ltd
3.	Paclo Super	PCL/19249/140 7G August 2019	Paclobutrazol (500g/kg)	II	Plant Gowth Regulator to Regulates growth of treetops in mango	Karida Agro Trading Co. Ltd., Kumasi
4.	Sun-Mequat SL	PCL/1957/1444 G October 2019	Chlormequat (50%)	III	Growth Regulator in anti-lodging of cotton	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.

(B) Provisionally Cleared Pesticides (PCL)

(B5) Nematicide

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Sun-Foza	PCL/1957/1451G October 2019	Fosthiazate (5%)	II	Nematicide for the control of root-knot nematode in cucumber	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra
2.	Nemover 10GR	PCL/2099/1538G January 2020	Fosthiazate (93%)	II	Nematicide for the control of cyst nematodes and wireworms in okro, cowpea and banana	Rainbow AgroSciences Co. Ltd., Tema
3.	Vytal 3G	PCL/2006/1505G January 2020	Oxamyl (30g/kg)	II	Nematicide for the control of nematodes and soil insects in tomatoes	Calli Ghana Company Limited, Accra

(B) Provisionally Cleared Pesticides (PCL)

(B6) Repellants

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	AV 5055	PCL/19221/1365G May 2019	Anthraquinone (18%)	III	Avicide for repelling birds in rice fields	API Produce Enterprise Ghana, Accra
2.	Bird Away SL	PCL/1957/1448G October 2019	Methyl anthranilate (264g/l)	III	Bird repellent for the control of birds	Wynca Sunshine Agro Products and Trading Company (Gh) Ltd., Accra
3.	D-Lion Snake Repellant	PCL/19208/1430G August 2019	Chlorpyrifos (480g/l) + Diazinon (50g/l)	III	Snake repellant for the control of snakes and public health purpose	Desert Lion International Ltd., Kumasi

(B) Provisionally Cleared Pesticides (PCL)

(B7) Rodenticide

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1	Super Guard	PCL/1902/1396R August 2019	Bromodialone (2.5%)	Ib	Rodenticide for the control of mice	Agrimat Ltd., Madina
2	Baraki 0.005% RB	PCL/1902/1397R August 2019	Bromodialone (0.005%)	Ib	Rodenticide for the control of mice	Agrimat Ltd., Madina

(B) Provisionally Cleared Pesticides (PCL)

(B8) Biocides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Biopol FI 31	PCL/20261/1536 R January 2020	5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-4-isothiazolin-3-one	II	Biocide/In-can preservative for the control of bacteria, yeasts and fungi	Azar Chemicals Ltd., Accra
2.	Fungipol 237G	PCL/20261/1537 R January 2020	Carbendazim + Diuron + Octylisothiazolone	II	Biocide/film preservative for the control of fungi, yeasts and algae	Azar Chemicals Ltd., Accra
2.	Versalis e®-BIOC 2000	PCL/19240/1307 G April 2019	Glutaraldehyde (40-50%)	II	Biocide for the control of microbes	Versalis Zeal Limited, Takoradi

(B) Provisionally Cleared Pesticides (PCL)

(B9) Bactericide

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	BBS Master WP	PCL/20263/1554 G March 2020	Oxolinic Acid (Oxolinic acid copper 20% WP)	III	Bactericide for the control of mango blackspot disease	Bomart Farms

(C) Banned Pesticides

No	Name of Pesticide
1.	2,4,5-T and its salts and esters
2.	Aldrin
3.	Binapacryl
4.	Captafol
5.	Chlordane
6.	Chlordimeform
7.	Chlorobenzilate
8.	Dichlorodiphenyltrichloroethane (DDT)
9.	Dieldrin
10.	Dinoseb and its salts and esters
11.	Dinitro-*ortho*-cresol (DNOC) and its salts (such as ammonium salt, potassium salt and sodium salt)
12.	Endrin
13.	HCH (mixed isomers)
14.	Heptachlor
15.	Hexachlorobenzene
16.	Parathion
17.	Pentachlorophenol and its salts and esters
18.	Toxaphene
19.	Mirex
20.	Methamidophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)
21.	Methyl-parathion (emulsifiable concentrates (EC) with at or above 19.5% active ingredient and dusts at or above 1.5% active ingredient)
22.	Monocrotophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)
23.	Parathion (all formulations – aerosols, dustable powder (DP), emulsifiable concentrate (EC), granules (GR) and wettable powders (WP) – of this substance are included, except capsule suspensions (CS))
24.	Phosphamidon (Soluble liquid formulations of the substance that exceed 1000 g active ingredient/l)
25.	Dustable powder formulations containing a combination of Benomyl at or above 7%, Carbofuran at or above 10% and Thiram at or above 15%
26.	Methyl Bromide

