

REPUBLIC OF GHANA



MINISTRY OF FOOD AND AGRICULTURE

WEST AFRICAN AGRICULTURAL TRANSFORMATION PROGRAM (WAATP)



PEST MANAGEMENT PLAN (PMP)

DRAFT REPORT

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LIST OF ABBREVIATIONS

AESA	Alliance for Accelerating Excellence in Science in Africa
CAADP	Comprehensive Africa Agriculture Development Project
CARGS	Competitive Agricultural Research Grant Fund
CLAME	Crop Life Africa Middle East
CPPs	Chronic Pelvic Pain syndrome
CRIG	Cocoa Research Institute of Ghana
CSIR	Council for Scientific and Industrial Research
DAES	Directorate of Agricultural Extension Services
E.I	Executive Instrument
ECOWAS	Economic Community of West African States
EFSP	Environmental and Social Focal Point
EPA	Environmental Protection Agency
EPC	Environmental Protection Council
ER	Ecological Restorations
EU's	European Union
FAO	Food and Agriculture Organization
FASDEP	Food and Agriculture Sector Development Policy
FDA	Food and Drugs Authority
FFS	Farmer Field School
GEPC	Ghana Export Promotion Council
GHS	Ghana Health Service
GoG	Government of Ghana
GRA	Ghana Revenue Authority
GSA	Ghana Standard Authority
GSGDA II	Ghana Shared Growth Development Agenda
GTCP	Ghana Tree Crop Policy
GTZ/GIZ	German Development Cooperation
ICAT	Institute of Consulting and Technical Support
ICPM/FFS	Integrated Crop and Pest Management Farmers' Field School
IDA	International Development Association
IITA	International Institute of Tropical Agriculture
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ITRA	Togolese Institute of Agronomic Research
IUCN	International Union for Conservation of Nature
MDA	Ministries, Departments and Agencies
MEAs	Multilateral Environmental Agreements
MELR	Ministry of Employment and Labour Relations
MESTI	Ministry of Environment, Science, Technology and Innovation
METASIP	Medium Term Agriculture Sector Investment Plan
MiDA 1	Millennium Development Authority 1
MLGRD	Ministry of Local Government and Rural Development
MoFA	Ministry of Food and Agriculture
MoH	Ministry of Health
MRLs	Maximum Residue level
NEPAD	New Partnerships of Africa Development
NPRP	National Poverty Reduction Program
NPV	Net Present Value

NRC	National Research Council
NRGP	Northern Rural Growth Project
PFJ	Planting for Food and Jobs
PIC	Prior Informed Consent
PMP	Pest Management Plan
POPs	Persistent Organic Pollutants
PPEs	Personal Protective Equipments
PPRSD	Plant Protection and Regulatory Services Directorate
PTC	Pesticide Technical Committee
R&D	Research and Development
RAFiP	Rural and Agricultural Finance Project
RAGB	Revenue Agencies Governing Board
REP	Rural Enterprise Project
RESR	Regional Environmental and Social Respondents/EPA
SCPOP	Stockholm Convention on Persistent Organic Pollutants
SPFS	Special Program for Food Security /MoFA
SPS	Sanitary and Phytosanitary Agreement
TCP	Technical Cooperation Program
TOTs	Training of Trainers
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VAT	Value Added Tax
WAAPP	West Africa Agricultural Productivity Program
WAATP	West Africa Agricultural Transformation Program
WARDA	West Africa Rice Development Association
WHO	World Health Organization

EXECUTIVE SUMMARY

The Economic Community of West African States (ECOWAS) initiated the West Africa Agriculture Transformation Program (WAATP) with financial support from the World Bank.

In order to contribute to the structural transformation of Ghana's agriculture for a strong, resilient, inclusive and job-creating growth, especially for young people, the Government of Ghana, in collaboration with the CORAF and the World Bank, undertook since 2017, the preparation of the West Africa Agriculture Transformation Program (WAATP) for Ghana.

The overall objective of the WAATP is to accelerate the adoption of improved technologies, create jobs for youth and strengthen enabling conditions for access to regional markets for the participating countries' priority agricultural commodity areas, and to enable Governments to respond promptly and effectively to eligible emergencies. Specifically, the following objectives are pursued: (i) strengthen the new generation model of innovations in West Africa as part of the transformation of Ghana's National Centers of Excellence into Regional Centers of Excellence (RCoE); (ii) increase agricultural productivity through the acceleration of the massive adoption of technologies; (iii) promote technologies and value-enhancing innovations in agri-silvo-pastoral and fisheries value chains that are likely to create jobs, especially for youth and women, and that can improve food security and increase incomes populations supported by the program; (iv) strengthen the institutional framework, policies and markets; and (v) contribute to the management of crisis management.

To achieve this goal, the Program will be implemented through five (5) components as follows:

- **Component 1: Strengthening the new model of Innovation delivery in West Africa**
 - ✓ Sub-Component 1.1: Strengthening National Centers of Specialization
 - ✓ Sub-component 1.2: Strengthening of adaptive research (R&D) Priority Value Chains:
1. Cassava, sweet potato, cocoyam, and yam. 2. Maize, rice, sorghum, pearl millet
- **Component 2: Accelerating mass adoption of improved technologies and innovations.**
 - ✓ Sub-component 2.1: Demand driven market based interventions
 - ✓ Sub-component 2.2: Strengthening the seed sector
 - ✓ Sub-component 2.3: Jobs for the youth
- **Component 3 : Policies, markets and institutional strengthening**
 - ✓ Sub-component 3.1: Policy formulation and regulation in favour of markets and institutional strengthening
 - ✓ Sub-component 3.2: Regional market development for targeted products.
 - ✓ Sub-component 3.3: National and regional institutional capacity building.
- **Component 4 : Contingent emergency response**
- **Component 5: Program management, learning, monitoring and evaluation.**
 - ✓ Sub-component 5.1: Harmonized Coordination and Management
 - ✓ Sub-component 5.2: Monitoring and evaluation, Knowledge management
Communication

The components 2 and 3 will support improvement in agricultural productivity through mass adoption of climate smart technologies (extension), production and certification of improved seeds and planting materials (maize, rice, cassava, yam, sweet potato etc.), promotion of the use of fertilizers, promotion of safe and responsible use of pesticides, provision of modern infrastructure to ensure access to quality pest control products for optimum results, as well as the regulation of veterinary products in the livestock (small ruminant) and poultry sectors.

The implementation of these components could directly or indirectly, result in increased use of plant protection products or induce the use of pesticides or other pest control methods (pests, diseases and weeds) by farmers for increased productivity.

However, several negative impacts could result from the intensive application of pesticides; namely: the reduction or elimination of bio-control agents or crop aids, contamination of soil, pollution of water resources, health risks and poor management of obsolete packaging and products. These impacts could have serious consequences on farmers' income and the country's food security.

To meet the requirements of a productive and sustainable agriculture that minimizes health and environmental risks, there is the need for Integrated Pest Management approaches to be adopted in order to regulate the potential use of these chemicals to address pest problems and crop diseases.

In this respect, and in order to comply with national requirements and the World Bank's environmental and social safeguard policies, in particular OP4.09 on pest management, the Government developed this Pest Management Plan (PMP) to ensure rational use of pesticides in integrated pest and weed control.

The general objective of the Pest Management Plan (PMP) is to prevent or mitigate the impacts of pests and pesticides on human and biological environment and to provide an effective integrated pest control framework.

The plan also highlights the different categories of actors whose roles and modes of involvement have impacts that can differentially influence the effectiveness of environmental and health management. These actors include ministries in charge of, Agriculture (MoFA), Environment (MESTI) and Health (MoH) as well as private operators, local authorities, laboratories and research institutions, health and environmental NGOs, farmers' organizations, etc.

The political context of the environmental protection and natural resources sector in which WAATP will be implemented is marked by the existence of relevant policies and strategy papers, among other: the Environmental Policy, National Plant Protection Policy; Health Policy and Environmental Hygiene and the Investment Plan for the Agricultural Sector.

On the legislative level, plant protection in Ghana is governed by: (i) Plants and Fertilizer Act, 2010 (Act 803): The Plant and Fertilizer Act of 2010 combines the Seed Inspection and Certification Order, NRCD 100 of 1972, and the Pest and Plant Disease Prevention and Control Act 307 of 1965. The law provides for effective plant protection to prevent the introduction and spread of pests and diseases to regulate the import and export of plants and planting material; the regulation and control of exports, imports and commercial transactions in the seed sector and related matters; and the control and regulation of the fertilizer trade; (ii) the Prevention & Control of Pests and Diseases of Plants Act, 1965 (Act 307); (iii) the Environmental Protection Agency Act, (Act 490) of 1994, an act to amend and consolidate the law relating to environmental protection, pesticides control and regulation and for related purposes. The Act provides rules for registration, manufacturing, use, disposal and non-disclosure of information, classification, licensing, reporting, labelling and inspections of pesticides. This law addresses the registration of all pesticides prior to their use in Ghana.

In addition, Ghana has signed and ratified several international legal instruments relating to chemicals.

In WAATP's intervention zone, several crops are grown, including those supported by the program: cereal crops (maize, rice, soya bean, sorghum), roots and tubers (cassava, yam, sweet potato) and market gardening (tomatoes, peppers, okra, onion, etc.) and the rearing of small ruminants and poultry.

The main pests of the target crops that occur in this area are: Variegated grasshopper, *Zonocerus variegatus* (Cassava), Termites, *Microtermes* spp. (Yam) and Armyworms (*Spodoptera exempta*) (maize, rice, sorghum). With regard to animal diseases, the Newcastle disease and the Infectious bursal disease (Gumboro) affect poultry; Anthrax and Blackleg are a disease that affects small ruminants (sheep, goats).

Discussions with some stakeholders demonstrated the use of pesticides for the treatment of these pests in target crops and storage facilities for agricultural products in the Program area. The vast majority of farmers systematically resort to chemical pesticides to control pests.

Most farmers use unregistered pesticides. The main reason for using these unregistered pesticides includes:

- relatively lower cost compared to registered pesticides;
- their availability (sold on local markets);
- insufficient technical training and difficulties in effective control of indiscriminate use of pesticides;
- difficult access to registered pesticides (in terms of proximity).

Therefore, this PMP pays special attention to the following aspects:

- information, awareness-raising, capacity building for the various actors in the target crops sector on responsible and effective methods of using plant protection products in general, and integrated pest management approaches (IPM) in particular,
- appropriate equipment and infrastructural support,
- application of certain regulatory provisions.

The main hazards associated with the use of pesticides in the implementation of WAATP are:

- **Human intoxication:** in most cases, many users of pesticides neglect or ignore the risks and dangers of pesticides. Therefore, they manipulate them without any precaution causing risks of poisoning ;
 - **Animal intoxication:** Pesticides also kill other non-target insects and birds that may be natural predators of pests. Similarly, water polluted by pesticides becomes dangerous for terrestrial (domestic and wild) and aquatic animals with the phenomenon of bioaccumulation thus endangering the entire food chain.
 - **Water pollution:** Water is the main collector of surplus of pesticides. The principal lakes or rivers can thus be environmental components liable to be polluted leading to pollution of water table and thus of entering of the pesticides in the food chain;
 - **Soil pollution:** pollution of soils through increased use of pesticides contributes to kill both harmful insects and microorganisms in soils. However, these microorganisms are important for removing soil nutrient deficiencies and stimulating respiratory and mineralization activities;
- Air pollution:** air pollution through increased use of pesticides has negative impacts on the quality of air. It could cause respiratory problems. It could also impact negatively beekeeping activities by reducing population of bee.

Under the WAATP, guidance on pest management will be based on Integrated Pest Management (IPM) approach. This approach recommends the association of all possible and useful control methods against pests while considering the use of chemical pesticides as a last resort. Thus, several control methods are available: biological control; agronomic control, reasoned chemical control, varietal selection; mechanical, genetic and legislative fight. They will have to be conducted under a preventive or curative fight and encourage farmers to make IPM decisions using agro-ecosystem analysis (AESAs).

For targeted crops, an overview of the protocols recommended in the program, the suitable pesticides and the motivation for choosing them are given in the document. It should be noted that the recommended pesticides are selected from the list of phytosanitary products approved by World Health Organization and registered in Ghana.

The diagnosis of the pest situation and the use of pesticides in the WAATP intervention area requires development of an Action Plan to deal with the negative impacts of the use of pesticides on environment and people, as well as the effective protection of targeted crops. This should help minimizing the anticipated negative impacts associated with the implementation of the Program activities.

This Action Plan includes:

1. Promoting the use of alternative pest management strategies in the project areas;
2. Development and promotion of IPM technologies;
3. Strengthening of controls during importation of phytosanitary products;
4. Capacity building of key actors on the rational use of pesticides;
5. Sensitization of farmers on IPM methods and good phytosanitary practices (transport, storage, application and other safety measures);
6. Environmental monitoring of the physico-chemical quality of water resources (groundwater and ponds);
7. Health monitoring of pesticides users and management of empty containers.

Ongoing monitoring, supervision and annual evaluation will be done.

The Plant Protection Services (PPRSD) of MoFA will be responsible for the internal environmental monitoring of the PMP in the intervention sites of the program through the regional PPRSD divisions; the Environmental Protection Agency (EPA) / CCMC will be responsible for the external environmental monitoring of the PMP in the intervention sites of the program and Health monitoring will be provided by the regional health districts. Their capacities should be reinforced for this purpose.

Members of the Steering Committee, the CORAF/WECARD and the World Bank will also be involved in the supervision of the Program activities.

The implementation of the recommended measures will be carried out under the coordination of the WAATP Environmental and Social Specialist (ESS) of the Program with involvement of the Environmental and Social Respondents (RES) or Focal Points in the regions, farmers' organizations and NGOs actively involved in field activities.

The costs of the PMP are estimated at **US \$. 507, 000** .These costs are spread over the five (5) years of the Program implementation.

The table below outlines the cost composition of the PMP's Action Plan.

N°	Activities	Unit	Quantity	Unit cost (US \$)	Total cost (US \$)
1	Strengthen the institutional framework for pest and pesticide management				125,000
2	Strengthen technical and organizational measures for the management of pests and pesticides				205, 000
3	Capacity building of actors involved in integrated pest management				125,000
4	Provide control, monitoring and evaluation of pest and pesticide management				52,000
TOTAL (US \$)					507, 000

1. INTRODUCTION

1.1. Context of Program

The agricultural sector (including crops, livestock and fisheries) is one of the main drivers of Ghana's economy. It is a major contributor to exports, employment, incomes and poverty reduction.

Livestock production (cattle, sheep, goats, chickens and guinea fowl), concentrated in rural savanna areas where 86% of draft animals, 63% of cattle and about 80% of guinea fowl are bred (GSS 2013), is an important alternative livelihood for the small Ghanaian farmer.

However, the finding in recent years shows a loss of competitiveness of agriculture, given the progressive reduction of its contribution to GDP from 42% in 2005 to 22% in 2013 (ESG 2014) and 19.1% in 2016 (ESG 2017).

The gradual decline in agricultural productivity can be attributed to several aggravating factors, including (i) the dominance of the sector by smallholders, women and the elderly who have limited access to financial, technical and managerial services: (i) extension services; (ii) over-dependence on natural rainfall conditions, soil fertility and even planting material; (iii) endemic post-harvest losses, reducing productivity by almost a third (IFAD, 2008) and (iv) limited animal production by challenges related to inferior breeds, diseases, fires, floods, and conflicts with crop producers.

In addition, Ghana's agricultural sector is just coming out of a fight against the Fall Army Worm (FAW). In April 2016, the worm caused devastating consequences on several crops, especially maize and some perennial crops such as cocoa.

Also, despite the Government's efforts to meet the challenge of modernizing agriculture and introducing improved technologies for farmers and other value chain actors for mass adoption, through Development of the Food and Agricultural Sector (FASDEP), the Investment Plan for the Agricultural Sector in the Medium Term (METASIP) and the "One Village One Dam" Policy, food security is still a major challenge at the national level.

In a quest to improve agricultural productivity to satisfy food needs of a growing population, promote sustainable economic growth and reduce rural poverty in the Economic Community of West African States (ECOWAS) sub-region, Ghana benefited from a two-phase 10-year Adoptable Program Lending (APL) funded by the World Bank, with each phase spanning five-year duration (i.e. between 2007 and 2017). The West Africa Agricultural Productivity Program (WAAPP) supported the implementation of CAADP's agricultural research and development (R&D) pillar, as reflected in the national agricultural investment plans and the regional mobilizing program.

In view of the satisfactory results achieved by WAAPP and to further contribute to the structural transformation of Ghana's agriculture for a strong, resilient, inclusive and job-creating growth, especially for young people, the Economic Community of West African States (ECOWAS) and the World Bank have (WAATP) reaffirmed their willingness to support Ghana in the formulation of a West Africa Agriculture Transformation Program

Under WAATP-Ghana, it is planned, especially in components 2 and 3, to ensure improvement in agricultural productivity through mass adoption of climate smart technologies (extension), production and certification of improved seeds and planting materials (maize, rice, cassava, yam, sweet potato etc.), promotion of the use of fertilizers, promotion of safe and responsible use of pesticides, provision of modern infrastructure to ensure access to quality pest control products for optimum results, as well as the regulation of veterinary products in the livestock (small ruminant) and poultry sectors.

These activities could directly or indirectly, result in increased use of plant protection products or induce the use of pesticides or other pest control methods (pests, diseases and weeds) by farmers for increased productivity.

However, the intensive application of pesticides (insecticides) 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.

There is the need for Integrated Pest Management approaches to be adopted in order to regulate the potential use of these chemicals to address pest problems and crop diseases; thus meeting the requirements of a productive and sustainable agriculture and minimizing the health and environmental risks. This Pest Management Plan (PMP) is developed as a result of the triggering of the World Bank Operational policy OP 4.09 (Pest management).

1.2. Objectives of the PMP

The overall objective of the study is to develop the WAATP-targeted Crop and Livestock Pest Management Plan to prevent or mitigate the negative impacts of pesticide use on the natural and human environment.

The Pest Management Plan (PMP) is designed, on the one hand, to minimize potential negative impacts of pesticides on human and animal health as well as the environment; and on the other hand, to promote the use of integrated pest management methods and approaches under the program.

The PMP also addresses a major objective by assessing and strengthening the capacity of the country's institutional, regulatory and technical framework to promote and support the safe, effective and efficient management of pests and pesticides and their residues and incorporate safeguards proposals into the program.

It is more specifically about:

- identify all the potential risks of plant protection products on natural and human resources, with regard to the interventions envisaged under the program;
- propose an action plan for Integrated Pest Management;
- define the institutional arrangements for implementation and monitoring of the action plan before, during and after the implementation of the Program and the implementation of activities to eliminate or mitigate negative environmental and social impacts.

1.3. Methodology

The methodology adopted for the development of this PMP is based on a participatory approach, involving all stakeholders and partners concerned with WAATP, including those in the regions of Ghana. This participatory approach supported by Government and key stakeholders, allowed the opinions and proposals of the different actors to be integrated into the PMP. To achieve the results of the study, the underlisted strategies were adopted:

- an analysis of program documents (Program Concept Note) for a better understanding of the objectives, components of WAATP and its potential activities; as well as other strategic and planning documents and training tools at the national or local levels;
- a bibliographic review of national laws and regulations on the protection of the environment and natural resources, agriculture (phytosanitary regulations) and environmental and social safeguard policies established by the World Bank;

- meetings and consultations of institutional and socio-professional actors mainly concerned by the WAATP: Ministry of Food and Agriculture (MoFA); Ministry of the Environment, Science, Technology and Innovation (MESTI), NGOs and farmers' organizations;
- site visits (crop field and greenhouse activities) and interviews with beneficiaries and potentially affected persons, officials and resource persons in the various localities concerned (Pokuase, Kpone Katamansu, Abokobi, Appolonia) in the Greater Accra region.

1.4. Structure of the report

The report is structured around the following:

- Introduction;
- Description of the program;
- Political, legal and institutional framework;
- Diagnosis of the current situation of pests and pesticides;
- Analysis of environmental and social risks and impacts, mitigation measures associated with the use of phytosanitary products;
- Action Plan for the Integrated Management of Pests and Pesticides;
- Budget for implementation of the PMP.

2. DESCRIPTION OF THE PROGRAM

2.1. Program Development Objective (PDO)

The Project Development Objective (PDO) of WAATP is to accelerate adoption of improved technologies and youth job creation and strengthen enabling conditions for access to regional markets for the participating countries' priority agricultural commodity areas, and to enable the Governments to respond promptly and effectively to eligible emergencies.

Specifically, the following objectives are pursued: (i) strengthen the new generation model of innovations in West Africa as part of the transformation of Ghana's National Centers of Excellence into Regional Centers of Excellence (RCoE); (ii) increase agricultural productivity through the acceleration of the massive adoption of technologies; (iii) promote technologies and value-enhancing innovations in agri-silvo-pastoral and fisheries value chains that are likely to create jobs, especially for youth and women, and that can improve food security and increase incomes populations supported by the program; (iv) strengthen the institutional framework, policies and markets; and (v) contribute to the management of crisis management.

2.2. Description of Components

The program will be implemented over a five (5) year period and includes the following five (5) components:

- **Component 1: Strengthening the new model of Innovation delivery in West Africa**

The component aims to strengthen the National Centers of Excellence supported under WAAPP and upgrade them to become ECOWAS Regional Centers of Excellence (RCoE) for research focusing on priority lines of research to be addressed regionally. The RCoE will play a key role on ensuring a solid link with research system, (CGIAR, other advanced research centers, the private sector, etc.) and the networking of national agricultural research and extension systems to deliver in a sustainable manner improved technologies and innovation -which will be screened to ensure that they are climate-smart and gender sensitive for scaling up.

It has two sub-components:

- ✓ **Sub-Component 1.1: Strengthening National Centers of Specialization**

This sub-component relates to support for:

- *Strengthening the new model of innovation delivery*
- *Procure items to support WAATP implementation*
- *Promotion of research uptake*
- *Priority partnership*
- *NCoS to RCoEs consolidated*

- ✓ **Sub-component 1.2: Strengthening of adaptive research (R&D) Priority Value Chains: 1. Cassava, sweet potato, cocoyam, and yam. 2. Maize, rice, sorghum, pearl millet**

This subcomponent includes activities below:

- *Develop MOUs with National Partners*
- *Strengthen staff capacity in seed related training activities*
- *Adaptive research projects/innovative platforms*
- *Production and supply of breeder and foundation seeds*

- *Appropriate processing methods for high quality dried tomatoes, pepper, onions and leafy vegetables developed, tested and technology transferred to processors*
- *Soil studies for optimizing fertilizer use in Ghana's ecological zones*
- *Participate in CORAF Research and Regional Activities*

- **Component 2: Accelerating mass adoption of improved technologies and innovations.**

The component aims to intensify the adoption of innovations that will accelerate productivity increases, improve climate resilience, reduce post-harvest losses, promote value addition, and accelerate job creation for youth.

The component has the following three subcomponents:

- ✓ ***Sub-component 2.1 : Demand driven market based interventions***

This subcomponent will support the following activities:

- *Reform/ strengthen Agricultural Service Delivery*
- *Scaling up technology dissemination*
- *Improving access to extension services*

- ✓ ***Sub-component 2.2 : Strengthening the seed sector***

The activities to be implemented relate to:

- *Access of seed value chain actors to finance and markets*
- *Support to Agricultural stations*
- *Procurement of certified seed*
- *Seed production for planting for food and jobs*
- *Promote e-Agricultural Services*

- ✓ ***Sub-component 2.3 : Jobs for the youth***

The sub-component aims to increase youth employment by using the regional pool of technologies and best practices in collaboration with the private sector. The sub-component will be developed around the following activities:

- *Procurement of materials in support of youth employment:*

- **Component 3 : Policies, markets and institutional strengthening**

The objective of the component is to create a favorable policy environment to accelerate the transformation of agriculture, link production to markets and strengthen regional integration institutions. The component will have 3 sub-components.:

- ✓ ***Sub-component 3.1 : Policy formulation and regulation in favour of markets and institutional strengthening***

The component will support the following activities: (i) promote the safe and responsible use of pesticides; (ii) provide infrastructural support to ensure that pest control products are of the quality needed to optimize resources; (iii) strengthen the legal and institutional framework for pesticide management; (iv) support sub-regional efforts for the harmonization of pesticide regulations; (v) monitor interventions on the use and management of pesticides; (vi) certification of planting material / seeds; ; (vii) regulate veterinary products; (viii) implement the ECOWAS Regulations on Seeds and Fertilizers; (ix) establish and implement a sustainable financing mechanism; and (x) update existing strategies and action plans on gender, communication, climate change and nutrition, and improve their implementation. In addition, sub-component 3.1 will also undertake value chain studies on priority products at the national level.

- *Policy formulation and regulation in favour of markets and institutional strengthening*
- *Reporting on project activities*

- ✓ **Sub-component 3.2: Regional market development for targeted products.** This sub-component 3.2 will support regional studies on cassava, yams, rice and maize.

- ✓ **Sub-component 3.3: National and regional institutional capacity building.**

This sub-component will deploy activities for strengthening national and regional institutional capacities.

To strengthen regional institutional capacity, WAATP will support (i) collaborative work between quarantine units to reduce the incidence of disastrous pests in the respective countries; and (ii) develop demand-driven multi-country research proposal funding from CORAF.

- *Regional Institutional Capacity Building*
- *Recruitment and operational costs*

- **Component 4 : Contingent emergency response**

The objective of this component, known as the Contingent Emergency Response Component (CERC), will be to make available resource to strengthen the response capacity of the Government of Ghana in case of emergency.

The checklist of eligible disaster situation will be the following:

- *pest and diseases infestation, such as FAW, locusts, swine fever and bird flu*
- *severe climate change resulting extreme drought or floods*
- *severe bush and wild land fires*
- *protracted community conflicts*

- **Component 5: Program management, learning, monitoring and evaluation.**

- ✓ **Sub-component 5.1 : Harmonized Coordination and Management–**

- ✓ **Sub-component 5.2 : Monitoring and evaluation, Knowledge management Communication**

2.3. Program intervention area

The West Africa Agricultural Transformation Program (WAATP) is a national scope program whose activities will be implemented in the different regions of Ghana as shown in the figure below.

All the project implementation sites are strictly for agricultural purposes. There are no protected areas, such as national parks and wildlife reserves, nor are there any forest reserves or other sensitive habitats in the vicinity.

Figure 1 : Administrative map of Ghana



Source: www.touringghana.com, June 2018

2.4. Arrangement for Program implementation

The institutional arrangements for program implementation are recorded in the following table.

Table 1: Implementing mechanism of the project

Actors	Role
Regional level	
Executive Secretariat of the West and Central African Council for Research and Development (ES/WECARD)	The ES / WECARD ensures the WAATP Regional Coordination and the capacity of the Environmental and Social Focal Points (PFESFP) of the technical institutions involved in the implementation of the program are built.
Program Implementation phase: National Level	
The Program Steering Committee (PSC)	The PSC will be responsible for: (i) monitoring and evaluation of progress of key activity implementation as well as the validation and recommendation of all the activities carried out and the documents produced (ii) ensure the integration and budgeting of environmental and social procedures in Annual Work Plans and Budgets (AWPBs); (iii) approve the annual procurement plan; and (iv) review the annual performance report on implementation to be prepared by WAATP's PCU / MoFA and oversee the implementation of the PMP activities.

Actors	Role
Ministry of Food and Agriculture (MoFA)	MoFA is the lead Institution/ministry to manage and implement the program .It will offer managerial, technical and financial services in strong collaboration with relevant institution and key stakeholder.
Program Coordinating Unit (PCU) /MoFA	The PCU will coordinate, monitor and provide technical and fiduciary services in the management of program resources. It falls under the technical supervision of the Ministry of Food and Agriculture (MoFA). The WAATP Coordinator, in collaboration with the ESS at PCU, will ensure the effective implementation of the PMP's Action Plan and take into account environmental and social aspects and issues in the implementation of the program activities.
Environmental Protection Agency (EPA)/Ministry of Environment, Science, Technology and Innovation (MESTI)	The implementation of the program will involve the delegation of certain activities to the national entities of the environmental protection sector: The EPA will participate in the dissemination of good agri-environmental practices and the extension of IPM methods. The Agency will participate in the information and dissemination of the PMP. EPA will also monitor the negative environmental impacts of pest and pesticide management under the PMP and offer critical technical advice.
NGOs and civil society	In addition to social mobilization, civil society and NGOs will participate in the citizen engagement and monitoring of the actual implementation and evaluation of the environmental impact of the PMP implementation.
Executing Agency (RCoE/NCoS)	RCoE / NCoS will also be involved in the implementation of the WAATP PMP through the Environmental and Social Focal Point / Research (ESFP / R) which will also ensure the integration of environmental and social aspects into research requests. A Memorandum of Understanding will delegate responsibility for the implementation of the project to the management or partner concerned and specify the implementation modalities.
Appropriate public and private service providers	The private / public service provider will be responsible for carrying out all relevant activities in a given geographical area (technical rehabilitation / construction works, technology extension, preparation of seed certification applications etc.), and submit all documents to the PCU.

Source : Program Concept Note

3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK FOR PEST/DISEASE MANAGEMENT

3.1. Policy framework

3.1.1. Environmental policy

Environmental policy in Ghana is based on the achievement of strategic objectives related to the sustainable management of natural resources; promoting the application of science, technology and innovation in all sectors of the economy; the development of research and its application for equitable and balanced spatial and socio-economic development.

3.1.2. Health policy and environmental hygiene

Health policy in Ghana is based on Primary Health Care. In the field of Health and Hygiene, the Ministry places special emphasis on: the elimination of excreta and other wastes including biomedical waste; community awareness of the benefits of environmental health; the extension and application of hygiene rules, even those relating to the use and management of plant protection products, etc.

3.1.3. National plant protection policy

The overall goal of the national plant protection policy is to achieve an efficient system that ensures that crop losses caused by biological, environmental and ecological factors are contained in a sustainable and economical manner. There are thirteen (13) principles underlying the Plant Protection Policy. Three of the underlying principles, namely principle 7 (IPM), 8 (Coordination of IPM Activities) and 9 (Contribute to IPM research) provide for integrated pest management (IPM) issues.

Principle 7 on IPM specifically fix *promoting Integrated Pest Management (IPM) as the standard plant protection strategy for all crops to effectively reduce crop losses with minimum pesticide use.*

3.2. Legislative and regulatory framework

The legal framework that has a direct and / or indirect relationship to the management of pests and pesticides, involves several laws and regulations at the national level, guidelines, import and export procedures, codes of conduct or practice as well as international agreements, treaties and conventions ratified by the countries.

3.2.1. National legal instruments relevant to pest management

Ghana has relatively large legislation in the area of chemicals management, particularly in pesticide management. These include, among others:

- *The 1992 Constitution of Ghana* provides the broad policy basis for the protection of the environment. The relevant sections are as follows:

Economic Development - Article 36 (9): The State shall take appropriate measures needed to protect and safeguard the national environment for posterity; and shall seek co-operation with other states and bodies for the purposes of protecting the wider international environment for mankind.

Economic Development - Article 36 (10): The State shall safeguard the health, safety and welfare of all persons in employment, and shall establish the basis for the full deployment of the creative potential of all Ghanaians.

Duties of a Citizen - Article 41 (k): The exercise and enjoyment of rights and freedoms is inseparable from the performance of duties and obligations, and accordingly, it shall be the duty of every citizen to protect and safeguard the environment Article 268 of the 1992 Constitution states that “Any transaction, contract or undertaking involving the grant of a right or concession by or on behalf of any person including the Government of Ghana, to any other person or body of persons howsoever described, for the exploitation of any mineral, water or other natural resource of Ghana made or entered into after the coming into force of this Constitution shall be subject to ratification by Parliament.

- *The Environmental Protection Agency Act, (Act 490) of 1994, an act to amend and consolidate the law relating to environmental protection, pesticides control and regulation and for related purposes.* The Act provides rules for registration, manufacturing, use, disposal and non-disclosure of information, classification, licensing, reporting, labelling and inspections of pesticides.

This law addresses the registration of all pesticides prior to their use in Ghana. It recognizes the need for the safe handling and use of pesticides and as such as provisions for licensing of persons or entities engaged in all pesticide use activity such as retailing, commercial pest control, importation, manufacture, formulation, distribution, use and transportation of pesticides in Ghana. Issues regarding safeguards to pesticide use such as the use of personal protective equipment have been provided in the law with stated penalties for non-compliance. In addition, the law also has provisions for the listing or registration of pesticides as banned pesticides. A gazette register is produced yearly which provides details of all registered and banned pesticides in Ghana.

There are other related regulatory frameworks whose implementation seeks to augment the overall objectives of pesticides management in general. These include but not limited to the following:

- *Plants and Fertilizer Act, 2010 (Act 803):* The Plant and Fertilizer Act of 2010 combines the Seed Inspection and Certification Order, NRCD 100 of 1972, and the Pest and Plant Disease Prevention and Control Act 307 of 1965. The law provides for effective plant protection to prevent the introduction and spread of pests and diseases to regulate the import and export of plants and planting material; the regulation and control of exports, imports and commercial transactions in the seed sector and related matters; and the control and regulation of the fertilizer trade
- *Local Governance Act, 2016 (Act 936);*
- *Labour Act, 2003 (Act 651);*
- *Factories, Offices and Shops Act, 1970 (Act 328);*
- *Public Health Act, 2012 (Act 851);*
- *Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917);*
- *Environmental Assessment Regulations 1999 (LI 1652);*
- *Pesticides Use and Policies in Ghana. 2001;*
- *The Prevention & Control of Pests and Diseases of Plants Act, 1965 (Act 307);*
- *Ghana Revenue Authority Act, 2009 (Act 791).*

These legislative documents are poorly known by the public, because of the lack of a powerful system and the lack of dissemination. This fact reflects the free circulation of certain products containing the incriminated active ingredients. Few actions are taken to control the import and use of pesticides.

