FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

REVIEW OF PESTICIDE EVALUATION REPORT AND SAFE USE AND ACTION PLAN (PERSUAP) FOR USAID FUNDED FEED THE FUTURE GHANA AGRICULTURAL DEVELOPMENT AND VALUE CHAIN ENHANCEMENT PROJECT (FTF ADVANCE II)

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PROJECT/ACTIVITY DATA

Project/Activity Name:	Feed The Future Ghana Agricultural Development and Value Chain Enhancement Activity (FTF ADVANCE II)
Amendment (Y/N):	Y
Geographic Location(s) (Country/Region):	Ghana, Northern Region, Tamale / West Africa
Implementation Start/End:	February 2014 to April 2020
Organizational/Administrative Data	
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Date Prepared:	**August, 2019**

ENVIRONMENTAL ACTION RECOMMENDED (Place X where applicable)

Categorical Exclusion: **N/A** Negative Determination: **X**

Positive Determination: **N/A** Deferral: **N/A**

ADDITIONAL ELEMENTS: (Place X where applicable)

CONDITIONS: **X** PVO/NGO: **X** EMMP (SUAP): **X** ERR:

Contents

ACRONYMS

ADVANCE	Agriculture Development and Value Chain Enhancement
AESA	Agro-ecosystem Analyses
AI	Active Ingredient
BMP	Best Management Practice
BT	Bacillus thuringiensis (a bacteria that produces a toxin used as a pesticide)
CABI	Center for Agriculture and Bioscience International
CBO	Community Based Organisation
CRIG	Ghana Cocoa Research Institute of Ghana
DDT	Dichloro-Diphenyl-Trichloroethane
EC	Emulsifiable Concentrate (pesticide formulation)
EMMP	Environmental Mitigation & Monitoring Plan
EPA	Environmental Protection Agency
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
FAW	Fall Army Worm
FTF	Feed The Future
FRE	Fully Registered Pesticides
FBO	Farmer Based Organisation
GAMSAP	Ghana Advance Maize Seed Adoption Program
GAP	Good Agriculture Practice
GAIDA	Ghana Agric- Input Dealers Association
GCAP	Ghana Commercial Agriculture Project
GhEPA	Ghana Environmental Protection Agency

GIS	Geographic Information Systems
GPS	Global Positioning Systems
GSID	Ghana Seed Inspection Division
GUP	General Use pesticide
Ha	Hectares
HT	Highly Toxic
IEE	Initial Environmental Examination
IPM	Integrated Pest Management
MOFA	Ministry of Food and Agriculture (Ghana)
MRL	Maximum/Minimum Residue Level/Limit
MSDS	Material Safety Data Sheet
NASTAG	National Seed Trade Association of Ghana
NF	Nucleus Farmer
NPASP	Northern Presbyterian Agricultural Services and Partners
NPV	Net Present Value
PERSUAP	Pesticide Evaluation Report and Safe Use Action Plan
PFRD	Pesticide and Fertility Regulatory Division
pH	log of Hydrogen concentration, measure of acidity
PHI	Pre-Harvest Interval
PIC	Prior Informed Consent (a treaty on toxic pesticides)
POPs	Persistent Organic Pollutants (a treaty on toxic persistent pesticides)
PPE	Personal Protection Equipment
PPRSD	Plant Protection and Regulatory Services Directorate
PSB	Phosphate-solubilizing bacteria
R&D	toxin Reproductive and Developmental toxin
RUP	Restricted Use Pesticide

S&C	Standards and Certification
SSP	Spray Service Provider
SUAP	Safe Use Action Plan
UN	United Nations
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USEPA US	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
WAATP	West African Agricultural Transformation Program
WHO	World Health Organization
ZOI	Zone of Influence

EXECUTIVE SUMMARY

This PERSUAP provides a general assessment of the use of pesticides in Ghana as a direct or indirect result of assistance provided through USAID funded Feed The Future Agricultural Development and Value Chain Enhancement Activity (FTF ADVANCE II). The focus of FTF ADVANCE II is to increase the competitiveness of maize, rice and soya value chains in northern Ghana to foster economic growth and reduce poverty, in line with USAID funded Ghana's FTF strategy.

This report has screened the pesticides typically recommended by extension agents and used by farmers on the target crops based on their registration status with the United States Environmental Protection Agency (USEPA) as well as the Ghana EPA (GhEPA) registration status as at December 2018. In section 15 of the Pesticide Control and Management Act (Act 490) Part II, pesticides which have not been registered cannot be used in Ghana.

The report stresses the use of non-chemical methods as an important consideration in pest/disease management through the adoption of an integrated pest management (IPM) approach. The report also lays out the extent to which the proposed pesticides will be part of an IPM program, stressing the need for the adoption of rationale pesticide use (RPU) with the aim to maximize efficacy and mitigate the problems associated with pesticides through improving precision in biological activity of control agents. Thus, applying good agronomic practices is key, particularly in terms of integrated soil management, nursery management, seed selection, appropriate and timely land preparation practices, row and appropriate spaced planting, record keeping, water management, to ensure environmental sustainability and natural resource conservation. Harvest and post-harvest as well as marketing strategies are all seen as integral parts of the pest management strategy.

The report is presented in 3 major parts with annexes. Part I lays out the background on FTF ADVANCE II and PERSUAP. Part 2 outlines the results of the pesticide evaluation study addressing the major issues concerned with compliance with the USAID PERSUAP procedures. Part 3 proposes a pesticide safer use action plan. The annexes of the report contain more detailed and relevant documentation to various aspects of this report.