27.	Chlordecone
28.	Alpha hexachlorocyclohexane
29.	Beta hexachlorocyclohexane
30.	Lindane
31.	Pentachlorobenzene
32.	Technical Endosulfan and its related isomers

Summary of Register of Pesticides as at January 2020

Category	FRE	PCL	Banned	Total
Insecticides	139	75	32	246
a. Public health	26	8	0	34
b. Stored produce	8	2	0	10
Fungicides	62	30	0	92
Herbicides	162	110	0	272
Plant Growth Regulators	8	3	0	11
Molluscicide	0	0	0	0
Rodenticides	0	2	0	2
Nematicides	3	3	0	6
Adjuvants	2	0	0	2
Biocides	5	3	0	8
Bactericide	0	1	0	1
Repellents	0	3	0	3
Total	415	240	32	687

Legend to Register of Pesticides

FRE - Full Registration (valid for 3 years)	The Agency may approve and register a pesticide subject to such other conditions as it may determine and may only register a pesticide if it is satisfied that the pesticide is safe and effective for the use for which it is intended and that the pesticide has been tested for efficacy and safety under local conditions (Section 31, Part II of Act 490)
PCL - Provisional Clearance Permit (Valid for a maximum of 1 year)	Where in respect of an application for registration of a pesticide, the Agency is satisfied that most information required for its registration has been provided to the Agency, and the pesticide does not present a toxicological risk to people, animals, crops or the environment, it may clear the pesticide for use without the registration, and this clearance shall be known as provisional clearance and shall be temporary pending the registration by the Agency of the pesticide (Section 32, Part II of Act 490)
Experimental permit	The Agency may authorize the importation of unregistered pesticide if the pesticide is imported for experimental or research purposes and not for distribution Section 28, (2), (a), (i)
General use pesticides (G)	Pesticides when applied for the use for which it is registered will not have unreasonable adverse effects on people, animals, crops or on the environment (Section 30 (1), (a) of Part II of Act 490)
Restricted use pesticides (R)	Pesticide when used in accordance with widespread commonly recognized practice in the absence of additional regulatory restrictions may cause unreasonable adverse effect on people, animals, crops or on the environment (section 30 (1), (b) of Part II of Act 490). Such pesticides are restricted for use on only selected crops

	by competent pesticide applicators and should be sold by dealers licensed to handle restricted pesticides
Suspended or Banned Pesticides	Pesticide when used in accordance with widespread commonly recognized practice even in the presence of additional regulatory restrictions will cause unreasonable adverse effect on people, animals, crops or on the environment. Such pesticides are prohibited for use in the country (Section 30, (1), (c).

ANNEX 2: GHANA 2020 FERTILIZER STATISTICS SUMMARY

New HS code	Product	Production	Imports Total Solid (MT)	Imports Total Liquid (Liters)	Fertilizer Exports Solid (MT)	Fertilizer Exports Liquid (Liters)	NFU Imports Solid (MT)	NFU Imports Liquid (Liters)	2020 Solid Fertilizer Imports (MT)	2020 Liquid Fertilizer Imports (liters)	2020 Apparent Consumption - Solid (MT)	2020 Apparent Consumption - Liquid (Liters)	2019	% Change
3105200000	NPK		299,423	734,325	2,782		0		299,423	734,325	296,641	734,325		
3102100000	Urea		90,025	-	1,576		69		89,956	-	88,379	-		
3104200000	MOP		55,621	1			10	1	55,611	-	55,611			
3105400000	MAP		47,966	-			0		47,966	-	47,966	-		
3102210000	Ammonium sulphate		44,084	-			90		43,994	-	43,994	-		
3103101000	TSP		35,268	-			0		35,268	-	35,268	-		
3104900000	Other potash fertilizers		10,378	72,391					10,378	72,391	10,378	72,391		
3105300000	DAP		9,938	-	219		0		9,938	-	9,719	-		
3103900000	Other phosphate fertilizers		9,174	-					9,174	-	9,174	-		
3104300000	SOP		6,538	-			0		6,538	-	6,538	-		
9999999990	Enhancers		5,098	253,697					5,098	253,697	5,098	253,697		
3102900000	Other nitrogenous fertilizers		3,862	-	19				3,862	-	3,843	-		
2510000000	Rock phosphate		494	-	50				494	-	444	-		