These laws and implementing decrees serve as a reference base in phytosanitary legislation and pest management in Ghana.

It should be noted that a draft Regulation on the storage and use conditions of approved plant protection products is being processed (EPA).

The adoption and application of this law should systematically contribute to the dissemination of good phytosanitary practices in the basic production communities, relating to the storage and handling of products as well as a consequent reduction of the resulting risks.

3.2.2. International legal instruments

Ghana has signed and / or ratified several international conventions related to chemicals. These conventions are:

- Convention concerning protection against the risks of poisoning due to benzene, adopted in Geneva in 1971;
- 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;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, adopted on 22 March 1989;
- Convention on Persistent Organic Pollutants (POPs), adopted in Stockholm 22 May 2001;
- Vienna Convention for the Protection of the Ozone Layer, adopted on 22 March 1985;
- 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;

Convention on Chemical Weapons adopted on 13 January 1993 and put into effect in April 1997;

- 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 02 February 1971 and entered into force 197;

By the act of ratification, Ghana agreed to be bound by the obligations imposed on Parties by the Convention. The obligations arising from the ratification of the Convention are a commitment to comply with and implement its provisions and the enactment of a national law to give effect to our obligations under the Convention.

Among the conventions mentioned above, a certain number are of direct importance with pesticides and the fight against pollution (see table 2) notably the Stockholm Convention on Persistent Organic Pollutants. This Convention aims, in accordance with Principle 15 of the Rio Declaration on Environment and Development, to protect human health and the environment from persistent organic pollutants such as aldrin, dieldrin, chlordane, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, DDT and PCBs.

The Rotterdam Convention also plays a key role in the management of pesticides as it is a measure of protection for the country in that it has a number of measures that limit the import of pesticides that are recognized as hazardous and exclusion by the international community.

The Ramsar Convention (the Convention on Wetlands) provides a framework for national action and international cooperation on the conservation and wise use of wetlands and their resources. Water pollution resulting from the misuse of pesticides could seriously hinder the functioning of wetland ecological processes.

The table below shows the conventions ratified and or signed by Ghana, in connection with the WAATP.

Table 2: International conventions ratified by Ghana, in connection with WAATP

N°	Convention signed / ratified	Date and place of adoption of the agreement	Date of accession of Ghana	Link with WAATP
1	Convention on Persistent Organic Pollutants (POPs)	Stockholm, May 22, 2001	23/05/2001(Signed) 30/05/2003 (Ratification/ Approval) 17/05/2004 (Entry into force)	Pesticides affected by persistent organic pollutants are banned from use in Ghana. WAATP will need to ensure that pesticides used in IPM are registered.
2	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.	Rotterdam, September 10, 1998	11/09/1998 (Signed) 30/05/2003 (Ratification/ Approval) 24/02/2004 (Entry into force)	The WAATP through support to the improvement of crop productivity (tubers, cereals, small ruminants and poultry) is addressed by this convention. WAATP will have to ensure (i) that pesticides that will be used in the context of integrated pest management are registered, (ii) ensure that users are aware of the hazards and risks associated with the use of pesticides and (ii) ensure the development of user capacity for the responsible management of pests and pesticides.
3	Ramsar Convention on Wetlands of International Importance	Ramsar, February 02, 1971	The convention entered into force in Ghana on 22 June 1988.	WAATP's support for the production of irrigated seeds and planting materials raises fears of systematic use of pesticides by beneficiaries for crop protection. The WAATP is therefore challenged by this convention and will have to ensure the rational use of wetlands (maintenance of their ecological characteristics).

3.2.3. Common Regulatory at ECOWAS level

In 2005, the ECOWAS countries joined the process of harmonization of the rules defining the accreditation of pesticides in the ECOWAS region. In 2008, a regulatory was issued 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.

3.2.4. *International Code of Conduct on Pesticide Management (Rome 2014)*

This Code establishes voluntary rules of conduct for all public and private bodies responsible for or associated with the management of pesticides, particularly where national legislation regulating pesticides is non-existent or insufficient.

This Code has Article 1.7.3, which promotes practices that reduce risks throughout the life cycle of pesticides, with a view to minimizing their adverse effects on humans, animals and the environment, and preventing accidental poisoning due to handling, storage, transportation, use or disposal, and the presence of pesticide residues in food and feed.

3.2.5. *FAO guidelines for locust control*

FAO has given high priority to EMPRES (System for Prevention and Rapid Response to Transboundary Animal and Plant Pests and Diseases) to build national capacity. To this end, it has prepared a set of six guidelines for national and international organizations and institutions engaged in locust survey and control, which deal with Desert Locust biology and behavior, information and forecasts, the organization and execution of a campaign and the precautions of use of pesticides on human health and the environment.

3.2.6. *Operational Policy 4.09 on Pest Management*

Pest management is based on the World Bank OP 4.09 Operational Policy. The objective of this policy, integrated into the activities of the institutions, is to: (i) promote the use of biological or environmental control and reduce the dependence on synthetic chemical pesticides; (ii) strengthen regulatory and institutional capacity to promote and support safe, effective and environmentally sustainable pest management.

The policy is triggered if: (i) the acquisition of pesticides or pesticide application equipment is considered (either directly through the project, or indirectly through the allocation of loans, co-financing, or financing of government counterpart); (ii) the project may affect pest control in a way that the harm could be done, even if the project is not contemplated to obtain pesticides.

In Ghana, the national plant protection policy is based on integrated pest management by principle. The German Development Cooperation (GTZ) has supported the PPRSD of MOFA to develop separate booklets to serve as extension guides on integrated pest management practices for the production of (i) vegetables; (ii) cereals/pulses; (iii) roots and tubers, and plantains.

National IPM approaches have been developed for cereals, root and tubers and vegetables largely based upon 16 principles and practices on the cropping calendar of the crops in each case.

MoFA in collaboration with the EPA develops IPM capacity building for key actors (extension services, agricultural organizations). These extension guides include: Principles of Integrated Pest Management Healthy Crops; Integrated Pest Management Practices for the Production of Cereals and Pulses, etc.

However, extension IPM approaches among farmers, remains a challenge. In addition, Universities and Research Centers are developing research activities based essentially on knowledge of the biology and ecology of crop pests.

In Operational Policy OP 4.09 on pest management, the World Bank establishes criteria for the selection and use of pesticides in the projects and programs it finances. These last are:

- (a) the products selected must have negligible effects on human health;
- (b) their effectiveness against the target species must be established;
- (c) they must have very limited effects on non-target species and the environment;
- (d) their use must take into account the need to prevent the emergence of resistant species.

The methods, the timing of the intervention and the frequency of the applications must make it possible to protect as much as possible the natural selection and the biological control vectors. It must be demonstrated that the pesticides used are harmless to the inhabitants and domestic animals in the treated areas, as well as to the personnel who apply them.

The World Bank does not fund the procurement of World Health Organization (WHO) Class IA and IB products or Class II formulations if: (i) the country has no restrictions on their distribution and use, or (ii) if non-specialists, farmers or other persons are likely to use them or have ready access without the necessary training, materials and infrastructure to handle, store and apply them properly. For the classification of pesticides or formulas specific to each of the products under consideration, the World Bank refers to the classification recommended by WHO. The classification of pesticides by risk or hazard is based on their acute toxicity expressed as the LD50 oral and intradermal LD50 values (see Table 3).

Table 3: WHO Recommended Classification of Pesticides for Hazards

Class		LD50 for a rat (mg / kg body weight)			
		Oral way		Dermal	
		Solid	Liquid	Solid	Liquid
Ia	Extremely dangerous	<5	<20	<10	<40
Ib	Very dangerous	5-50	20-200	10-100	40-400
II	Moderately dangerous	50 - 500	200 - 2000	100 – 1000	400 – 4 000
III	Slightly dangerous	>500	>2000	>1000	>4000
U	Safe in case of use Normal	>2000	>3000	-	-

Source: Copplestone J.L (1988). *The development of the WHO recommended Classification of Pesticides by Hazard*

3.3. Institutional Framework

An institutional framework exists for multi-sectoral collaboration in the control and management of pest and pesticides in the country, with Environmental Protection Agency (EPA) as the coordinating center. All of these stakeholders are presented below.

3.3.1. Ministry of Environment, Science, Technology and Innovation (MESTI)

MESTI's mission is to design, develop and coordinate the implementation of the Government's policy in the areas of environmental protection, the rational management of natural resources and the improvement of the environment quality of life.

MESTI has adopted a number of policy objectives from the Ghana Shared Growth Development Agenda (GSGDA II) including the following:

1. Strengthen institutional and regulatory frameworks for sustainable natural resource management;
2. Promote the application of Science, Technology and Innovation in all sectors of the economy;
3. Strengthen the institutional framework to promote the development of research and its application;
4. Strengthen policy formulation, development planning, and M&E processes for equitable and balanced spatial and socio- economic development

MESTI has under his tutelage the Environmental Protection Agency (EPA).

3.3.1.1 Environmental Protection Agency (EPA)

The environmental protection agency is the leading public body responsible for protecting and improving the environment in Ghana. The Agency was formally established on 30th December, 1994

by Act 490 and given the responsibility of regulating the environment and ensuring the implementation of Government policies on the environment; and having regulatory and enforcement powers.

One of the EPA 's core function to regulate the import, export, manufacture, distribution, sale and use of pesticides. These functions are carried out through the Chemical Control and Management Center (CCMC).

With regard to its attributions, EPA is deployed in all regions of the country with 10 Regional Offices and 216 district offices.

3.3.2. Ministry of Food and Agriculture (MoFA)

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.

3.3.2.1 Plant Protection and Regulatory Services Directorate (PPRSD)

The PPRSD was established in 1965 by an Act of Parliament: Prevention and Control of Pests and Diseases of Plants Act, 307 now replaced by “Plants and Fertilizer Act, 2010 (Act 803). The PPRSD is the National Institution with the mandate and capacity to organize, regulate, implement and coordinate the plant protection services (including pests 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 10 regions of the country. It 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 in support of sustainable growth and development of Agriculture.

The PPRSD is divided into four (4) main Divisions and these include:

- Crop Pests & Disease Management Division
- Pesticide and Fertilizer Regulatory Division
- Ghana Seed Inspection Division
- Plant Quarantine Division.

Table 4: Role and Mandate of the PPRSD Divisions

Division	Role and mandate
Crop Pests & Disease Management Division	• Develops Good Agricultural Practices (GAPs), guidelines for Integrated Pest Management (IPM) of food crops • provides information on pests and disease situation • 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	• 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.

	• Supervises bio-efficacy trials carried out by research.
Ghana Seed Inspection Division (GSID)	• responsible for seed certification <u>Seed growers:</u> • 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. <u>Seed dealers:</u> • Registration of Seed Dealers • Monitoring of Seed Dealers' outlets <u>Seed importers and exporters:</u> • Registration of importers • Monitoring of importers' outlets • Registration of exporters • Monitoring of exporters' outlets <u>Farmers:</u> • Education and awareness creation on the benefits of utilization of certified seed/planting materials
Plant Quarantine Division	• Works closely with the customs authorities (CEPS) at all the official entry points. • Supervises and trains Phytosanitary Inspectors, develops and publishes information material, keeps records of plant imports and exports, the importers and exporters, as well as the pests and diseases of quarantine importance. • Issues phytosanitary certificates and import permits according to the IPPC format. • Inspects plant materials and makes sure they are free from pests. • Operates the National SPS Enquiry Point. • Carries out inspection on marketing quality standards on fresh fruits and vegetables for export. • Implements relevant International Standards for Phytosanitary Measures (ISPMs).

Source: MoFA, 2018

3.3.2.2 Directorate of Crop Services (DCS)

The Directorate is responsible for the following among other things:

- Ensuring that there are planting materials (seeds) in adequate quantities at affordable prices at appropriate times and places;
- Recommending issuance of permits and waivers for the importation of agricultural materials for the crops sub-sector/industry.
- Sourcing, soliciting, and analyzing information for the crop sub sector development-Provision of information to development partners on suitable areas for intervention.

The Directorate has five Units including the Environment, Land and Water Management Unit. The Unit is responsible for promoting sustainable use of natural resources for agricultural production. It is also to ensure that environmental sustainability is mainstreamed into sectoral policies, plans and programmes. This Unit undertakes programmes and activities with regard to agroforestry. The Unit

hosts the climate change desk of the Ministry of Food and Agriculture and facilitates the mainstreaming of Climate Smart Agricultural (CSA) principles and practices in agricultural sector activities.

The Unit has the oversight responsibility of implementing the National Climate Smart Agriculture and Food Security Action Plan.

3.3.2.3 Veterinary Services Directorate

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 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 10 regional offices and field technicians in all the 216 districts. This notwithstanding the directorate still faces many logistical and human capacity challenges in its operations. For instance, with the expected number of 429 veterinarians countrywide, only 50 (11.65%) are post currently. Again, there are challenges with inadequate quarantine facilities and veterinary laboratories (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 WAATP, the Veterinary Services would be called upon to play 3 specific roles:

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

3.3.2.4 Directorate of Agricultural Extension Services

The Directorate of Agricultural Extension Services (DAES) is responsible for the overseeing of 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 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.

3.3.3. Ministry of Health (MoH)

3.3.3.1 Ghana Health Services

The Ghana Health Service (GHS) is a Public Service body established under Act 525 of 1996 as required by the 1992 constitution. It is an autonomous Executive Agency responsible for implementation of national policies under the control of the Minister for Health through its governing Council - the Ghana Health Service Council.

- **Mandate**

To provide and prudently manage comprehensive and accessible health service with special emphasis on primary health care at regional, district and sub-district levels in accordance with approved national policies.

- **Functions**

For the purposes of achieving its objectives, the Ghana Health Service will perform the following functions amongst others:

- Provide comprehensive health services at all levels directly and by contracting out to other agencies. As part of this function, the GHS will:
 - Develop appropriate strategies and set technical guidelines to achieve national policy goals/objectives
 - Undertake management and administration of the overall health resources within the service
 - Promote healthy mode of living and good health habits by people
 - Establish effective mechanism for disease surveillance, prevention and control
- Perform any other functions relevant to the promotion, protection and restoration of health.

3.3.3.2 Food and Drugs Authority

It is the National Regulatory Authority mandated by the public Health Act, 2012 (Act 851) to regulate food, drugs, food supplements, herbal and homeopathic medicines, veterinary medicines, cosmetics, medical devices, household chemical substances, tobacco and tobacco products.

The FDA is an Agency under the Ministry of Health which aims to provide and enforce standards for the sale of food, herbal medicinal products, cosmetics, drugs, medical devices and household chemical substances. Its function consists of:

- Ensure adequate and effective standards for food, drugs, cosmetics, household chemicals and medical devices;
- Monitor through the District Assemblies and any other agency of State compliance with the provisions of Part 6,7 and 8 of the Public Health Act,2012 (ACT 851);
- Advise the Minister on measures for the protection of the health of consumers;
- Advise the Minister on the preparation of effective Regulations for the implementation of Part 6,7 and 8 of the Public Health Act, 2012 (ACT 851).

3.3.4. Ministry of Finance (MoF)

3.3.4.1 *Ghana Revenue Authority- Customs Division*

The Customs Division is responsible for collection of Import Duty, Import VAT, Export Duty, Petroleum Tax, Import Excise and other taxes.

The Customs Division also ensure the protection of revenue by preventing smuggling. As a frontline institution at the country's borders, Customs Division also plays a key role in surmounting external aggression and maintains the territorial integrity of Ghana. Customs Division is part of the country's security network.

The important role of customs officials in the success of any enforcement efforts has been recognized through several years of collaboration with the EPA in the implementation of chemical regulations. Under Act 490 section 61, the Customs Division serves on the Pesticides Technical Committee

3.3.5. Pesticides Technical Committee

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

- The Chemistry Department of the National Nuclear Research Institute of the Ghana Atomic Energy Commission,
- Cocoa Services Division of the Ghana Cocoa Board;
- Plant Protection and Regulatory Services 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 responsible Lands and Forestry;
- Ministry of Environment Science Technology and Innovation;
- The Environmental Protection Agency.

3.3.6. Research institutes

Research Institutions in Ghana and the Universities have also successfully conducted projects IPM strategies on pests in several commodities (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.

• **Council for Scientific and Industrial Research**

The Council for Scientific and Industrial Research (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 in its present form 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 CSIR is mandated to pursue, among others, the implementation of government policies on scientific research and development, coordinate R&D activities in the CSIR and other 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.

Some CSIR's Institutes 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.

3.3.7. Specialized laboratories

These are the National Seed Testing Laboratory (NSTL); the Central Veterinary Laboratory and the regional veterinary laboratories and the Poison Control Center.

- **National Seed Testing Laboratory (NSTL)**

The National Seed Testing Laboratory (NSTL) located at Pokuase near Accra carries out seed sampling and laboratory seed quality tests such as moisture, purity, germination and health before seeds are certified for distribution and marketing. The National Seed Testing Laboratory is a member of the International Seed Testing Association (ISTA) and now awaits accreditation.

- **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:

Differential diagnosis, samples collection and submission to world reference laboratories.

- Serological surveillance and testing.
- Training in disease recognition and confirmation.
- Training in sample collection, processing and submission.
- Training of laboratory Technicians.
- Vaccine production: I-2 Newcastle disease vaccine for rural poultry; Anthrax spore vaccine; Blackleg vaccine.

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

Research- problem solving research: Currently the laboratory in collaboration with the Animal Research Institute 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.

- **Poison Control Center**

The need for a poison centre in Ghana has been well demonstrated over the years as evidenced by the occurrence of a variety of cases of poisoning. Important causes are accidental poisoning from mishandling of pesticides among children from kerosene and pesticide' ingestion due to unsafe storage methods in the home, use of herbal potions of unknown composition, overdoses of certain

pharmaceuticals for illegal abortion, and accidental food poisonings. Bites from venomous animals particularly snakes are also common. Though preparations toward the establishment of a poison control centre started in mid 1999, it was not until early 2002 that the operations of a modest information centre commenced. Major roles the centre are currently performing include providing: an information service for health professionals on management advice in cases of poisoning; training for primary health personnel in the management of common poisonings; training for agricultural personnel in prevention and first aid management of pesticide poisoning; public awareness education and information programmes for prevention of poisoning. Key challenges include inadequate particularly among health professionals, inadequate number of staff coupled with appropriate training for staff of the centre, dedicated phone lines, literature and timely acquisition of toxicological data-bases, poor networking with the regions and the absence of clinical and laboratory toxicology services dedicated to managing poisonings. There is however the need for multi-sectoral involvement to facilitate establishment of model centres countrywide to suit local conditions. (http://mofa.gov.gh/site/?page_id=74)

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.

3.3.8. 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.).

3.3.9. Agricultural Professional Organizations and Civil Society

These organizations are groups of cooperative farmers or NGOs for the direct acquisition of pesticides from importers or distributors.

- **Ghana National Association of Farmers and Fishermen (GNAFF)**

The Ghana National Association of farmers and Fishermen is the umbrella organization for rural agricultural producers. 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: (i) facilitate procurement of agricultural inputs (fertilizers, pesticides) and also marketing of members produce, (ii) organize training programmes and commodity group visits for group for exposure among others.

- **Ecological Restorations**

Ecological Restorations (ER) carries out advocacy, raises awareness and builds capacity on environmental issues including the sound management of chemicals including pesticides.

These organizations collaborate as part of their activities with a number of stakeholders presented below.

3.3.10. Professionals in the Phytosanitary Sector

There are three (3) main professional pesticide associations in Ghana: CropLife-Ghana, Ghana Agri Input Dealers Association (GAIDA) and 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.

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: (i) promoting responsible uses (RU) & effective handling of CPPs through effective stewardship programs; (ii) organizing training programs for both members and stakeholders in the industry; (iii) 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 a national body of agricultural input dealers in Ghana. Its mission is to provide services and training for Agri-Input Dealers in Ghana for the Development of competitive agri-input market.

CropLife-Ghana, Ghana Agri Input Dealers Association (GAIDA) and Pesticide Importers Association 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.

3.3.11. 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.

3.3.12. 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.

3.3.13. Pesticide Users

It is the farmers who will benefit from the training actions of the national initiatives set up by the State of Côte d'Ivoire. These farmers are mainly men, but also women and young people, most of whom are out of school. Users of pesticides include approved applicators who are part of the chain of professionals in the phytosanitary sector.

3.3.14. 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 1:2,192 (DAES, 2017). The inadequate number was also confirmed during a field visit to Appolonia Operational area in the Kpone Katamansu District in the Greater Accra region.

There are also private initiatives and Non-Governmental Organisations (NGOs) involved in agricultural advisory services and support to farmers under the private sector. Key among them include, the CARE International, Agricultural Development and Value Chain Enhancement Program (ADVANCE), International Fertilizer Development Center (IFDC) and Alliance for Green Revolution in Africa

(AGRA). Most of these private sectors entities engage in the distribution of fertilizers and pesticides to farmers to enhance crop yields.

3.4. Regulatory and Institutional Gap Analysis

3.4.1. Legislative and regulatory Gap

Ghana's effort towards the sound management of pesticides has been enhanced greatly by the enactment and implementation of the EPA Act 1994, Act 490. Consequently, the EPA has established a pesticide management scheme, which involves the management of pesticides from cradle to grave. Despite these efforts, there are still some challenges in the effective implementation of the law. This is due to the absence of a full complement of relevant regulations to give effect to some of the provisions of the law. There is therefore a need to address the gap in the legal framework and other legislative inadequacies by reviewing and enacting the relevant regulations to enhance compliance.

3.4.2. Institutional Capacity Gaps

The gaps identified are in terms of human and institutional capacity. All the institutions involved with pesticides regulation or management do have experts with the necessary qualifications. These experts are however not adequate compared to the enormity of the task. As a result, there is heavy work pressure. The remuneration and motivation in most state institutions are so low that, experts in the relevant fields are often enticed by foreign and private organisations to leave the government sector. The 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.

As part of the extension capacity of IPM approaches and methods, there are also several gaps. Access of farmers to extension services is deplorable in Ghana. One extension officer, who is hardly resourced with the necessary transportation logistics and equipment, is responsible for over 2,200 farmers. It is therefore 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.

Government has however, taken bold steps to improve extension services by procuring 3,000 motorbikes, 216 pick-up vehicles and recruit at least 2,500 extensionists enhance visibility.

4. DIAGNOSIS OF THE CURRENT SITUATION OF PEST AND PESTICIDES MANAGEMENT IN GHANA

4.1. Agricultural background

4.1.1. *Major insect pests and diseases of root & tuber- Cassava, yam and sweet potato*

The main target crop pests and diseases commonly encountered by MoFA services in the program area are given in the table below.

Table 5:Major insect pests and diseases of Cassava (*Manihot esculenta*) Crantz

Major Insect pests and Diseases	Damage	Illustration
Variegated grasshopper, <i>Zonocerus variegatus</i>	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.	 source: https://link.springer.com
Cassava Mealybug, <i>Phenacoccus manihoti</i> (Homoptera: Pseudococcidae)	They may 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.	 source: https://www.researchgate.net/figure/Cassava-mealy-bug-Phenacoccus-manihoti-Homoptera-Pseudococcidae-Matile-Ferrero_fig1_233523958
Striped mealybug (<i>Ferrisia virgata</i>), Green mealybug (<i>Phenacoccus madeirensis</i>)	These are indigenous minor pests which suck sap of cassava plants but do not inject poison into the plants. Severely attacked plants show general symptoms of weakness and stunting, but do not show leaf distortion.	 source: https://mrec.ifas.ufl.edu/lso/mealybug
The green spider mite, <i>Mononychellus tanajoa</i>	Feeding on young leaves causes shrivelling, deformation and drying up of the leaves. Young shoots die, the whole plant becomes shrunk and deformed with a greatly reduced tuber yield.	 source: https://www.researchgate.net

	Damage is most serious in the dry season.	
White flies <i>Bemisia tabaci</i>	Adults suck sap and secrete copious amounts of honeydew to cover the leaves and stem with sooty moulds. Affected leaves dry and drop.	 Source: https://en.wikipedia.org/wiki/Silverleaf_whitefly
Termites (<i>Macrotermes</i> and <i>Odontermes species</i>)	Termites are occasional pests, particularly under very dry conditions. They attack cassava planted late or during the dry season. They can destroy the whole rooting system	 Source: http://termitesandants.blogspot.com/2011/10/odontotermes-sp3.html
Millipedes (<i>Myriapoda</i>)	These are occasional pests which bore into cassava tubers and feed, causing secondary infection that may lead to roting.	 Source: https://www.agefotostock.com/age/fr/Stock-Images/Rights-Managed/IBR-4292572

Source: PPRSD (2015), Pests' list of Ghana (unpublished)

Table 6: Major Insect Pests and Diseases of Yam (*Dioscorea* Sp)

Major Insect pests and Diseases	Damage	Illustration
The yam beetle, <i>Heteroligus meles</i> and <i>Prionoryctes</i> spp (Coleoptera: Scarabaeidae)	In Ghana, yam tuber beetles can cause serious economic losses by making extensive feeding holes in the yam tubers, often only just before harvest.	 Source: https://unmondeencouleurs.piwigo.com/index?category/5442-eophileurus_arrow_1908
Leaf beetles <i>Crioceris livida</i> and <i>Lema armata</i>	Yam leaves beetles are occasional pests and do not usually cause any serious problem.	 Source: http://scanbugs.org/portal/taxa/index.php?taxauthid=1&taxon=CHRYSOEOMELIDAE&cl=68
Termites, <i>Microtermes</i> spp.	Termites 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.	

		Source: https://home.czu.cz/en/sobotnik/termi
Scale insects <i>Aspidiella hartii</i>	Yam scale insects mainly attack tubers in storage. They suck the sap causing shriveling and also promote attack by fungal rots, and can inhibit subsequent germination of tubers. Occasional severe infestation can kill young shoots in the field.	 Source: https://www.researchgate.net/publication/282798387_Les_Arthropodes_continents_de_Guadeloupe_Petites_Antilles_Synthese_bibliographique_pour_un_etat_des_lieux_des_connaissances
Yam nematodes- The important species of yam nematodes are the spiral nematode <i>Scutellonema bradys</i> , the lesion nematode <i>Pratylenchus</i> spp. and the root knot nematode <i>Meloidogyne</i> spp.	Infections by above-ground yam nematodes are rarely noticed in the field, except occasionally as a general chlorosis and stunting of yam vines.	 Source: http://www.pestnet.org/SummariesofMessages/Pests/PestsEntities/Nematodes/Pratylenchus.Dioscoreaalata.SolomonIsPNG.aspx

Source: PPRSD (2015), Pests' list of Ghana (unpublished)

Table 7: Major Insect Pests and Diseases of Sweet Potato (Ipomoea Batatas Poir.)

Major Insect pests and Diseases	Damage	Illustration
Variegated grasshopper, <i>Zonocerus variegatus</i>	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.	 Source: https://www.alamy.com/stock-photo-variegated-grasshopper-zonocerus-variegatus-acrididae-final-instar-20500046.html
Cassava Mealybug, <i>Phenacoccus manihoti</i> (Homoptera: Pseudococcidae)	They may 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.	 Source: http://rachel.golearn.us/module/eninfo/export/default\$ct\$94\$pests.html

Striped mealybug (<i>Ferrisia virgata</i>), Green mealybug (<i>Phenacoccus madeirensis</i>)	These are indigenous minor pests which suck sap of cassava plants but do not inject poison into the plants. Severely attacked plants show general symptoms of weakness and stunting, but do not show leaf distortion.	 Source: https://mrec.ifas.ufl.edu/Iso/Mealybugs.htm
Mites-Several mite species attack sweet potato. <i>Aceria</i> spp is a tiny whitish mite and causes leaf blister on sweet potato	4.0 The feeding of the mite induces the epidermis of the young shoots to form a dense growth, which covers the tips of the stem and young leaves. The infested stems are short and abnormally thick. Yield may be reduced by 80% in severe attacks.	 Source: http://ftpmirror.your.org/pub/misc/cd3wd/1004/ag_crops_5_bv_en_lp
Nematodes- Important nematodes, which attack sweet potato are root knot nematode <i>Meloidogyne</i> spp, <i>Rotylenchus reniformis</i> and <i>Ditylenchus</i> spp.	Like <i>R. reinformis</i> , it causes the splitting of the tuber-forming roots. <i>Ditylenchus</i> spp is endoparasitic nematode which produces necrosis on the tubers	 Source: https://nematodeblog.wordpress.com/

PPRSD (2015), Pests' list of Ghana (unpublished)

4.1.2. Major insect pests and diseases of Cereals – Maize, Rice and Sorghum

Table 8: Major Insect Pests and Diseases of Maize

Major Insect pests and Diseases	Damage	Illustration
Armyworms (<i>Spodoptera exempta</i>)	Attack leaves	 Source: http://www.theeastafrican.co.ke/scienceandhealth/Call-for-GM-maize-to-fight-armyworm/.html
Larger grain borers (<i>Prostephanus truncatus</i>)	Attack stored maize grain	 Source: http://www.infonetbiovision.org/PlantHealth/MinorPests/Storage-pests-2

Greater grain weevil (<i>Sitophilus spp.</i>)	Attack stored maize grain	
		Source: https://alibdaapcc.com
Stem borers (<i>Busseola fusca</i> , <i>Sesamia calamistis</i> , <i>Eldana saccharina</i>)	Destruction of leaves and boring into stems	
		Source: http://sesamia.pagesperso-orange.fr/ForeursTigeMais.html
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	
		Source: http://eol.org/pages/567/details
Striga (witchweed) (<i>Striga hermonthica</i> , <i>S. asiatica</i>)	Is a parasitic weed that grows on the roots of maize and prevents the crop from growing properly	
		Source: https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Striga_hermonthica_(Purple_Witchweed).htm
Fall Army Worm (<i>Spodoptera frugiperda</i>)	Feeds on leaves and whorls of the plants especially maize.	
		Source: https://www.forestryimages.org/browse/detail.cfm?imgnum=1673034

PPRSD (2015), Pests' list of Ghana (unpublished)

Table 9: Major Insect Pests and Diseases of Rice

Major Insect pests and Diseases	Damage	Illustration
Armyworms (<i>Spodoptera exempta</i>)	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	

		Source: https://fr.globalvoices.org/2017/06/21/211791/
African gall midges (<i>Orseolina oryzivora</i>)	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 (<i>Diopsis spp</i>)	Dark brown fly. Lay eggs at the base of rice plants and hatched maggots feed on the stem tissues.	 Source: https://www.pinterest.com/pin/287526757443080127/
Stem borers (<i>Chilo spp</i> , <i>Maliarpha separata</i> , <i>Sesamia calamistis</i>)	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)	 Source: https://www.dailytrust.com.ng/news/agriculture/what-you-need-to-know-about-stem-borers-expert/165457.html
Rice blast (<i>Pyricularia oryzae</i>)	Most widespread and destructive disease. Affects all the leaves and stem of plant, starting with spots on leaves	 Source: http://rstb.royalsocietypublishing.org/content/371/1709/20150467/F2
Rice brown leaf spot (<i>Helminthosporium oryzae</i>)	Fungus disease which starts as tiny brown spots on rice leaves. Attack seedlings more often.	 Source: http://agritech.tnau.ac.in/crop_protection/rice_diseases/rice_2.html
Rice yellow mottle virus (RYMV)	Attacked rice plants show yellow leaves and stunted growth	 Source: https://www.usask.ca/agriculture/plantsci/winter_cereals/winter-wheat-production-manual/chapter-22/viruses.php

PPRSD (2015), Pests' list of Ghana (unpublished)

Table 10: Major Insect Pests and Diseases of Sorghum

Major Insect pests and Diseases	Damage	Illustration
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Armyworms (<i>Spodoptera exempta</i>)	Attack leaves	
Greater grain weevil (<i>Sitophilus spp.</i>)	Attack stored sorghum grains	
Sorghum shoot flies (<i>Atherigona soccata</i>)	Most important insect pest of sorghum seedlings. White larvae of sorghum shoot fly bore into the seedlings and feed inside. Result in 'deadhearts' phenomenon.	 Source:
Sorghum midges (<i>Contarinia sorghicola</i>)	Pest sucks developing seeds and removes all contents. Adults lay eggs inside flowering heads and small orange larvae that hatch feed on developing seeds.	 Source: https://agrobasesapp.com/australia/pest/sorghum-midge
Stem borers (<i>Busseola fusca</i> , <i>Sesamia calamistis</i> , <i>Eldana saccharina</i>)	Destruction of leaves and boring into stems. Same species which attach maize, millet also attack sorghum.	
Downy mildew (<i>Sclerospora sorghi</i>)	Fungus disease causes dwarfing or reduction of upper internodes. Results in 'crazy top' phenomenon.	 Source: http://www.guaminsects.net/gisac2015/index.php?title=Sclerospora_sorghi
Striga (witchweed) (<i>Striga hermonthica</i> , <i>S. asiatica</i>)	Is a parasitic weed that grows on the roots of sorghum plants and prevents the crop from growing properly	

PPRSD (2015), Pests' list of Ghana (unpublished)

4.1.3. Major insect Pests of Legume- Soybean

Table 11:Major Insect Pests and Diseases of Soya Bean

Major Insect pests and Diseases	Damage	Illustration
Aphids (<i>Aphis craccivora</i> 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	 Source:http://www.infonet-biovision.org/PlantHealth/Pests/Aphids
Storage mothss (<i>Ephestia cantella</i> , <i>Corcyra cephabonica</i>)	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 (<i>Callosobruchus maculatus</i>)	Storage weevils attack soybean during storage	 Source:https://www.learnaboutnature.com/insects/beetles/get-rid-of-weevils/
Sucking bugs (<i>Anoplocnemis spp.</i> , <i>Clavigralla spp.</i> and other species)	Same group of six insect species that attack cowpea also attack soybean plants	 Source:http://animal.memozee.com/view.php?tid=2&did=12075&lang=kr
Anthrachnose disease (<i>Colletotrichum truncatum</i>)	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.	