PART 1: INTRODUCTION

1.1 Project Background

Feed The Future Ghana Agricultural Development and Value Chain Enhancement (FTF ADVANCE II) program is a USAID funded project implemented in northern Ghana. The project goal is to increase the competitiveness of the maize and soybean value chains through increased market access and trade; increased agricultural productivity and strengthened local capacity for advocacy and activity implementation. The project has been implemented since February 2014 and will end in April 2020. In its final year, the project focuses on local capacity strengthening efforts through behavior change and business networking. The project will however continue to implement underlying agribusiness activities to foster crop productivity, by improving access to agricultural machinery, inputs and services. Some of these activities involve the use, storage and marketing of pesticides. USAID approved a PERSUAP for use in 2015, and two subsequent amendments in September 2016 and February 2017. The Pesticide Evaluation Report and Safe Use and Action Plan (PERSUAP) evaluates background and risks across the inputs sectors in the project area including treatment of seed, field crops, spraying services as well as processing. It promotes the use of preventive and curative integrated pest management (IPM) and good agriculture practices (GAP). It analyzes pesticide active ingredients registered for use in Ghana and disapproves/rejects pesticides containing active ingredients that are: not Environmental Protection Agency (EPA) registered, Restricted Use Pesticides (RUPs), Class I, Known Carcinogens, and Known Water Pollutants.

1.2 Objectives

This report's objective is to revise and update the project's PERSUAP for its final year's activities and provide guidelines for the project team and participants to remain compliant with USG environmental regulations on any activities that involve pesticide use, distribution or sale. This PERSUAP will identify available pesticides and their applicability to the maize and soybean value chains in the zone of influence (ZOI) in Ghana and provide recommendations and information about their handling, use and disposal.

Training sessions organized to educate farmers and other stakeholders in GAP and IPM will promote judicious use of pesticides.

The FTF ADVANCE II pesticide management plan seeks to-

I. Ensure compliance with Title 22 of the Code of Federal Regulations section 216,

II. Promote safe use of agrochemicals, and

III. Prevent environmental pollution that can result from improper pesticide applications and disposal.

The project will implement programs that reduce reliance on agrochemicals through an IPM approach. When the use of pesticides is unavoidable, the project will advocate for the use of personal protective equipment (PPEs) that is appropriate for the specific agrochemical toxicity. The project will also take precaution to prevent the re-use of empty pesticide containers by promoting safe disposal methods. Women and children are strongly discouraged from pesticide applications. The project will further ensure that highly toxic and banned pesticides are not promoted. Safe use training will be incorporated in any pesticide promotion activities by the project.

1.3 Methodology

The information gathered through literature reviews were critically analyzed in the context of FTF ADVANCE II objectives, climate smart strategy, and Ghana's pest management policy following the 12-point pesticide evaluation criteria as provided for in Regulation 216. A detailed desk study and analysis of relevant documents was also conducted.

The reference documents included the following:-

- United States Environmental Protection Agency, Ingredients Used in Pesticide Products (https://www.epa.gov/ingredients-used-pesticide-products)
- EU Pesticides Database - Active Substances (https://ec.europa.eu/food/plant/pesticides/eu-pesticides database/public/?event=activesubstance.selection&language=EN)
- Environmental Protection Agency, Ghana (Revised Register of Pesticide December 2018)
- Title 22 of the Code of federal regulations Section 216 (https://www.usaid.gov/our_work/environment/compliance/22cfr216#216.1)
- FTF ADVANCE II PERSUAP, 2015
- FTF ADVANCE II PERSUAP, Amendment 1, 2016
- FTF ADVANCE II PERSUAP Amendment2_Fall Armyworm_Spinosad_, 2017Ministry of Food and Agriculture (MOFA) / Ghana Commercial Agriculture Project (GCAP) Pest Management Plan (PMP)
- Pest Management Plan of **West African Agricultural Transformation Programme (**WAATP) DRAFT,2018
- Diseases List for Ghana, 2018

- Pest List of Ghana, 2016
- https://pesticidestewardship.org/ipm/

1.4 Summary of Findings & Recommendations

This PERSUAP addresses the condition of USAID/Ghana initial environmental examination (IEE) for the project to maintain its negative determination, meaning that the project will not implement any activities expected to have significant adverse effect on the environment.

This PERSUAP covers the following:

1. FTF ADVANCE II PERSUAP, 2016 and its amendment, 2017;
2. Review of the Ghana Environmental Protection Agency pesticide register, dated December 2018;
3. Diseases, weeds, insects and other pests of each crop and the choice of the registered pesticides;
4. Safer pesticide use action and implementation plan;
5. A guide to training on safe pesticide use;
6. A host of useful resources in the annexes.

The PERSUAP will closely inform the technical assistance and capacity building needed for FTF ADVANCE II staff, partners and beneficiary actors during the final year implementation of the project.

1.4.1 Addressing IPM and crop protection capacity

Guidelines for providing training on IPM are provided in Annexes. The project will incorporate IPM training into its core activities so that all participants will receive comprehensive training in the responsible use of pesticides during the project implementation period. GAPs will also be promoted as a way of improving productivity of smallholder farmers.

1.4.2 Pesticide Choice

Selections of the least hazardous yet effective products are considered in this report. The choice of preferred products is based on criteria such as the toxicity classification, suitability for integrated pest management, registration approval by the United States Environmental

Protection Agency (USEPA) and Ghana Environmental Protection Agency (EPA), and its availability on the market as well as accessibility and affordability.