2834210000	Potassium nitrate	398	-			12		386	-	386	-		
3102600000	Calcium nitrate	275	-					275	-	275	-		
3101000000	Organic fertilizer	270	339,335	50	10	0		270	339,335	219	339,335		
3102400000	CAN	8	-					8	-	8	-		
3105600000	PK fertilizer	-	8					-	8	-	8		
3102300000	Ammonium nitrate	79,812	-			79,812		-	-	-	-		
3102500000	Sodium nitrate	312	-			312		-	-	-	-		
3103100000	SSP	0	-			0		-	-	-	-		
Grand Total without Enhancers		**693,844**	**1,146,060**	**4,696**	**10**	**80,304**	**1**	**613,540**	**1,146,059**	**608,844**	**1,146,059**	**422,447**	**44%**
Grand Total with Enhancers		**698,943**	**1,399,757**	**4,696**	**10**	**80,304**	**1**	**618,638**	**1,399,756**	**613,942**	**1,399,756**	**423,603**	**45%**

ANNEX 3 2020 NPK IMPORTS

2020 NPK Imports	Solid Imports (MT)	Liquid Imports (Liters)
NPK 20 10 10	52,892	
NPK 20 10 10 + 3S	37,813	
NPK 23 10 5	34,957	
NPK 23 10 5 + 2MgO + 3 S + 0.3Zn	27,281	
NPK	22,516	109,050
NPK 11 22 21 + 5S + 0.5B + 0.7Zn	21,500	
NPK 27 6 6	20,000	
NPK 7 20 13 + 6CaO + 5S + 5MgO + 0.4B + TE + Zn	18,907	
NPK 25 10 10 + TE	18,900	
NPK 27 6 6 + TE	18,000	
NPK 2-23- 18+8 CaO+6SO3+6MGO+0.5ZN+0.5B	10,200	
NPK 2 18 16	9,700	
NPK 15 15 15	6,465	
NPK 20 20 20	137	
NPK 19 19 19	36	
NPK 15 8 33 + TE	25	
NPK 20 20 20 + TE	20	
NPK 28 10 10 + TE	13	
NPK 30 10 10 + TE	13	
NPK 30 10 10	12	
NPK 18 18 18 + TE	12	
NPK 12 12 36 + TE	8	
NPK 19 19 19 + TE	8	
NPK 28 4 4	5	
NPK 15 5 30	4	
NPK 13 40 13	0	
NPK 10 8 10 + TE		389,588
NPK 10 10 10		93,096
NPK 12 8 4 + 1.2S +0.07Zn + 0.07Fe +0.03Mn + 0.04Cu + 0.31B		62,505
NPK 10 8 10		50,386
NPK 8.5 3.4 6 + 0.2B +1Cu +1.3Mg + 0.03Mo + 0.7Zn		20,004
NPK 14 6 5 + TE		3,984
NPK 4 16 28 + TE		3,984
NPK 7 21 7 + TE		1,728
Total	299,423	734,325

ANNEX 4: 2020 PESTICIDE IMPORT DATA

Tel: (0302) 664697 / 664698 / 662465
667524 / 0289673960 / 1 / 2
Fax: 233 (0302) 662690
Email: info@epa.gov.gh
Ghana Post (GPS): GA-107-1998

Environmental Protection Agency
P. O. Box MB 326
Ministries Post Office
Accra, Ghana
Website: http://www.epa.gov.gh

OUR REF: HA. 220/245/11/138 **31st March 2021**

THE HON MINISTER
MINISTRY OF FOOD AND AGRICULTURE
ACCRA

Dear Sir,

RE: REQUEST FOR INFORMATION ON ARGO-CHEMICAL IMPORTS: 2020

Your letter of 1st March 2021, on the above subject refers.