PPRSD (2015), Pests' list of Ghana (unpublished)

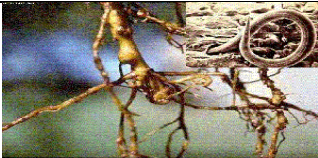
4.1.4. Major Insect Pests and Diseases of Vegetables- Pepper Okra & Tomato

It is widely accepted that vegetables are important component of a healthy diet and that the consumption can help prevent a wide range of diseases. WHO/FAO recommends a minimum of 400g of fruit and vegetables per day for the prevention of chronic diseases such as heart disease, cancer, diabetes and obesity, as well as for the prevention and alleviation of several micronutrient deficiencies, especially in less developed countries. Fruit and vegetable crops generate more income for farmers compared to traditional staple crops. In addition, they generate employment for the rural workers, and therefore improve access to food (Weinberger and Lumpkin, 2007). As a result poverty rates are much lower

among workers employed in the vegetable sector therefore a contributing factor to reducing food insecurity in developing countries.

The table below is some major pest and diseases that attack some selected vegetables;

Table 12: Major Insect Pests and Diseases of Pepper

Major Insect pests and Diseases	Damage	Illustration
Root-knot nematodes (<i>Meloidogyne spp</i>)	Are same nematodes that attack eggplant 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	 Source:
White flies (<i>Bemisia tabaci</i>) and Aphids (<i>Aphis gossypii</i>)	White flies and aphids are important as vectors of virus diseases. Same aphids attack cabbage and same white flies attack tomatoes	 Source:
Leaf spot (<i>Cercospora capsicii</i>)	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.	 Source:
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-	 Source: https://phys.org/news/2017-01-secret-weapon-insect-transmitted-viruses-exposed.html

PPRSD (2015), Pests' list of Ghana (unpublished)

Table 13: Major insect pests and diseases of Okra

Major Insect pests and Diseases	Damage	Illustration
Aphids (<i>Aphis gossypii</i> , <i>Myzus persicae</i>)	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 (<i>Dysdercus spp.</i>) and other sucking bugs (<i>Nezara viridula</i>)	Cotton stainer adults and nymphs are very common on okra plants at fruiting stage and abundant during dry season. When stainers attack mature fruits, they damage the seeds. The bugs are conspicuously red, with black bands. They pierce through both 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.	Source: http://what-when-how.com/insects/prosorrhyncha-heteroptera-and-coleorrhyncha-insects/
Flea beetles (<i>Nisotra spp.</i> , <i>Podagrica spp.</i>)	Very common pest that occur on almost all okra plants. Feed on okra leaves and make many small holes in the leaves	 Source: http://www.discoverlife.org/mp/20q?search=Chrysomelidae&flags=col3:glean:&res=320
Root-knot nematodes (<i>Meloidogyne spp.</i>)	Several species of soil-living root-knot 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	
Anthrax disease (<i>Colletotrichum spp.</i>)	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	 Source: https://www.revolvy.com/main/index.php?s=Mosaic+virus

PPRSD (2015), Pests' list of Ghana (unpublished)

Table 14: Major insect pests and diseases of Tomato

Major Insect pests and Diseases	Damage	Illustration
Aphids (<i>Aphis gossypii</i>)	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' cause's unsightly black moulds on tomatoes which reduces their market value. Attacked plants may wilt and die	
Fruit borers (American bollworms [<i>Helicoverpa armigera</i>] and leaf-eating caterpillars (cotton leafworms [<i>Spodoptera littoralis</i>]))	Different kinds of caterpillars attack developing and mature fruits of tomato. The American bollworm comes in various colours. A single caterpillar can bore into many 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	Source: http://www.infonet-biovision.org/PlantHealth/Pests/Anthracnose
Fruit fly (<i>Rhagoletisochraspis</i>)	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.	 Source: http://www.omafra.gov.on.ca/french/crops/facts/05-070.htm

PPRSD (2015), Pests' list of Ghana (unpublished)

4.1.5. Seed borne pests identified in the Seed Laboratory

In general, major pests detected in imported seeds that have been sampled and tested in the laboratory are small. Because most of them are well treated. Only a few pests were identified in the local seeds sampled in the dealer's shops, which include the following: *Sitophilus zeamais* and *Tribolium castaneum*.

4.1.6. Common pests' problems

Common pests problems in the project areas include: rodents and migratory and outbreak pests such as birds, locusts and armyworms. IPM strategies are recommended and used by some farmers as much as it is possible because there is no one controls practice/measure that can provide acceptable control of the target pest.

Table 15: The following table presents common pests for target crops

Common Pests	Crop affected	Damage/symptom	Current situation	Recommendation for crop protection and the environment
Rodents (<i>rattus rattus</i>)	Maize, millets, paddy and cassava	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.	Regular surveillance: -Sanitation -Proofing -Trapping -Use recommended rodenticide Predation: Keep cats in stores and homesteads.	• Weeding for clean bunds and fields
Migratory and outbreak pests				
Bird (weaver birds and the <i>quelea quelea</i>)	Rice, maize, sorghum and millet.	The sucking of juice from grains or the removal of whole grains from the plant's spike.	Traditional methods, slings, bird scares, and scarecrows, are still being used in many parts	---

Locust	Maize, wheat sorghum, rice and millets)	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.	There being no research done on the management of the pest, farmers are forced to use any recommended insecticide whenever outbreaks occur.	---
Armyworm	Maize, rice, sorghum and millets), bétail	Larval outbreaks can appear suddenly at alarming densities, catching farmers unawares and unprepared.	Insect traps	Its control combines monitoring in identified breeding areas, forecasting and early warning of potential outbreaks and release of stock of insecticides to all regions to combat these noxious pests.
Invasive alien species:	Maize, cassava and plantain, savannahs and tropical forests, in fresh water	Invasive alien species Eutrophication phenomenon	Mechanical fight	Frequent pest risk surveillance and continuous updating of the existing pest list.

4.1.7. Major Pests and disease encountered in animal production-small ruminants-poultry-cow

In order to strengthen Ghana's capacity to produce more meat to reduce the country's meat deficit and increase farmers' incomes, VSD has used various strategies across the country to control and contain outbreaks of listed 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 immunization. prophylactic treatments. The following diseases have been detected and controlled effectively: 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.

According to the veterinary services, the most frequently observed diseases in the field of animal protection are the following:

- Anthrax is an acute infectious disease caused by the bacterium *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) is mainly caused by the bacterium *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 also 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. (www.gdscentre.fr/index.php/sante-animal).
- PPR is a highly contagious viral disease of sheep and goats.

- Blackleg is a disease that affects small ruminants (sheep, goats), pigs and cattle.
- Infectious bursal disease (Gumboro), a contagious avian viral disease, and fowl pox occur in commercial poultry.
- Newcastle disease is an infection of domestic poultry and other bird species with virulent Newcastle disease virus (NDV).
- Contagious bovine pleuropneumonia (CBPP) is an important bovine disease caused by *Mycoplasma mycoides* ssp. *Mycoides* (*M. mycoides*).

4.2. Public Health Context: Malaria

Vector transmitted diseases (VTD): malaria (*Anopheles gambiae*) bilharziosis (*Schistosoma Haematobi um*), onchocercose (*Onchocerca volvulus* *volvulu*), lymphatic filarirose (Wuchewriabancrofti), the arboviroses (*Aedes furcifer*, *Aedes luteocephalus*, *Aedes taylori*, *Aedes neo africanus* *Aedes vitatus* and *Aedes aegypti*), dracunculose (*Dracunculus medinensis*), and the african human trypanomiasis (THA) (*Glossina palpalis gambiensis*, *Glossina morsitans submorsitans*) constitute a major health problem in West Africa. Senegal, Burkina, Mali, and Ghana have several programmes to combat these diseases combining curative measures, which target the parasite with preventive measures integrating anti-vector operations, which for a long time depended exclusively on the use of insecticides having consequences on the environment.

This strategy follows from the WHO resolution 50.13 on chemical security adopted at the 50th World Health Assembly, which urged member States to “take measures to reduce dependence on insecticides, to combat vector diseases through the promotion of integrated approaches of fight against vectors in accordance with these directives”.

In fact, it resulted in the adoption of the Integrated Vector Management (IVM) by the WHO Regional Office for Africa (WHO/AFR) during its workshop, held in Harare (Zimbabwe) in February 2001, as a strategic approach to reduce the morbidity and mortality associated with vector diseases. A regional elaboration and implementation framework was set up to that effect.

This strategy can be adopted by the WAATP program given that it utilizes the combination of technological means to arrive at a reduction or a suppression of vectors, with such a low impact on the environment. The permeation of mosquito nets, curtains and other materials with insecticides, as well as larva control, pest control are included in this program.

In Ghana, malaria accounts for 40% of medical consultations cases. Nonetheless, a decrease in the number of cases was observed between 2004 and 2005 concomitant with the decrease in the number of cases among infants of less than 5 years of age and among pregnant women.

4.3. Pesticides Used in Program Areas

Ghana has on the one hand, a list of registered pesticides and the other hand, that of banned pesticides (negative list). These pesticides are tested and appreciated; In order to improve the quality of the pesticides used (the reduction of the toxicity and the increase of the efficiency for example). Lists are regularly updated. The last update is from February 2017 (see appendix).

Exchanges with the Chemical Protection and Management Center (CCMC) from the Environmental Protection Agency (EPA) indicate that registered products are popularized at the level of producers of the targeted crops.

There is also the use of unregistered pesticides in certain areas of the country, coming from some neighboring countries such as Côte d'Ivoire according to the exchanges with the technical services (CCMC).

Unfortunately, there are several reasons for the use of pesticides not approved by farmers. It is:

- their reduced cost compared to approved pesticides;
- their availability from producers (sold on local markets);

- access to pesticides approved for food crops that remains difficult (in terms of proximity).

Table 16: Summary of Register of Pesticides as at February 2017

Category	FRE	PCL	Banned	Total
Insecticides	153	51	32	236
Fungicides	59	15	0	74
Herbicides	173	50	0	223
Plant Growth Regulators	8	2	0	10
Molluscicide	1	0	0	1
Rodenticides	0	2	0	2
Nematicides	4	2	0	6
Adjuvants	5	0	0	5
Biocides	11	0	0	11
Repellents	0	1	0	1
Total	414	123	32	569

Table 17: Legend to Register of Pesticide

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).

Source: EPA/CCMC, 2018

4.4. Developed Strategies for Crop Pest Control and Animal Production

4.4.1. Integrated Pest Management Approaches

Integrated pest management or integrated management is a strategy adopted for the control of pests in an efficient and economical way, while respecting the environment. It aims to reduce pesticide residues in fruits and crops and maintain pests at a tolerable level in the context of sustainable agriculture. Integrated pest management aims to combine all possible and useful control methods against the pest while considering the use of chemical pesticides as a last resort. Thus, several control methods are available: biological control; cultural (agronomic) control, reasoned chemical control, varietal selection; mechanical fight, the Genetic fight and the legislative fight.

4.4.1.1 Preventive fight

Preventive control is more important for pests such as locusts. With the help of international cooperation, prospecting teams are working 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.

At the population level, preventive control consists of the destruction of the causative agent in the fields of the target and surrounding crops. Populations also use crushed neem grains with oil to prevent insect attack.

The following methods can be used for preventive control:

- **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:** it is carried out by the adoption of favorable cultural techniques. These include: (i) plowing, (ii) adequate cropping system, (iii) good date of planting or planting, (iv) cover crops, (v) weeding, (vi) associated crop.
- **Biological control:** Biological control 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 favorable to the development of auxiliaries.).

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).

Predation, competition and parasitism of the auxiliaries are the main biotic factors that influence the evolution of pests, and control the stability of their populations. When the auxiliary and pest (pest) populations are in equilibrium, they are active auxiliaries that play a regulating role and prevent outbreaks.

Environmental management is based on two complementary 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.
- *The creation of 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.

4.4.1.2 Curative fight

With regard to curative control, locust invasions are managed at the national or even sub-regional level. With regard to other pests, farmers facing pest problems are getting closer to the competent MoFA services to eventually receive control advice that they will apply in the field. Also, decentralized plant protection services play 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. The healing methods are as follows:

- **Mechanical control:** There are a number of 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 ...). It is the case of fruit fly (*Rhagoletis ochraspis*) 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:** it is also used in curative by techniques such as:
 - *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 favoring 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.

In addition, subregional initiatives led by structures such as ITRA and ICAT in Togo have led to convincing results. The use of chemical pesticides is 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 were also made from papaya leaf extracts. These different results of proven initiatives could be capitalized as part of integrated pest management in Ghana.

- **Reasonable chemical control:** the rational use of pesticides, ie 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), (iii) improving its income by reducing the use of inputs (fertilizer and especially pesticides).

4.5. Alternatives to pesticides

Alternatives to POPs (Persistent Organic Pollutants) have been developed with the aim of reducing the use of pesticides in agriculture in particular and the areas of use of these pesticides. These alternatives are the legislative or administrative struggle, cultural control, physical control, genetic control, integrated pest management, the use of bio-pesticides, biological control, 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...) are also used as bio-pesticides and research is continuing. 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 bio-pesticides.

The exchanges with the populations of the different sites of the Program show that they have a good knowledge of alternatives to pesticides. Practices such as the use of neem grains, or bark of *caïlédrat* 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) are mentioned during the exchanges. The populations are also aware of cultural techniques (cultural association, crop rotation, transplanting, organic manure, etc.). However, the

preference for chemical pesticides lies in their efficiency and availability (to treat large areas) compared to these alternative methods.

Table 18: 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	- Organophosphorus, pyrethroid, and other new generations of agricultural insecticides; - 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 biological control (use of organisms natural enemies to control crop pests and the use of conventional or repellent insecticides); - Practice of genetic control (use of resistant or tolerant varieties); - 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).
Animal health	Aldrine, Dieldrine, Endrine, DDT	- Organophosphorus, pyrethroid, and other new generations of insecticides for veterinary use; - Hygiene measures to be observed and quarantined; - Use of plants with proven bio-activity.

4.6. Pesticide management approaches

4.6.1. Pesticide distribution channels

In Ghana, there are three (3) stakeholder groups in the field of plant protection products:

- Group 1: Importers comprised of the main firms grouped into CropLife-Ghana (16) and Ghana Agri Input Dealers Association (GAIDA) and Pesticides Importers Association;
- Group 2: Distributors and Resellers and their intermediaries;
- Group 3: Approved Applicators (are not part of the distribution chain).

Phytosanitary firms that formulate and repackage are considered as industrial units. As such, they do not distribute pesticides; except if they are in addition, approved as Distributors by the Pesticides Technical Committee. This distribution is done through specialized department stores, mixed department stores, market kiosks, the informal sector and internal distributors of pesticides. Shops selling approved pesticides are usually in urban centers, sometimes with relay distributors in some villages.

Photo 1 : Shop selling registered phytosanitary product in Abokobi



Photo 2 : Shop selling phytosanitary product in Appolonia



Source: B. Mobongol/ June 20, 2018

Access to products by farmers is difficult when there is no distributor nearby; and, moreover, their cost is high according to the farmers. This situation creates fertile ground for the spread of unregistered pesticides that enter the country illegally from foreign countries. These hazardous products are exposed in local markets without any standards, and at lower costs than the first ones. The indications (label) are very often in a foreign language. Given their affordability, farmers are turning to these unregistered products, with or without knowledge of the potential consequences for human health and the environment.

The lack of protection of Distributors against fires and accidental leaks due to the mishandling of pesticides as well as disordered and sometimes inadequate storage at the farmer's level are all problems related to the distribution and use of pesticides.

In the same way, pesticides are most often transported to secondary centers and villages from public transport vehicles, exposing passengers to certain dangers. In addition, the lack of storage standards is a major concern.

4.6.2. Pesticide storage devices

All the activities of the actors of the pesticide industry (importers, distributors, resellers and applicators) are approved by the Pesticides Technical Committee. In addition, these actors have storage warehouses.

The finding is that agricultural producers in general, and in particular targeted crops, generally do not have adequate pesticide storage facilities. At the population level, the storage system is not compliant, which exposes populations, especially children, to the risk of intoxication. Indeed, these producers keep the pesticides, for the majority of the people questioned, in the homes, even in the rooms. Some say they keep (hide) their stocks in stores or in their fields or in the attics.

4.6.3. Application methods of phytosanitary products

Farmers spray pesticides themselves, but only very few have received adequate training in this area. It should also be noted that protection is deficient, especially when it comes to powder. Dusting by hand, without gloves or protection mask has adverse consequences for the health of the applicator and that of his assistants.

The products are applied using a UBV sprayer ("Ultra LowVolume" spray) after obtaining the slurry (Preparation resulting from the dilution of the concentrated product in water). There, too, the dosages are not mastered by farmers and who most often take these dosages of local dealers of phytosanitary products.

Exchanges with the populations have shown that some of them have received training from the PPRSD / MoFA. But this remains insufficient, according to farmers, and is confirmed through their protective equipment that is often rudimentary (masks and ordinary dress) and inadequate dosages.

One of the major risks of pesticide use in the program area is its use in the field of hunting and fishing. Indeed, it happens that some ill-intentioned and greedy farmers of easy gain do not hesitate to use plant protection products to fish or hunt, endangering the lives of consumers as a result of serious cases of food poisoning.

They are also used for non-recommended treatments: for example in the field treatments or stockpiles of cowpea, maize, starchy foods with products intended for the treatment of cotton. These are also causes of serious food poisoning.

Pesticides are also used for controlling insects in poultry houses or treating fleas on cattle. Also, to protect themselves from theft, the main places of pesticide storage by farmers are their bedrooms, which is not without risk to health if only by inhalation.

In addition, documents to track the traceability of products used are rare or non-existent as well as the notification of the processes of use. All this could result in the existence of residues in the products with the difficulties of export flow.

4.6.4. Disposal device for obsolete pesticides and empty containers/packaging

4.6.4.1. Obsolete and expired pesticides

There is currently no industry and technology for the destruction of obsolete and outdated pesticides in Ghana. Obsolete and outdated products are shipped abroad for processing. This was the case with an FAO project which was a technical assistance facilitated the removal of 25.6 metric tonnes (MT) of obsolete pesticides from the Temporal Storage Facility at Pokuase for onward destruction in Europe. It was however, a left over stock of 7 MT which has been safeguarded and is currently under storage at the Temporal Storage Facility.

Under the WAATP-Ghana, obsolete and outdated pesticides could be transported to RMG-Côte d'Ivoire SA where a disposal device exists, which may well receive this waste. This company has a modern industrial incinerator, suitable for the destruction of a number of particular wastes namely obsolete products, soiled packaging, sludge, used pallets, paper, cardboard and soiled rags and saturated activated carbons. Empty packages rinsed three times are pre-collected in sealed bags and sealed. The storage is done either in containers on an uncovered area, or in a room dedicated to obsolete products within RMG Côte d'Ivoire SA's factory. The phase of elimination consists in the destruction of the waste by incineration in a furnace of type HOVAL V 180 - BS 31 / TR8 and a furnace of type H.P 1000-12H1S. The destruction of organic and combustible substances by incineration consists in eliminating them at a very high temperature and reducing their weight and volume. This is the mode of disposal commonly used by FAO, UNEP and WHO.

4.6.4.2. Packaging/containers management at the farmer level

The management of pesticides containers is under the responsibility of resellers and farmers because of the retail sales system.

During exchanges with farmers and regional technical services, it appears that packaging is often reused by the population. Some farmers claim to destroy pesticide packaging after use by incineration, landfilling, perforation, etc. However, cases of mismanagement of these packaging still exist in the localities of the country. Metal or plastic or cardboard containers are reused to store the products (salt, oil, water, etc.). The corrosive aggressiveness of these products endangers the health of populations and

the environment. Photo 3 below illustrates an example of a wild deposit of empty pesticide packaging under a tomato greenhouse.

However, with big commercial farms or companies, management of pesticide containers are expected to be clearly stated in their environmental management plans (EMP) to the EPA. Usually, these companies indicated that they will liaise with the MoFA office, in particular the PPRSD to provide guidance to the disposal of the containers.

Equipment for the treatment of large empty containers are not known to be installed or in use in the country at the moment. Such equipments will be useful for the treatment of high capacity drums for recycling or reuse.

However, there are companies currently recycling empty pesticide containers such as: Pureplast Company Limited, located in Tema- Greater Accra Region and Cyclox Company Limited located in Central Region.

The FAO project mentioned above in the previous section did not transport pesticide empty containers as part of the obsolete stocks for destruction in Europe.

The empty containers were handled under a different activity in selected districts/ municipalities in five (5) regions of Ghana namely:

- Sefwi Wiawso Municipal Assembly-Western Region;
- Agogo District Assembly- Ashanti Region;
- Nkoranza Municipal Assembly - Brong Ahafo Region;
- Begoro, Fanteakwa North District Assembly - Eastern Region;
- Keta Municipal Assembly - Volta Region.

There was an arrangement for farmers to put their empty containers/ packaging in recycle metal bins at selected locations in these districts above. The empty containers then transported to Pure Plast Recycling Company in Tema for recycling.

A collection and disposal system and cleaning of pesticide containers need to be put in place by PPRSD-MoFA and the EPA under the Program.

Photo 3 : Empty pesticide packaging found in a greenhouse of tomato production in Abokobi



Source : B. Mobongol/ June 2018

4.7. Pest management option for target crops: Cereal; vegetable, root and tuber

These crops are mainly grown for the local market but have high economic returns for the family. Consequently; farmers are prone to rely on use of pesticides in the field and in storage to control pests

and diseases. Non-chemical methods are however available for the production of healthy products (Table 19 to 26). Farmers will also be trained in Agro-Ecosystems Analysis (AESA) as practiced in IPM-Farmers' Field Schools. So they can decide where and if pesticides used are necessary.

- ***Making IPM decisions using agro-ecosystem analysis (AESA)***

Agro-ecosystem analysis (AESA) is based on a process of making observation in the environment where crops are growing, analysing the findings and, based on the findings, making decisions about appropriate crop management actions to take at the time. This tool is location-specific. This means that the action taken applies only to the particular pest or disease problem identified at that particular location at the time of the observations and decision.

In doing so, the AESA has the advantage of avoiding the systematic and regular application of pesticides by farmers.

- ***Procedure for conducting AESA***

The procedure for conducting an AESA is quite simple and fast. AESA fits into a variety of participatory extension approaches as the central field tool. During an AESA, farmers are able to:

- Inspect crops weekly to monitor their growth and development;
- quickly detect the appearance of weeds, diseases and pests and make detailed observations on the biology of pests and their natural enemies;
- analyse crop production practices;
- adapt technologies to specific farmers needs;
- Make a decision on the cultural operations to be carried out by choosing the management approaches from a variety of options.

4.7.1.1. Cereals- rice, maize and sorghum

The tables below provide specific pests/diseases and Pest Management options including IPM strategies for rice and soya bean.

Table 19: Management of Insect Pests and Disease Of Rice

RICE (<i>Oryza sativa</i>)		
PLANT PROTECTION PROBLEM		CONTROL RECOMMENDATION
Pest Names	Symptom or Damage	Cultural Practices and Direct Interventions
Seedling blight <i>Corticium/Sclerotium rolfsii</i> <i>Fusarium spp.</i>	Occasional disease. Affected plants grow slowly; leaves turn yellow and dry up due to a rot at the base of the stems, which becomes dark brown.	• Deep ploughing to bury crop debris reduces the disease. • Use recommended chemicals for seed treatment and field sprays with appropriate fungicides and antibiotics (e.g. kasugamycin).
Brown leaf spot, <i>Cochliobolus miyebianus</i> <i>Bipolaris</i> = (<i>Helminthosporium oryzae</i>)	Major disease. Affects coleoptiles and leaf blades, leaf sheaths and glumes but most commonly seen on leaves. Spots appear as minute brown dots becoming oval to circular with light brown, fawn or grey centre and dark or reddish margin. Seedlings are often more susceptible. Fungus is seed-borne. Fungus may also	• Careful use of fertilizer can do much to prevent the disease. • Burn or feed stubbles after harvest (stubble management). • Hot water seed treatment.

	attack the grains forming small oval spots on glumes. Heavy attack can result in blackening of the grains, which becomes lightweight with spotted hulls.	• Seed treatment with appropriate fungicides.
Sheath blight, <i>Corticium</i> = <i>Rhizoctonia oryza</i>	Large necrotic lesions, irregular with reddish brown margins. Most common below lingual. Both seedlings and mature plants affected	• Field sanitation and stubble management (i.e. burning or feeding of debris after harvest to livestock). • Ensure balanced nutrition. • Avoid close planting to reduce humidity. • Spray appropriate fungicides.
Sheath rot	Graying brown spots with grayish centers on uppermost leaf sheath that encloses youngest panicle. Common in irrigated sites	• Field sanitation and stubble management (i.e. burning or feeding of debris after harvest to livestock). • Balance nutrition. • Avoid close planting to reduce humidity. • Use appropriate fungicides.
Rice blast, <i>Pyricularia oryzae</i>	The most widespread and destructive disease of rice. Can affect all aerial parts of rice. Spots appear on leaves and coalesce resulting in whitening.	• Time of planting influence blast development (do not plant too early nor too late). • Avoid application of excessive amounts of nitrogenous fertilizers. • Avoid close planting in the nurseries. • Use resistant varieties. • Burn stubbles after harvest (stubble management). • Foliar spray of a recommended antibiotic or fungicides.

False green smut, <i>Ustilaginoides virens</i>	The head becomes filled with orange coloured masses of spores. Spores replace grains. Common in irrigated sites.	• Field sanitation and stubble management (i.e. burning or feeding of debris after harvest to livestock). • Seed treatment or use hot water treatment if disease occurred already in earlier seasons.
White tip, <i>Aphelenchoides besseyi</i>	Minor disease. Tips of leaves become light yellow to white, then darker and die off. Plants are stunted. Panicles poorly formed and smaller. Nematode live on aerial parts of the plants invading the grain as it matures. The nematode becomes dormant under the husk.	• Avoid the use of infected seeds. • Hot water treatment of seeds. • Burn stubbles after harvest.
Virus, Rice Yellow Mottle virus	Minor disease. Chlorosis and stunting leading to reduction in yield.	• Use resistant varieties.
African rice gall midge, <i>Orseolia oryzivora</i>	Occasional pest. Borers into buds during seedling to panicle initiation causing swelling of infected parts. Tillers do not produce panicles. Serious attacks result in stunted growth and the production of more tillers which do not produce panicles.	• Plant resistant and early maturing varieties. • Remove rotten crop before land preparation. • Embark on early and synchronized planting. • Seed dress with suitable pesticide.
Stalk-eyed shoot fly, <i>Diapsis spp.</i>	Occasional pests. Maggots feed on the stem tissues below the growing zone. Central whorl does not unfold and dries up, resulting in “dead hearts”. Excessive tillering possibly apply a fast acting chemical soon as flying	• In general do not apply any insecticide in the valleys, where natural enemies can build up. • Where good weed management is practiced, scatter or heap cleared weeds to provide cover for increased natural enemy activity. • Use moderate amounts of fertilizer, split doses over the main growth stages to discourage rapid development and multiplication of flies. • Avoid panicle harvesting (leaving tall stems and destroy

		stubbles to get rid of diapausing larvae. • Water management: keep bases of stems always under water.
Leaf and stem suckers: Green leafhopper <i>Nephotettix spp.</i>, White leaf hopper, <i>Cofana spp.</i>, Spittle bugs, <i>Locris spp.</i>	Occasional pests. Both nymphs and adults suck plant sap. High populations cause wilting and drying resulting in “hopper burn”.	• Practice good cultural and agronomic practices, i.e. early planting, using early maturing varieties. • Keep farm weed free. • Judicious use of fertilizers, especially nitrogen, keeps populations of plant suckers low.
Rice bugs, <i>Stenocoris spp.</i> <i>Mirperus spp.</i> <i>Aspavia spp.</i> <i>Riptortus spp.</i> <i>Nezara spp.</i>	Occasional pests. The bugs invade rice fields during flowering stage and lay eggs on leaves. Both adults and nymphs suck developing grains during milk and dough stages. Adults live long and are very mobile.	• Grassy weeds should be eliminated from the farm and surrounding areas and staggered planting should be avoided. • Encourage predatory assassin bugs by creating refugia, i.e. good weed management with scattering or heaping cleared weeds to provide cover for increased natural enemy activity.
Rice beetle, <i>Lagria villosa</i>	Chew growing tips and flowers. Minor pest.	• Chemical control not necessary.
Hispid beetles, <i>Trichispa spp.</i>	Occasional, but then destructive pest. Attack rice panicles and eat the grains. Suspected to be vector for Rice Yellow Mottle Virus (RYMV).	• Use close spacing. • Keep bunds and surroundings free of grass weeds. • Destroy stubbles and avoid rottoning. • Top the tips of leaves of seedlings before transplanting to destroy egg masses. • Ensure balance nutrition (avoid excessive nitrogen application)

Table 20: Management of Insect Pests and Diseases of Soybean

Soybeans (<i>Glycine max</i> = soy)		
Plant protection problem		Control recommendation
Pest Name	Symptom or Damage	Cultural Practices and Direct Interventions
Seed decay, Damping off, <i>Pythium</i> sp. <i>Corticium</i> = <i>Rhizoctonia solani</i>	Occasional diseases. Poor germination. Poor stand. Sees rot in soil. Symptoms appear on hypocotyls as reddish collar region at which point seedling topples (<i>Corticium</i> sp.). <i>Pythium</i> infects the whole hypocotyls giving it a grey-green wet appearance leading to watery collapse.	• Use healthy seeds. • Treat seeds with appropriate fungicides as seed treatment and PCNB drench in limited areas (spot treatment).
Sclerotium blight <i>Sclerotium rolfsii</i>	Occasional disease. Infection occurs at or just below the soil surface, causing light-brown lesions, which quickly darken and enlarge until the hypocotyls or stem is girdled. Plant then wilts. Mycelium forms around the stem bases, leaf debris and the soil around infected plants. Numerous tan to brown sclerotia form in the mycelium, on soil surface, in plan material.	• Alternate soybean with non host crop e.g. maize (rotation). • Clean fallow for up to two years to reduce inoculums. • Bury crop residue 15-25 cm deep to reduce inoculums and delay disease. • Plant resistant or tolerant cultivars.
Wilts, Fusarium rot, light or Root rot <i>Fusarium oxysporum</i> f. sp <i>tracheiphilum</i>	Minor diseases. Characteristic are browning or blackening of vascular system in roots and stems. Seedlings emergence is slow and poor, affected seedlings are slanted and weak later sudden wilting/death occur. Older plants are stunted, leaves yellow and fall, the plant gradually dies. Pod infection may result in seed transmission of the pathogen.	• Pathogen is soil-borne and seed transmitted. • Don't use seeds from infested crops. Grow cultivars resistant to <i>Fusarium</i> and soybean cyst nematode and root knot nematodes. • Plant high quality seeds in warm well drained soils. • Delay cultivation until soil moisture is low. • In fields with a history of the disease, ridge soil around plant bases to promote development

		of adventitious rots from stem base. Practice long term rotation with non-host crops (e.g. cereals, cassava).
Web blight <i>Rhizoctonia solani</i>	Occasional disease, potentially serious. Symptoms appear on leaves, stems, and pods. Infected leaves are water soaked, and then become greenish-brown. Old lesions fall off in dry weather, creating a ragged shot-hole effect. Total defoliation with severe infections.	- Use resistant varieties where available. - Treat seeds with appropriate fungicide to limit early season disease development. - Apply a foliar fungicide at first sight of the disease.
Leaf rust <i>Uromyces sp.</i>	Minor disease. Open pustules with rusty masses of spores on leaf blades.	- No direct control is required. - Use resistant varieties, where available.
Anthrachnose <i>Colletotrichum truncatum</i> <i>C. glycines</i>	Major disease. All stages can be affected. In early stages it appears on stems, pods and petioles as irregularly shaped brown areas. Later, infected tissues are covered with black fruiting bodies. Necrosis occurs on foliage and laminar veins after pro-longed periods of high humidity. Leaf rolling, petiole canker-ring and premature defoliation occur. Early pod infection results in pod blackening, no seed or fewer shriveled seeds. Mycelia mat fill pod cavity and seeds become mouldy.	- Sow seeds free of the pathogen. - Treat infected seed with recommended fungicide. - Plough crop residue under, burn or feed trash to livestock. - Rotate soybean with non-host crops (e.g. cereals, rot and tubers, vegetables). - Spray with appropriate fungicide when conditions favouring infection occurs between bloom and pod-fill (humidity). Use fungicides on foliage when disease symptoms appear.
Cotton Aphid <i>Aphis gossypii</i>	Major pest. Small, soft insects, found in clusters (colonies) around stems, young shoots and pods and underside of leaves.	Observe build-up of aphid populations and of natural enemies (predators like lady bird beetles, hover flies, lacewings, parasitic wasps like <i>Aphidius spp.</i>)

		• Use recommended pesticides and/or Neem seed or leaf extracts.
Sucking bugs <i>Anoplocnemis curvipes</i>, <i>Clavigralla tomentosicollis</i>, <i>C. shadabi</i>, <i>Riptortus dentipes</i>, <i>Mirperus jacundus</i>, <i>Aspavia sp.</i> <i>Nezara viridula</i>	Major pests. Suck the contents of pods and soft growing parts. Inject poison into pods/seeds causing necrosis.	• Control weeds to destroy roosting sites. • Limited control occurs in nature by <i>Trissolus basalis</i> a biological control agent as well as assassin bugs (<i>Reduviids</i>). • Scout and at the rate of 2 bugs/ meter row and spray with Organophosphate or other recommended pesticides.
Storage moths <i>Ephestia cantella</i>, <i>Corcyra cephabonica</i>	Larvae feed on grains causing extensive webbing of grains	• Solar disinfection, thorough drying of harvest produce. • Do triple bagging using plastic sacks. • Divide crop into a batch for short term storage (<3 months), and long term storage (>3 months). Treat only long term storage batch. • Store small quantities with wood ash, ground nut oil, neem oil, black pepper powder etc. • Apply neem oil (2-5ml/kg seeds). • Apply appropriate storage pesticide for long term storage batch.