1.4.3 Training

This PERSUAP proposes training programs where the project will support and strengthen Spray Service Providers (SSPs) to provide professional spray services using the best safety methods available to minimize pesticide poisoning of persons and the environment. Field officers will work closely with the EPA, Plant Protection and Regulatory Services Directorate (PPRSD), Ghana Agri-input Dealers Association (GAIDA), National Seed Trade Association of Ghana (NASTAG) and other partners to train project beneficiaries. The safe use action plan will be a guideline for all training purposes.

1.4.4 Environmental conservation and Climate Smart Agriculture:

The key to sustainable agricultural production is environmental conservation and climate smart agriculture. A number of challenges influencing the choice of pest management approach including application of IPM and use of chemical crop protection products (Agrochemicals) have been identified. Methods for reducing pests must be environmentally acceptable and economically viable. Continued training on safer use of agrochemicals especially guidance on how to use the products in fragile production environments such as areas close to river beds, surface water bodies, protected areas, and similar areas have been identified.

Table 1.1: Analysis of issues identified in Pesticides Evaluation Report (PER) and conclusions

Issues	Analysis and conclusions
Reduce reliance on pesticides	Farmers do not normally select crop varieties based on pesticide need but more on expected economic returns. However, in order to minimize the potential losses from pests and diseases, a useful starting point is to obtain appropriate planting materials of crop varieties that have been proven, through local field trials, to demonstrate acceptable levels of resistance or tolerance to major pests and diseases. These may be obtained by working in collaboration with CSIR-SARI, CSIR-CRI, and local Universities. To reduce over reliance on pesticides, farmers should also be encouraged to cultivate plants that host natural enemies of pests and disease pathogens and practice crop rotational systems of farming[1].
	Smallholder farmers do not view investments in personal protective equipment (PPEs) as an economically useful venture. Farmers are

[1] FTF ADVANCE PERSUAP II review;

Promote use of PPEs	aware of the potential hazards when spraying pesticides but are not fully appreciative of the need to be protected. The project has developed a corps of commercial Safe Spray Providers (SSPs) that are linked to either input dealers or NFs. This way, out growers who are associated to an NF can access the services of SSPs from a centralized and coordinated point at a fee, thus making the purchase of PPE unnecessary. This approach has the advantage of reducing the number of inexperienced and casual users exposed to pesticides. In addition, this market-driven approach does not only help ensure effective and efficient application and safe handling, but provides a medium for the dealers to promote their products and gain respect of customers under the premise that judicious application of pesticides will maximize crop yields and can convince farmers of the need to continue purchasing the product. The initial cost of these PPEs is perceived by many farmers as unaffordable. The project should encourage the production and use of local cheap materials such as old rice or fertilizer sacks sewn into overalls that can be affordable for these smallholder farmers.
Discourage re-use of pesticide containers	Preventing re-use of pesticide containers is still a big challenge among farmers and their families. Empty pesticide containers are used to store water, salt, pito, and many other items in local villages. A regular program of public awareness, education and training of all categories of farm workers on the risks associated with reuse of pesticide containers is needed. These should include radio jingles and training topics during GAPs dissemination and field day trainings. In addition, a reward system where farmers are given incentives for packing and returning used pesticide containers will go a long way to discourage re-use of these containers. This should be spearheaded by Agrochemical dealers to ensure sustainability.
Promote safe disposal of pesticide containers	The Ghana EPA recommends that empty pesticide containers are punctured/destroyed and buried. Burning is not recommended. There have been programs that encouraged farmers to return empty containers to a central point for collection and re-use, but these have suffered the challenges of sustainability. Proper disposal of pesticide containers therefore continues to be a big challenge among smallholder famers in northern Ghana. It is easier to have trained SSPs do proper disposal than individual farmers. There is the need for collaboration between FTF ADVANCE project and EPA to compel pesticide dealers to mop up used pesticide containers from farmers as a way of reducing or eliminating these used containers from the environment. Radio programs should be carried out to educate farmers on the need to return used pesticide containers to the point of purchase.
	Water bodies in Ghana, including the large Lake Volta, have been found to be contaminated with multiple pesticides such as DDT and lindane. This has a secondary contamination effect on lake sediments and freshwater fish. Contamination in food produce includes, for example, lettuce in Kumasi in with levels of DDT up to 400 micrograms per kilogram (or 400 parts per billion). Fianko et al (2011), Darko and Acquaah (2008) and Laary (2012) all report pesticide contamination in multiple areas of the food chain and natural