Please find below data on imports of pesticides for 2020 as requested.

Insecticides	**Herbicides**	**Fungicides**
Mt	**Mt**	**Mt**
6,354.1	30,154.1	1,105

Yours faithfully

DR. SAM ADU-KUMI
AG. DIRECTOR/CCMC
FOR: AG. EXECUTIVE DIRECTOR

ANNEX 5 GCAP Manual for Safe Use of Pesticides (Extracts)

MINISTRY OF FOOD
AND AGRICULTURE

GHANA COMMERCIAL AGRICULTURE PROJECT (GCAP)

MANUAL FOR SAFE USE OF PESTICIDES

Compiled by Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture (MOFA) with support and funding from the Ghana Commercial Agriculture Project (GCAP)

Ministry of Food & Agriculture · GCAP · USAID · THE WORLD BANK

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ANNEX 6 Stakeholder Consultation Outcomes

1.0 Stakeholder Engagement

1.1 Purpose of Stakeholder Engagement

Stakeholders in the field of pest and vector management were engaged to obtain the full support of key actors within the sector to promote the effective implementation of the IPMP. Stakeholder involvement in the development of the IPMP was a participatory process involving interactions between technical resource persons and various stakeholders including:

- Government institutions directly or indirectly involved in pest or vector management;
- Agricultural importers and exporters organizations;
- Non-Governmental Organizations;
- Agrochemicals industry;
- Private crop protection advisory firms;
- Producers of biological control agents; and
- Bilateral and multilateral development partners.

This facilitated the preparation of appropriate action plans for project sub-components to implement ecologically sound management of pest and vectors. It also aided in decision making through increased mutual understanding, promoting the feeling of ownership and establishing good rapport, and gaining technical expertise and first-hand knowledge on the subject matter. The institutions and agencies identified for consultation have regulatory mandate, oversight responsibility, extension service provision or enforcement powers in the pest and vector management sector. The other stakeholders identified were groups of people, companies, individuals or associations that have interest in the sectors, or whose operations are key to the implementation of the IPMP.

1.2 Stakeholder Engagement Methodology

1.2.1 Stakeholder Identification and Mapping

In identifying the stakeholders, an initial prospective list was developed by matching the main issues of the IPMP with the various stakeholder groups in a Stakeholder Identification Matrix (SIM). Table 1 gives the SIM used to help elicit inputs from the various stakeholders with respect to their relevance for involvement in the engagement processes. The review of the relevant legislation of incorporation and institutional mandates also defined the relevance of the identified stakeholders to the assignment and their areas of interest in order to identify the key issues of engagement (Table 1). The key stakeholders identified have been listed under the respective category in Table 2.

Table1 Stakeholder Identification Matrix

No.	Stakeholder Categories / Main Issues	Sector Oversight	Enforcement Agency	NGOs/Civil Society /Associations	Regulatory Authority
1)	Institutional collaboration	DAES / PPRSD / VSD	Customs Division	CLG / GAIDA / PIA	EPA / FDA / GSA
2)	Monitoring activities	DAES / PPRSD / VSD	Customs Division	CLG / GAIDA / PIA	EPA / FDA / GSA
3)	Capacity building	DAES / PPRSD / VSD	Customs Division	CLG / GAIDA / PIA	EPA / FDA / GSA

5)	Extension services	DAES		CLG / GAIDA / PIA	
7)	Pest and vector management issues	PPRSD / VSD	Customs Division	CLG / GAIDA / PIA	EPA / FDA / GSA
8)	Outbreak of animal disease	PPRSD VSD		CLG / GAIDA / PIA	EPA / FDA / GSA
9)	Disposal of unwholesome/pest infested produce	PPRSD	Customs Division		EPA / FDA / GSA
10)	Accreditation of pesticides	PPRSD	Customs Division	PIA	EPA / FDA / GSA
11)	Requirements for international standards	PPRSD	Customs Division	CLG / GAIDA / PIA	EPA / FDA / GSA
12)	Importation of pesticides	PPRSD	Customs Division	PIA	EPA / FDA / GSA
13)	Pest and vector control methods	DAES / PPRSD / VSD	Customs Division	CLG / GAIDA / PIA	EPA / FDA / GSA