Source: Handbook of Crop Protection Recommendations in Ghana: An IPM Approach vol 1. Cereals and Pulses (2002)

4.7.1.2. Pepper, okra and tomato

The tables below provide specific pests/diseases and Pest Management options including IPM strategies for pepper, okra and tomato.

Table 21: Management of Insect Pests and Diseases of Pepper

Management of pepper pests	1. Cultural practices Good farm sanitation practices such as deep ploughing, stubble burning, destruction of crop residues and regular weed control can help reduce pest infestation Infested plants should be uprooted and destroyed by burning. 2. Use of Insecticides •Application of neem seed extract and Bt can help reduce pest infestation to the crop.
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SOURCE: Handbook of Crop Protection Recommendations in Ghana: An IPM Approach vol 1. Cereals and Pulses (2002)

Table 22: Management of Insect Pests and Diseases of Okra

Management of okra pests	3. Use of Insecticides •Foliar application of appropriate short-persistence insecticide or neem seed extract or Bt can reduce damage by pests to plant foliage. •Synthetic insecticides should only be used as a last resort.
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Source: Handbook of Crop Protection Recommendations in Ghana: An IPM Approach vol 1. Cereals and Pulses (2002)

Table 23: Management of Insect Pests and Diseases of Tomato

Management of tomato pests	1. Host Plant Resistance Planting resistant varieties of tomato can reduce the spread and incidence of TYLCV 2. Insecticides •Neem seed extract and Bt are effective against some of the pests of tomato. It is cheap and also less detrimental to the environment. •These bio-pesticides have shown good promise in the field as possible alternative control agents against major tomato pests since some of these pests have developed resistance to almost all the available insecticides. •The use of Bt and neem insecticides should be encouraged. •As much as possible avoid the use of high persistent insecticides to allow predators to effect natural control. •Use short-persistence organophosphorus or pyrethroid insecticides with low mammalian toxicity should be applied e.g. karate, deltamethrin, pawa. •Application of contact insecticides is not effective against leaf miners because the larvae are well protected in the mining cavities. •Use recommended dosage and observe pre-harvest intervals Cultural Practices •Mined leaves may be picked and burnt. •Regular control of weeds which serve as alternative host plants between cropping season is useful in reducing pest infestation. •Yellow sticky traps can reduce the numbers of adults of whiteflies.
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	•Frequent weeding is crucial because it can deprive pests of their hiding places during the day so that they are exposed to the vagaries of weather. •Since the preferred hosts of some of the tomato pests are malvaceae plants such as cotton and jute, tomato should not be grown in close proximity to these crops. •Good farm sanitation practices such as ploughing, stubble burning, destruction of crop residues and regular weed control can help reduce population of major pests of tomato. •To avoid damage by the fruit piercing moths, prompt harvest of fruits as soon as they mature is recommended. •Sting bugs are difficult to control with chemicals because both the nymphs and adults drop quickly to the ground when disturbed. •Insecticides are not effective against the fruit piercing moths because they are nocturnal and their breeding sites are difficult to locate. They also have wide host range. 3. Biological Control •Natural control of sting bugs is caused by parasitic wasps and flies which can cause up to 90% parasitism of the eggs and adults, respectively.
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Source: Handbook of Crop Protection Recommendations in Ghana: An IPM Approach vol 1. Cereals and Pulses (2002)

4.7.1.3. Root and Tuber crops-Cassava, Yam and Sweet potato

The tables below provide specific pests/diseases and Pest Management options including IPM strategies for cassava, yam and sweet potato.

Table 24: Management of Insect Pests and Diseases of Cassava

Management of cassava pests	•An IPM with biological control as its backbone was developed in 1984 and a parasitoid wasp, <i>Epidinocarsis lopezi</i> (De Santis) (Hymenoptera: Encyrtidae) and predatory insects, <i>Diomus</i> spp. and two <i>Hyperdaspis</i> spp. (Coleoptera: Coccinellidae) were released in Ghana. Later, a predatory lace-wing insect <i>Symphorobius</i> spp. (Neuroptera: Hemerobiidae) was released against the mealybug and predatory mites and <i>N. Anonymus</i> Chant and Baker (Acari: Phytoseiidae) against the green spider mite by IITA in conjunction with the PPRSD of the MoFA. Planting of cassava on uninfected land. • Planting of disease free cuttings. • Healthy stock should not be planted side by side with diseased plants.
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SOURCE: Handbook of Crop Protection Recommendations in Ghana: An IPM Approach vol 1. Cereals and Pulses (2002)

Table 25: Management of Insect Pests and Diseases of Yam

Management of yam pests	Cultural • Late-planting has been found to reduce yam beetle infestation. Yams planted early suffer more damage than later planted yams since the beetles are more
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	attracted to plants with more advanced growth and do not usually attack plants with vines less than 1.3 m. • Site selection is also important. Yam farms should be located further from possible breeding sites of yam beetles. • Trapping of beetles can help reduce their population. Light traps hung on a tripod and a container with water placed just below them can be used to trap the migrating beetles. • Dipping of yam setts in hot water before planting can kill immature stages of beetles on tubers. • Planting clean and healthy yam setts • Removal of mealybug or other pest infested tubers before storage • Pest infested tubers should not be stored or used as planting material • Brush yam tubers to remove scale insects before storage. Nematodes are best controlled by • Avoiding planting of infected setts, • Ensuring sufficiently long fallow periods between yam croppings, • Dipping yam setts in hot water, • The use of non-host “bait crops” during the fallow period or as an intercrop with the yams can help reduce soil populations of the nematodes.
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Source: Handbook of Crop Protection Recommendations in Ghana: An IPM Approach vol 1. Cereals and Pulses (2002)

Table 26: Management of Insect Pests and Diseases of Sweet potato

Management of sweet potato pests	Cultural Practice • Early planting and harvesting to escape pest attack • Use of insect-free planting materials (vines, tubers). • Frequent re-ridging or earthen up to close soil cracks to prevent beetles depositing eggs in the tubers or at the base of stems. • Proper disposal of infested vines and tubers. • Clones with deep tuberization should be preferred if available. • Crop rotation with non-host crops • Resistant varieties are being developed against the weevils. • Neem seed extract is effective against pests of sweet potato. • Application of microbial agents such as <i>Beauveria</i> spp for biological control of weevils.
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Source: Handbook of Crop Protection Recommendations in Ghana: An IPM Approach vol 1. Cereals and Pulses (2002)

5. ANALYSIS OF POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND MITIGATION MEASURES OF THE USE OF PHYTOPHARMACEUTICAL PRODUCTS

Pesticides are often applied without Personal Protective Equipment (PPE) resulting in significant health risks. The country is full of resellers and window dressers whose management is a problem for the regulatory and supervisory services. Indeed, many of them do not meet the profiles required by the profession. Concerning empty pesticide packaging, they are used to store, store and transport drinks (including water, milk, etc.) as well as foods such as oil and salt.

5.1. Critical steps in pesticides management

Uncontrolled use of pesticides has negative impacts on the body when absorbed. The impacts of toxic products on the body are related to their concentration in the target organs. The foreseeable risks are related to the following steps:

- the storage of products;
- handling and transport;
- the dosage during the treatments (contamination of the applicators) that could be exposed to the effects of the pesticides when the standards of use are not respected if the instructions relating to the standards of use of the products are not sufficiently applied;
- the consumption of the products harvested immediately after their treatment if the populations are not sufficiently informed and associated with the preventive control.

The table below summarizes the environmental and social risks of pesticide management.

Table 27: Summary of the environmental and social risks of pesticide management methods

Step	Determinants	Risks		
		Public Health	Environnement	Staff
Transport	Lack of training	discovery of pesticides in inhabited places	Accidental spill, ground water pollution by leaching	-Inhalation of product: steam, dust, -risk of skin contact
Storage	- Lack of means to realize the warehouse -training deficit on pesticide management	Accidental contamination -Gene, nuisance of the nearby populations	Soil contamination	Contact with the skin by reversal caused by the exiguity of the places
Handling / manipulation	Training and awareness deficit	Contamination of water sources by washing containers	Soil contamination by accidental or intentional spill, groundwater pollution	Inhalation of steam, dermal contact by splashing during preparation or transfer of porridge
Elimination of Packaging/containers	Training and awareness deficit	Ingestion of products through the reuse of containers	Dermal contact	Dermal contact
Washing containers	Training and awareness deficit	Dermal contact, wells contamination	-Intoxication of fish and other crustaceans, -pollution of wells and ponds, groundwater, -Selection of resistance at the larval stage	Dermal contact

Large quantities of unregistered or obsolete pesticides pose major risks to the health of humans, animals and the environment of the program area. The conditions of transport and storage of this toxic waste are

often very precarious. This is a source of diseases of all kinds (cancer, rashes, and others) for humans. Moreover, with regard to the use of pesticides, its health consequences are often cases of death or intoxication. Indeed, over the years, there have been several cases of intoxication, including fatal for humans, livestock or the fish population that are not declared for lack of a good monitoring and evaluation and documentation.

5.2. Populations at risk

Many people are exposed to the risks of pesticide management. This situation concerns both carriers and unauthorized resellers as well as manipulators (applicators) of these products. However, it should be noted that those involved in treatment operations are considered to be the most exposed link, although it is important to note that all other segments of the population may be at risk. Risks occur during:

- the application of pesticides for foot applicators and manipulators of the apparatus;
- transport: contamination of containers, containers, bursting or spilling of drums;
- monitoring during treatment or prospecting operations.

5.3. Negative impacts on the environment

The use of pesticides has a number of disadvantages and side effects, including environmental pollution and the risk of intoxication that justify the need to abandon the method and the use of other methods natural protection methods. Negative impacts on fauna, flora, soil, air and water are:

- risk of mortality on non-target species that fulfill important ecological functions: bees and other pollinators, natural enemies of certain pests (parasites, predators, pathogens);
- pollution during space treatments of parks and nature reserves, fishing and farming areas with contamination of fauna and flora;
- water pollution either directly or through runoff;
- appearance of resistance in insect populations.

Table 28: Negative impacts of uncontrolled use of pesticides on the environment

Receiving environment	Nature of the impact
Soil	• Falling fertility • Acidification • Alkalinization • Salinization
Surface water (plans, inland wetland)	• Loss of quality (contamination) • PH change
Well water or drilling Groundwater	• Contamination • PH change
Biodiversity	• Chemoresistance of pests • Intoxication of wildlife • Poisoning and mortality • Reduction of number and / or biomasses • Disappearance of species or groups of species • Breaking off of ecological balance • Biodiversity erosion • Loss of natural habitats or useful species
Air	• Air contamination, • Olfactory nuisances

5.4. Negative health impacts

Plant protection products intended to prevent and control pests and diseases in agricultural production have started to be harmful to humans and their environment. Thus, it should be noted that some plant protection product storage depots are:

- installed in inappropriate geographical areas (in the middle of agglomerations);
- constructed without respect of conventional standards (without holding tank, without sump and without a firebreak);
- poorly ventilated and poorly lit.

In addition, the personal protection measures and the recommended doses are not respected. Plant protection products cause burns, human poisoning (nausea, vomiting, dizziness, coma, death) and animal poisoning in rural areas, especially in the vegetable growing areas, pollute water and air, destroy wildlife and dangerously modify the functioning of the ecosystem.

Table 29: Negative impacts of uncontrolled use of pesticides on health

Receiving environment	Nature of the impact
Human health	• Acute poisoning - headache, dizziness, nausea, chest pain, vomiting, - rashes, muscle aches, excessive sweating, cramps, - diarrhea and breathing difficulties, staining and falling nails, poisoning, death • Chronic poisoning: - Lowering of cholinesterase levels, - Effects on the nervous system (neurotoxins), - Effects on the liver, - Effects on the stomach, - Decrease of the immune system, - Disruption of hormonal balance (brain, thyroid, parathyroid, kidney, adrenal, testes and ovaries), - Risk of abortion (embryotoxins), - Mortality at birth (fetotoxins), - Sterility in humans (spermatotoxins)

5.5. Assessment of knowledge and practices in pesticide management - public consultations

In discussions with the MoFA Technical Services, the Department of Crop Services (DCS), the Department of Agricultural Extension Services (DAES), Veterinary Services Directorate of MoFA and the EPA of the Ministry of Environment, Science, Technology and Innovation, in this case the Chemical Protection and Management Center (CCMC) of the EPA, it was observed that knowledge about IPM and good phytosanitary practices are relatively well mastered. But it remains that at the level of users (agro dealers, vegetable-gardeners, cereal, and legume and root tuber farmers), there is still the urgent need in terms of information, training and awareness on regulatory procedures, product characteristics and good practices.

Most of the users or sellers as well as the populations, ignore the adequate and relevant use of pesticides and the different alternative methods. We also note that safety measures are generally precarious 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 program, it is necessary to provide information - education - communication

(IEC) actions through local radios and posters. The photos below illustrate some images of the actors met during public consultations in the program area.

Photo 4 : Public Consultation with Ministry of Food and Agriculture Officers in Pokuase



Photo 5 : Individual consultation with a farmer in Kpone Katamansu



Source : B. Mobongol/June 2018

The interviews (interviewees) revealed the following:

- **The farmers :**
 - The packaging is either buried or thrown in the fields or is incinerated;
 - Pesticide products are stored at home;
 - The non-use of personal protective equipment (PPE);
 - The need for agricultural advice provided by the extension services of MoFA.
- **The distributors:**
 - Competition with sellers of expired or near-expired products at low prices;
 - The presence of unauthorized dealer shops.
- **MoFA and EPA agents:**
 - Lack of storage facilities for prohibited products seized;
 - Lack of adequate storage facilities for the seeds produced;
 - Poor packaging management (abandonment, burning, reuse as container);
 - No protective measures during the preparation and application of pesticides;
 - Challenge of compliance with phytosanitary regulations;
 - Insufficient human resources, equipment (high-performance laboratories), logistical and financial resources for monitoring in the field;
 - Need for capacity building.

Analysis of the results of the stakeholder and beneficiary consultation on pesticide management led to the following recommendations:

- develop 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;
- Organize mass sensitization on the responsible use of pesticides given the level of knowledge of the populations, especially the farmers in this field;
- Strengthen the capacity of health workers in the management of pesticide poisoning cases and the establishment of databases on the various cases treated;
- Strengthen the technical platform of health centers for better management of cases of intoxication;

- Establish storage facilities for unregistered pesticide and empty packaging products and regulate the removal of such packaging by distributors;

5.6. Synthesis of minimization of the negative impacts of Pesticides

The use of pesticides by users could lead to environmental and social impacts or risks. Pesticides can cause the decline of soil fertility, cause its acidification and strengthen its content of heavy metals with various consequences, especially for the food chain. Their intrusion or discharge into groundwater or surface water contributes to the increase of heavy metals, nitrates that may cause eutrophication phenomena and / or inconvenience or even destroy the fauna and flora.

Pesticides could also contribute significantly to the decline of the wildlife population, especially birds whose eggs do not reach hatching because of weak shell texture. In humans and livestock, the impacts can be mortality shock effects or be more insidious with the long-term accumulation that can cause, including mutagenic effects, loss of fertility, bronchopulmonary problems, etc. The following table outlines some measures that can mitigate these negative impacts of pesticides.

Table 30: Measures to Mitigate the Negative Impact of Pesticides

Environment	Nature of impact	Mitigation measures
Soil	Falling fertility	• Popularize the use of manure or compost; • Use mineral fertilizer rationally; • Apply appropriate farming techniques and recommended by the departments of the Ministry of Food and Agriculture; • Fight against deforestation and erosion.
	Acidification	• Minimize and respect the dosages of nitrogen fertilizer use • Apply appropriate cultivation techniques
	Pollution by phosphates, heavy metals (Pb ++, ZN ++, Mn ++)	• Strengthen the pesticide control system; • Provide obsolete and outdated pesticide disposal devices; • Use pesticides efficiently; • Popularize and encourage integrated pest management (IPM); • Establish empty container storage facilities and regulate their removal by manufacturers.
Surface and underground water	Pollution by nitrates, heavy metals	• Minimize the use of nitrogen fertilizers; • Establish empty container storage facilities and require their removal by the manufacturers.
Flora	Deforestation	• Fight against deforestation and erosion.
Biodiversity	Chimoresistance of pest	• Practice the Agroecosystem Analysis (AESA) before making decisions on the choice of pest management method; • Identify pests and pesticides that are specific to them; • Rational application of pesticides; • Diversification of pesticides used.
	Intoxication of aquatic and terrestrial fauna	• Educate users about the risks of intoxication; • Sensitize livestock farmers on watering at safe water points.
	Terrestrial biodiversity loss	• Apply integrated pest management methods (biological control, genetics, use of attractants, repellents, hormones, etc.).

Environment	Nature of impact	Mitigation measures
Health	Intoxication Poisoning, Death, Cholinesterase	• Respect the storage and storage conditions of pesticides; • To sensitize the populations on the risks of food poisoning; • Strictly apply rational measures of use; • Use personal protective equipment.

6. ACTIONS PLAN FOR PEST AND PESTICIDE MANAGEMENT

The pest and pesticide management action plan as part of the implementation of WAATP will make it possible to regulate the use of pesticides more effectively and specially to recommend a set of measures to limit the negative impacts. Its main purpose 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.

6.1. Priority issues identified in the program area

The following issues and constraints have been identified and prioritized as a result of stakeholder consultations to improve pest and pesticide management:

6.1.1. On the plan of Institutional, legislative and regulatory

- Non-compliance with the regulations;
- Insufficient regulation;
- Porosity of national borders;
- Lack of quarantine infrastructure (station);
- Lack of awareness / absence of confirmation of farm animal diseases by the Veterinary Services Directorate;
- Absence of database on diseases in animal production;
- Insufficient human resources, equipment (efficient laboratories) logistical and financial resources for the field monitoring of IPM approaches.
- Need for capacity building.

6.1.2. On the plan of capacities of the actors and the awareness of the populations

- Insufficient farmers training on pesticide use and management of empty packaging;
- Insufficient information of the populations on the dangers related to the use of pesticides;
- Illiteracy of the populations.

6.1.3. On the plan of technical management of pests

- Insufficient extension of alternative methods to pesticides and integrated pest management;
- Lack of efficient treatment and waste disposal systems;
- Unavailability of approved pesticides near farmers.

6.1.4. At the level of control and monitoring

- Insufficient control over the use of products (personnel and equipment);
- Insufficient control and monitoring of negative impacts related to pesticides (pollution, intoxication, etc.).

6.2. Plan for Integrated Pest Management

For the most part, the action plan is structured around the axes as indicated by the following logical framework:

Table 31: Logical framework of the pest management action plan

Objectives	Activities to be implemented in response to identified problems	Indicators	Sources of verification
1 : Strengthen the institutional framework for pest and pesticide management	Strengthen the capacity of action (financial and material resources) of the directorates of the Ministry of Food and Agriculture and its representations in the regions and Environmental Protection Agency (EPA)	Number (Nb) of vehicles purchased or repaired available to divisions and operational units	Minutes of de reception
	Organize a regional and national workshop to share the Pest Management Action Plan	Number of workshops organized Number of participants	workshop organization report
	Ensure effective enforcement of pesticide management regulatory	Number of awareness sessions	Awareness campaign report
	Promote an incentive policy to recover pesticide packaging and require production / distribution companies to recover packaging	Number of empty packages recovered	Activity Report
2 : Strengthen technical and organizational measures for the management of pests and pesticides	Support research institutions and universities to develop technologies and alternatives to pesticides, seeds and planting material resistant to diseases and pests	Types and number of plant and seed varieties	Activity Report
	Popularize techniques of alternatives to pesticides and methods of integrated pest management	Number of extension sessions	Minutes
	Disclose periodically / regularly the list of registered pesticides	Number of publications	Disclosure
	Make available to farmers the results / technologies resulting from research (local radio, TV, brochure, etc.)	Number of diffusions carried out Number of brochures	Project activity report
	Proceed with collection, storage and final disposal of obsolete and outdated chemicals products	Number of pesticides seized	Minutes of confiscation
	Proceed to recycle some empty packaging	Quantity of empty recycled packaging	Minutes of the operation
	Prepare Information-Education-Communication (IEC) booklets so that populations (farmers) are informed and sensitized on IPM approaches and the responsible use of pesticides.	Number of training booklets produced	Activity Report
	Accompany and subsidize farmers in the acquisition of personal protective equipment	Number of farmers with Personal Protective Equipment (PPE)	Subvention report
	Promote the setting up of communautaries committees; train them to provide a relay for raising awareness about good agri-environmental practices (IPM,	Number of IEC missions completed	Information-Education and

Objectives	Activities to be implemented in response to identified problems	Indicators	Sources of verification
	alternatives, and management of empty packaging), equip them with the means to carry out their sensitization mission on pests and pesticides.		Communication report
	Develop database with appropriate formats in collaboration with the PPRSD divisions, VSD (MoFA) and EPA division to monitor negative impacts of pesticides on the environment of program sites and livestock disease cases	Database	Database Implementation Report
3 : Capacity building of actors involved in integrated pest management	Conduct IEC to farmers and populations on IPM approaches and the judicious use and management of pesticides, hazards and good hygiene practices in the use of agricultural inputs	Number of IEC Number of participants	Activity Report
	Strengthen the exchange of information on pesticide management with other stakeholders involved in pesticides.	Number of meetings made	Minutes of meeting
	Train regional health officers on the management of poisoning cases due to pesticides (toxicology) and set up a database to monitor cases of intoxication.	Number of health workers trained Existing database	Training report Database Implementation Report
	Actively involve civil society, including NGOs and outreach committee in information / education / communication in popularizing approaches to integrated pest management	Number of civil society involved in IEC on pesticide management	Project activity report
4 : Provide control, monitoring and evaluation of pest and pesticide management	Perform periodic checks and analyzes	Number of checks and analyzes carried out	Project activity report
	Provide supervision and final evaluation of the PMP	Number of monitoring and evaluation missions	Project activity report
	Provide post-clearance import control before customs clearance	Number of checks	Report of Coustoms

6.3. Participatory Monitoring and Evaluation Plan

The monitoring will verify, in the field, the accuracy of the assessment of certain impacts and the effectiveness of certain mitigation measures provided for in the PMP, and for which there is still uncertainty in the analysis of data to verify whether the implementation of the activities is proceeding as planned and to make immediate adjustments, if necessary. It is therefore a short-term evaluation activity to enable real-time action. The frequency of monitoring will depend on the type of information needed, however it will be ongoing throughout the implementation of the action plan.

Overall monitoring will be provided by the project's environmental unit. It will be organized through periodic visits to the field. A comprehensive monitoring plan will be developed and made available to other actors involved in the implementation and who are challenged; each as far as it is concerned, in monitoring.

6.3.1. Activities to monitor

To measure the effectiveness of the Pest Management Plan (PMP) on the level of reduction of the diseases and intoxications of the people concerned, particularly the safety in the treatment environment (in the field), the recommended actions should be the subject of monitoring / evaluation. Thus, all activities concerning the purchase and use of pesticides requiring quantitative or qualitative information on the environmental and social impacts and benefits of WAATP should also be monitored by the Environmental Unit.

6.3.2. Reference situation

The reference situation on the management of pesticides and zoo-sanitary products will have to be established as part of the overall study of the reference situation of the Program (WAATP). This situation should establish the basic level of indicators to be observed throughout the Project with regard to the progress made in the management of pesticides and other zoo-sanitary products, for a better and lasting protection of the different components of the biophysical environment and human (human beings, fauna, flora, ecosystems).

6.3.3. Monitoring indicators

Indicators to be followed during the implementation of the project by the actors involved including Regional Environmental and Social Respondents (RESR), researchers, agricultural extensionists, plant protection services, environmental services and health services are the following :

6.3.3.1.Strategic indicators to be monitored by the Environmental and Social Unit (ESC) of the program

The strategic indicators to be followed by the ESC are:

- designation of Regional Environmental and Social Respondents at the level of the structures involved in the implementation of the project;
- regional workshops and a national workshop organized to share and disseminate the PMP before or just at the beginning of project implementation;
- number of actors trained / sensitized on good management practices for pesticides and their packaging;
- number of people subject to intoxication;
- number of complaints received.

6.3.3.2.Indicators to be followed by the RESR of the project implementation structures

The indicators below are proposed to be followed by the RESR of the project implementation structures:

Table 32: Indicators to be followed by RESR

Designation	Indicators
<i>Health and Environment</i>	- Degree of toxicity of the pesticide products used; - Level of knowledge of good management practices (pesticides, empty packaging, etc.); - Level of impact on domestic animals, aquatic organisms and fauna; - Level of contamination of water resources.
<i>Conditions of storage management of pesticides and empty packaging</i>	- % of available and adequate storage facilities; - Level of risks associated with transportation and storage; - Level of control of spraying and impregnation processes; - Number of disposal equipment, functional packaging, quantity of packaging eliminated
<i>Training of staff /awareness of farmers</i>	- Number of training sessions carried out; - Number of agents trained by category; - Number of farmers adopting integrated pest management, good pesticide management practices; - % of the population affected by the awareness campaigns; - Level of users' knowledge of phytosanitary products (pesticides) and associated risks; - Level of knowledge of traders / distributors on the phytosanitary products (pesticides) sold.
<i>Productivity</i>	- Impact of the adoption of IPM on production performance of farmers

6.3.3.3. Indicators to be followed by other state institutions

During the implementation phase of the activities of the PMP, the monitoring will focus on the main environmental components (water, soil, vegetation and fauna, living environment, health, etc.) and will be provided by the State structures in charge of the project management of these components: the Environmental Protection Agency; the services of the MoFA; Laboratories or National Center of Public Health, Health Districts, etc.).

6.3.4. Responsibilities for monitoring of the PMP

The WAATP's Program Coordinating Unit (PCU) will be responsible for implementing of the PMP. The overall coordination of the monitoring of the PMP will be under the supervision of the Environmental and Social Safeguard Specialist (ESSS) of the PCU, in collaboration with the relevant national institutions as follow:

- The Plant Protection Services (PPRSD) of MoFA will be responsible for the internal environmental monitoring of the PMP in the intervention sites of the program through the regional PPRSD divisions;
- The EPA / CCMC will be responsible for the external environmental monitoring of the PMP in the intervention sites of the program, with NGOs participation;
- Health monitoring will be provided by the regional health districts.

6.3.5. Evaluation of the plan

Two evaluations will be carried out during the implementation of the PMP. This is an internal mid-term evaluation and external evaluation during the month following the end of implementation in order to maintain the objectives of the action plan. The mid-term evaluation will be carried out by a Consultant (international or local). The purpose will be to determine the correct evolution of the management plan, the mid-term results. The financial partners, the project beneficiaries and the other partners involved will participate fully in this evaluation. The external evaluation will measure the effectiveness of the project and its performance and identify lessons learned. This evaluation will be integrated into the evaluation of the WAATP action.

6.3.6. Summary of the monitoring plan

The plan below summarizes the monitoring elements, monitoring indicators, periodicity and monitoring responsibilities.

Table 33: Summary of the Monitoring Plan

Component	Elements of monitoring	Indicators and elements to collect	Periodicity	Responsible of monitoring
Water	State of pollution / Contamination of surface water and underground resources (wells)	Physicochemical and bacteriological parameters of bodies of water (rate of presence of organochlorines, pesticide residues, etc.)	Twice a year (Start and end of campaigns)	- WAATP's PCU - PPRSD/MoFA - EPA/MESTI - Specialized laboratories
Soils	State of pollution of the sites Pesticide storage	Typology and quantity of discharges (solid and liquid)	Once a year	- WAATP's PCU - PPRSD - EPA /MESTI - Specialized laboratories
Vegetation and fauna	Evolution of fauna and microfauna; the state of the flora of animal and plant biodiversity	Presence of toxic residues in plants and crops Levels of destruction of non-targets (animals, aquatic fauna and vegetation)	Once a year	- WAATP's PCU - PPRSD/MoFA - VSD (MoFA) - EPA - Ministry in charge of Waters and Forests - Municipality
Human Environment	Hygiene and health Pollution and nuisances Protection and Security during operations	Types and quality of pesticides used Number of accidents / intoxication Waste management (pesticide residues and empty packaging) Respect for the wearing of protective equipment	Once a year	- WAATP's PCU - PPRSD - EPA - Services or health laboratory

Component	Elements of monitoring	Indicators and elements to collect	Periodicity	Responsible of monitoring
		Compliance with pesticide storage and use measures Number of farmers sensitized on the use of pesticides Level of monitoring by plant protection officers		

6.4. Training of actors involved in the pest integrated management

In order to ensure the effective integration of WAATP's environmental concerns, a capacity building program (training and awareness raising) will be implemented for all stakeholders, which will have to focus on the following areas: make operational the strategy of Integrated Pest Management; foster the emergence of expertise and professionals in pesticide management; raise the level of employee responsibility in pesticide management; protect the health and safety of people, plant protectionist and veterinary laboratories personnel. The training should be targeted and adapted to the following target groups: Agents of the Regional Agriculture Departement (DADs) and MESTI, in particular, EPA; health staff, farmers' organizations and other NGOs active in phytosanitary and anti-vector control.

As a general rule, the best trainers are found in the staff of the Ministries of Health, Environment and Agriculture. The training will mainly concern the pesticide management staff (extension agents), to enable them to acquire the necessary knowledge on the content and methods of prevention, to be able to evaluate their work environment in order to improve it by reducing the risk factors. It will also enable them, adopt precautionary measures likely to reduce the risk of intoxication, promote the use of protective equipment and to correctly apply the procedures to be followed in the event of accidents or intoxication. The training must also concern the beneficiaries of the program and other local people active in phytosanitary and anti-vector control.

The training modules will cover: (i) Integrated Pest Management (IPM) methods and approaches; (ii) risks related to the handling of pesticides, ecological methods of management (collection, disposal, storage, transportation, treatment); (iii) the appropriate behavior and good agro-environmental practices, (iv) the maintenance of treatment facilities and equipment, protective measures and measures to be taken in case of intoxication, etc. Particular emphasis will be placed on the requirements of secure storage, to avoid mixing with other common household products, but also on the reuse of empty packaging. An indication of the contents of the training modules is described below:

- Methods, routes and technical approaches to integrated pest management;
- Alternative methods and approaches to chemical control;
- Sufficient knowledge of the pests and diseases of the target crops;
- Knowledge of methods of agro-ecosystem analysis;
- Risk information as well as health and safety advice;
- Methods and approaches for integrated pest and disease management of crops and livestock;
- Knowledge of the Harmonized System for the Labeling of Chemicals (Pesticides);
- Basic knowledge of handling and risk management procedures;
- Port of protection and safety equipment;
- Risks related to production, use, storage, transportation, distribution / marketing, handling use, disposal of pesticides;

- Outline of the process of treatment and operation;
- Health and safety related to the operations (transport, storage, treatment ...);
- Emergency and rescue procedures;
- Technical procedures;
- Maintenance of agricultural equipment;
- Process and residue monitoring;
- Biological monitoring of pesticide exposure;
- Knowledge of the risks and dangers of pesticides for humans and the environment;
- Measures and good practices to be followed during the transport, storage, distribution and use of pesticides;
- Secure management of empty packaging / containers and pesticide stocks;
- Information and knowledge on national phytosanitary regulations.

6.5. Awareness campaigns on pesticide management

In the field of agriculture, the most imminent dangers come from the unregulated use of pesticides usually used for plant protection. However, these products are inappropriately used in the production of cereals and for market gardening, hence the need for awareness on correct use of pesticides and chemical fertilizers. Also, the awareness campaign should first address the users of chemicals, including beneficiaries and traders on the risks of using certain chemicals hazardous to human health. This awareness should aim at seeking and popularizing modern methods of protection and conservation and even traditional methods of highly efficient granaries as well as biological and natural methods of controlling pests.

For the public, media broadcasts should be regularly organized. The risk of poisoning by chemicals is a serious public health problem. On the one hand, it is necessary to distinguish between: (i) health problems resulting from eating, that is to say, from the consumption of food products (especially vegetables or cereals) contaminated by dangerous chemicals ; (ii) health problems due to the consumption of damaged products (due to expiry date) that have been chemically decomposed or contain chemical sweeteners; (iii) health problems due to the use of outdated plant protection products whose chemical components are corrupted or disintegrated due to non-compliance with the rules of conservation, storage or normal duration; (iv) health problems due to overdose.

In total, according to farmers, information and awareness on environmental and health risks are very poorly organized due to insufficient human and financial resources. One-off actions by public services and the desire to regulate through legal texts remain marginal. It is necessary to develop long-term strategies and effective approaches to inform and sensitize all stakeholders (window vendors, wholesalers, agricultural users, rural populations, etc.), by moving towards the following areas of intervention:

- develop and distribute video documents and posters / leaflets / posters on the various risks and good practices in the use of pesticides;
- sensitize actors through radio and television debate programs;
- provide support to actors operating in the various sectors concerned to raise the awareness of their members of the occupational risks related to chemicals (pesticides) in their respective fields;
- support consumer associations to raise awareness among the general public;
- strengthen the training of rural supervisors and extend their action through rural radios.

Information and awareness programs, especially for the general public and decision-makers in particular, are essential to reduce the risk of disease and poisoning by pesticides, and ultimately, to induce a real change in behavior. These programs will have to be multifaceted and rely on several supports. Public media can play a relatively important role in raising awareness among the public and users. NGOs and associations / groups of agricultural producers, but also community structures and health services, should also be involved in raising awareness.