Minimize ground and surface water contamination	environment. Water samples from rivers in the intensive cocoa growing areas in the Ashanti and Eastern Regions of Ghana have been found to contain lindane and endosulfan. Water samples from Akumadan, a vegetable farming community in the Ashanti Region and different areas of Ghana revealed the presence of significant levels of pesticide residues. The possible reasons for pesticides reaching these aquatic environments are through direct runoff, leaching, and careless disposal of empty containers, equipment washing, and use of toxic products. In the Upper East Region of Ghana, a 2012 report by NPASP stated that 15 farmers died from suspected pesticide poisoning in 2010. A quarter of farmers surveyed had recently suffered health problems from inhaling pesticides because no protective clothing or masks are used when spraying. Farmers using agro-chemicals are most at risk of poisoning and contamination, but because these chemicals are also making their way into the environment and food produce, the general public is also at risk. Every precaution would be taken to minimize spraying near standing water bodies or streams, and wells. In particular, spray operators would be trained on the risks associated with (a) pouring excess pesticide mixtures in rivers, streams or ponds, (b) washing pesticide application equipment in rivers, streams, ponds and other water bodies and (c) discarding empty pesticide containers in rivers, streams and ponds.
Minimize potential for using pesticides more than necessary	A basic principle of IPM is judicious use of pesticides. This means that chemical pesticides will be used only as a last resort, for example, in the case of unexpected pest invasion by migratory pests such as armyworms and grasshoppers or grain eating birds. Pesticides would also only be used when it is economic to do so, on a needs basis, after detailed field surveys and assessment of the extent of the pest distribution schedule to prevent pest incidence and damage
Conduct safe pesticide use training	It is important to ensure that beneficiary farmers do not use locally available pesticides containing banned substances and unregistered products. All field staff will be trained on how to apply this PERSUAP to their work on specific topics outlined in Annex 4 of this PERSUAP.

Table 1.2: Actions required by Objectives/Issues identified in PERSUAP

Objective	Issues	Interventions required	Outputs
A. PESTICIDE RISK AWARENESS			
A1. Reduce reliance on pesticides.	• Local pest control options are limited. • Pesticides are costly and may not be used safely.	• Follow GAPs recommendations • Use of IPM • Practice crop rotation •Select resistant/tolerant varieties	• Reduced incidence of diseases and pests. • More farmers adopt IPM.

A2. Promote use of PPEs	• Farmers do not fully appreciate the importance of PPEs • Farmers do not fully appreciate the potential hazards of using pesticides.	• Continuous education of farmers on the importance of PPEs • Promote use of less hazardous agrochemicals	• Increased use of PPEs by farmers.
A3. Discourage re-use of pesticide containers	• Containers are used to store household items including food. • Farmers are unaware of the dangers involved.	• A sustained campaign to discourage re-use of containers. • Provide a central point for collecting and disposing containers. • Collaboration between FTF ADVANCE II and EPA to embark on a campaign to compel pesticide dealers to mop up used containers from farmers.	• Reduced number of people using pesticide Containers.
A4. Discourage women and children from pesticide application	• Limited farm labor compelling women to apply pesticides. • Inability of women to pay for SSP services.	• Provide special training to women on the effects of pesticides on women and children. Training methodology should be in the form of video training where women would see the hazards associated with pesticides exposure.	• Reduced cases of women applying pesticides.
B. PREVENT ENVIRONMENTAL POLLUTION			
B1. Promote safe disposal of pesticide containers	• Empty pesticide containers are either left on farms or reused for domestic purposes • Some farmers are not aware of the proper forms of disposal	• Set up container collection centers with nucleus farmers where all containers used by outgrowers will be collected. • Gather all pesticide containers for return to manufacturers for recycling or reuse.	• Reduced incidence of empty containers littered on farms

B2. Minimize ground and surface water contamination	• Pesticide used near water • Pesticide used on wet fields with flowering water • Pesticide used immediately after rainfall • Burying of used pesticide containers in the soil	• Reduce soil disturbance practices such as tillage • Leave a buffer to rivers and streams of at least 5m to flat land, 10m to gentle slope, 15m to slope >30º • Encourage conservation agriculture	• Farmers adopt conservation farming methods
B3. Minimize potential for using pesticides more than necessary.	Farmers may apply pesticides, especially for storage grain, without actually encountering the threat of a pest invasion leading sometimes to avoidable high cost of agrochemicals and over application of pesticides.	• Promote GAPs and IPM to reduce over reliance on pesticides. Proper and intense education of farmers on the correct dosages for all classes of agro-chemicals. • Review pesticide regulation to include usage and restricted doses of pesticides. Restricted use of certain pesticides as well as sanctions for non-compliance. • Promotion of ecological infrastructures i.e. creating a border round the field with flowering plants which will encourage the abundance of natural enemies as well as pollinators to minimize pest populations and increase yield.	More farmers able to interpret Pesticide labels
C. ACTIONS TO ENSURE COMPLIANCE			
C1. Conduct safe pesticide use training	• Farmers and other persons who handle pesticides have inadequate knowledge of pesticide products and labels.	• Develop training content targeting specific groups – farmers, women, dealers, partners, extension agents both public and private.	• Training contents developed

C2. Promote the services of SSPs	• Farmers may do their own spraying because they have no access to trained spray service providers. • Farmers who do their own spraying often do not wear PPEs and may apply more chemical than needed.	• Work with NFs and FBOs to include spray services in their extension support to outgrowers. • Provide regular training to SSPs on environmental safety procedures.	• Training programs for SSPs conducted
C3. Avoid the use of highly toxic products	• Farmers do not appreciate the short and long term consequences of very toxic products on their health and the environment. • Some farmers simply do not know the toxic levels of the products they use and the need to avoid them.	• Train farmers to read and understand the symbols and colors on pesticide labels. • Promote use of non-chemical pest control option	• Farmers adopt IPM approaches

PART 2: PESTICIDE EVALUATION REPORT

The information presented in the pesticide evaluation report corresponds to the 12 factors in 22 CFR 216.3, USAID's Pesticide Procedures. It addresses pesticide choices based upon environmental and human health issues, uses, alternate options, IPM, biodiversity, conservation, training, PPE options, monitoring and mitigation recommendations.