Table 2 Categorization of Stakeholders

Government Ministries (Sector Oversight)	NGOs /Civil Society/ Associations
➢ Ministry of Food and Agriculture (MOFA): • Directorate of Agricultural Extension Services (DAES) • Plant Protection & Regulatory Services Directorate (PPRSD) ○ *Crop Pest and Disease Management Division* ○ *Pesticides and Fertilizer Regulatory Division* ○ *Ghana Seed Inspection Division* ○ *Plant Quarantine Division* • Veterinary Services Directorate (VSD)	➢ CropLife Ghana (CLG) ➢ Ghana Agri-Input Dealers Association (GAIDA) ➢ Pesticides Importers Association (PIA) **Enforcement Agencies** ➢ Customs Division (CD) of the Ghana Revenue Authority (GRA) **Regulatory Institutions** ➢ Environmental Protection Agency (EPA) ➢ Ghana Standards Authority (GSA) ➢ Food and Drugs Authority (FDA)

1.2.2 Stakeholder Engagement Planning

A formal introduction was made by GCAP via voice calls to all the stakeholders introducing the IPMP consultant and requesting their involvement in the consultative engagement process.

The initial engagements were organized between 9th–12th April and took place remotely either through voice calls or over a virtual zoom meeting. Subsequent communication was held via emails as follow-up to clarify information provided at the first engagement or to request for relevant documents. The engagement schedule employed is presented in Table 3 showing the respective engagement tool used, the key contact person and their contact details.

Table 3 Stakeholder Engagement Schedule

Date	Stakeholder	Engagement Tool	Main Contact Person	Position	Contact Details
09/04/2021	DAES	Voice call	Mr. Paul Siameh	Director	paulsiame@yahoo.com 0244641260
09/04/2021	PPRSD	Voice call	Eric Dzimado	Senior Agricultural Officer	agabusm2@gmail.com 0243413991
09/04/2020	FDA	Voice call	Roderick Daddey-Adjei	Dep. Chief Executive, Food Division	0208125860 0244339630

12/04/2020	GSA	Voice call	Dzienyo Akutor Akafia	General Chemistry Lab (TM)	dzienyo.akafia@gsa.gov.gh; 0277421005
20/04/2020	EPA	Voice call	Kwabena Badu-Yeboah	Head, Environmental Assessment and Audit	kwabenabaduyeboah@gmail.com 0501301396

1.3 Engagement Issues and Guides

Institution-specific stakeholder issues were developed and delivered through semi-structured questionnaire to elicit initial stakeholder responses. This comprised background information on the IPMP as well as the specific issues of relevance and interest to the respective stakeholders. The engagement issues/guides for the specific stakeholders are presented in Table 4 below.

Table 4 Issues/Guides for Stakeholder Engagement

Respondents (Name, Position, Tel. &/ E-mail):
Engagement Tool: **Date:** **Time:**

Engagement Issues – CEPS

Issues
1) What is your role in managing pest and vectors in the country, specifically the agriculture sector?
2) What is your relationship with the Plant quarantine division of MOFA PPRSD?

Engagement Issues – DAES

Issues
1) What has been your involvement in pest and vector management?
2) What is the agriculture extension agent to farmer ratio?
3) How will digitization of extension service help address pest and vectors?
4) What is the major pest of interest in the country?
5) What monitoring activities are you involved in?
6) What capacity building activities are you involved in?

Engagement Issues – CLG

Issues
1) What has been your involvement in pest and vector management?
2) What are the major pest and vector management issues in the country?
3) What are some existing solutions and new solutions that can be implements?
4) What capacity building activities do you undertake?

Engagement Issues – GAIDA

Issues
1) What has been your involvement in pest and vector management?
2) What are the major pest and vector management issues in the country?
3) What are some existing solutions and new solutions that can be implements?
4) What capacity building activities do you undertake?

Engagement Issues – VSD

Issues
1) What are the number of veterinarians in the country?
2) What has been the recent disease outbreaks in the poultry sector?

Engagement Issues – GSA

Issues
1) What has been the authority's involvement in pest and vector management in the agriculture sector?
2) What are the disposal measure for unwholesome or pest infected food/farm produce?
3) What are the monitoring activities the Authority is engaged in under pest management?
4) What are the major pests in the country that are a treat to food security and current measures being used to manage the situation?
5) What are the major pest management issues faced by the country?
6) What capacity building activities do you undertake?