6.6. Coordination and monitoring of integrated pest management

The implementation of the pest and pesticide management strategy is a concern for many stakeholders and requires the participation of a wide range of national organizations. Development activities, such as agricultural projects, can lead to the creation of suitable habitats (habitats) for vectors and ultimately to the increased incidence of vector-borne diseases. In addition, the safe and appropriate use of insecticides, including quality control and resistance management, requires intersectoral collaboration. Several actors are involved individually or in partnership in the implementation of planned actions. The management of pests and pesticides requires a frank and close collaboration between the Project, the health services, the population, the MoFA and EPA, the local communities, the private sector involved in the import and distribution of pesticides and producer organizations. It will be necessary to establish communication and close collaboration among the various actors to ensure the necessary support for the proper implementation of policies and strategies.

6.7. Reporting and review arrangement

Annual report on the progress of pest and pesticide management at the project sites will be prepared by the Program Coordinating Unit of WAATP. 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.).

Concerning the management reviews, the PCU 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 PMP. Recommendations from the reviews will help the PCU to refocus and plan effectively towards achieving planned targets.

6.8. Institutional arrangements for the implementation and monitoring of the PMP

The implementation of the PMP requires an institutional arrangement as follows:

- The PMP will be implemented under the coordination of the WAATP environmental unit;
- **The PPRSD:** it will ensure the internal monitoring of the implementation of the environment and health component of the PMP and will regularly report to the Program Coordination Unit. It will intervene in the training of the regional agents of the Ministry in charge of Agriculture;
- **The EPA:** It is responsible for the external monitoring of the "environment" component of the implementation of the PMP;
- **Health Services:** They will provide external monitoring of the implementation of the health component of the PMP and will regularly report to the Program Coordination Unit;
- **The 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 PMP;
- **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 PMP, but also to monitoring of the implementation and monitoring of the environment.

6.9. Budget of PMP

The budget for implementing the PMP Action Plan is estimated at US \$ 507, 000 as shown in the table below.

Table 34: Cost of activities for the implementation of the PMP for the WAATP in Ghana

Activity	Units	Qties	Unit Cost (US \$)	Total cost (US \$)	Calendar
Objective 1 : Strengthen the institutional framework for pest and pesticide management					
Strengthen the capacity of action (financial and material resources) of the directorates of the MoFA and its representations in the regions and EPA	Number	5	15, 000	75, 000	Year1
Regional and National PMP sharing workshop	Number	5	5, 000	25, 000	Year1
Ensure effective enforcement of pesticide management regulatory	Region	5	2, 000	10,000	Year2
Promote an incentive policy to recover pesticide packaging and require production companies to recover packagin	Subvention/ Region	5	3, 000	15, 000	Year2
Objectif 2 : Strengthen technical and organizational measures for the management of pests and pesticides					
Support research institutions and universities to develop technologies and alternatives to pesticides, seeds and planting material resistant to diseases and pests	Fate rate	1	60, 000	60, 000	Year1 to Year3
Popularize techniques of alternatives to pesticides and methods of integrated pest management	Fate rate	1	10,000	10,000	Year2, Year3 & Year4
Disclose periodically / regularly the list of registered pesticides	An	5	2, 000	10, 000	Year1 to Year5
Make available to farmers the results / technologies resulting from research (local radio, TV, brochure, etc.)	Year	5	2,000	10,000	Year1 to Year5
Proceed with collection, storage and final disposal of obsolete and outdated chemicals products	Year	5	10, 000	50, 000	Year1 to Year5
Prepare Information-Education-Communication (IEC) booklets so that populations (farmers) are informed and sensitized on IPM approaches and the responsible use of pesticides.	Year	5	4, 000	20, 000	Year1
Accompany and subsidize farmers in the acquisition of personal protective equipment	Region	5	4, 000	20, 000	Year2

Activity	Units	Qties	Unit Cost (US \$)	Total cost (US \$)	Calendar
Promote the establishment of community committees and provide them with the means to carry out their mission to raise awareness about IPM and good phytosanitary practices	Region	5	2, 000	10, 000	Year2 and Year3
Develop database with appropriate formats in collaboration with the PPRSD divisions, VSD (MoFA) and EPA	Fate rate	5	3, 000	15, 000	Year1
Objectif 3 : Capacity building of actors involved in integrated pest management					
Conduct IEC to farmers and populations on IPM approaches and the judicious use and management of pesticides, hazards and good hygiene practices in the use of agricultural inputs	Region	5	10, 000	50, 000	Year2, Year3 and Year4
Strengthen the exchange of information on pesticide management with other stakeholders involved in pesticides.	Region	5	1, 000	5,000	Year1 to Year5
Train regional health officers on the management of poisoning cases due to pesticides (toxicology) and set up a database to monitor cases of intoxication.	Region	5	10, 000	50, 000	Year1 and Year1
Actively involve civil society, including NGOs and outreach committee in information / education / communication in popularizing approaches to integrated pest management	Region	5	4, 000	20, 000	Year1 to Year5
Objectif 4 : Provide control, monitoring and evaluation of pest and pesticide management					
Perform periodic checks and analyzes	Fate rate	1	20, 000	20, 000	Year1 to Year5
Provide supervision and final evaluation of the PMP	Fate rate	1	30, 000	30, 000	Year2 to Year5
Provide post-clearance import control before customs clearance	Fate rate	1	2, 000	2, 000	Year1 to Year5
TOTAL				507, 000	

CONCLUSION

The implementation of WAATP 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.

In terms of 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.

Potential negative impacts 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.

In order to minimize and manage the environmental and health risks associated with the use of pesticides, integrated pest management and pesticide control is envisaged through the implementation of the PMP.

The diagnosis on the phytosanitary situation made it possible to draw up an inventory of the pests and the diseases which could affect the Production of seeds, planting material and animal in the program area.

The main pests of the target crops that occur in this area are: Variegated grasshopper, *Zonocerus variegatus* (Cassava), Termites, *Microtermes spp.* (Yam) and Armyworms (*Spodoptera exempta*) (maize, rice, sorghum). With regard to animal diseases, the Newcastle disease and the Infectious bursal disease (Gumboro) affect poultry; Anthrax and Blackleg are a disease that affects small ruminants (sheep, goats).

The Exchanges with the various stakeholders made it possible to note that farmers in general, systematically resort to chemical pesticides to control pests.

Farmers do not master the techniques of identifying phytosanitary problems and pesticide use patterns well enough. Most farmers use unregistered pesticides. Unfortunately, there are several reasons for the use of unapproved pesticides by producers. Key among them includes:

- reduced cost compared to approved pesticides;
- availability to farmers in terms of proximity (unapproved products sold on local markets);
- inadequate supervision and the difficulties associated with effective control of the pesticides used;
- difficult access to approved pesticides (in terms of proximity).

Therefore, this PMP pays special attention to the following aspects:

- 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,
- support/enforcement of certain regulatory provisions

The implementation of the PMP will 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 PMP 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.

The results of the stakeholders' consultation on pest management concluded on the following recommendations:

- develop organic farming to minimize environmental degradation and reduce the increased use of plant protection products;

- establish pest and pesticide safety and management committees in each village to effectively educate users on these products;
- strengthen agricultural advisory services by focusing on integrated pest management (IPM) methods to farmers;
- organize mass sensitization on the responsible use of pesticides, in view of the current knowledge level of populations, especially farmers;
- strengthen the capacity of health workers in the management of pesticide-related intoxication cases and establish a database of the various cases treated;
- strengthen the technical platform of health centers for better management of cases of intoxication;
- set up storage facilities for unregistered pesticide and empty packaging and regulate the removal of these packaging by distributors.

The implementation of the Action Plan of the PMP will require the mobilization of **US \$ 507, 000**. This budget will be fully funded by WAATP.

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APPENDICES

Appendice1 : Basic principle for integrated pest management

PRINCIPLES	IMPLEMENTATION	RESULTS
PRINCIPLE 1 Obtain and plant quality planting material	Choose seeds, cuttings, tubers, or discards from varieties that are highly productive, healthy, and resistant to pests / diseases. To obtain certified seed, contact certified seed companies or national research centers. Farmers will be able to plant material taken from healthy plants from the previous season. Do not store planting material for more than one season. Perform summary germination tests.	The use of quality planting material will result in a healthy and productive crop and, therefore, a quality crop. Certified varieties are often resistant to many pests and diseases. Remember the popular saying that good seeds make good crops.
PRINCIPLE 2 Choose fertile soils and places suitable for planting	Select soils with good natural drainage, suitable for growing. Some crops (eg lowland rice or irrigated rice) prefer submerged soils. Always plant in fields free of weeds. Establish nurseries on disease-free soil to promote seedling development. Cover the soil with a mulch of neem leaves or dry grass. Cut only selected material that is free of pests / diseases.	Crops need maximum soil and water management to grow and compete effectively with weeds
PRINCIPLE 3 Adopt good nursery practices	Establish nurseries on disease-free soil to promote seedling development. Cover the soil with a mulch of neem leaves or dry grass. Cut only selected material that is free of pests / diseases.	After transplanting in the field, the rigorous seedlings thus obtained will produce robust plants.
PRINCIPLE 4 Adopt appropriate planting devices and devices	Plant in line, with appropriate spacing, to avoid excessive stand density. Intercropping is usually done in lines, alternate lines or strips.	Too high a density hinders the development of the crop and, by creating a humid environment, promotes the appearance of diseases. Online planting saves seeds and makes it easier for farmers to agricultural operations such as weeding and harvesting. Intercropping reduces insect pressure and guarantees yields
PRINCIPLE 5 Plant crops in a timely manner to match growing season with low incidence of pests and diseases	Plan the planting to avoid periods of prevalence of pests and diseases in the fields. Coordinate planting dates at the regional level to prevent the passage of pests between crops and to maintain a seasonal rest period.	Culture escapes periods of high incidence of pests and diseases during their growth and development. The pest development cycle is interrupted. Pest populations do not have the time to reproduce massively.
PRINCIPLE 6 Practice crop rotation	Plant crops that do not have pests in common (rotation of cereals and root and tuber crops with vegetables or legumes, for example). Plant cover crops during the fallow period	Crop rotation prevents the proliferation of soil-borne diseases and pests (eg nematodes or pathogens). Cover crops enrich the soil and smother the weeds.

PRINCIPLES	IMPLEMENTATION	RESULTS
PRINCIPLE 7 Adopt good soil conservation practices	Cover the soil with mulch, amend the soil with compost or organic fertilizer and, if necessary, rectify the nutrient balance with mineral fertilizers to enrich poor soils. Split fertilizer inputs, especially nitrogen, to better meet the needs of the crop.	Poor soils are enriched inexpensively to stimulate growth and development of healthy crops and to obtain high yields. The fertilizer is used economically.
PRINCIPLE 8 Adopt appropriate water management practices	Plant in well drained soils (except for rice). If necessary, construct drainage channels to remove excess water; prepare water collection canals (in plantain plantations, for example) to provide a water reserve sufficient. In irrigated condition, regularly irrigate the plants as needed	Growth and development of culture are not compromised by lack of water; in addition, the plants do not suffer from waterlogging.
PRINCIPLE 9 Weed regularly	Install crops in fields free of weeds. To prevent the production of weed seeds, bale within three weeks after planting and superficially sow by hand until the crop canopy closes. Tear off the first weeds before they are bloomed and mounted.	This measure saves manpower and to avoid hurting the roots of culture. Competition between crops and weeds is eliminated; they can not produce seeds. Parasitic weeds can not be established in fields
PRINCIPLE 10 Regularly inspect the fields	Inspect fields weekly to monitor crop growth and development, track auxiliary populations, and quickly detect pests, diseases and weeds; perform an agroecosystem analysis and make a decision on the cultural operations to be carried out.	Regular field inspection allows farmers to detect problems and implement the integrated control measures needed to prevent further damage and, as a result, significant yield losses.
PRINCIPLE 11 Keep the fields perfectly clean	Always keep the fields in a clean state. Eliminate all residues (previous campaign plants and plant residues, for example); most residues are used as fodder for livestock. Tear up and destroy crops with symptoms of disease early in the growing season. After the harvest, remove crop residues (mow them and use them as fodder for cattle or bury them)	These results prevent the proliferation of pests and diseases and their passage from one companion to another. Pests and diseases can not spread to the entire farm.
PRINCIPLE 12 Effectively fight pests and diseases	Adopt a strategy on prevention and augmentation of auxiliary populations. Avoid the means of fight harmful to the man or the culture as well as those which degrade the environment; favor mechanical or natural methods (seed extract / neem leaves, soapy solution for example). If the use of chemical pesticides proves to be unavoidable, (eg cases of pest infestation forests, apply the appropriate product to the recommended areas, according to the required technique, respecting the precautionary measures.	Pest problems and diseases are circumscribed, allowing high and sustainable production, with a minimum of expensive inputs. Natural products are less expensive and less harmful to humans and

PRINCIPLES

IMPLEMENTATION

RESULTS

PRINCIPLE 13

Encourage the growth of natural enemies (auxiliary) populations

Adopt practices that create environmental conditions favorable to the reproduction of enemies (minimal use of synthetic pesticide, use of plant-based producers such as neem extracts and mulching to stimulate the reproduction of natural enemies such as predatory ants, spiders, carabids, syrphids and ladybugs).

Pest populations are effectively and naturally controlled by large populations of natural enemies. Natural control of pests does not harm humans or the environment.

PRINCIPLE 14

Minimize the application of chemical pesticides

Avoid the systematic and regular application of pesticides. In case of real need, treat only with selective pesticides. Prefer products of plant origin. Refrain from dealing with plant protection products as soon as the first pests or symptoms appear. Always analyze the agro-system before any treatment decision. In the event of pest outbreaks and serious damage, treat with natural products (seed extracts / neem leaves or soapy solution).

The parsimonious use of selective chemical pesticides allows auxiliary populations (eg ants, predators, spiders, mantids and ladybugs) to grow at the expense of pests. This is a natural method of pest control

PRINCIPLE 15

Adopt good harvesting practices

Harvest the crops as they mature; be careful not to injure, tear, break or otherwise damage the harvested products. Avoid harvesting or storing fruits and vegetables in direct sunlight.

Farmers get better prices for clean and unharmed products. Pest free products are more easily preserved because they have no entry point to pests and pathogens. Products freshly harvested and kept at a low temperature are kept longer.

PRINCIPLE 16

Adopt clean and quality storage devices.

The stores are always clean, dry and well ventilated. Store only whole products. Keep crops in airtight containers to protect them from attic pests. In general, the damage caused by stock pests worsens sharply after three months of storage; therefore, divide the harvests into several lots according to the shelf life. Only treat lots for long-term storage (with suitable products such as neem oil or pesticides recommended for stored products).

The quality of stored products is retained during storage. Stored products have little exposure to pests and pathogens. The stored grains remain dry. The pesticides recommended for the treatment of stocks are used economically.

Appendice2 : Guide to Good Pesticide Management Practices

Actions required to reduce the risks of pesticides

Safe use of pesticides .

Pesticides are toxic for vermin but also for humans. However, taking sufficient precautions should not pose a threat to the public or to non-target animal species. Most of them can have harmful effects if swallowed or if they remain in prolonged contact with the skin. When a pesticide is sprayed in the form of fine particles, it may be absorbed by the air being breathed. There is also a risk of contamination of water, food and soil. Special precautions must be taken during transport, storage and handling of pesticides. The spreading equipment should be cleaned regularly and maintained to avoid leaks. People who use pesticides must learn to use them safely.

Homologation of insecticides

Strengthen the procedure for the approval of insecticides by ensuring:

- harmonization between the national pesticide registration system and other products used in public health;
- the adoption of the WHO specifications for pesticides for the purposes of the national approval procedure;
- strengthening the regulatory lead agency;
- the collection and publication of data on imported and manufactured products;
- the periodic review of the approval.

It is also recommended, when purchasing pesticides for vector control, to follow WHO guidelines. For the procurement of insecticides for public health the following guidelines are recommended:

- develop national guidelines for the procurement of vector control commodities and ensure that all procurement agencies adhere to them scrupulously;
- refer to guidelines issued by WHO or FAO regarding tendering, FAO recommendations for labeling and WHO recommendations for products (for in-house spraying);
- include in the calls for tenders the details of the technical support, maintenance, training and recycling of the products that will form part of the after-sales service involving the manufacturers; apply the principle of return to sender;
- control the quality and quantity of each batch of insecticides and impregnated substrates before receiving orders;• ensure that products are clearly labeled in French and if possible in the local language and in strict compliance with national requirements;
- specify what type of packaging will ensure efficiency, shelf life and human and environmental safety when handling packaged products, in strict compliance with national requirements;
- ensure that public health pesticide donations meet the requirements of the Mali Licensing Procedure (CSP) and can be used before their expiry date;
- Establish a consultation, before receiving a donation, between the ministries, structures concerned and donors for rational use of the product;
- require users to wear recommended protective clothing and equipment to minimize insecticide exposure;
- obtain from the manufacturer a physico-chemical analysis report and certification of the acceptability of the product;

- require from the manufacturer an analysis report of the product and its formulation with indication of what to do in case of intoxication;
- have the buyer perform a physico-chemical analysis of the product before shipment and upon arrival at the site.

Precautions

Labeling

Pesticides must be packaged and labeled in accordance with WHO standards. The label must be written in English and French and in the language of the place; it must indicate the contents, the safety instructions (warning) and all measures to be taken in case of ingestion or accidental contamination. The product should always remain in its original container. Take appropriate precautionary measures and wear protective clothing as recommended. Storage and transport Pesticides must be kept in a place that can be locked and not accessible to unauthorized persons or children. In no case should pesticides be kept in a place where they might be taken for food or drink. They must be kept dry and out of direct sunlight. They should not be transported in a vehicle that is also used for transporting foodstuffs. In order to ensure safety in storage and transport, the public or private structure in charge of managing the insecticides and insecticide-treated supports that have been acquired must comply with the regulations in force and the storage conditions recommended by the manufacturer related to:

- the preservation of the original labeling,
- prevention of spills or accidental spills,
- the use of appropriate containers,
- the proper marking of stored products,
- specifications relating to the premises,
- the separation of products,
- protection against moisture and contamination by other products, restriction of access to storage rooms,
- the locked storage warehouse to ensure the integrity and safety of the products Pesticide warehouses should be located away from human dwellings or animal shelters, water sources, wells and canals. They must be located on a height and secured by fences, their access being reserved for authorized persons.

Pesticides should not be stored where they are likely to be exposed to sunlight, water or moisture, which could affect their stability. Warehouses must be secure and well ventilated. Pesticides and agricultural products, foodstuffs, clothing, toys or cosmetics should not be carried in the same vehicle as these products could become dangerous in the event of contamination. Pesticide containers must be loaded into vehicles so that they are not damaged during transport, their labels are not torn off, and they do not slip and fall on a road whose coating may be irregular. Vehicles carrying pesticides must have a warning sign in a prominent position indicating the nature of the load.

Distribution

Distribution should be guided by the following guidelines:

- The packaging (original packaging or new packaging) must ensure safety during distribution and avoid the unauthorized sale or distribution of products for vector control;
- the distributor must be informed and aware of the dangerous nature of his load; the distributor must make deliveries within the agreed deadlines; the system of distribution of

insecticides and impregnated supports must make it possible to reduce the risks linked to the multiplicity of the manipulations and the transports;

- If the purchasing department is not able to transport the products and equipment, it must be stipulated in the calls for tenders that the supplier is obliged to transport the insecticides and impregnated supports until warehouse;
- all insecticide dispensers and spreading equipment must have an operating license in accordance with the regulations in force in Mali.

Elimination of pesticide stocks

After the operations, residual insecticide can be disposed of safely by dumping it into a specially dug hole or pit latrine. Do not dispose of a pesticide by dumping it in a place where it may contaminate water used for washing or reach a pond or stream. Some insecticides, such as pyrethroids, are very toxic to fish. Dig a hole at least 100 meters from any watercourse, well or dwelling. If you are in a hilly area, you have to dig the hole below. Pour all the water used for hand washing after treatment. Bury all containers, boxes, bottles etc. which contained pesticides. Fill in the hole as quickly as possible. Packaging or containers made of cardboard, paper or plastic - these, cleaned - may be burned, if permitted, away from homes and sources of drinking water. Regarding the reuse of containers after cleaning.

Pyrethroid suspensions can be spilled on dry soil where they will be rapidly absorbed and subsequently decomposed to render them harmless to the environment.

If a certain amount of insecticide solution remains, it can be used to kill ants and cockroaches. Simply pour a little solution on the infested places (under the kitchen sink, in the corners) or spend a soaked sponge. To temporarily hinder the growth of insects, a certain amount of solution can be poured into and around latrines or other breeding sites. Pyrethroid solutions for the treatment of mosquito nets and other tissues can be used within days of their preparation. It can also be used to treat mats and rope mats to prevent mosquitoes from stinging from below. You can also treat mattresses to fight bed bugs.

Cleaning empty packaging and containers of pesticides

Reusing empty pesticide containers is a risk and it is not recommended to do so. However, it can be considered that some pesticide containers are too useful to be discarded purely and simply after use. Can we clean and reuse such containers? It depends on both the material and the content. In principle, the label should indicate the possibilities of reusing containers and how to clean them. Under no circumstances should containers that have contained pesticides classified as very dangerous or extremely dangerous be reused. Under certain conditions, pesticide containers classified as low risk or not normally hazardous under normal use may be re-used provided that it is not intended to contain food, drink or feed. Containers made of materials such as polyethylene, which preferentially absorb pesticides, should not be re-used if they have contained pesticides whose active ingredient is classified as moderately, very or extremely dangerous, regardless of the formulation. Once a container is empty, rinse it, then fill it completely with water and let it sit for 24 hours. Then it is emptied and the operation is repeated twice.

General hygiene

Do not eat, drink or smoke when handling insecticides. The food should be stored in hermetically sealed boxes. Measurement, dilution and decanting of insecticides should be done with the appropriate equipment. Do not shake or take liquids with bare hands. If the nozzle has blown

Individual protection

- Suitable combination covering the whole hand and the whole foot.
- Anti-vapor or respiratory dust masks depending on the type of treatment and product used.

- Gloves.
- Glasses.
- Hoods (face shield).

Protection of populations

- Minimize exposure of local populations and livestock.
- Cover wells and other water supplies.
- Make people aware of the risks.

Protective clothing

Treatments inside homes

Operators should wear a work overall or long-sleeved shirt over pants, a wide-brimmed hat, a turban or other type of headgear and boots or large shoes. Sandals are not suitable. You must protect your mouth and nose with a simple means, such as a disposable paper mask, a disposable or washable surgical mask or a clean cotton cloth. As soon as the fabric is wet, it must be changed. Clothes must also be made of cotton to facilitate washing and drying. They must cover the body and have no openings. In hot and humid climates, it may be uncomfortable to wear extra protective clothing, so you will try to spread the pesticides during the hours when the heat is lowest.

Preparation of suspensions

People who are responsible for bagging insecticides and preparing suspensions, especially at the nets impregnation units, must take special precautions. In addition to the protective clothing mentioned above, they must wear gloves, an apron and eye protection, such as a face shield or glasses. Face shields protect the entire face and keep it warmer. Cover your mouth and nose as indicated for indoor treatments. Do not touch any part of your body with gloves while handling pesticides.

Impregnation of fabrics

To treat mosquito nets, clothes, fences or tsetse traps with insecticides, it is imperative to wear long rubber gloves. In some cases, additional protection is needed, for example against vapors, dust or spray of insecticides that can be dangerous. These additional protective accessories must be mentioned on the product label and may consist of aprons, boots, face masks, coveralls and hats.

Interview

Protective clothing should always be kept clean and periodic checks should be made to ensure that there are no tears or wear on the fabric that could lead to contamination of the epidermis. Protective clothing and equipment should be washed daily with soap and water, separately from other clothing. Gloves should be given special attention and should be replaced as soon as they are torn or show signs of wear. After use, rinse with plenty of water before removing. At the end of each working day, wash them outdoors and indoors.

Security measures

During spraying

The jet coming out of the sprayer must not be directed towards a part of the body. A leaking sprayer must be repaired and the skin washed if accidentally contaminated. The occupants of the house and the animals must stay outside for the duration of the operations. Avoid treating a room in which there is a person - a patient for example - that can not be transported outside. Before spraying begins, all kitchen utensils, crockery and everything that contains drinks or food should be taken out. They can also be assembled in the center of a room and covered with a plastic sheet. Hammocks and paintings or hangings should not be treated. If it is necessary to treat the bottom of the furniture and the side towards the wall, one will take care that the other surfaces are actually

treated. The floor must be swept or washed after spraying. Occupants should avoid contact with the walls.

Clothing and equipment should be washed daily. Avoid spraying organophosphates or carbamates for more than 5 to 6 hours per day and wash hands after each fill. If Fenitrothion or old stocks of Malathion are used, all operators must have their blood cholinesterase checked weekly.

Organophosphorus exposure monitoring

Field kits are commercially available to control the activity of blood cholinesterase. If this activity is low, it can be inferred that there has been excessive exposure to an organophosphorus insecticide. These dosages must be performed every week in all people who handle such products. Anyone whose cholinesterase activity is too low should be put off work until they return to normal. Impregnation of fabrics When handling insecticide concentrates or preparing suspensions, gloves should be worn. It is necessary to pay attention especially to projections in the eyes. It is necessary to use a large basin not too high and it is necessary that the room is well ventilated so that one does not risk to inhale the fumes.

Measures to reduce the risks of transport, storage, handling and use

Step	Determinants	Risks			Mitigation measure
		Public Health	Environement	Staff	
Transport	Lack of training	discoverment of pesticides in inhabited places	Accidental spill, ground water pollution by leaching	-Inhalation of product: steam, dust, -risk of skin contact	extensive training-awareness-raising of pesticide management staff on all aspects of the pesticide pipeline as well as on emergency responses - equip staff with protective equipment and encourage its full port - provide adequate storage equipment, rehabilitate existing sites - to raise public awareness about the use of pesticides and their containers - training on the management of empty containers for safe disposal - prohibit high volume containers to prevent decanting - decrease the quantity of
Storage	- Lack of means to realize the warehouse -training deficit on pesticide management	Accidental contamination -Gene, nuisance of the nearby populations	Soil contamination	Contact with the skin by reversal caused by the exiguity of the places	
Handling / manipulation	Training and awareness deficit	Contamination of water sources by washing containers	Soil contamination by accidental or intentional spill, groundwater pollution	Inhalation of steam, dermal contact by splashing during preparation or transfer of porridge	
Elimination of Packaging/ containers	Training and awareness deficit	Ingestion of products through the reuse of containers	Dermal contact and respiratory system	Elimination of Packaging	
Washing containers	Training and awareness deficit	Dermal contact, wells contamination	-Intoxication of fish and other crustaceans, -pollution of wells and	Dermal contact	

Step	Determinants	Risks			Mitigation measure
		Public Health	Environement	Staff	
			ponds, groundwater, -Selection of resistance at the larval stage		pesticides used by the effective use of alternatives

Signs of intoxication and appropriate care for the victims

Signs of poisoning

Contamination of the eyes (pain or irritation)

Appropriate care

Rinse thoroughly with tap water

- ☐ If this worsens, consult a doctor

Irritation of the skin (tingling and burning sensations)

Wash contaminated area with water, *never with oil*

Put a soothing cream on

If it does not calm, consult a doctor

Feeling tired, headaches or dizziness

To rest

- ☐ Do not do it again before feeling totally rested
- ☐ If this does not calm, consult a doctor

Contamination of the lungs

Stay in the shade

- ☐ Put under medical supervision

Modes of treatment of empty containers

The treatment of empty containers revolves around two fundamental operations: decontamination and elimination as such with its conditioning prerequisite.

Decontamination

It comprises three stages and concerns all pesticide containers:

- ensure the maximum draining of the product and draining for 30 seconds (the contents are emptied into a mixing container, into a glass for the last dosage with regard to the impregnation);
- rinse the container at least three times with a volume of water that should not be less than 10% of the total volume of the container;
- pour the rinsing water into a sprayer, into a pit (impregnation).

However, a decontaminated container is not eligible for storage of food or feed products or water for domestic consumption.

Elimination

Unless it is contemplated that the containers will be recovered, the first disposal operation is to render them unusable for other purposes: "conditioning". Also make sure to make holes with a sharp tool and flatten the container when it comes to metal drums and for drums; glass bottles must be broken into a bag to avoid splinters; the plastics are shredded and crushed. Bungs or capsules are previously removed.

Combustible containers are removed by controlled burning (paper and plastic packaging [PVC cans should not be burned], cardboard) or deposited in a landfill accepting toxic waste of this nature (cut into cans) plastic, glass and metal); ashes resulting from bare burning are buried. However, the label affixed to the receptacle may bear a mention against burning. Indeed the burning for example of certain containers of herbicides (based on phenoxy acid) may cause the release of toxic vapors for man or the surrounding flora.

Precautions: Combustion should only occur under conditions where there is no risk of the wind pushing toxic smoke towards nearby dwellings, people, livestock or crops, or to those who do not smoke surgery.

Large non-combustible containers 50 to 200l can follow the following channels:

- return to the supplier,
- sale / recovery to / by a company specialized in the trade of used barrels and barrels having the technology of neutralization of the toxicity of the adherent materials which can also proceed to their recovery,
- evacuation to a controlled landfill where the operator is informed of the contents of the drums and is warned of the potential release of toxic vapors if a combustion is applied,
- evacuation to a private site, fenced, guarded, respecting environmental standards and used specifically for pesticides.

Small non-combustible containers up to 20 l are either:

- sent to the landfill,
- buried on a private site after removal of the capsules or lids, perforations of the containers, breaking of the glass containers.

The 1 to 1.5 m deep pit used for landfilling will be filled up to 50 cm from the soil surface and then covered with soil. The site will be remote from homes and water points (wells, ponds, streams), must be uncultivated and will not be in a flood zone; the aquifer must be at least 3 m from the surface of the ground, the ground must be impervious (clay or clear). The site will be closed and identified.