2.1 USEPA & GhEPA registration status of the proposed pesticide

USAID is effectively limited to using pesticide active ingredients registered in the U.S. by the U.S. Environmental Protection Agency for the same or similar uses. Other pesticides not registered in the U.S. may be authorized, but only if the USAID program can show that alternatives are not available, as required under USAID pest management guidelines for the use on non-U.S. registered pesticides. USAID also require that host country pesticide registration procedures are identified and followed.

Issue: Unregistered pesticides

The GhEPA register of pesticides is revised quarterly to take out products that have lost their registration status and to include newly registered substances. There are basically 2 categories of registration. A full registration is valid for 3 years, while a provisional clearance permit is valid for up to a year. It is not uncommon to find unregistered pesticide products in pesticide retail shops within the project area. Pesticides marked NOT FOR SALE may also be found, as well as pesticides registered for use in neighboring Burkina Faso, Togo, and Ivory Coast.

Recommendation:

This PERSUAP lists the pesticide products that are recommended for use on the project in Table 2.3 This approach eliminates the potential for Field Officers to select pesticides based on only recommended Active Ingredients which eliminates the possibility of selection of unregistered pesticides.

Issue: Unlicensed pesticide dealers

On market days in remote communities, provision shops and table top sellers may be seen selling pesticide products as part of their business. These are not licensed pesticide sellers. They also lack the required training to transport and store pesticides in a safe manner to minimize human and environmental contamination. This practice is unlawful. Purchasing pesticides from such retailers is also unlawful

Recommendation:

The project is already working with a number of registered pesticide dealers and linking farmers to them. The linkage between farmers and pesticide dealers should be sustained by encouraging pesticide dealers to sponsor demonstration plots and attend field days as well.

Table 2.1: List of recommended pesticides, registration status and the basis for their selection

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
INSECTICIDES									
1.	Abamectin (18g/L)	Bomec EC	RUP	II-III	GUP	II	Maize Soy	Effective for controlling hoppers, beetles, aphids, and caterpillars	Readily available and particularly effective against hoppers in soy fields
2.	Acetamiprid (20g/L) ambda cyhalothrin (15g/L)	K-Optimal EC	GUP	III	GUP	II		Broad spectrum Insecticide	Registered in Ghana, readily available and effective
3.	Dimethoate (400g/L)	Dimeking EC	GUP	II	GUP	II		Broad spectrum Insecticide	Registered in Ghana, readily available and Effective
4.	Imidacloprid (200g/L)	Dimiprid 20SL	GUP	II-III	GUP	II	Maize	Insecticide-fungicide powder for seed	Contact and ingestion, Systemic

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								dressing. Effective against aphids, leafhoppers and fungi.	and broad spectrum; widely used insecticide with relatively low human toxicity
5.	Indoxacarp(30g/L) Acetamiprid(16g/L)	Viper 46EC	GUP	III	GUP	II	Maize, soya	Effective against chewing, biting, and sucking insects	Readily available on the market. Protective clothing available.
6.	Lambda-cyhalothrin(25g/L)	Lambdacot EC	RUP	I-III	GUP	II	Maize	Effective against hoppers, beetles, aphids and their caterpillars	Readily available on the market. Protective clothing available.
7.	Lambda-cyhalothrin(25g/L)	Striker EC	RUP	I-III	GUP	II	Maize	Effective against hoppers, beetles, aphids and their caterpillars	Readily available on the market. Protective clothing available.
8.	Lambda-cyhalothrin(25g/L)	Lambda Master2.5EC	RUP	I-III	GUP	II	Maize	Effective against hoppers, beetles, aphids and their caterpillars	Readily available on the market. Protective clothing available.
9.	Lambda-cyhalothrin(25g/L)	Rainlambda2.5EC	RUP	I-III	GUP	II	Maize	Effective against hoppers, beetles, aphids and their caterpillars	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
10.	Pirimiphos-methyl (80g/l) + Permethrin (15g/l)	Antuka 95EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of maize *weevil cowpea weevil,* aphids and bollworms in cereals and legumes	Readily available on the market. Protective clothing available.
11.	Emamectin-benzoate (1.9%)	Attack 1.9 EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of insect pests in vegetables	Readily available on the market. Protective clothing available.
12.	Lambda-cyhalothrin (25g/l)	Bossmate 2.5EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of insect pests in vegetables, cowpea and soybean	Readily available on the market. Protective clothing available.
13.	Emamectin benzoate (5%)	Control 5WDG	GUP	II	GUP	II	Maize, soya	Insecticide for the control of aphids, worms and borers in vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
14.	Emamectin benzoate (48g/l) + Acetamiprid (64g/l)	Ema Star 112EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of whiteflies, diamondback moth, aphids in okra and eggplant	Readily available on the market. Protective clothing available.
15.	Maltodextrin (282g/l)	Eradicoat T	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in fruits and vegetables	Readily available on the market. Protective clothing available.
16.	Profenofos (40%) + Cypermethrin (4%)	Hitcel	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in field crops	Readily available on the market. Protective clothing available.
17.	Acetamiprid (20g/l) + Lambda-cyhalothrin (16g/l)	K-Optimal EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of insect pests in vegetables	Readily available on the market. Protective clothing available.
18.	Lambda-cyhalothrin (25g/l)	Lambad 2.5 EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
18.	Dimethoate (300g/l) + Lambda-cyhalothrin (15g/l)	Lamsate EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of aphids, thrips, planthoppers, whiteflies in cowpea, soybean, cotton, maize, sorghum, millet, melons and yams	Readily available on the market. Protective clothing available.
19.	Oxymatrin (2.4%)	Levo 2.4SL	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pest in vegetables and fruit crops	Readily available on the market. Protective clothing available.
20.	Dimethoate (400g/l)	Methoate 40EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in vegetables and fruit crops	Readily available on the market. Protective clothing available.
21.	Spirotetramat (100g/l)	Movento 100 SC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in fruits and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
22.	Emamectin Benzoate (5%)	Porselen 5 SG	GUP	II	GUP	III	Maize, soya	Insecticide for the control of worms and other insect pest in cabbage	Readily available on the market. Protective clothing available.
23.	Emamectin-benzoate (1.9%)	Protect 1.9EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in cotton, vegetables and maize	Readily available on the market. Protective clothing available.
24.	Thiamethoxam (350g/l)	Raintham 350 SC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in vegetables and fruit crops	Readily available on the market. Protective clothing available.
25.	Novaluron (100g/l)	Rimon 10 EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in cabbage, tomato and pepper	Readily available on the market. Protective clothing available.
26.	Imidacloprid (200g/kg) + Metalaxyl (200g/kg)+ Anthraquinone (40g/kg)	Seed Power 44 WS	GUP	II	GUP	II	Maize, soya	Insecticide/fungicide for the control of downy mildew and damping off diseases and insect pests in	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								cereals, sorghum, soybean and seed treatment	
27.	Imidacloprid (350g/l)	Seed Shield	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in field crops	Readily available on the market. Protective clothing available.
28.	Thiamethoxam (30g/l)	Spike 30SC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pests in vegetables and cereals	Readily available on the market. Protective clothing available.
29.	Spinosad (0.24g/l)	Success Appat	GUP	II	GUP	U	Maize, soya	Insecticide for the control of fruit flies in fruits and vegetables	Readily available on the market. Protective clothing available.
30.	Dimethoate (40%)	Tornado EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of insect pest in rice, cotton, citrus and vegetables	Readily available on the market. Protective clothing available.
31.	Indoxacarb (60g/l) + Acetamiprid (20g/l)	Viper Super 80EC	GUP	II	GUP	II	Maize, soya	Insecticide for control of cocoa mirids	Readily available on the market. Protective clothing