Engagement Issues – FDA

Issues
1) What has been the authority's involvement in pest and vector management in the agriculture sector?
2) What are the disposal measure for unwholesome or pest infected food/farm produce?
3) What are the monitoring activities the Authority is engaged in under pest management?
4) What are the major pests in the country that are a treat to food security and current measures being used to manage the situation?
5) What are the major pest management issues faced by the country?
6) What capacity building activities do you undertake?

Engagement Issues – PIA

Issues
1) What has been your involvement in pest and vector management?
2) What are the major pest and vector management issues in the country?
3) What are some existing solutions and new solutions that can be implements?
4) What capacity building activities do you undertake?

Engagement Issues – EPA

Issues
1) What are the registered pesticides and banned pesticides for public consumption?
2) What is the volume of pesticides imported into the country?
3) What is the volume of fertilizer importation ?
4) List of registered pesticide importers in Ghana
5) Registered pesticide distributors in Ghana
6) What are the requirements for the International Standards for Phytosanitary Measures (ISPMs)?
7) What are the pesticides in use in Ghana as registered by EPA and the livestock, crops or vectors for which they are used?
8) What monitoring activities does the agency do?
9) What capacity building activities does the agency do?

Engagement Issues – PPRSD

Issues
1) What Capacity building of pesticides use is done for farmers farmers?
2) What are the recent guidelines for Integrated Pest Management (IPM) of food crops?
3) What has been a major pest infestation over the last decade in the agriculture sector?
4) What are the volumes of pesticides imported into the country?

5) What are the volumes of fertilizer importation into the country?	
6) What are some new pest or vector control methods or approaches that are being tested or introduced into Ghana?	

1.4 Stakeholder Engagement Highlights

The highlights from the engagement with stakeholders has been provided in the Table 5. with the full responses in Table 6 This will inform pest and vector management on a project sub-component level as well as apprise the IPMP.

Table 5 Major Highlights from Engagement

Stakeholder	Key Highlight
DAES	The agriculture extension agent to farmer ratio is as follows: • 2016 – 1:2000 farmers • 2017 – 1:706 farmers • Ideally, the ratio should be 1:500. • Areas like Saboba, Bawku West and parts of the Western Region are lucking with respect to extension services because of fewer extension agents
FDA	• The FDA conducts compliance monitoring on food crops in the markets. It randomly buys food items (the commonly consumed ones) from various markets and test them to check the level of chemical (pesticides) on them. These chemicals are not supposed to be above a certain level due to its effects on human health. The result of the test determines the regulatory action the FDA takes. • The FDA is also starting a traceability system to identify farmers who overuse chemicals on the crops.
PPRSD	The major pest infestation over the last decade are: • Phenacoccus manihoti (cassava mealybug); • Rastrococcus iceryoides (mango mealybug); • Fruit flies; • Vegetable flies; • Paracoccus marginatus (papaya mealybug); • Spodoptera frugiperda (fall armyworm); • Mononychellus tanajoa (cassava green mite); • Sternochetus mangiferae (mango stone weevil); • Tetranychus urticae (spider mite of fruits and vegetables); • Tetranychus urticae (red spider mite on pawpaw); • Prostephanus truncatus (larger grain borer); and • Spodoptera exempta (African armyworm – it appears once in two years. They attack grains, mainly rice.). New evasive pest that attacks crops include: • Tuta absoluta (American tomato pink borer); and • Thaumatotibia leucotreta (false codling moth)

GSA	• The Authority sets standards in relevant production standards, i.e., Good Agricultural Practices (GAPs) for various crops
	• The Authority provides sensitization on appropriate pest management techniques directly to key stakeholders.
	• The major pest management issues include, but not limited to
	  ○ Re-infestation of agricultural crops by pests and vectors migrating from similar or related crops that are growing in the wild or are even grown as ornamental plants; and
	  ○ Pesticides residues being higher than the permissible maximum residue limits (MRLs)