Annexe 3 : List of Registered or Banned Pesticides

(A) Fully Registered Pesticides (FRE)

(A1) Insecticides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1	Abalone 18 EC	FRE/1706/1114G February 2017	Abamectin (18g/l)	II	Acaricide for the control of red spider mite, two-spotted spider mite and tomatoes russet mite in tomatoes.	Calli Ghana Limited, Tema
2	Abamet	FRE/1699/1002G August 2016	Abamectin (92%)	II	Insecticide for the control of two-spotted mite in cotton and tomato	Rainbow AgroSciences Co. Ltd., Tema
3	Aceta Star EC	FRE/15100/00914G September 2015	Bifenthrin (30g/l) + Acetamiprid (16g/l)	II	Insecticide for the control of capsids in cocoa	Adama West Africa Ltd., Accra
4	Actellic 300CS	FRE/1406/00811G December 2014	Pirimiphos-methyl (300g/l)	III	Insecticide for public health purposes	Calli Ghana Co. Ltd., Tema
5	Actellic Gold Dust	FRE/1506/00920G September 2015	Pirimiphos-methyl (16g/kg) + Thiamethoxam (3.6g/kg)	III	Insecticide for control of <i>sitophilus zeamais</i> in stored maize	Calli Ghana Ltd., Tema
6	Actforce 48EC	FRE/15145/00940G December 2015	Chlorpyrifos-ethyl (48%)	II	Insecticide for the control of insect pests in rice, cotton, vegetables and citrus	Jubaili Agrotec Ltd, Accra
7	Agricombi 40EC	FRE/1602/1040G August 2016	Fenitrothion (30%) + Fenvalerate (10%)	III	Insecticide for the control of aphids, mites and weevils in cotton, fruits and vegetables	Agrimat Ltd., Madina, Accra
8	Akape 20SC	FRE/1602/1041G August 2016	Imidacloprid (20%)	III	Insecticide for the control of insect pests in vegetables	Agrimat Ltd., Madina, Accra
9	Alphacep 10 SC	FRE/1502/00935G December 2015	Alpha-cypermethrin (100 g/l)	III	Insecticide for the control of insect pest in vegetables and fruit crops	Agrimat Limited, Accra
10	Antuka 95EC	FRE/1655/00959G January 2016	Pirimiphos-methyl (80g/l) + Permethrin (15g/l)	II	Insecticide for the control of <i>Sitophilus zeamais</i> , <i>Callosobruchus maculatus</i> , aphids	Louis Dreyfus Commodities Ghana Ltd., Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					and bollworms in cereals	
11	Ateco Super 25EC	FRE/1543/00867G June 2015	Pirimiphos-methyl (250g/l)	II	Insecticide for the control of insect pests in stored cereals, cowpea and soybean	Kumark Company Limited, Kumasi
12	Attack 1.9EC	FRE/14104/00723G October 2014	Emamectin Benzoate (1.9%)	II	Insecticide for the control of insect pests in vegetables	Agrimat Limited, Madina, Accra
13	Ataka Super EC	FRE/1657/1062G September 2016	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.
14	Aventall 300WG	FRE/15139/00893G August 2015	Indoxacarb (300g/kg)	III	Insecticide for the control of insect pests in fruits, vegetables, rice and cotton	Jingbo Agrochemicals Tech. Gh. Co. Ltd., Accra.
15	Bastion Extra SG 3%	FRE/1655/00960G January 2016	Imidacloprid (3%)	II	Insecticide for the control of rice hoppers, aphids, thrips, whiteflies, termites, and beetles in cereals	Louis Dreyfus Commodities Ghana Ltd., Accra
16	Betallic Super	FRE/1425/00790G November 2014	Pirimiphos methyl (400g/l) + Permethrin (75g/l)	II	Insecticide for the control of insect pests in maize and cowpea	Bentronic Productions, Kumasi
17	Bextoxin	FRE/1425/00776R November 2014	Aluminium Phosphide (57%)	II	Insecticide for the control of pest in stored grains	Bentronic Productions, Kumasi
18	Black Mosquito Coil	FRE/1441/00714G October 2014	Dimefluthrin (0.03%)	III	Insecticide for the control of mosquitoes	Jayraj Company Ltd, Accra
19	Bomec EC	FRE/1555/00881G August 2015	Abamectin (18g/l)	II	Insecticide for the control of aphids, caterpillars, whiteflies, grasshoppers and bollworms in vegetables	Louis Dreyfus Commodities Ghana Ltd, Tema
20	Bonlambda 2.5EC	FRE/15149/00937G December 2015	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of aphids, whiteflies and mealybugs in vegetables	Bon Agro Company Limited, Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
21	Bossmate 2.5EC	FRE/1635/1098G October 2016	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables, cowpea and soybean	K. Badu Agrochemicals , Kumasi
22	Box 18EC	FRE/17145/1090G February 2017	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
23	Bypel 1	FRE/16133/1033G August 2016	Perisrapae Granulosis Virus + Bacillus thuringiensis	II	Bio-insecticide for the control of whiteflies and worms in vegetables and fruits	Abnark Agro Services, Kumasi
24	Callifan Super 200SC	FRE/1506/00930G December 2015	Acetamiprid (100g/l)+Bifenthrin (100g/l)	II	Insecticide for the control of mirids in cocoa	Calli Ghana, Tema
25	CeraTrap	FRE/1408/00823G December 2014	Hydrolyzed proteins (5.5%w/w)	U	Fruit fly attractant	Dizengoff Ghana Ltd., Accra
26	Chlorlet 48EC	FRE/15145/00940G December 2015	Chlorpyrifos-ethyl (48%)	II	Insecticide for the control of insect pests in rice and cotton	Jubaili Agrotec Limited Kumasi
27	Clear 2.5EC	FRE/1650/00986G March 2016	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Ransfum Enterprise, Kumasi
28	Condifor Super	FRE/1543/00872G June 2015	Imidacloprid (20%)	II	Insecticide for the control of insect pests in vegetables	Kumark Company Limited, Kumasi
29	Condor SL	FRE/1425/00777G November 2014	Imidacloprid (20%)	II	Insecticide for the control of insect pests in vegetables	Bentronics Productions, Kumasi
30	Confidor 200 OD	FRE/17185/1107G February 2017	Imidacloprid (200g/l)	III	Insecticide for the control of mirids in cocoa.	RMG Ghana Limited, Accra
31	Conpyrifos 48EC	FRE/1578/00915G September 2015	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of scale and borers in cereals and vegetables	Five Continents, Accra
32	Consider Super 200SL	FRE/1623/1085G November 2016	Imidacloprid (200g/l)	II	Insecticide for the control of insect pests in vegetables	Thomas Fosu Enterprise, Accra
33	Contihalothrin 2.5EC	FRE/1578/00916G September 2015	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests	Five Continents, Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					in vegetables and pulses	
34	Conti-zol 50EC	FRE/1578/00917G September 2015	Diazinon (50%)	II	Insecticide for the control of pests in vegetables	Five Continents, Accra
35	Control 5WDG	FRE/14104/00720G October 2014	Emamectin benzoate (5%)	II	Insecticide for the control of aphids, worms and borers in vegetables	Agrimat Limited, Accra
36	Controller super 2.5 EC	FRE/1698/1122G December 2016	Lambda-cyhalothrin (2.5g/l)	II	Insecticide for the control of insect pest in vegetables and horticulture crops	J. K. Duku Enterprise, Kumasi
37	Cydim Super EC	FRE/14104/00719G October 2014	Dimethoate (400g/l) + Cypermethrin (36g/l)	II	Insecticide for the control of aphids, caterpillars, whiteflies, grasshoppers, bollworms in vegetables	Agrimat Limited, Accra
38	Cyhalon 2.5 EC	FRE/1718/1124G January 2017	Lambda-cyhalothrin (25g/L)	III	Insecticide for the control of pests in vegetables	Rhemaco Enterprise, Kumasi
39	Cypadem 43.6EC	FRE/1657/1067G September 2016	Dimethoate (400g/l) + Cypermethrin (36g/l)	II	Insecticide for the control of insect pests in vegetables and field crops	Wynca Sunshine Agric Products & Trading Co. Ltd., Accra
40	Cypersect super	FRE/1425/00779G November 2014	Dimethoate (400g/l) + Cypermethrin (36g/l)	II	Insecticide for the control of aphids, caterpillars, whiteflies, grasshoppers and bollworms in vegetables	Bentronics Productions, Kumasi
41	Cypercal 50 EC	FRE/1706/1110G February 2017	Cypermethrin (50g/l)	II	Insecticide for the control of insect pest in cotton.	Calli Ghana Company Ltd., Tema.
42	Cyperdim EC	FRE/1416/00769G November 2014	Dimethoate (250g/l) + Cypermethrin (35g/l)	II	Broad spectrum insecticide for the control of pests in fruits and vegetables	Kurama Company Limited, Accra
43	Cypex Maxi Smoke Generator	FRE/14104/00724G October 2014	Potassium chlorate (20% w/w) + Cypermethrin (13.5% w/w)	II	Insecticide for general indoor disinfection	Agrimat Limited, Madina, Accra
44	D-Ban Super 48EC	FRE/1543/00869G June 2015	Chlorpyrifos (48%)	II	Insecticide for the control of insect pests in vegetables	Kumark Company Ltd, Kumasi
45	Dean 62EC	FRE/1655/1032G August 2016	Imidacloprid (50g/l) + Emamectin benzoate (12g/l)	II	Insecticide for the control of insect pests in vegetables	Louis Dreyfus Commodities

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
						Ghana Ltd, Tema
46	Deltacal 12.5 EC	FRE/1706/1111G February 2017	Deltamethrin (12.5g/l)	II	Insecticide for the control <i>helicoverpa armigera</i> and whiteflies in green beans and tomatoes	Calli Ghana Company Ltd., Tema.
47	Deltapaz 1.25EC	FRE/1400/00814G December 2014	Deltamethrin (12.5g/l)	II	Insecticide for the control of insect pests in various crops	Adama West Africa Ltd., Accra
48	Diazol 50EW	FRE/14100/00757G November 2014	Diazinon (500g/l)	II	Insecticide for the control of insect pests in vegetables	Adama West Africa Ltd., Accra
49	Dimeking EC	FRE/1599/00852G August 2015	Dimethoate (400 g/l)	II	Insecticide for the control of insect pests in fruits, cotton and vegetables	Rainbow AgroSciences Company Limited, Accra
50	Dimex 400EC	FRE/1455/00735G October 2014	Dimethoate (400g/l)	II	Insecticide for the control of aphids, plant bugs, fruit flies and leaf miners	Louis Dreyfus Commodities Ghana Ltd, Tema
51	Dursban 4E	FRE/1505/00908G August 2015	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of scale, borers and cockroaches	Chemico Ltd Tema
52	Dusfos 480EC	FRE/1455/00781G November 2014	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in crops and for public health	Bentronics Productions, Kumasi
53	Efforia 45EC	FRE/16185/1024G August 2016	Lambda- cyhalothrin (25%) + Thiamethoxam (3%)	II	Insecticide for the control of insect pests in vegetables	RMG Ghana Limited, Accra
54	Ekuapa 2.5EC	FRE/1623/1084G November 2016	Lambda- cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables and pulses	Thomas Fosu Enterprise, Accra
55	Ema 19.2EC	FRE/16100/00998G August 2016	Emamectin benzoate (19.2%)	II	Insecticide for control of pests in vegetables and pulses	Adama West Africa Ltd., Accra
56	Ema Star 112EC	FRE/16100/1079G November 2016	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.
57	Eradicoat T	FRE/16125/1074G September 2016	Maltodextrin (282g/l)	III	Insecticides for the control of insect pests in fruits and vegetables	Positiveware Trading Company Limited, Accra
58	Evict EC	FRE/1453/00786G November 2014	Lambda- cyhalothrin (2.5%)	II	Insecticide for the control of insect pest in vegetables	L'espoir Company Limited, Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
59	Evisect 50SP	SFRE/1506/00918G September 2015	Thiocyclam oxalate (500g/kg)	II	Insecticide for the control of leaf miners in oil palm	Calli Ghana Co Ltd Accra
60	Evite 340WP	FRE/15139/00890G August 2015	Tebufoenozide (300g/kg) + Emamectin benzoate (40g/kg)	II	Insecticide for the control of armyworms, bollworm, corn borers, caterpillars, plutella of cabbage and cereals	Jingbo Agro. Tech. Gh. Co. Ltd., Accra.
61	Farin 200EC	FRE/15142/00844G June 2015	Chlorpyrifos-ethyl (200g/l)	II	Insecticide for the control of fruit borers, whiteflies, thrips, caterpillars of pepper, oil palm, soybean and tomatoes	Vista 2000 Limited, Accra
62	Fastrack 10 SC	FRE/1502/00954G December 2015	Alpha-cypermethrin (100 g/l)	III	Insecticide for the control of insect pest in vegetables and fruit crops	Agrimat Limited, Accra
63	Fendona 5SC	FRE/1498/00808G November 2014	Alpha-cypermethrin (50g/kg)	III	Insecticide for public health purposes	Cama Agro Consult, Accra.
64	Fenitrothion 50ECE	FRE/1602/1042G August 2016	Fenitrothion (50%)	III	Insecticide for the control of chewing, boring and sucking insects in tropical fruits, vegetables and cereals	Agrimat Ltd., Madina
65	Ficam VC 80WP	FRE/16183/1030G August 2016	Bendiocarb (80%)	II	Insecticide for public health purposes	RMG Ltd., Accra
66	Fipro 50EC	FRE/1608/1012G August 2016	Fipronil (500g/l)	II	Insecticide for the control of insect pests in vegetables and cereals	Dizengoff (Ghana) Limited, Accra
67	Frankofen 20EC	FRE/1539/00943G December 2015	Fenvalerate (200g/l)	II	Insecticide for the control of insect pests in vegetables	Frankatson Limited, Accra
68	Furadan 3G	FRE/1505/00907R August 2015	Carbofuran (3%)	II	Insecticide for the control of insect pests in rice, vegetables and oil palm	Chemico Ltd., Tema
69	Galil 300SC	FRE/16100/00999G August 2016	Imidacloprid (250g/l) + Bifenthrin (50g/l)	II	Insecticide for the control of mirids in cocoa	Adama West Africa Ltd, Accra.
70	Golan 20SL	FRE/1608/1013G August 2016	Acetamiprid (200g/l)	II	Insecticide for the control of insect pests in vegetables, citrus, cotton, coffee and maize	Dizengoff (Ghana) Limited, Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
71	Goliath Gel	FRE/1598/00879G August 2015	Fipronil (0.05%)	III	Insecticide for the control of flying and crawling domestic insects	Cama Agro Consulting Limited, Accra
72	Hercules 50SC	FRE/14104/00721G October 2014	Fipronil (50g/l)	II	Insecticide for public health purposes	Agrimat Limited, Madina, Accra
73	Hercules Extra 20SC	FRE/14104/00722G October 2014	Fipronil (200g/l)	II	Insecticide for public health purposes	Agrimat Limited, Madina, Accra
74	Impact 25EC	FRE/15142/00845G June 2015	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of army worms in pepper and soybeans	Vista 2000 Limited, Accra
75	Inesfly Body Repellant	FRE/15143/00831G August 2015	Pyrethrum extracts 1.2% + Piperonyl butoxide 0.3% + Ethanol 7.5%)	III	Insecticide for repelling mosquitoes	Inesfly Africa Ltd., Accra
76	Inesfly EM House IGR NG	FRE/15143/00832G June 2015	D-Allethrin (1.0%) + Alpha-cypermethrin (0.7%) + Pyriproxifen (0.01%)	III	Insecticide for the control of insect pest in field crops and for public health purposes	Inesfly Africa Ltd., Accra
77	Inesfly EM House IGR NG Paint	FRE/15143/00833G August 2015	D-Allethrin (1.0%) + Alpha-cypermethrin (0.7%) + Pyriproxifen (0.01%)	III	Insecticide/ Miticide paint for the control of mosquitoes and other household pests	Inesfly Africa Limited, Accra
78	Inesfly EM House 5A IGR	FRE/14104/00716G October 2014	Chlorpyrifos (3%) + Pyriproxifen (0.063%)	IV	Insecticide for the control of insect pests in mango, pawpaw, citrus and vegetables	Inesfly Africa Limited Tema.
79	Inespalm	FRE/14104/00718G October 2014	Deltamethrin (0.5%) + excipients q.s.p. (100%)	IV	Insecticide for the control of leaf miners oil palm weevil, brown stripped rhinoceros beetle in oil palm	Inesfly Africa Limited Tema.
80	Insector TDS	FRE/1655/00961G January 2016	Imidacloprid (350g/kg) + Thiram (100g/kg)	II	Insecticide for the control of aphids, leafhoppers, other insect pest and fungal diseases	Louis Dreyfus Commodities, Ghana Ltd, Tema
81	Kakalika Gel	FRE/1608/1015G August 2016	Fipronil (0.05%)	III	Insecticide for the control of cockroaches	Dizengoff Ghana Limited
82	KD 415EC	FRE/1505/00909G August 2015	Chlorpyrifos (400g/l) + Lambda-cyhalothrin (15g/l)	II	Insecticide for the control of scale and borers in cereals, vegetables and for	Chemico Limited, Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					public health purposes	
83	K-Optimal EC	FRE/1455/00736G October 2014	Acetamiprid (20g/l) + Lambda-cyhalothrin (16g/l)	II	Insecticide for the control of insect pests in vegetables	Louis Dreyfus Commodities, Ghana Ltd, Tema
84	K-Othrine 250WG	FRE/16183/1031G August 2016	Deltamethrin (250g/kg)	II	Insecticide for public health purposes	RMG Ghana Limited, Accra
85	Kilsect 2.5EC	FRE/1425/00775G November 2014	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Bentronic Productions, Kumasi
86	Lambad 2.5 EC	FRE/1581/00885G August 2015	Lambda-cyhalothrin (25g/l)	III	Insecticide for the control of insect pests in cereals and vegetables	Badu Kaakyire Agrochemical Co. Ltd., Kumasi
87	Lambdaking 2.5EC	FRE/1599/00842G December 2015	Lambda-cyhalothrin (2.5%)	II	Insecticide for use on vegetables and horticulture	Rainbow AgroSciences Company Limited, Tema
88	Lambda Super 2.5EC	FRE/1543/00868G June 2015	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables and pulses	Kumark Company Limited, Kumasi
89	Lambdacot EC	FRE/1458/00788G November 2014	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables and pulses	Afcott Ghana Limited, Accra
90	Lamsate EC	FRE/17145/1089G February 2017	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
91	Levo 2.4SL	FRE/1608/1016G August 2016	Oxymatrin (2.4%)	III	Insecticide for the control of insect pest in vegetables and fruit crops	Dizengoff Ghana Ltd, Accra
92	Lionguard EC	FRE/16145/1036G August 2016	Dimethoate (25%) + Cypermethrin (3%)	II	Insecticide for the control of aphids, mealy bugs and whiteflies in vegetables	Jubaili Agrotec Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
93	Lufu 150SC	FRE/16192/1077G October 2016	Thiamethoxam (100g/l) + Deltamethrin (50g/l)	II	Insecticide for the control of capsids in cocoa	Agrateam Ghana Ltd, Accra
94	Master 2.5EC	FRE/1422/00801G November 2014	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Annoh & Sons Enterprise, Accra
95	Mectin 1.8EC	FRE/1608/1014G August 2016	Abamectin (18g/l)	II	Insecticide for the control of leafminers, spidermites, caterpillars and thrips in citrus, cotton, coffee, vegetables and maize	Dizengoff Ghana Ltd, Accra
96	Methoate 40EC	FRE/1425/00778G November 2014	Dimethoate (400g/l)	II	Insecticide for the control of sucking, biting insects and spider mites	Bentronics Productions, Kumasi
97	Miricon EC	FRE/1614/1049G September 2016	Pyrethrum (12g/l) + Deltamethrin (6g/l)	II	Insecticide for the control of mirids in cocoa	Afropa (Ghana) Ltd., Accra
98	Nomax 150SC	FRE/1698/1034G August 2016	Alpha-cypermethrin (75g/l) + Teflubenzuron (75g/l)	II	Insecticide for the control of mirids in cocoa	Cama Agro Consulting (CAC) Ltd., Accra
99	Okumakate SC	FRE/1635/1076G October 2016	Thiamethoxam (200g/l)	II	Insecticide for the control of capsid bugs in cocoa	K. Badu Agro Chemicals Kumasi
100	Pawa 2.5EC	FRE/1505/00910G August 2015	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of insect pests in vegetables	Chemico Ltd, Tema
101	Perfecto 175SC	FRE/1410/00803G November 2014	Imidacloprid (12.2%)+ lambda cyhalothrin (5.0%)	II	Insecticide for the control of insect pests of vegetables and cereals	Reiss & Co, Accra
102	Phostoxin T	FRE/16185/1020R August 2016	Aluminium Phosphide (56%)	Ib	Insecticide for the control of insect pests in stored grains	RMG Ghana Limited, Accra
103	Protect 1.9EC	FRE/1608/1017G August 2016	Emamectin benzoate (1.9%)	III	Insecticide for the control of insect pests in cotton, vegetables and maize	Dizengoff (Ghana) Limited, Accra
104	Punto SL	FRE/1565/00853G August 2015	Imidacloprid (200g/l)	II	Insecticide for the control of aphids and whiteflies in egg-plant, tomatoes and sweetpotatoes	Rainbow AgroSciences Company Limited, Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
105	Pyrical 5G	FRE/1606/00955G January 2016	Chlorpyrifos-ethyl (50g/kg)	II	Insecticide for the control of insect pests in vegetables	Calli Ghana Company Ltd, Tema.
106	Pyrical 480EC	FRE/1406/00744G November 2014	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in pineapples	Calli Ghana Co. Ltd., Tema
107	Pyrinex 48EC	FRE/14100/00763G November 2014	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in vegetables and for public health purposes	Adama West Africa Ltd., Accra
108	Pyrinex Quick 256EC	FRE/16100/00993G August 2016	Chlorpyrifos (250g/l) + Deltamethrin (6g/l)	II	Insecticide for the control of insect pests in vegetables and for public health purposes	Adama West Africa Ltd., Accra
109	Rainlambda Plus	FRE/1565/00854G August 2015	Dimethoate (300g/l) + Lambda-cyhalothrin (15g/l)	II	Insecticide for the control of insect pests in vegetables	Rainbow AgroSciences Co Ltd, Accra
110	Raintoxin 57TB	FRE/1565/00825R June 2015	Aluminium Phosphide (57%)	Ib	Insecticide for the control of insect pests in stored produce	Rainbow AgroSciences Company Limited, Accra
111	Responsar EW	FRE/1461/00821G December 2014	Cyfluthrin (50g/l)	II	Insecticide for the control of flying and crawling insects	The Huge Ltd., Accra Newtown
112	Rimon 10EC	FRE/14100/00764G November 2014	Novaluron (100g/l)	III	Insecticide for the control of insect pests in cabbage, tomatoes and pepper	Adama West Africa Ltd., Accra
113	Rocky Super 2.5EC	FRE/15165/00888G August 2015	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests in pulses and vegetables	PakGhana Co. Ltd., Kumasi
114	Sanitox 20EC	FRE/1422/00799G November 2014	Fenvalerate (200g/l)	II	Insecticide for the control of insect pests in vegetables and cowpea	Annoh and Sons, Accra
115	Seed Shield	FRE/1657/1069G September 2016	Imidacloprid (350g/l)	III	Insecticide for the control of insect pests in field crops and for public health purposes	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
116	Siege Pro	FRE/1498/00737G October 2014	Hydramethylon (0.73%)	II	Insecticide for the control of cockroaches and termites	Cama Agro, Consult, Accra
117	Simida 2.5EC	FRE/1530/00826/G December 2015	Lambda-cyhalothrin (25%)	II	Insecticide for the control of insect pests in vegetables, cereals, fruits and sugarcane	Natosh Enterprise, Kumasi
118	Sinoban EC	FRE/1422/00800G November 2014	Chlorpyrifos-ethyl (480g/l)	II	Insecticide for the control of insect pests in vegetables	Annoh and Sons, Accra
119	Spike 30SC	FRE/1608/1011G August 2016	Thiamethoxam (30g/l)	III	Insecticide for the control of insect pests in vegetables and cereals	Dizengoff Ghana Limited, Accra
120	Stop Mating Block	FRE/1592/00882G August 2015	Methyl Eugenol (5ml/block) + Malathion (1ml/block)	II	Insecticide for the control of <i>Batrocera spp.</i> in fruits	Splendid Agro Products, New Pokuase
121	Striker 2.5EC	FRE/1655/00962G January 2016	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of aphids, bollworms and diamondback moth in cereals, vegetables and sugarcane	Louis Dreyfus Commodities Ghana Ltd, Tema
122	Sumico 20EC	FRE/1543/00865G August 2015	Fenvalerate (200g/l)	II	Insecticide for the control of insect pests in vegetables	Kumark Company Limited, Kumasi
123	Sumitex 40EC	FRE/1543/00871G June 2015	Dimethoate (400g/l)	II	Insecticide for the control of mealy bugs, mites, thrips, and borer larvae in vegetables and pineapples	Kumark Company Limited, Kumasi
124	Super Tiger 2.5EC	FRE/1467/00792G November 2014	Lambda-cyhalothrin (25g/l)	III	Insecticide for the control of insect pests in vegetables	Jakess Agro Chemicals, Kumasi
125	Suncombi 30EC	FRE/1657/1068G September 2016	Fenitrothion (25%) + Fenvalerate (5%)	II	Insecticide for the control of insect pests in crops and for public health purposes	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
126	Sun-Docarb SC	FRE/1657/10065G August 2015	Indoxacarb (150g/l)	II	Insecticide for the control of bollworms, caterpillars and diamondback moth in cotton, cabbage and rice	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
127	Sunhalothrin 2.5EC	FRE/1757/1102G February 2017	Lambda-cyhalothrin (25%)	II	Insecticide for the control of insect pests in vegetables and pulses	Wynca Sunshine Agric Products & Trading Co., Ltd, Accra
128	Sun-Lambda EC	FRE/1657/1064GG September 2016	Lambda-cyhalothrin (2.5g/l)	II	Insecticide for the control of diamondback moth and cotton bollworms in cabbage and cotton	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
129	Sun-Thiamethoxam WDG	FRE/1657/1063G September 2016	Thiamethoxam (25%)	II	Insecticide for the control of plant hoppers and aphids in rice and cotton	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
130	Sunpyram 20WG	FRE/1657/1100G February 2017	Nitenpyram (20%)	II	Insecticide for the control of external parasites of livestock	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
131	Sunpyrifos 48 EC	FRE/1657/1006G September 2016	Chlorpyrifos ethyl (480g/l)	II	Insecticide for the control of insect pests in crops	Wynca Sunshine Agric Prod & Trading Co., Ltd., Accra
132	ULV 900IC	FRE/1614/1048G September 2016	Pyrethrum (50%) + Deltamethrin (0.674%)	II	Insecticide for the control of flying and crawling insects in cocoa, stored produce and public health	Afropa (Ghana) Ltd., Accra
133	Vectobac G	FRE/1402/00741G October 2014	<i>Bacillus thuringiensis</i> , serotype H-14, 3000 Units/mg	IV	Insecticide for the control of mosquito larvae	Agrimat Limited, Accra
134	VectoBac 12AS	FRE/1402/00742G October 2014	<i>Bacillus thuringiensis</i> , serotype H-14, 3000 Units/mg	IV	Insecticide for the control of mosquito larvae	Agrimat Limited, Accra
135	VectoBac WDG	FRE/1480/00810G December 2014	<i>Bacillus thuringiensis</i> subsp. <i>Israelensis</i> 3000 ITU/mg	IV	Insecticide for the control of mosquito larvae	Challux Limited, Accra
136	Vectolex WG	FRE/1402/00740G October 2014	<i>Bacillus sphaericus</i> (3000 ITU/mg)	IV	Insecticide for the control of larvae of mosquitoes	Agrimat Limited, Accra
137	Verate 200 EC	FRE/1699/00976G March 2016	Fenvalerate (200g/l)	II	Insecticide for the control of stalkborer, bollworms, cotton stainers in cotton, maize and sorghum	Rainbow AgroSciences Co. Ltd., Tema
138	Vertigo 100EC	FRE/15142/00846G June 2015	Cypermethrin (100g/l)	III	Insecticide for the control of army worms, thrips, whiteflies and fruit sucking bugs in onion and soybean	Vista 2000 Limited, Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
139	Vigilant 25EC	FRE/1410/00766G November 2014	Bifenthrin (25g/l)	III	Insecticide for the control of bollworms, jassids, aphids, whiteflies, mites, hoppers in cotton and mango	Reiss &Co (Ghana), Accra
140	Viper 46EC	FRE/1506/00932/G December 2015	Acetamiprid (16g/l) + Indoxacarb (30g/l)	II	Insecticide for the control of lepidoptera, sucking and biting insects	Calli Ghana Ltd., Tema
141	Wreko 2.5EC	FRE/1623/00987G March 2016	Lambda-cyhalothrin(25g/l)	II	Insecticide for the control of insect pests in vegetables	Thomhcof Company Limited, Kumasi
142	Zap 2.5EC	FRE/1726/1115G February 2017	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests in vegetables	The Candel Company Limited, 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
143	Acticide EPW	FRE/1520/00950G December 2015	Diuron (20%) + Carbendazim (9%) + 2-octyl-2H-isothiazol-3-one (2.8%)	III	Fungal and algal paint preservative	BBC Industrials Co. Ltd., Accra
144	Amistar Top 325SC	FRE/16185/1022G August 2016	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	III	Systemic fungicide for the control of early blight, late blight, powdery mildew, leaf spot, anthracnose and rust in beans, pea, tomatoes and pepper	RMG Ghana Limited, Accra
145	Athelete 80WP	FRE/1655/00966G January 2016	Fosetyl-aluminium (800g/kg)	III	Fungicide for the control of mildew and <i>Phytophthora sp.</i> , <i>Pythium plasmopara</i> and <i>Bremia sp.</i> in vegetables, fruits and pineapples	Louis Dreyfus Commodities Ghana Ltd, Tema
146	Agro-Comet 72WP	FRE/1410/00802G November 2014	Metalaxyl (12%) + Copper (I) oxide (60%)	III	Fungicide for the control of fungal diseases on cocoa	Reiss &Co Ghana Limited, Accra

147	Banjo Forte 400SC	FRE/16100/1080G November 2016	Fluazinam (200g/l) + Dimethorph (200g/l)	III	Fungicide for the control of <i>Phytophthora megakarya</i> in cocoa	Adama West Africa Ltd., Accra
148	Bartoline	FRE/1631/1009G August 2016	Dichlofuanid (39.6g/l)	IV	Fungicide/algaecide for the preservation of wood	TM3/RCL Enterprise, Accra
149	Benco 80 WP	FRE/1425/00783G November 2014	Mancozeb (800g/kg)	III	Fungicide for control of leaf spots, mildew, leaf blight and in vegetables, fruits and ornamentals	Bentronic Productions, Kumasi
150	Bosun 300SC	FRE/15139/00891G August 2015	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.

No.	Trade Name
151	Calthio Mix 485WS
152	Callet 50WP
153	Calliette 80WP
154	Caldo Bordeles Valles 20WP
155	Callis 400OL
156	Carbendazim 50WP
157	Conti-Zeb
158	Cosavet DF
159	Cuprozin 35WP
160	Curennox 50WP
161	Damazez 80WP

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
162	Dithane M45 WP	FRE/1505/00902G August 2015	Mancozeb (800g/kg)	III	Fungicide for the control of leaf spots, mildew, leaf blight and scab of fruits and vegetables	Chemico Limited, Tema
163	Fantic Plus 69WP	FRE/1606/00957G January 2016	Cuprous oxide (60%) + Benalaxyl-M (9%)	III	Fungicide for the control of <i>Phytophthora megakarya</i> in cocoa	Calli Ghana Co. Ltd., Tema
164	Foko 80WP	FRE/1623/00991G March 2016	Mancozeb (800g/kg)	III	Fungicide for the control of diseases in vegetables	Thomas Fosu Enterprise, Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
165	Foko Super 80WP	FRE/1623/00991G March 2016	Mancozeb (800g/kg)	III	Fungicide for the control of diseases in vegetables	Thomas Fosu Enterprise, Accra
166	Folicur 250EW	FRE/16183/1028G August 2016	Tebuconazole (250g/l)	II	Fungicide for the control of black and yellow sigatoka in plantain and banana	RMG Ghana Limited, Accra
167	Folpan 50WP	FRE/14100/00760G November 2014	Folpet (500g/l)	III	Fungicide for the control of diseases in vegetables	Adama West Africa Ltd., Accra
168	Fungikill 50WP	FRE/1505/00926G October 2015	Copper (35%) + Metalaxyl (15%)	III	Fungicide for the control of <i>P. palmivora</i> and <i>P. megakarya</i> in cocoa	Chemico Ltd, Tema
169	Funguran OH-50WP	FRE/1608/1088G December 2016	Copper Hydroxide (77%)	III	Fungicide for the control of <i>Phytophthora sp.</i> in cocoa	Dizengoff Ghana Limited, Accra.
170	Goldazim 500SC	FRE/1416/00773G November 2014	Carbendazim (500g/l)	III	Systemic fungicide for the control of diseases in fruits and vegetables	Kurama Company Limited
171	Impulse 800EC	FRE/16183/1029G August 2016	Spiroxamine (800g/l)	II	Fungicide for the control of black and yellow sigatoka in plantain and banana	RMG Ghana Limited, Accra
172	Ivory 80WP	FRE/1606/00530G January 2016	Mancozeb (800g/kg)	III	Fungicide for the control of diseases in vegetables and fruits	Calli Ghana Company Ltd., Tema
173	Kentan 40 WG	FRE/1706/1113G February 2017	Copper Hydroxide (400g/kg)	III	Fungicide for the control of black pod disease in cocoa	Calli Ghana Company Limited, Tema
174	Kilazeb 80WP	FRE/1543/00877G June 2015	Mancozeb (800g/kg)	III	Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables and fruits	Kumark Company Limited, Kumasi
175	Kocide 2000 WP	FRE/1406/00798G December 2014	Cupric hydroxide (53.8%)	III	Fungicide for the control diseases in cocoa	Calli Ghana Limited, Accra

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
176	Limaneb 80WP	FRE/1698/1123G December 2016	Maneb (80%)	III	Fungicide for the control of powdery mildew and leaf spot	J. K. Duku Enterprise, Kumasi
177	Mancozan Super WP	FRE/1655/00967G January 2016	Mancozeb (640g/kg) + Metalaxyl (80g/kg)	III	Fungicide for the control of potato blight, leafspot and scab in vegetables	Louis Dreyfus Commodities, Ghana Ltd, Tema
178	Mandazim WP	FRE/17145/1094G February 2017	Mancozeb (63%) + Carbendazim (12.5%)	III	Fungicide for the control of late leaf spot and peanut rust in groundnuts	Jubaili Agrotec Ltd., Kumasi
179	Manlax	FRE/1565/00857G June 2015	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, Accra
180	Merpan 50WP	FRE/14100/00761G November 2014	Captan (500g/kg)	III	Fungicide for the control of diseases in fruits, and vegetables	Adama West Africa Ltd., Accra
181	Metalm 72WP	FRE/1416/00774G November 2014	Cuprous oxide (60%) + Metalaxyl (12%)	III	Fungicide for the control of black pod disease in cocoa	Kurama Company Limited, Accra
182	Nativo 300SC	FRE/16183/1027G August 2016	Terbuconazole (200g/l) + Trifloxystrobin (100g/l)	III	Fungicide for the control of diseases in vegetables	RMG Ghana, limited, Accra
183	Ortiva Top	FRE/1706/1112G February 2017	Azoxystrobin (200g/l) + Difenconazole (125g/l)	III	Fungicide for control of leaf spot and <i>Anthrachnose</i> of Tomato	Calli Ghana Ltd., Accra
184	Ortiva 250SC	FRE/16185/1023G August 2016	Azoxystrobin (250g/l)	III	Fungicide for the control of anthracnose disease in vegetables	RMG Ghana Limited, Accra
185	Rainmanco z 80WP	FRE/1699/1006G August 2016	Mancozeb (800g/kg)	III	Fungicide for the control of leaf spots, mildew and leaf blight in vegetables, fruits, and ornamentals	Rainbow Agrosiences Company Limited, Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
186	Rainprozol 250EC	FRE/1699/00983G March 2016	Propiconazole (250g/l)	III	Fungicide for the control of fungal diseases in rice and pineapple	Rainbow Agrosiences Company Limited, Tema
187	Raintop-M 70WP	FRE/1699/1078G October 2016	Thiophanate methyl (700g/kg)	III	Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables	Rainbow AgroSciences Company Limited, Accra
188	Shavit F 715WP	FRE/14100/00759G November 2014	Folpet (700g/kg) + Triadimenol (1.5g/kg)	III	Fungicide for the control of diseases in vegetables	Adama West Africa Ltd., Accra
189	Sphinx star 480WDG	FRE/14100/00818G December 2014	Dimethomorph (80g/l) + Chlorothalonil (400g/l)	III	Fungicide for the control of diseases in vegetables	Adama West Africa Ltd, Accra
190	Sulphur 80WP	FRE/1602/1046G August 2016	Sulphur (80%)	III	Fungicide for the control of fungal diseases in ornamentals	Agrimat Limited, Madina
191	Sun-Anil SC	FRE/1657/1073G September 2016	Pyrimethanil (50g/l)	III	Contact fungicide for the control of downy mildew of tomatoes and cucumber	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
192	Suncozeb 80WP	FRE/1657/1072G September 2016	Mancozeb (800g/kg)	III	Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables	Wynca Sunshine Agric Products & Trading Co Ltd, Accra
193	Sun-Lonil WP	FRE/1657/1099G February 2016	Chlorothalonil (75%)	II	Fungicide for the control of downy mildew and early blight of cucumber and tomatoes	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
194	Sun-Vege WP	FRE/1657/1071G November 2016	Dimethomorph (50%)	II	Fungicide for the control of downy mildew of Cucumber	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
195	Tilt	FRE/1406/00745G November 2014	Propiconazole (250g/l)	III	Fungicide for the control of fungal	Calli Ghana Company Limited, Tema