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
									available.
32.	Ethyl palmitate	Adepa Agro Organic Pesticide	GUP	II	GUP	U	Maize, soya	Insecticide for the control of mites, ticks, caterpillars, mealybugs and bacteria blight in vegetables, cashew, mango and citrus	Readily available on the market. Protective clothing available.
33.	Bt (55%) + Monosultap (45%)	Agoo	GUP	II	GUP	III	Maize, soya	Insecticide for the control of diamondback moth and fall army worm in maize and cabbage	Readily available on the market. Protective clothing available.
34.	Emamectin-benzoate (50g/kg)	Chemomectin 50SG	GUP	II	GUP		Maize, soya	Insecticide for the control of Fall armyworm in maize	Readily available on the market. Protective clothing available.
35.	Deltamethrin (2.5 g/l)	DeltaGold 2.5 EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of Fall armyworm in maize	Readily available on the market. Protective clothing

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
									available.
36.	Soybean Oil Extract	Greenline 88	GUP	II	GUP	U	Maize, soya	Insecticide for the control of flies, whiteflies, red spidermite, mosquito larvae and biting and sucking insects in cowpea	Readily available on the market. Protective clothing available.
37.	Imidacloprid (15%) + Lambda-cyhalothrin (5%)	Imicare Plus	GUP	II	GUP	II	Maize, soya	Insecticide for the control of contact and stomach acting insects in fruit trees, maize, sorghum, millet, cowpea, soybean, groundnut, cassava, oil palm and vegetables	Readily available on the market. Protective clothing available.
38.	Alpha-cypermethrin (75g/l) + Teflubenzuron (75g/l)	Imunit	GUP	II	GUP	II	Maize, soya	Insecticide for the control of fall armyworm in maize	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
39.	Lambda-cyhalothrin (2.5%)	Intact 2.5EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of bollworms, leafhoppers, caterpillars, and strainers in cotton, maize and vegetables	Readily available on the market. Protective clothing available.
40.	Karanjin (900g/l)	Karanj Bio	GUP	II	GUP	III	Maize, soya	Insecticide for the control of leaf-eating beetle, spiny bollworm and pink bollworm in okro	Readily available on the market. Protective clothing available.
41.	Azadirachtin (0.3%)	NeemAzal EC	GUP	II	GUP	U	Maize, soya	Insecticide/miticide for the control of caterpillar, beetles, aphids, leafminer, thrips, grasshoppers, whiteflies, leaf hopper in paddy rice, cotton and tomatoes	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
42.	Azadirachtin (860g/l)	Neemox Bio	GUP	II	GUP	III	Maize, soya	Insecticide for the control of aphids, bollworms and diamondback moth in tomatoes and other vegetables	Readily available on the market. Protective clothing available.
43.	Azadirachtin (3%)	Neem Seed Oil	GUP	II	GUP	U	Maize, soya	Insecticide for the control of Fall Armyworm in maize	Readily available on the market. Protective clothing available.
44.	White Mineral Oil	Organic JMS Stylet Oil	GUP	II	GUP	U	Maize, soya	Insecticide/ fungicide for the control of aphids, mites, thrips, powdery mildew, botrytis and rust in vegetables and fruits	Readily available on the market. Protective clothing available.
45.	Azadirachtin (1%)	Ozoneem	GUP	II	GUP	II	Maize, soya	Insecticide for the control of fall armyworm, diamondback moth in maize, okra and cabbage	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
46.	Profenofos (500g/l) + Lufenuron (50g/l)	Ronfos 550 EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of pod borers, bollworm, beet armyworm, leaf moths in kidney bean, tomato and cabbage	Readily available on the market. Protective clothing available.
47.	Acetamiprid (32g/l) + Lambda-cyhalothrin (30g/l)	Sauveur 62EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of fall armyworm in maize	Readily available on the market. Protective clothing available.
48.	Bifenthrin (100g/l)	Seizer EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of mirids in cocoa	Readily available on the market. Protective clothing available.
49.	Imidacloprid (210g/l) + Beta-cyfluthrin (90g/l)	Spartan 300 OD	GUP	II	GUP	II	Maize, soya	Insecticide for the control of armyworm, stem borer and bollworms in rice and maize	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
50.	Emamectin-benzoate (19.2g/l)	Strike 1.9EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of leaf-eating beetle, spiny bollworm and pink bollworm in okro	Readily available on the market. Protective clothing available.
51.	Bisultap (400g/l)	Sultan 400SL	GUP	II	GUP	II	Maize, soya	Insecticide for the control of armyworm and stem borers in maize and rice	Readily available on the market. Protective clothing available.