Food and Drugs Authority

Engagement Tool: Voice Call	**Date:** 09/04/2021	**Time:** 2:00pm
Attendance: Roderick Daddey-Adjei (0208125860/0244339630), Dep. Chief Executive Food Division		**Consultant Team:** Kwabena Kwakye Mamphey
Engagement Issues The engagement covered the following 2 key areas: 1) FDAs involvement in pest and vector management in Ghana's Agric sector. 2) Monitoring activities conducted by the Authority in relation to pest and vector management in the Agric Sector.		
Discussions/Suggestions and Comments		
1) FDAs Involvement in Pest and Vector Management With respect to pest and vector management, the national plant protection unit (PPRSD) of the country is responsible. The FDAs interest is food safety issues i.e., the effect pesticide uses on consumers.		
2) Monitoring Activities There is a rise in the use of plant products in Ghana and due to this, the FDA conducts compliance monitoring on food crops in the markets. It randomly buys food items (the commonly consumed ones) from various markets and test them to check the level of chemical (pesticides) on them. These chemicals are not supposed to be above a certain level due to its effects on human health. The result of the test determines the regulatory action the FDA takes. The FDA is also starting a traceability system to identify farmers who over use chemicals on the crops.		

Plant Protection and Regulatory Services Directorate

Engagement Tool: Voice call	**Date:** 09/04/2021	**Time: 1.00 pm**
Attendance: Eric Dzimado, Senior Agricultural Officer (0243413991), agabusm2@gmail.com Kobafil K. Banini, Dep Director Crop Pest and Division Management Division		**Consultant Team:** Kwabena Kwakye Mamphey
Engagement Issues The engagement covered the following 8 key areas: 1) Role in pest management 2) Capacity building of pesticides use for farmers 3) Recent guidelines for Integrated Pest Management (IPM) of food crops 4) Major pest infestation over the last decade in the agriculture sector 5) Volume of pesticides imported into the country 6) Volume of fertilizer importation 7) New pest or vector control methods or approaches that are being tested or introduced into Ghana 8) Concerns of PPRSD		
Discussions/Suggestions and Comments		
1) Role in Pest Management PPRSD is involved in pest management, disease surveillance and also provide advisory support on levels of disease outbreak. The Directorate also assist the EPA with post registration monitoring (monitoring of pesticide use by farmers after gaining permit from EPA). PPRSD also conduct bio-efficacy trials, train farmers on safe use and handling of products, training dealers on safe handling and storage of products and other		

pesticide related issues. Are also involved in the management of obsolete pesticide and empty pesticide containers

2) Capacity Building of Pesticides Use For Farmers

Provide advisory and training for farmers and how to use the product.

3) Recent guidelines for Integrated Pest Management (IPM) of food crops

The guidelines for pest management include:

- IPM for Cereals and Pulses;
- IPM for Roots and Tubers;
- IPM for Vegetables; and
- IPM for Plantain.

These guidelines were developed in 2004 and needs to be revised.

4) Major Pest Infestation Over the Last Decade in the Agriculture Sector

The major pes infestation over the last decade are:

- Phenacoccus manihoti (cassava mealybug);
- Rastrococcus iceryoides (mango mealybug);
- Fruit flies;
- Vegetable flies;
- Paracoccus marginatus (papaya mealybug);
- Spodoptera frugiperda (fall armyworm);
- Mononychellus tanajoa (cassava green mite);
- Sternochetus mangiferae (mango stone weevil);
- Tetranychus urticae (spider mite of fruits and vegetables);
- Tetranychus urticae (red spider mite on pawpaw);
- Prostephanus truncatus (larger grain borer); and
- Spodoptera exempta (African armyworm – it appears once in two years. They attack grains, mainly rice.).

There also new evasive pest that attack crops. These pests include:

- Tuta absoluta (American tomato pink borer); and
- Thaumatotibia leucotreta (false codling moth)

According to FAO about 40% of Ghana's crops are lost to pests annually.