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
					diseases in banana	
196	Top Cop	FRE/1505/00903G August 2015	Sulphur (50%) + Copper (8%)	III	Fungicide / miticide for the control of diseases in vegetables	Chemico Limited, Tema
197	Trimangol 80WP	FRE/1505/00901G August 2015	Maneb (800g/kg)	III	Fungicide for the control of leaf spot, downy mildew, leaf blight and scab of cereals, vegetables	Chemico Limited, Tema
198	Vamos 500SC	FRE/16100/1081G November 2016	Fluazinam (500g/l)	III	Fungicide for the control of <i>Phytophthora megakarya</i> in cocoa	Adama West Africa Ltd., Accra
199	Volley 88OL	FRE/1598/00880G August 2015	Fenpropimorph (880g/l)	III	Fungicide for the control of <i>Mycosphaerella musicola</i> and <i>Mycosphaerella fijiensis</i> in banana	Cama Agro Consulting Limited, Accra
200	Xanbac D EC	FRE/1608/1087G December 2016	Dichlorophen (200g/l)	III	Contact fungicide/algaecide/bactericide for the control of root rot, angular leafspot, bacterial spot and damping off disease in green pepper, cotton and beans	Dizengoff Ghana Limited, Accra
201	Zeb-care 80WP	FRE/17145/1093G February 2017	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

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
202	2,4-D Super Herb	FRE/1467/00793G November 2014	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds	Jakess Agrochemical Kumasi
203	Aboextra 72SL	FRE/15113/00921G September 2015	2,4-D Amine Salts (720g/l)	III	Selective herbicide for	Aboboyaa Enterprise

					control of broadleaf weeds in rice, maize, sorghum, millet and sugarcane	Limited, Kumasi
204	Adom 48SL	FRE/1467/00791G November 2014	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Jakess Agro Company Ltd, Kumasi
205	Adwuma Wura 480SL	FRE/1543/00863G August 2015	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
206	Adwumaye 41 SL	FRE/1682/1128G December 2016	Glyphosate (410 g/l)	III	Herbicide for the control of broadleaf weeds and grasses	Cropstar Enterprise, Kumasi
207	Adwuma Wura 75.7WSG	FRE/1543/00864G August 2015	Glyphosate (75.7%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
208	Afuo Wura 48SL	FRE/15108/00851G June 2015	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	WAAF Agro Limited, Techiman
209	Agilox 170 EC	FRE/16100/00995G August 2016	Propaquizafop (50g/l) + Oxyfluorfen (120g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in onion	Adama West Africa Ltd., Accra
210	Agil 100EC	FRE/14100/00758G November 2014	Propaquizafop (100g/l)	III	Herbicide for the control of grasses	Adama West Africa Ltd., Accra
211	Agristomp 500E	FRE/1602/1047G August 2016	Pendimethalin (500g/l)	III	Pre-emergent herbicide for the control of weeds in maize, cotton, rice and soybean	Agrimat Limited, Madina
212	Alligator 400EC	FRE/1455/00728G October 2014	Pendimethalin (400g/l)	III	Herbicide for the control of grasses in rice	Louis Dreyfus Commodities Ghana Ltd, Tema
213	Amazon 10WP	FRE/1506/00933G December 2015	Pyrazosulfuron ethyl (10%)	III	Herbicide for the control of weeds in rice	Calli Ghana Co., Ltd, Tema

214	Amino 72SL	FRE/1505/00911G August 2015	2, 4-D Amine (720g/l)	III	Selective herbicide for the control of broadleaf weeds in cereals and sugarcane	Chemico Limited, Tema
215	Aminoforce 72SL	FRE/15145/00827G June 2015	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds and sedges in cereals and tree crops	Jubaili Agrotec Ltd, Accra
216	Aminespray 720SL	FRE/1699/1005G August 2016	2,4-D Amine (720g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals, sugarcane and citrus	Rainbow AgroSciences Co. Ltd., Tema
217	Arrow 75WDG	FRE/1608/1018G August 2016	Nicosulfuron (75%)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Dizengoff Ghana Ltd, Accra
218	Arsenal Gen 2SL	FRE/1498/805G August 2014	Imazapyr (250g/l)	II	Selective post emergence herbicide for the control of grasses in cereals	Cama Agro Consultancy Accra.
219	Basta 200SL	FRE/16183/1000G August 2016	Glufosinate-ammonium (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses in banana	RMG Ghana, Limited, Accra
220	Bastnate 200 SL	FRE/1699/00977G March 2016	Glufosinate-ammonium (200g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds in banana, plantain, mango and pineapple	Rainbow AgroSciences Company Limited, Tema
221	Benaxone Super SL	FRE/1425/00780R November 2014	Paraquat (276g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Bentronic Productions, Kumasi
222	Baccara 435 EC	FRE/1506/00934G December 2015	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, Tema
223	Basagran 480 SL	FRE/1498/00806G November 2014	Bentazon (480g/l)	II	Herbicide for the control of broadleaf weeds in beans,	Cama Agro Consultancy, Accra.

					groundnut and maize	
224	Best Up 480SL	FRE/15142/00850G August 2015	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize, rubber, oil palm and rice	Vista Limited, Accra 2000
225	Bonamine 720EC	FRE/15149/00935G December 2015	2,4-D Amine (720 g/l)	II	Herbicide for the control of broadleaf weeds in maize and rice	Bon Agro Company Limited, Kumasi
226	Bonsate 480SL	FRE/15149/00936G December 2015	Glyphosate (480g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Bon Agro Company Limited, Kumasi
227	Butaforce EC	FRE/15145/00828G June 2015	Butachlor (500g/l)	III	Pre-emergent herbicide for the control of grasses and broadleaf weeds in rice, soybean, cotton and vegetables	Jubaili Agrotec Ltd., Accra
228	Butaplast EC	FRE/1543/00876G August 2015	Butachlor (50%)	III	Pre-emergent herbicide for the control of annual, perennial grasses and broadleaf weeds in rice, soybean, cotton and vegetables	Kumark Company Limited, Kumasi
229	Calliherbe 720SL	FRE/1606/00956G January 2016	2,4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in cereals and tree crops	Calli Ghana Co. Ltd, Tema
230	Caritek 80WP	FRE/1699/1004G August 2016	Diuron (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in pineapple	Rainbow AgroSciences Co. Ltd., Tema
231	Bextra 72SL	FRE/1425/0022G October, 2014	2,4 D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in maize, rice and sorghum	Bentronics Productions, Kumasi
232	Chemopax 500 SC	FRE/1705/1126G February 2017	Ametryn (485g/l) + Trazine (15g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Chemico Limited, Tema

233	Chemosate 360SL	FRE/1405/00687G March 2015	Glyphosate (360g/l)	III	Herbicide for the control of annual and perennial weeds	Chemico Limited, Tema
234	Chemovar 80WP	FRE/1505/00895G August 2015	Bromacil (800g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in pineapples	Chemico Limited, Tema
235	Chemuron 80WP	FRE/1505/00896G August 2015	Diuron (80%)	III	Herbicide for the control of grasses in pineapples, citrus and mangoes	Chemico Limited, Tema
236	Chemostorm 500EC	FRE/1705/1127G February 2017	Pendimethalin (500g/l)	III	Pre-emergent herbicide for the control of weeds in cereals, cotton and soybean	Chemico Limited, Tema
237	Chemoxone SL	FRE/1505/00897R August 2015	Paraquat dichloride (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Chemico Limited, Tema
238	Clearforce	FRE/14145/1037G August 2016	Glyphosate (250g/l) + Diuron (250g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cotton, citrus, sugarcane, oil palm and rubber	Jubaili Agrotec Ltd, Kumasi.
239	Bisonrice 400SC	FRE/1565/00839G June 2015	Bispyribac-sodium (400g/l)	III	Selective herbicide for the control of grasses and broadleaf weeds in rice	Rainbow AgroSciences Company Limited, Accra
240	Cleanspray 80SG	FRE/1699/00978G March 2016	2,4-D Amine (960g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in millet	Rainbow AgroSciences Company Limited, Tema
241	Condax WP	FRE/1678/00925G October 2016	Bensulfuron-methyl (30%)	III	Systemic herbicide for the control of annual and perennial broad leaved and sedges weeds in rice	Five Continents, Accra
242	Corta 480EC	FRE/1655/00963G January 2016	Trichlopyr (480g/l)	III	Selective herbicide for the control of broadleaf weeds in oil palm, rice and sugarcane	Louis Dreyfus Commodities Ghana Ltd, Tema

243	Cut Out 100SC	FRE/16100/00996G August 2016	Bispyribac sodium (100g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in rice	Adama West Africa Ltd., Accra
244	Delsate 41SL	FRE/1626/1053G September 2016	Glyphosate (410g/l)	II	Herbicide for the control of grasses and broadleaf weeds in pineapple	The Candel Company Limited, Accra
245	Destroyer	FRE/1718/1125G January 2017	Glyphosate (360g/l)	III	Herbicide for the control of annual and perennial weeds	Rhemaco Enterprise, Kumasi
246	Dinamic Plus 500EC	FRE/1606/1007G August 2016	Amicarbazone (100g/l) + Propisochlor (400g/l)	III	Herbicide for the control of grasses broadleaf and sedges in arable crops	Calli Ghana Limited, Tema
247	Di-On WP	FRE/1543/00874G August 2015	Diuron (80%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in pineapples, citrus and mangoes	Kumark Company Limited, Kumasi
248	Diuron 80WP	FRE/1602/1044G August 2016	Diuron (80%)	III	Herbicide for the control of grass weeds in cotton and sugarcane	Agrimat Limited, Madina
249	Diurex 80WDG	FRE/16100/00994G August 2016	Diuron (800g/kg)	II	Herbicide for the control of broadleaf weeds and grasses in sugarcane and cotton	Adama West Africa Ltd., Accra
250	Diutop 80WP	FRE/1626/1051G September 2016	Diuron (80g/kg)	II	Herbicide for the control of grasses and broadleaf weeds in pineapple	The Candel Company Limited, Accra
251	Doubleforce	FRE/16145/1039G August 2016	Diuron (350g/l) + Paraquat dichloride (150g/l)	II	Herbicide for the control of broadleaf weeds and grasses in field crops	Jubaili Agrotec Ltd. Kumasi
252	Eduodzi 480SL	FRE/1699/00971G March 2016	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in vegetables	Rainbow AgroSciences Co. Ltd., Tema

253	Eduodzi 757 SG	FRE/1699/00970G March 2016	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in vegetables	Rainbow AgroSciences Co. Ltd., Tema
254	Eliminator Plus 150SL	FRE/1565/00841R June 2015	Diquat dibromide (150g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Rainbow AgroSciences Co., Limited, Accra
255	Eliminator Plus 200SL	FRE/1565/00840R June 2015	Diquat dibromide (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Rainbow AgroSciences Co, Limited, Accra
256	Ervextra SC	FRE/1655/00964G January 2016	2, 4-D Amine (720g/l)	III	Selective herbicide for the control of broadleaf weeds in rice, maize, oil palm, coconut, rubber and sugarcane	Louis Dreyfus Commodities, Ghana Ltd, Tema
257	Fenfen 240EC	FRE/1699/00979G March 2016	Oxyfluorfen (240g/l)	U	Herbicide for the control of annual, perennial broadleaf weeds and grasses in groundnut, fruit trees, onion and cotton	Rainbow AgroSciences Company Limited, Tema
258	ForceUp SL	FRE/15145/00829G August 2015	Glyphosate (41%)	III	Herbicide for the control of weeds in crops	Jubaili Agrotec Ltd., Kumasi
259	Force Uron 50SC	FRE/15145/00942G December 2015	Diuron (50%)	III	Herbicide for the control of grasses in fruits and cotton	Jubaili Agrotec Ltd, Kumasi
260	Force Uron 80WP	FRE/16145/1038G September 2016	Diuron (80%)	III	Herbicide for the control of grasses in fruits and cotton	Jubaili Agrotec Ltd, Kumasi
261	Franko-2, 4-D	FRE/1439/00797G November 2014	2,4-D Amine salts (720g/l)	II	Herbicide for the control of broadleaf weeds and sedges	Frankatson Limited, Accra
262	Frankosate 41SL	FRE/1439/00794G November 2014	Glyphosate (410g/l)	III	Herbicide for the control of broadleaf weeds, sedges and grasses	Frankatson Limited, Accra
263	Frankosulfuron	FRE/1539/00944G December 2015	Nicosulfuron (40g/l)	III	Herbicide for the control of grasses in Maize	Frankatson Limited, Accra.
264	Gallant Super	FRE/1505/00898G August 2015	Haloxyfop (108g/l)	III	Post emergence herbicide for the	Chemico Limited, Tema

					control of broadleaf weeds in vegetables	
265	Garlon 4 EC	FRE/1505/00899G August 2015	Triclopyr (480g/l)	III	Herbicide for use as tree killer and the control of broadleaf weeds	Chemico Limited, Tema
266	Glycel 41SL	FRE/1610/1001G August 2016	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Reiss and Co. Ghana Ltd., Accra
267	Glycot 41SL	FRE/1458/00789G November 2014	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals	Afcott Ghana Limited, Accra
268	Glyfos 41SL	FRE/1402/00809G December 2014	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Agrimat Limited, Accra
269	Glygold 41SL	FRE/1453/00768G November 2014	Glyphosate (410g/l)	III	Herbicide for the control of broadleaf weeds and grasses	L'espoir Company Limited Accra
270	Glyking 480 SL	FRE/1699/00975G March 2016	Glyphosate (480g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Rainbow AgroSciences Co. Ltd., Tema
271	Glyphader 480SC	FRE/1455/00734G October 2014	Glyphosate (480g/l)	III	Herbicide for the control of broadleaf weeds and grasses	Louis Dreyfus Commodities, Ghana Ltd, Tema
272	Glyphader 75SG	FRE/1455/00733G October 2014	Glyphosate (757g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Louis Dreyfus Commodities Ghana. Ltd, Tema
273	Glyphogan 480SL	FRE/14100/00813G December 2014	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Adama West Africa Ltd., Accra
274	Glyphosate Technical	FRE/1557/00886G August 2015	Glyphosate Ammonium Salt (88 Min)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric Products & Trading, Accra
275	Glyphosate Technical	FRE/1557/00887G August 2015	Glyphosate Ammonium Salt (95 Min)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric Products & Trading, Accra

276	Glystar 41SL	FRE/1553/00894G August 2015	Glyphosate (41%)	III	Herbicide for the control of broadleaf weeds and grasses	Cropstar Enterprise, Kumasi
277	Gramoquat Super	FRE/1643/1082R November 2016	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of broadleaf weeds and grasses	Kumark Co. Ltd., Kumasi
278	Grammoshar p Super 20SL	FRE/1682/1131R December 2016	Paraquat dichloride (20%)	II	Non-selective broad-spectrum herbicide for the control of broadleaf weeds and grasses	Cropstar Enterprise, Kumasi
279	Guardforce OD	FRE/15145/00941G December 2015	Nicosulfuron (4%)	III	Herbicide for the control of annual grass weeds	Jubaili Agrotec Ltd, Accra
280	Granite 240 SC	FRE/17185/1109G February 2017	Penoxsulam (240 g/l)	U	Herbicide for the control of broadleaf weeds, grasses, and sedges in rice	Dow Chemical West Africa LLC Accra
281	Herbacut 72 SL	FRE/1682/1132G December 2016	2,4-D Amine Salt (720g/l)	II	Herbicide for the control of grasses and broadleaf weeds and sedges.	Cropstar Enterprise, Adum-Kumasi
282	Herbaking 720SL	FRE/1699/00980G March 2016	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds and grasses in sorghum and maize	Rainbow AgroSciences Company Limited, Tema
283	Herbextra 72SL	FRE/1543/00859G August 2015	2, 4-D Amine (720g/l)	II	Herbicide for the control of grasses in rice, sorghum and maize	Kumark Company Limited, Kumasi
284	Herbimais WG	FRE/1455/00730G October 2014	Atrazine (750g/kg) Nicosulfuron (40g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Louis Dreyfus Commodities Gh. Ltd, Tema
285	Hyvar X 80WP	FRE/1606/1008G August 2016	Bromacil (800g/kg)	III	Pre-emergent herbicide for the control of weeds in pineapple	Calli Ghana Co Ltd, Tema
286	Kabaherb SL	FRE/1581/00884G August 2015	2,4-D Amine Salts (720g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in rice	Badu Kaakyire Agrochemical Co. Ltd., Kumasi
287	Kabasate 41SL	FRE/1581/00883G August 2015	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses	Badu Kaakyire Agrochemical

					and broadleaf weeds in cereals and vegetables	Co. Ltd., Kumasi
288	Kalach Extra 70SG	FRE/1406/00712G October 2014	Glyphosate (700g/kg)	III	Herbicide for the control of grasses and broadleaf weeds	Calli Ghana Company Limited, Tema
289	Kalach 360SL	FRE/1406/00711G October 2014	Glyphosate (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses	Calli Ghana Company Limited, Tema
290	Kamazone	FRE/1635/1097R October 2016	Paraquat dichloride (200g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds	K. Badu Agrochemicals, Kumasi
291	Kondem 41SL	FRE/1635/1075G October 2016	Glyphosate (410g/l)	III	Herbicide for the control of broadleaf weeds and grasses	K. Badu Agro Chemicals Kumasi
292	Kwatriqua 20SL	FRE/1402/00804R December 2014	Paraquat dichloride (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Agrimat Limited, Accra
293	Kurasate 360SL	FRE/1416/00772G November 2014	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Kurama Company Limited, Accra
294	Labada 75G	FRE/1455/00731G October 2014	Glyphosate (757g/kg)	III	Herbicide for the control of grasses and broadleaf weeds	Louis Dreyfus Commodities Gh., Ltd, Tema
295	Lagon 575SC	FRE/16183/1025G August 2016	Aclonifen (500g/l) + Isoxaflucol (50g/l)	III	Pre-emergent herbicide for the control of grasses and broadleaf weeds in maize	RMG Ghana Limited, Accra.
296	Laudis 630SC	FRE/17185/1108G February 2017	Tembotrione (420g/l) + Isoxadifen-ethyl (210g/l)	III	Herbicide for the control of grasses and broadleaf weeds in maize	RMG Ghana Limited, Accra.
297	Maestro 960EC	FRE/1699/00981G March 2016	Metolachlor (960g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize	Rainbow AgroSciences Company Limited, Tema
298	Maxitol 865SL	FRE/15142/00847G June 2015	2,4-D Amine Salts (865g/l)	III	Herbicide for the control of broadleaf weeds in cereals and sugarcane	Vista 2000 Limited, Accra
299	Nico 40OD	FRE/15139/00892G August 2015	Nicosulfuron (40g/l)	III	Herbicide for the control of grasses	Jingbo Agrochemicals

					and broadleaf weeds in cereals	Tech. Gh. Co. Ltd., Accra.
300	Nicobest 75WG	FRE/1565/00838G June 2015	Nicosulfuron (75%)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Rainbow AgroSciences Company Limited, Accra
301	Nicogan 40OD	FRE/14100/00817G December 2014	Nicosulfuron (40g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and legumes	Adama West Africa Ltd., Accra
302	Nicoherb 40OD	FRE/1498/00738G October 2014	Nicosulfuron (40g/l)	III	Herbicide for the control of weeds in cereals and vegetables	J.K. Duku Enterprise, Kumasi
303	Nicoking 40SL	FRE/1699/1003G August 2016	Nicosulfuron (400g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize, rice and soybean	Rainbow AgroSciences Co. Ltd., Tema
304	Nico Plus OD	FRE/1543/00873G August 2015	Nicosulfuron (4%)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
305	Nicostar 40 SL	FRE/1682/1130G December 2016	Nicosulfuron (40%)	III	Herbicide for the control of weeds in cereals and vegetables	Cropstar Enterprise, Adum-Kumasi
306	Nnobia 41SL	FRE/1455/00739G October 2014	Glyphosate (41%)	III	Herbicide for the control of grasses and broadleaf weeds	J. K. Duku Enterprise, Kumasi
307	Nwura Wura 360SL	FRE/1457/00749G November 2014	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Wynca Sunshine Agric Products & Trading, Accra
308	Odyssey 70 WG	FRE/1798/1101G February 2017	Imazamox 350g/l + imazethapyr (350g/l)	II	Herbicide for the control of annual and perennial broadleaf weeds, grasses and sedges in groundnuts and soybeans	CAMA Agro Consult, Accra
309	Ogyatanaa 41SL	FRE/1635/1096G October 2016	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals in vegetables	K. Badu Agrochemicals, Kumasi

310	Orizo Plus SL	FRE/1426/00819G December 2014	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
311	Oyeadieyie 41SL	FRE/1439/00795G November 2014	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Frankatson Limited, Accra
312	Paracot SL	FRE/1458/00787R November 2014	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of grasses and broadleaf weeds	Afcott Ghana Ltd, Kumasi
313	Pencal 500EC	FRE/1506/00928G December 2015	Pendimethalin (500g/l)	II	Herbicide for the control of grasses and broadleaf weeds and	Calli Ghana Ltd., Tema
314	Pendico 50EC	FRE/1410/00765G November 2014	Pendimethalin (500g/l)	III	Selective pre-emergent herbicide for the control of weeds in cereals, cotton and soybean	Reiss &Co., Accra
315	Pendigan 400CS	FRE/14100/00815G December 2014	Pendimethalin (400g/l)	II	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Adama West Africa Ltd., Accra
316	Pointer 276SL	FRE/15142/00848R June 2015	Paraquat dichloride (276g/l)	II	Non-Selective contact herbicide for the control of grasses and broadleaf weeds in soybean, corn, oil palm, rubber and rice	VISTA 2000 Ltd Accra
317	Power 41SL	FRE/1498/00740G October 2014	Glyphosate (41% w/w)	III	Herbicide for the control of grasses and broadleaf weeds	J. K. Duku Enterprise, Kumasi
318	Pronil Plus SL	FRE/1425/00782G November 2014	Propanil (360g/l) + 2, 4 D Amine Salt (200g/l)	III	Selective herbicide for the control of grasses and broadleaf weeds in rice	Bentronic Productions, Kumasi
319	Propa Super 36EC	FRE/1623/00988G March 2016	Propanil (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses in corn, sugarcane,	Thomhcof Company Limited, Kumasi

					sorghum and pineapple	
320	Propa Gold EC	FRE/1655/00565G January 2016	Propanil (360g/l) + 2,4-D Amine (200g/l)	II	Systemic herbicide for the control of broadleaf weeds in rice	Louis Dreyfus Commodities Ghana, Tema
321	Propacal-Plus 480EC	FRE/1543/00861G August 2015	Propanil (240g/l) + 2, 4-D Isobutyl Ester (240g/l)	II	Selective herbicide for the control of grasses and broadleaf weeds in rice	Kumark Company Limited, Kumasi
322	Propaforce Plus EC	FRE/15145/00830G June 2015	Propanil (36%) + 2,4-D Isobutyl Ester (20%)	III	Herbicide for the control of weeds in rice	Jubaili Agrotec Ltd., Accra
323	Rainbow 25OD	FRE/1498/00740G October 2014	Penoxsulam (250g/l)	III	Herbicide for the control weeds in rice	Chemico Limited, Tema
324	Aminespray 72SL	FRE/1699/1005G August 2016	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds in rice	Rainbow Agrosciences Co Ltd, Accra
325	Rainpendim	FRE/1565/00855G August 2015	Pendimethalin (500g/l)	III	Herbicide for the control of grasses and broadleaf weeds in maize and sugarcane	Rainbow AgroSciences Company Limited, Accra
326	Rainpropa Plus	FRE/1565/00856G August 2015	Propanil (360g/l) + 2,4 D Amine (200g/l)	III	Herbicide for the control of <i>Amaranthus retroflexus</i> , <i>Digitaria spp.</i> , <i>Echinochloa spp.</i> , <i>Panicum spp.</i> in rice	Rainbow AgroSciences Company Limited, Accra
327	Ricenice 360EC	FRE/1699/00982G March 2016	Propanil (360g/l)	III	Herbicide for the control of <i>Amaranthus retroflexus</i> , <i>Digitaria spp.</i> , and <i>Echinochloa spp.</i> in rice	Rainbow AgroSciences Company Limited, Tema
328	Rid Out 480 SL	FRE/1699/00974G March 2016	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds.	Rainbow AgroSciences Co. Ltd., Tema
329	Rid Over 757 SG	FRE/1699/00972G March 2016	Glyphosate ammonium (75.7%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds.	Rainbow AgroSciences Co. Ltd., Tema

	Rival 360SL	FRE/1401/00820G December 2014	Glyphosate (360 g/l)	III	Herbicide for the control of annual and perennial grasses and broadleaf weeds	Wienco (Gh.) Ltd, Accra
330	Roundup 360SL	FRE/1455/00732G October 2014	Glyphosate (360g/l)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Louis Dreyfus Commodities, Ghana Ltd, Tema
331	Roundup 450 Turbo	FRE/1455/00822G December 2014	Glyphosate (450g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds	Louis Dreyfus Commodities, Ghana Ltd, Tema
332	Roundup Biosec 72SG	FRE/1555/00858G August 2015	Glyphosate (720g/kg)	III	Herbicide for the control of annual, perennial, grasses, sedges and broadleaf weeds in tree plantations and arable crops	Louis Dreyfus Commodities, Ghana Ltd, Tema
333	Sharp 480SL	FRE/1543/00860G August 2015	Glyphosate (480g/l)	III	Herbicide for the control of annual and perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
334	Shye Nwura SL	FRE/1425/00253G October 2014	Glyphosate (41%w/w)	III	Herbicide for the control of grasses and broadleaf weeds	Bentronic Productions Kumasi
335	Sikosto 360SL	FRE/1416/00771G November 2014	Glyphosate (360g/l)	III	Non-selective herbicide for the control of annual, perennial grasses and broadleaf weeds	Kurama Company Limited, Accra
336	Solito 320EC	FRE/16185/1021G August 2016	Pretilachlor (30%) + Pyrebenzoxim (2%)	III	Selective herbicide for the control of and broadleaf weeds and grasses in rice	RMG Ghana Limited, Accra
337	Squad 500EC	FRE/1506/00929G December 2015	Clomazone (150g/l) + Pendimethalin (300g/l)	II	Pre-emergence herbicide for the control of grasses and broadleaf weeds in rice	Calli Ghana Company Ltd., Tema
338	Stam F34EC	FRE/1505/00900G August 2015	Propanil (360g/l)	II	Herbicide for the control of post	Chemico Limited, Tema

					emergent annual weeds in rice	
339	Starm Plus 36EC	FRE/1602/1043G August 2016	Propanil (36%)	III	Herbicide for the control of grass weeds in cotton	Agrimat Limited, Madina
340	Star Force	FRE/17145/1092G February 2017	Fluazifop-P-butyl (150g/l)	III	Herbicides for the control of annual, perennial grasses and broadleaf weeds in cotton and groundnuts	Jubaili Agrotec Ltd., Kumasi
341	Stellar Star	FRE/1698/1034G August 2016	Topramezone (50g/l) + Dicamba (160g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize	Cama Agro Consult, Accra
342	Stomp 445CS	FRE/1498/00807G November 2014	Pendimethalin (445g/l)	II	Herbicide for the control of broadleaf weeds and grasses in maize, cotton and tomatoes	Cama Agro Consult, Accra
343	Sun Agogo 33EC	FRE/1657/1059G September 2016	Pendimethalin (33%)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
344	Sun-Anico OF	FRE/1657/1070R September 2016	Atrazine (20%) + Nicosulfuron (3%)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
345	Sunbuzin 70WP	FRE/1657/1054G September 2016	Metribuzin (700g/kg)	III	Herbicide for the control of broadleaf weeds in soybean	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
346	Sun 2,4-D Amine 72SL	FRE/1657/1061G September 2016	2, 4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds and sedges	Wynca Sunshine Agric Products & Trading Company Limited, Accra
347	Sun 2,4-D PRO 560EC	FRE/1457/00756G November 2014	2, 4-D Amine (560g/l)	II	Herbicide for the control of broadleaf weeds and sedges	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
348	Sun-Bromacil 80WP	FRE/1557/00835G June 2015	Bromacil (800g/kg)	III	Herbicide for the control of broadleaf weeds and grasses in pineapples	Wynca Sunshine Agric Products & Trading Co., Limited, Accra

349	Sun-Diuron 80WP	FRE/1557/00836G June 2015	Diuron (800g/kg)	III	Herbicide for the control of weeds in pineapples, mangoes and cashew	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
350	Sunfuron 75WDG	FRE/1457/00755G November 2014	Nicosulfuron (750g/kg)	III	Herbicide for the control of broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co. Ltd, Accra
351	Sunfuron 80WP	FRE/1457/00754G November 2014	Nicosulfuron (800g/kg)	III	Herbicide for the control of broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co. Limited, Accra
352	Sunfuron 40OD	FRE/1657/1055G September 2016	Nicosulfuron (40g/l)	III	Herbicide for the control of grasses and broadleaf weeds in maize	Wynca Sunshine Agric Prdts & Trading Co. Ltd, Accra
353	Sun-Paraquat 200SL	FRE/1557/00837R June 2015	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
354	Sunphosate 360 SL	FRE/1457/00750G November 2014	Glyphosate (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
355	Sunphosate 757 WSG	FRE/1457/00752G November 2014	Glyphosate (757g/kg)	III	Herbicide for the control of broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
356	Sun-Gallop	FRE/1657/1056G September 2016	Haloxypop-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
357	Sunphocate 360SL	FRE/1657/1058G September 2016	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.
358	Sunphosate Plus	FRE/1657/1060G September 2016	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.
359	Sunphosate Ultra SL	FRE/1657/1057G September 2016	Glufosinate Ammonium (200g/l)	III	Non-selective systemic herbicide for the	Wynca Sunshine Agric. Products

					control of weeds in rubber and citrus plantations	&Trading Co. Ltd., Accra.
360	Suprazone SC	FRE/1455/00729R October 2014	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of broadleaf weeds and grasses	Louis Dreyfus Commodities, Ghana Ltd, Tema
361	Tackle 360SL	FRE/1626/1052 September 2016	Glyphosate (360g/l)	IV	Herbicide for the control of grasses, sedges and broadleaf weeds in pineapple	The Candel Company Limited, Accra
362	Terbutor 500EC	FRE/15100/00913G September 2015	Metalachlor (333g/l) + Terbutryn (167g/l)	III	Non-selective, pre-emergent herbicide for the control of weeds in cereals, cotton and tubers	Adama West Africa Ltd., Accra
363	Thomabest Super 200SL	FRE/1623/00989R March 2016	Paraquat dichloride (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses in cereals	Thomhcof Company Limited, Kumasi
364	Topstar 400SC	FRE/16183/1026G August 2016	Oxadiargyl (400g/l)	III	Pre-emergent herbicide for the control of annual grasses and broadleaf weeds in rice	RMG Ghana, limited, Accra
365	Vezir 240SL	FRE/1410/00812G December 2014	Imazethapyr (204g/l)	III	Herbicide for control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Adama West Africa Ltd., Accra
366	Vision 568WG	FRE/1506/00927G December 2015	Amicarbozone (280g/kg) + Mesotrione (288g/kg)	III	Herbicide for the control of grasses and broadleaf weeds and sedges	Calli Ghana Ltd., Tema
367	Weedall SL	FRE/1543/00862G August 2015	Glyphosate (480g/l)	III	Selective herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
368	Winner 41SL	FRE/1623/00990G March 2016	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals	Thomhcof Company Limited, Kumasi

369	Wiper 720SL	FRE/14100/00816G December 2014	2,4-D (720g/l) Amine	II	Herbicide for the control of broadleaf weeds and sedges in cereals	Adama west Africa Ltd., Accra
370	Wynna SL	FRE/1457/00751G November 2014	Glyphosate (410g/l)	III	Non-selective herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co. Ltd, Accra
371	Wynna 360SL	FRE/1457/00753G November 2014	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading, Accra
372	XTRA-D	FRE/16108/00992G March 2016	2,4 -D Amine (720g/l)	III	Herbicide for the control of broadleaf weeds in cereals and tree crops	WAAF Agro Limited, Techiman
373	Zoomer 390SC	FRE/15100/00912G September 2015	Oxyfluorfen (300g/l)+ Glyphosate (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses in maize and vegetables	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
374	Callel 480SL	FRE/1406/00748G November 2014	Ethephon (280g/l)	III	Plant growth regulator for de-greening of pineapple	Calli Ghana Co. Ltd., Tema
375	Callel 5% PA	FRE/1506/00919G September 2015	Ethephon (5%)	III	Plant growth regulator for de-greening of pineapple	Calli Ghana Co. Ltd., Tema
376	Chemophon 480SL	FRE/1505/00904G August 2015	Ethephon (480g/l)	III	Plant growth regulator for de-greening of pineapples	Chemico Ltd, Tema
377	Flower Up 40SL	FRE/1557/00889/G August 2015	Ethephon (40%)	III	PGR for acceleration of maturation in tomatoes and bananas	Wynca Sunshine Agric Products & Trading Co. Ltd, Accra