52.	Fipronil (25g/l)	Termidor SC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of termites in cabbage, onion, eggplant and maize	Readily available on the market. Protective clothing available.
53.	Methomyl (440g/l) + Novaluron (35g/l)	Voraz 475EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of Fall army worm in maize	Readily available on the market. Protective clothing available.
54.	Acetamiprid (50g/l) + Emamectin-benzoate (20g/l)	Stricker Super 70EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of Fall armyworm in maize	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
55.	Methoxyfenozide (300g/l) + Spinetoram (60g/l)	Uphold 360SC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of fall armyworm in maize	Readily available on the market. Protective clothing available.
56.	Methomyl (440g/l) + Novaluron (35g/l)	Voraz 475EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of fall army worm in maize	Readily available on the market. Protective clothing available.
57.	Sophora flvescen plant extract (25%) + Emamectin-benzoate (1%)	Warrior Super 26EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of Fall armyworm in maize	Readily available on the market. Protective clothing available.
58.	Teflubenzuron (50g/l) + cypermethrin (20g/l)	WormAtack EC	GUP	II	GUP	III	Maize, soya	Insecticide for the control of fall armyworm in maize	Readily available on the market. Protective clothing available.
59	Pirimiphos-methyl (250g/l)	Ateco Super 25 EC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of insect pests in stored cereals, cowpea and soybean	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
60	Aluminium phosphide (57%)	Dastoxion T	GUP	Ib	GUP	Ib	Maize, soya	Insecticide for the control of insect pests in stored produce	Readily available on the market. Protective clothing available.
61	Magnesium phosphide (56%)	Degesch Plate	GUP	Ib	GUP	Ib	Maize, soya	Insecticide for the control of insect pests in stored grains	Readily available on the market. Protective clothing available.
62	Imidacloprid (233g/l) + Thiram (107g/l) + Pencycuron (50g/l)	Monceren GT 390 FS	GUP	II	GUP	II	Maize, soya	Insecticide/ fungicide for seed treatment	Readily available on the market. Protective clothing available.
63	Aluminium Phosphide (56%)	Phostoxin T	GUP	Ib	GUP	Ib	Maize, soya	Insecticide for the control of insect pests in stored grains	Readily available on the market. Protective clothing available.
64	Aluminium phosphide (57%)	Protex 57TB	GUP	Ib	GUP	Ib	Maize, soya	Insecticide for the control of insect pests in stored produce	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
65	Pyrethrum (10%)	Super Agro Blaster	GUP	II	GUP	II	Maize, soya	Insecticide for the control of insect pests in stored grains	Readily available on the market. Protective clothing available.
66	Beta-cyfluthrin (12.5%)	Supercare SC	GUP	II	GUP	II	Maize, soya	Insecticide for the control of insect pest in stored grains and household pests	Readily available on the market. Protective clothing available.
67	Aluminium phosphide (57%)	Thomaxin P	GUP	Ib	GUP	Ib	Maize, soya	Insecticide for the control of insect pests in stored produce	Readily available on the market. Protective clothing available.
68	Deltamethrin (3g/kg)	Zerofly Storage Bag	GUP	III	GUP	III	Maize, soya	Insecticide for the control of insect pests in stored grains	Readily available on the market. Protective clothing available.
FUNGICIDES									
1	Imidacloprid(350g/kg) Thiram(100g/kg) Metalaxyl-M(35g/kg)	Calthio Mix 485WS	GUP	II-III	GUP	II	Maize, soya	Fungicide for the control of diseases in maize	Relatively low human toxicity, readily available on market, properly packaged.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
2	Mancozeb80%WP	Rainmancoz80 WP	GUP	IV	GUP	III	Maize, soya	Broad spectrum fungicide with protective properties	Available and registered in Ghana. Protective clothing available.
3.	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	Amistar Top 325SC	GUP	III	GUP	III	Maize Soy	Systemic fungicide for the control of early blight, late blight, powdery mildew, leaf spot, anthracnose and rust in beans, pea, tomatoes and pepper	Available and registered in Ghana. Protective clothing available.
4	Azoxystrobin (200g/l) + Difenoconazole (125g/l)	Five Star 325 SC			GUP	U	Maize Soy	Fungicide for the control of brown spot, blackspot, rust and white mould in cabbage, cowpea, soybean, bulb vegetables, groundnut and sweetpotatoes	Available and registered in Ghana. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
5.	Azoxystrobin (49%) + Tebuconazole (36%)	Trustar 85WG			GUP	IV	Maize Soy	Fungicide for the control of diseases in sweetcorn, rice, soybean, tomato and banana	Available and registered in Ghana. Protective clothing available.