5) Volume of Pesticides Importation

Agro-chemical import, 2020

- Insecticides – 6,354.1 Mt
- Herbicides – 30,154.1 Mt
- Fungicides – 1, 105 Mt

6) Volume of Fertilizer Importation

Product	Import Total Solid (MT)	Imports Total Liquid (MT)
NPK	299,423	734,325
Urea	90,025	-
MOP	55,621	1
MAP	47,966	-
Ammonium sulphate	44,084	-
TSP	35,268	-
Other potash fertilizers	10,378	72,391
DAP	9,938	-
Other phosphate fertilizers	9,174	-
SOP	6,538	-
Enhancers	5,098	253,697

Other nitrogenous fertilizers	3,862	-
Rock phosphate	494	-
Potassium nitrate	398	-
Calcium nitrate	275	-
Organic fertilizer	270	339,335
CAN	8	-
PK fertilizer	-	8
Ammonium nitrate	79,812	-
Sodium nitrate	312	-
SSP	0	-

7) New Pest or Vector Control Methods or Approaches that are Being Tested or Introduced into Ghana

- Pheromone traps
- Sticky traps
- Biological control methods (mass produce biological control agents and released on the field)
- Bio pesticides; and
- IPM (use of synthetic pesticides).

8) Concerns of the Directorate

The Directorate have plans of improving the pest management system in the country. It wishes to deploy Surveillance Drones for pest management. This technology will make pest management easier and faster. The drones will be deployed to survey farms for pest infection, zone affected areas and also be used in spraying affected farms.

The Directorate will there need assistance (resources) to acquire this technology to reduce the annual crop loss and also to make work faster.

Directorate of Agric Extension Services

Engagement Tool: Voice call	**Date:** 09/04/2021	**Time:** 1:00pm
Attendance: Mr. Paul Siameh (0244641260), Director	**Consultant Team:** Kojo Amoyaw-Osei	

Engagement Issues

The engagement covered the following … key areas:

1) Involvement in pest and vector management
2) Current agriculture extension agent to farmer ratio
3) Digitization of extension service
4) Pests of interest

Discussions/Suggestions and Comments

1) Involvement in pest and vector management

Since we are in charge of extension services, we provide the farms with the necessary training on the safe use of pesticides and agrochemicals. For this, we collaborate largely with the PPRSD since they have the technical knowledge on the subject matter

2) Current agriculture agent to farmer ratio

2016 – 1:2000 farmers

2017 – 1:706 farmers

Ideally, the ratio should be 1:500.

Areas like Saboba, Bawku West and parts of the Western Region are lucking with respect to extension services because of fewer extension agents

3) Digitization of Extension Service

Digitization of extensions services has become very crucial now, also largely because of the covid situation. The use of digital platforms like phones, text messages and radio could prove vital in relaying vital information to farmers on pesticides use and other agro-chemicals

4) Pests of Interest

Since December 2016, Fall Army Worms have become the main pest of interest in the country. They affect rice and maize and could have significant challenges for food security in the country. Largely education has been used to manage the situation so far.

Ghana Standards Authority

Engagement Tool: Questionnaire	**Date:** 12/04/2021	**Time:** 8:50 AM	
Respondent: Dzienyo Akutor Akafia	**Designation:** General Chemistry Lab (TM)	**Contact:** 0277421005	**Email:** dzienyo.akafia@gsa.gov.gh

Engagement Issues

The engagement covered the following 3 key areas:

1) Involvement in pest and vector management in Ghana's Agric sector
2) Major pest management issues
3) Monitoring activities conducted by the Authority.

Discussions/Suggestions and Comments

1) Involvement in Pest and Vector Management in Ghana's Agric Sector

The Authority's engagement in pest and vector management is predominantly through setting standards in relevant production standards, ie Good Agricultural Practices (GAPs) for various crops. Through these GAPs, current and relevant recommendations on pest and vector management are provided. Also, through various Sensitization programs, eg the National Aflatoxins Sensitization and Management project (NASAM), relevant stakeholders are directly engaged in the appropriate ways of managing pests.

2) Major Pest Management Issues

In our opinion, the major pest management issues include, but not limited to:

- Re-infestation of agricultural crops by pests and vectors migrating from similar or related crops that are growing in the wild or are even grown as ornamental plants. For instance, it is suspected that the fight against mango stone weevils has been complicated by the fact that mango trees growing wildly or as shade trees in homes are usually not considered for pest management. As a result, pests from these trees easily re-infest cultivated mango trees after the latter have been treated or managed.
- Also, we are of the opinion that the issue of pesticides residues that are higher than the permissible maximum limits (MRLs) is an issue of enormous concern.

3) Monitoring Activities

Per the mandate and functions of the Authority, there have not been any monitoring activities by GSA.