378	Hevetex P	FRE/1655/00968G January 2016	Ethephon (5%)	III	Ethylene generator for stimulation of latex production	Louis Dreyfus Commodities Ghana Ltd, Tema
379	Mat 480SL	FRE/1455/00727G October 2014	Ethephon (480g/l)	III	Plant growth regulator for de-greening of pineapples	Louis Dreyfus Commodities Ghana Ltd, Tema
380	RyzUp 40SG	FRE/1480/00743G November 2014	Gibberellic acid 1.279 billion ITU/l	U	Plant growth regulator for banana	Challux Ltd, Accra
381	Sino Booster AS	FRE/1730/1120G February 2017	Humic Acid (16%)	IV	Plant Growth regulator for stimulating growth in potatoes, peanut and soybean.	Natosh Enterprise, Kumasi

(A5) Molluscicide

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
382	Carakol	FRE/16100/00997G August 2016	Acetic metaldehyde (50g/kg) + Denatonium benzoate (0.3g/kg)	III	Molluscicide for the control of snails, slugs and other gastropods	Adama West Africa Ltd., Accra

(A) Fully Registered Pesticides (FRE)

(A6) Nematicides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
383	Carbodan	FRE/1543/00866G June 2015	Carbofuran (3%)	II	Nematicide/ Insecticide for the control of nematodes in vegetables	Kumark Company Limited, Kumasi
384	Marshal 480EC	FRE/1505/00906G August 2015	Carbosulfan (480g/l)	II	Nematicide/ insecticide for the control of scale, nematodes and symphylids in pineapple	Chemico Ltd., Tema
385	Rugby 10G	FRE/1505/00905G August 2015	Cadusafos (10%)	II	Nematicide /insecticide for the control of nematodes	Chemico Ltd., Tema
386	Velum Prime 400SC	FRE/16183/00969G March 2016	Fluopyram (400g/l)	III	Nematicide for the control of nematodes in pepper, tomatoes and okro	RMG Ghana, limited, Accra

(A7) Adjuvants

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
387	Bladbuff 5	FRE/1408/00715G October 2014	Phosphoric acid + alcohol ethoxylate	U	An adjuvant for use as a wetting and spreading agent for contact and systemic fungicides and herbicides	Dizengoff, Gh. Ltd., Accra
388	Break-thru S240	FRE/14157/00784G November 2014	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.
389	EOS	FRE/14100/00762G November 2014	White summer spray oil (800g/l)	U	Adjuvant for public health use	Adama West Africa Ltd., Accra
390	Sticker	FRE/17133/1121G February 2017	Silicon/Trisiloxane surfactant	U	Spreader to improve spray coverage	Abnark Agro Services. Kumasi
391	Stockosorb 660	FRE/14157/00785G November 2014	Micro/Menum/ XL (Potassium Polyacrylate)	U	To improve water retention in soil	Evonik West Africa 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
392	BPC68950	FRE/15181/00949/G December 2015	2,2-dibromo-2-cyanoacetamide	III	Biocide against general anaerobic and sulphate reducing bacteria	Baker Hughes/Tullow Ghana Ltd., Accra
393	PFR8427 Rocide	FRE/15181/00946/G December 2015	5-chloro-2-methyl-4-isothiazolin-3-one 5% + 2-methyl-2H-isothiazol-3-one (5%)	III	Bactericide for the inhibition of the growth of bacteria	Baker Hughes/Tullow Ghana Ltd., Accra
394	Aquar Water Biocide	FRE/15181/00945/G December 2015	Glutaraldehyde (30-60%)	U	Biocide for the treatment of produced water system offshore for safe over boarding	Baker Hughes/Tullow Ghana Ltd., Accra
395	XC 82205	FRE/15181/00947/G December 2015	3,3-methylenebis-5methloxazolidine (60%)	III	Bactericide for the inhibition of the growth of bacteria	Baker Hughes/Tullow

						Ghana Ltd., Accra
396	XC 85293	FRE/15181/00948/G December 2015	Phosphonium Quaternary Salt (60%)	III	Bactericide for the inhibition of the growth of bacteria	Baker Hughes/Tullock Ghana Ltd., Accra
397	Promex DB-20	FRE/15120/00950/G December 2015	2,2-Dibromo-3- nitrilopropionamide (20%)	II	Bactericide/ fungicide for the control of bacteria and fungus in aqueous solutions	BBC Industrials Co. Ltd., Accra
398	Promex CHS-3	FRE/15120/00952/G December 2015	1,6-Dihydroxy-2, 5- dioxahexane (20%) + 5-chloro-2-methyl- 4-isothiazolin-3-one (1%) + 2-methyl-4- isothiazolin-3-one (1%)	II	Bactericide/ fungicide for the control of bacteria and fungus in aqueous solutions	BBC Industrials Co. Ltd., Accra
399	PermaClean PC-11	FRE/17200/1116G February 2017	2,2 Dibromo-3- nitrilopropionamide	U	Control bacteria fouling of ultrafiltration units, non medical or non potable reverse osmosis membranes and peripheral systems	Nalco Champion, Gh., Ltd, Accra
400	PermaClean PC-56	FRE/17200/1117G February 2017	5-Chloro-2-methyl- 4-isothiazoline-3- one + 2-Methyl-4- isothiazoline-3-one	U	For controlling bacteria fouling of ultrafiltration units, non medical or non potable reverse osmosis membranes and peripheral systems	Nalco Champion, Gh., Ltd, Accra
401	Nalco 303MC	FRE/17200/1118G February 2017	1-(2-hydroxyethyl)- 2-alkyl (C-18)-2- imidazoline	U	Diesel biocide	Nalco Champion, Gh., Ltd, Accra
402	BIOC11077 A	FRE/17200/1119G February 2017	Glutaraldehyde (15% + water (85%))	U	Biocide	Nalco Champion, Gh., 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
403	Adepa Agro Organic Pesticide	PCL/16193/00838G October 2016	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.

404	Agrifog Maxi Smoke Generator	PCL/17173/00891G February 2017	Deltamethrin (14%)	III	Insecticide for the control of household insect pests	Agromonti Co. Ltd., Accra
405	Agropy 5EW	PCL/16197/00867G November 2016	Pyrethrum (50g/l)		Insecticide for the control of mirids in cocoa	Yayra Glover Ltd., Suhum
406	Agroxin Tablet	PCL/16145/00872R December 2016	Aluminium Phosphide (57%)	Ib	Insecticide for the control of insect pests of stored grains	Jubaili Agrotec Ltd., Kumasi
407	Akate Asa	PCL/16196/00866G November 2016	Bifenthrin (3%)	II	Insecticide for the control of mirids in cocoa	Pear River Company Ltd. Accra
408	Akate Brafo 40EC	PCL/1606/00782G August 2016	Acetamiprid (20g/l) + Bifenthrin (20g/l)	III	Insecticide for the control of mirids in cocoa	Calli Ghana Ltd., Tema
409	Akate Commando	PCL/17198/00894G January 2017	Bifenthrin (30g/l) + Acetamiprid (16g/l)	II	Insecticide for the control of mirids in cocoa	Cedar Seal Co. Ltd., Accra
410	Ba-Pyrifos 48EC	PCL/1681/00881G December 2016	Chlorpyrifos (480g/l)	II	Insecticide for the control of insect pest in rice and vegetables	B. Kaakyire Agrochemicals, Kumasi
411	Belt Expert 480SC	PCL/1785/00904G February 2017	Flubendiamide (420g/l) + Thiacloprid (240g/l)	II	Insecticide for the control of insect pests in cotton	RMG Ghana, Limited, Accra
412	Bonfop EC	PCL/16149/00803G August 2016	Haloxypop-P-methyl (104g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in pineapples, vegetables, soybean and cotton	Bon Agro Company Ltd., Kumasi.
413	Bon Proplus	PCL/16149/00804G August 2016	Propanil (360g/l) + 2,4-D Amine (200g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in rice and field crops	Bon Agro Company Ltd., Kumasi.
414	Bonpyrifos 48EC	PCL/16149/00801G August 2016	Chlorpyrifos (480g/l)	II	Insecticide for the control of caterpillars, borers, beetles, spider mites, ticks, fire ants in vegetables	Bon Agro Company Ltd., Kumasi.
415	Bon Optimal EC	PCL/16149/00802G August 2016	Acetamiprid (2%) + Lambda-cyhalothrin (1.5%)	III	Insecticide for the control of aphids, whiteflies and leaf miners in vegetables	Bon Agro Company Ltd., Kumasi.

416	Bon Victory WP	PCL/16149/00805G August 2016	Mancozeb (640g/kg) + Metalaxyl (80g/kg)	II	Fungicide for the control of fungal diseases in vegetables	Bon Agro Company Ltd., Kumasi.
417	Cisthrin	PCL/1699/00787G August 2016	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.
418	Cocomate 24EC	PCL/16188/00821G September 2016	Thiamethoxam (24%)	III	Insecticide for the control of mirids and capsids in cocoa	West Africa Commodity Co. Ltd., Accra
419	Colam 247ZC	PCL/1699/00849G October 2016	Thiamethoxam (141g/l) + Lambda-cyhalothrin (106g/l)	II	Insecticide for the control of sucking and chewing insects in rice, tomato, cotton, beans, cabbage and watermelon	Rainbow Agrosciences Co. Ltd., Accra
420	Commander 20SL	PCL/16188/00819G September 2016	Imidacloprid (20%)	III	Insecticide for the control of mirids and capsids in cocoa	West Africa Commodity Co. Ltd., Accra
421	Dastoxion T	PCL/16166/00909R December 2016	Aluminium phosphide 57%)	Ib	Insecticide for the control of pest in stored grains	Dasimah Enterprise, Adum-Kumasi
422	Dresscare DS	PCL/16145/00876G December 2016	Imidacloprid (20%)+ Metalaxyl-M (20%) + Tebuconazole (2%)	II	Insecticide/ Fungicide for seed treatment	Jubaili Agrotec Ltd., Accra
423	Dynamo WP	PCL/16189/00823G September 2016	Beauveria bssiana (1%)	U	Insecticide for the control of caterpillars, diamondback moth, bollworm in vegetables, semi looper and fruit borers in vegetables and arable crops	Agropharm West Africa Ltd., Tema
424	Fixe 50SC	PCL/1635/00797G August 2016	Fipronil (50g/l)	II	Insecticide for the control of caterpillars, weevils, fire ant, termites and thrips in vegetables and fruits	Louis Dreyfus Commodities Ltd., Tema

425	Fly marshall SC (oils 55%)	PCL/17199/00903G February 2017	Spinosad (0.002% + aromatic compounds)	II	Insecticide for the control of fruit flies in vegetables and fruits	Chemyda Company Limited, Accra
426	Grain-Mate	PCL/1657/00842R October 2016	Aluminium phosphide (56%)	Ib	Insecticide for the control of storage pests in stored grain	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
427	Hoprole 30WG	PCL/1657/00848G October 2016	Indoxacarb (95%)	II	Insecticide for the control of diamondback moth, beetles, caterpillars and cabbage moth in cabbage, tomatoes and cowpea	Rainbow Agrosciences Co. Ltd., Accra
428	Imicare Plus	PCL/16145/00873G December 2016	Imidacloprid (15%) + Lambda- cyhalothrin (5%)	II	Insecticide for the control of contact and stomach acting insects in fruit trees, cereals, cowpea, soybean, groundnut, cassava, oil palm and vegetables	Jubaili Agrotec Ltd, Kumasi.
429	Imicare SL	PCL/16145/00874G December 2016	Imidacloprid (200g/l)	II	Insecticide for the control of plant hoppers aphids and whiteflies in rice and tomatoes	Jubaili Agrotec Ltd, Kumasi
430	Inspire 30 EC	PCL/1706/00900G February 2017	Etofenprox (303.68g/l)	U	Insecticide for the control of mirids in cocoa.	Calli Ghana Company Limited
431	Intact 2.5EC	PCL/16186/00795G August 2016	Lambda- cyhalothrin (2.5%)	III	Insecticide for the control of bollworms, leafhoppers, caterpillars, and strainers in cotton, rice maize and vegetables	Ivorychem Co. Ltd., Kumasi
432	J-Furan 3G	PCL/17145/00895R February 2017	(Carbofuran 3%)	II	Insecticide for the control of sugarcane shoot borer	Jubaili Agrotec Ltd, Kumasi
433	Killtox Insecticide Aerosol	PCL/16195/00840G October 2016	Permethrin (1.15%) + Tetramethrin (0.2%) + Piperonyl butoxide (0.6%) + Odorless kerosene (33.05%) + LPG (65%)	II	Insecticide for the control of flying insects	Mash Distribution, Accra

434	Klopar 24 SC	PCL/16133/00822G September 2016	Chlorfenapyr (240g/l)	II	Insecticide for the control of mites, armyworm, diamondback moth and cotton bollworm in vegetables	Abnark Agro Services Enterprise, Kumasi
435	Lagano 2.5EC	PCL/17184/00888G February 2017	Lambda-cyhalothrin (25g/l)	II	Insecticide for the control of aphids, beetles, thrips in cotton and vegetables	Ganorma Agrochemicals, Tamale
436	Laracare 2.5EC	PCL/16145/00875G December 2016	Lambda-cyhalothrin (2.5%)	II	Insecticide for the control of insect pests in vegetables and pulses	Jubaili Agrotec Ltd, Kumasi
437	Lycan WP	PCL/1672/00825G September 2016	<i>Verticilium lecanii</i> (1.15%)	U	Biological insecticide for the control of whiteflies, green hoppers, thrips, mealybugs, brown hoppers and leafminers in tomatoes and cowpea	Agropharm West Africa Ltd., Tema
438	Mosquito Hell	PCL/1757/00902G February 2017	S-Bioallethrin (0.2%)	II	Insecticide for control of mosquitoes	Wynca Sunshine Agric Products and Trading Co., (Gh) Ltd., Accra
439	Nemaran 3GR	PCL/1699/00850G October 2016	Carbofuran (3%)	II	Insecticide for the control of insect pests in vegetables, sugarcane, cotton, rice and groundnut	Rainbow Agrosciences Co. Ltd., Accra
440	Organic JMS Stylet Oil	PCL/1608/00818G October 2016	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
441	Orizon 120SC	PCL/1608/00829G October 2016	Acetamiprid (100g/l) + Abamectin (20g/l)	II	Insecticide for the control of insect pests in vegetables and citrus	Dizengoff Ghana Ltd., Accra
442	Pridapod	PCL/16191/00837G October 2016	Imidacloprid (200g/l)	II	Insecticide for the control of mirids in cocoa	USICO Gh. Ltd, Accra.
443	Proteus 170 O-TEG	PCL/17185/00905G February 2017	Thiacloprid	II	Systemic insecticide for the	RMG Ghana Limited, Accra

			(150g/l) + Deltamethrin (20g/l)		control of mirids in cocoa	
444	Rocket 20EC	PCL/16145/00871G December 2016	Chlorpyrifos (20%)	II	Insecticide for the control of insect pest in cotton, citrus and vegetables	Jubaili Agrotec Limited, Kumasi
445	Rockstar 2.5EC	PCL/16188/00820G September 2016	Bifenthrin (2.5%)	III	Insecticide for the control of mirids and capsids in cocoa	West Africa Commodity Co. Ltd., Accra
446	Savahaler WP	PCL/1635/00796G August 2016	Methomyl (250g/kg)	II	Insecticide for the control of insect pests in vegetables, fruits, cotton, soybean and other crops	Louis Dreyfus Commodities Ltd., Tema
447	Sivanto Energy 085 EC	PCL/17185/00899G February 2017	Flupyradifurone 75g/l + Deltamethrine (10 g/l)	II	Insecticide for the control of mirids in cocoa.	RMG Ghana Ltd., Accra
448	Sunpri-Lam 25EC	PCL/1657/00841G October 2016	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.
449	Swipe Mosquito Coil	PCL/16194/00839G October 2016	D-Allethrin (0.47%)	III	Insecticide for the control of mosquitoes	Haano Limited, Accra
450	Termidor SC	PCL/1698/00809G August 2016	Fipronil (25g/l)	III	Insecticide for the control of termites in cabbage, onion, eggplant and maize	Cama Agro Consulting (C.AC). Ltd., Accra
451	Trika Expert	PCL/1608/00817G September 2016	Lambda- cyhalothrin (25%)	II	Insecticide for the control of insect pests in vegetables and public health purposes	Dizengoff Gh. Ltd., Accra
452	Viper Super 80 EC	PCL/1706/00901G February 2017	Indoxacarb (60g/l) + Acetamiprid (20g/l)	III	Insecticide for control of cocoa mirids	Calli Ghana Ltd., Tema
453	Voliam Flexi 300SC	PCL/1606/00781G August, 2016	Chlorantraniliprole (100g/l) + Thiamethoxam (200g/l)	III	Insecticide for control of mirids in cocoa	Calli Ghana Ltd., Tema

(B) PROVISIONALLY CLEARED PESTICIDES (PCL)**(B2) Fungicides**

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
454	Archer 75 SP	PCL/1672/00826G September 2016	<i>Lantana camara</i> (75%)	U	Fungicide for the control of leafspot, blast, powdery mildew, leaf curl, early blight, late blight and leaf curl in fruits and vegetables	Agropharm West Africa Ltd., Tema
455	Arrest 325 SC	PCL/16189/00828G August 2016	Azoxystrobin (200g/l) + Difenconazole (125g/l)	III	Fungicide for the control of leafspot, leaf blight, blast, black spot, rust, brown spot in vegetables, tree crops, cereals and ornamentals	Matrix Innovation Ltd., Accra
456	Banko D 450SC	PCL/1606/00784G August 2016	Chlorothalonil (400g/l) + Difenconazole (50g/l)	III	Fungicide for the control of <i>Alternaria sp.</i> in tomatoes	Calli. Ghana Ltd., Tema
457	Carinho WP	PCL/1635/00799G August 2016	Carbendazim (500g/kg)	III	Fungicide for the control of leaf spot, leaf mould and stem rot in vegetables	Louis Dreyfus Commodities Ltd., Tema
458	Defender 35WP	PCL/1666/00869G November 2016	Copper oxychloride (350g/l)		Fungicide for the control of fungal diseases	Sidalco Co. Ltd., Accra
459	Five Star 325SC	PCL/1699/00857G October 2016	Azoxystrobin (200g/l) + Difenconazole (125g/l)	U	Fungicide for the control of brown spot, blackspot, rust and white mould in cabbage, cauliflower, cowpea, soybean, bulb vegetables, groundnut, sweetcorn and sweetpotato.	Rainbow Agrosiences Co. Ltd., Accra
460	Grosudine Super 50SC	PCL/16165/00792G August 2016	Imidacloprid (30g/l) + Bifenthrin (20g/l)	II	Insecticide for the control of aphids, whiteflies and mealybugs in vegetables	PakGhana Co. Ltd., Kumasi
461	Redox Super SL	PCL/16165/00790G	Imidacloprid (200g/l)	II	Insecticide for the control of aphids, whiteflies and	PakGhana Co. Ltd., Kumasi

					mealybugs in vegetables	
462	Shaolin 62.5WG	PCL/1699/00858G November 2016	Cyprodinil (37.5%) + Fludioxonil (25%)	III	Fungicide for the control of diseases in tomato, mango, green pepper, carrot and pawpaw	Rainbow Agrosciences Co. Ltd., Accra
463	Sun-Cotala WP	PCL/1657/00845G October 2016	Copper hydroxide (770g/kg)	III	Fungicide for the control of angular leaf spot in cucumber	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
464	Sunkopper 77WP	PCL/1657/00846G October 2016	Mancozeb (480g/kg) + Metalaxyl (100g/kg)	III	Fungicide for the control of downy mildew in cucumber	
465	Supreme 325SC	PCL/1610/00861G October 2016	Azoxystrobin (200g/l) + Difenconazole (125g/l)	U	Fungicide for the control of leaf blight, powdery mildew, early and late blight, blast and downy mildew in vegetables and cereals	Reiss & Co. (Gh) Ltd., Accra
466	Terminator	PCL/17173/00892 G February 2017	Mancozeb (640g/kg) + Metalaxyl (80g/kg)	III	Fungicide for the control of broad-spectrum fungi in vegetables	Agromonti Co. Ltd., Accra
467	Tricost	PCL/1672/00827G September 2016	<i>Trichoderma viride</i> (1%) WP	U	Microbial fungicide for the control of fungal diseases in rice, maize, sugarcane, cotton, millet and vegetables	Agropharm West Africa Ltd., Tema
468	Trustar 85WG	PCL/1699/00856G October 2016	Azoxystrobin (49%) + Terbuconazole (36%)	IV	Fungicide for the control of diseases in sweetcorn, rice, soybean, tomato and banana	Rainbow Agrosciences 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
469	Adwumaden 41 SL	PCL/16144/00864 G October 2016	Glyphosate (410g/l)	III	Herbicide for the control of annual,	S.O. Ansah Enterprise, Kejetia.

					perennial grasses and broadleaf weeds in field crops	Kumasi
470	Agronil 36EC	PCL/1610/00860G October 2016	Propanil (360g/l)	III	Herbicide for the control of annual grasses in rice	Reiss &Co. (Gh.) Ltd., Accra
471	Atraforce 50% SC	PCL/17145/00897 R February 2017	Atrazine (50%)	II	Herbicide for the control of annual and perennial broadleaf weeds and grasses in maize, and sugarcane,	Jubaili Agrotec Ltd, Kumasi
472	Atraforce 80% WP	PCL/17145/00898 R February 2017	(Atrazine 80%)	II	Herbicide for the control of annual and perennial broadleaf weeds and grasses in maize, and sugarcane,	Jubaili Agrotec Ltd, Kumasi
473	Atraherb 80WP	PCL/1698/00906R December 2016	Atrazine (80%)	II	Herbicide for the control of annual and perennial grasses and broadleaf weeds	J. K. Duku Enterprise, Kumasi
474	Atraplus 600SC	PCL/1699/00780G August 2016	Atrazine (300g/l) + Terbutylazine (300g/l)	III	Herbicide for the control of weeds in maize and sorghum	Rainbow AgroSciences Co., Ltd., Accra
475	Atrazine Super 80WP	PCL/1602/00811R August 2016	Atrazine (800g/kg)	III	Herbicide for the control of annual, perennial grass weeds in maize, sorghum and pineapple	Agrimat Limited, Accra
476	Benapa 460SL	PCL/1699/00853G October 2016	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., Accra
477	Bencinate 53WP	PCL/1610/00859G October 2016	Mefenacet (95%) + Bensulfuron-methyl (97.5%)	U	Herbicide for the control of grasses, sedges and broadleaf weeds in paddy rice	Reiss &Co. (Gh.) Ltd., Accra

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479						
480	Bonbuta	PCL/16149/00835 G October 2016	Butachlor (50%)	II	Herbicide for the control of annual, perennial broadleaf weeds in rice, groundnut and carrots	Bon Agro Company Ltd., Kumasi
481	Bon Nico	PCL/16149/00800 G October 2016	Niosulfuron (40g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Bon Agro Company Ltd., Kumasi
482	ButaClear 50EC	PCL/17184/00886 G February 2017	Butachlor (50%)	III	Pre-emergence herbicide for the control of annual, perennial and broadleaf weeds in paddy rice	Ganorma Agrochemicals, Tamale
483	Degan SC	PCL/17184/00883 G February 2017	Bispyribac sodium (455g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in paddy rice	Ganorma Agrochemicals, Tamale
484	Diz-Paraquat 20SL	PCL/1608/00807R August 2016	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial weeds and grasses in cereals and fruits	Dizengoff Gh. Ltd., Accra.
485	Flysate	PCL/16145/00877 G December 2016	Glyphosate (41%)	III	Herbicide for the control of annual, perennial weeds in cereals and vegetables	Jubaili Agrotec Limited, Kumasi
486	ForceUp Granular	PCL/16145/00878 G December 2016	Glyphosate Mono-ammonium salt (757g/kg)	III	Herbicide for the control of annual, perennial weeds in citrus	Jubaili Agrotec Ltd, Accra

487	Frankoquat 20SL	PCL/1639/00834R October 2016	Paraquat dichloride (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Frankatson Limited, Accra
488	Ganico 40EC	PCL/17184/00887G February 2017	Nicosulfuron (40g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in arable crops	Ganorma Agrochemicals, Tamale
489	Ganorherb SL	PCL/17184/00882G February 2017	2, 4-D Amine Salt (720g/l)	III	Herbicide for the control of annual, perennial weeds in maize	Ganorma Agrochemicals, Tamale
490	Ganorsate 360 SL	PCL/17184/00884G February 2017	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial weeds in arable crops	Ganorma Agrochemicals, Tamale
491	Ganorzine 80WP	PCL/17184/00885R February 2017	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds in maize	Ganorma Agrochemicals, Tamale
492	Gramoquick super SL	PCL/1698/00907R December 2016	Paraquat (200g/l)	II	Contact herbicide for the control of grasses and other weeds	J. K. Duku Enterprise, Kumasi
493	Gramotouch Super 20SL	PCL/16144/00865R October 2016	Paraquat (200g/l)	II	Herbicide for the control of grasses and broadleaf weeds in banana, rubber, coconut, oil palm, mango, corn and soybean	S.O. Ansah Enterprise, Kumasi
494	Halaxy 108EC	PCL/1699/00854G October 2016	Haloxypop-P-Methyl (108g/l)	IV	Herbicide for the control of weeds in cereals, leafy vegetables, pineapple, soybean, cowpea and cotton	Rainbow AgroSciences Co. Ltd., Accra
495	Hero Super 108EC	PCL/1643/00814G September 2016	Haloxypop-R-methyl ester (108g/l)	III	Herbicide for the control of annual grasses	Kumark Co. Ltd., Kumasi

					in vegetables and pulses	
496	King Kong	PCL/16149/00806 G August 2016	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial weeds and grasses in cereals, vegetables and fruit trees	Bon Agro Company Ltd., Kumasi.
497	Kodwooto 41SL	PCL/16129/00788 G August 2016	Glyphosate (410g/l)	III	Herbicide for the control of broadleaf weeds and grasses in arable crops	Akwees Man Agrochemical Enterprise, Kumasi
498	Impact EC	PCL/17173/00893 G February 2017	Haloxypop (108g/l)	III	Post-emergent herbicide for the control of annual and perennial grasses in vegetables, groundnuts and soybean	Agromonti Co. Ltd., Accra
499	Manazone Super 20SL	PCL/16129/00789 R August 2016	Paraquat dichloride (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses in arable crops	Akwees Man Agrochemical Enterprise, Kumasi
500	Mega Super	PCL/1643/00815G September 2016	Bispyribac sodium (400g/l)	III	Herbicide for the control of annual grasses in rice	Kumark Co. Ltd., Kumasi
501	Mofarno 160EC	PCL/1608/00830G October 2016	Quizalofop-p-methyl (35g/l)		Herbicide for the control of annual broadleaf weeds in soybean	Dizengoff Ghana Ltd., Accra
502	Pantera 40EC	PCL/1606/00783G August 2016	Quizalofop-P-Tefuryl (40g/l)	III	Herbicide for the control of annual, perennial grasses in vegetable crops	Calli. Ghana Ltd., Tema
503	Paraeforce 20SL	PCL/17145/00879 R February 2017	Paraquat dichloride (200g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice and vegetables	Jubaili Agrotec Ltd, Accra
504	Paraq SL	PCL/1726/00889R February 2017	Paraquat dichloride (24%)	II	Herbicide for control of broadleaf weeds and grasses in arable crops	The Candel Company Ltd., Accra

505	Pendimethalin 400EC	PCL/1643/00816G September 2016	Pendimethalin (40%)	III	Herbicide for the control of annual grasses and broadleaf weeds in rice, maize, onion and cotton	Kumark Co. Ltd., Kumasi
506	Phyto-General 360SL	PCL/1726/00890G February 2017	Glyphosate (360g/l)	III	Herbicide for control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	The Candel Company Ltd., Accra
507	Raze 20SL	PCL/16186/00793R August 2016	Paraquat dichloride (200g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Ivorychem Co. Ltd., Kumasi
508	Rhemazon e Super SL	PCL/1718/00908R January 2017	Paraquat dichloride (200g/l)	II	Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses	Rhemaco Enterprise, Kumasi
509	Ricecare 240SC	PCL/1699/00855G October 2016	Penoxsulam (240g/l)	IV	Herbicide for the control of broadleaf weeds and sedges in field crops	Rainbow Agrosiences Co. Ltd., Accra
510	Ridmax 510SL	PCL/1699/008851G October 2016	Glyphosate IPA (300g/l) + 2,4-D IPA (210g/l)	III	Herbicide for the control of annual, perennial weeds in field crops	Rainbow Agrosiences Co. Ltd., Accra
511	Riz-Diz	PCL/1608/00831G October 2016	Bispyribac sodium (100g/l)	III	Herbicide for the control of annual broadleaf weeds and grasses in rice	Dizengoff Ghana Ltd., Accra
512	Sinopat 41SL	PCL/16166/00910G December 2016	Glyphosate (41%)	III	Herbicide for the control of annual and perennial grasses and broadleaf weeds.	Dasimah Enterprise, Adum-Kumasi
513	Sun-Aceto EC	PCL/1657/00844G October 2016	Acetochlor (900g/l)	III	Herbicide for the control of annual and	Wynca Sunshine Agric Prdt

					perennial weeds in maize, soybean, cotton and peanut	&Trad. Co. Ltd, Accra.
514	Target 240SL	PCL/1699/00852G October 2016	Imazethapyr (240g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in soybean and cowpea	Rainbow Agrosiences Co. Ltd., Accra
515	United Force 360	PCL/17145/00896 G February 2017	Glyphosate (240g/l) + 2,4-D Amine (120g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses	Jubaili Agrotec Ltd., Kumasi
516	Viking 48SL	PCL/16186/00794 G August 2016	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Ivorychem Co. Ltd., Kumasi

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses
517	Voila EC	PCL/1635/00798G August 2016	Pretilachlor (225g/l) + Pyribenzoxim (15g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds, sedges and grasses in rice
518	Waano Waano 41SL	PCL/16190/00870 G December 2016	Glyphosate (41%)	III	Herbicide for the control of broadleaf weeds in arable crops
519	Weedcut 20SL	PCL/16145/00880 R December 2016	Paraquat dichloride (200g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice and vegetables
520	Weedcut 20SL	PCL/16145/00880 R February 2017	Paraquat dichloride (200g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice and vegetables

(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
521	Atonik SL	PCL/1606/00786G August 2016	Sodium 0-nitrophenolate (2g/l) + Sodium p-nitrophenolate (3g/l) + Sodium s-nitroguaiacolate (1g/l)	III	Plant Growth Regulator to improve crop development in rice	Calli Ghana Ltd., Tema

522	Sun-Mequat SL	PCL/1657/00847G October 2016	Chlormequat (50%)	III	Growth Regulator in anti-lodging of cotton	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.
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(B5) Nematicide

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
523	Nematox WP	PCL/1672/00863G October 2016	<i>Paecilomyces lilacinus</i> (1%)	III	Nematicide for the control of nematodes in rice, maize, pearl millet, citrus, soybean and tomato	Agropharm West Africa Ltd., Tema
524	Vytal 3G	PCL/1606/00785G August 2016	Oxamyl (30g/kg)	II	Nematicide for the control of nematodes and soil insects in tomatoes	Calli Ghana Ltd., Tema

(B6) (Repellants)

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
525	Bird Away SL	PCL/1657/00843G October 2016	Methyl anthranilate (264g/l)	III	Bird repellent for the control of birds.	Wynca Sunshine Agro Products and Trading Company (Gh) Ltd., Accra

(B7) (Rodenticide)

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
526	Baraki RB	PCL/1602/00810R August 2016	Bromadiolone (0.005%)		Rodenticide for the control of rats and mice	Agrimat Limited, Accra
527	Super Guard	PCL/1602/00812R August 2016	Bromadiolone (2.5%)		Rodenticide for the control of rats and mice	Agrimat Limited, Accra

(C) BANNED PESTICIDES

No	Name of Pesticide
528	2,4,5-T and its salts and esters
529	Aldrin
530	Binapacryl
531	Captafol
532	Chlordane
533	Chlordimeform
534	Chlorobenzilate
535	Dichlorodiphenyltrichloroethane (DDT)
536	Dieldrin
537	Dinoseb and its salts and esters
538	Dinitro- <i>ortho</i> -cresol (DNOC) and its salts (such as ammonium salt, potassium salt and sodium salt)
539	Endrin
540	HCH (mixed isomers)
541	Heptachlor
542	Hexachlorobenzene
543	Parathion
544	Pentachlorophenol and its salts and esters
545	Toxaphene
546	Mirex
547	Methamidophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)
548	Methyl-parathion (emulsifiable concentrates (EC) with at or above 19.5% active ingredient and dusts at or above 1.5% active ingredient)
549	Monocrotophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)
550	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))
551	Phosphamidon (Soluble liquid formulations of the substance that exceed 1000 g active ingredient/l)
552	Dustable powder formulations containing a combination of Benomyl at or above 7%, Carbofuran at or above 10% and Thiram at or above 15%
553	Methyl Bromide
554	Chlordecone
555	Alpha hexachlorocyclohexane
556	Beta hexachlorocyclohexane
557	Lindane
558	Pentachlorobenzene
559	Technical Endosulfan and its related isomers

Summary of Register of Pesticides as at February 2017

Category	FRE	PCL	Banned	Total
Insecticides	153	51	32	236
Fungicides	59	15	0	74
Herbicides	173	50	0	223
Plant Growth Regulators	8	2	0	10
Molluscicide	1	0	0	1
Rodenticides	0	2	0	2
Nematicides	4	2	0	6
Adjuvants	5	0	0	5
Biocides	11	0	0	11
Repellents	0	1	0	1
Total	414	123	32	569

Legend to Register of Pesticide

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).
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