6.	Four atoxigenic Aspergiluss flavus strains (0.0005%)	Aflasafe GH01			GUP	U	Maize Soy	Fungicide for the control of aflatoxins in maize, groundnuts and sorghum	Available and registered in Ghana. Protective clothing available.
7.	Four atoxigenic Aspergiluss flavus strains (0.0005%)	Aflasafe GH02			GUP	U	Maize Soy	Fungicide for the control of aflatoxins in maize, groundnuts and sorghum	Available and registered in Ghana. Protective clothing available.
HERBICIDES									
I	2,4-D Amine (720g/L)	Wiper 720SL	GUP	II	GUP	II	Maize Soy	Selective Herbicide for the control of broadleaf weeds	Selective herbicide available and registered in Ghana. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
2	2,4-D Amine (720g/L)	Bonamine	GUP	II	GUP	II	Maize Soy	Selective Herbicide for the control of broadleaf weeds	Selective herbicide available and registered in Ghana. Protective clothing available.
3	2,4-D Amine (720g/L)	Calliherb	GUP	II	GUP	II	Maize Soy	Selective Herbicide for the control of broadleaf weeds	Selective herbicide available and registered in Ghana. Protective clothing available.
4	Bispyribac-sodium (400g/L)	Bisonrice 400SC	EU Registered	WHO III	GUP	III	Maize Soy	Post emergence selective herbicide for control of grasses, sedges, and broad leaves in rice fields	Most effective compared to other selective herbicides for rice. Readily available on market.
5	Glyphosate (41%)	Glycot	GUP	II-III	GUP	III	Maize Soy	Annual and perennial broadleaved weeds and grasses	Registered in Ghana. Protective clothing available.
6	Glyphosate (41%)	Glycel	GUP	II-III	GUP	III	Maize Soy	Annual and perennial broadleaved weeds and grasses	Registered in Ghana. Protective clothing available.
7.	Glyphosate	Sunphosate	GUP	II-III	GUP	III	Rice	Herbicide for the	Registered in Ghana.
8.	(360g/L)						Maize Soy	control of annual and perennial broad leaf weeds and grasses	Protective clothing available. Registered in Ghana.
9.	Glyphosate (360g/L)	Kalach 360SL	GUP	II-III	GUP	III	Soy Maize	Herbicide for the control of annual and perennial broad leaf weeds and grasses	Protective clothing available.
10.	Glyphosate	Afuo Wura	GUP	II-III	GUP	III	Maize Soy	Herbicide for the	Registered in Ghana.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
	(360g/L)							control of annual and perennial broad leaf weeds and grasses	Protective clothing available.
11.	Glyphosate (480g/L)	Power	GUP	II-III	GUP	III	Maize Soy	Herbicide for the control of annual and perennial broad leaf weeds and grasses	Registered in Ghana. Protective clothing available.
12.	Glyphosate (480g/L)	Bonsate 480SL	GUP	II-III	GUP	III	Maize Soy	Foliar acting non-selective herbicide for control of annual and perennial weeds	Readily available on the market. Less hazardous, protective clothing available
13.	Glyphosate (480g/L)	Chemosate 480SL	GUP	II-III	GUP	III	Maize Soy	Foliar acting non-selective herbicide for control of annual and perennial weeds	Readily available on the market. Less hazardous, protective clothing available
14.	Glyphosate (480g/L)	Nnoboa	GUP	II-III	GUP	III	Maize Soy	Foliar acting non-selective herbicide for control of annual and perennial weeds	Readily available on the market. Less hazardous, protective clothing available
15.	Glyphosate (480g/L)	Glyphogan	GUP	II-III	GUP	III	Maize Soy	Foliar acting non-selective herbicide for control of annual and perennial weeds	Readily available on the market. Less hazardous, protective clothing available
16.	Nicosulfuron (40g/L)	Nicoking	GUP	III	GUP	III	Maize	Post emergence herbicide for control of weeds in maize.	Readily available, especially in the maize belt of Ghana relatively low toxicity.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
17.	Nicosulfuron (40g/L)	Nicogan	GUP	III	GUP	III	Maize	Post emergence herbicide for control of weeds in maize.	Readily available, especially in the maize belt of Ghana, relatively low toxicity.
18.	Nicosulfuron (40g/L)	Nicoherb	GUP	III	GUP	III	Maize	Post emergence herbicide for control of weeds in maize.	Readily available, especially in the maize belt of Ghana, relatively low toxicity.
19.	Nicosulfuron (40g/L)	Nico 40OD	GUP	III	GUP	III	Maize	Post emergence herbicide for control of weeds in maize.	Readily available, especially in the maize belt of Ghana, relatively low toxicity.
20.	Nicosulfuron (40g/L)	Nicoplus	GUP	III	GUP	III	Maize	Post emergence herbicide for control of weeds in maize.	Readily available, especially in the maize belt of Ghana, relatively low toxicity.
21.	Oxadiagyl (400g/L)	Topstar 400SC	GUP		GUP	III	Maize Soy	Pre-emergence or early post emergent herbicide for a broad spectrum of weeds	Readily available and used by growers in the Regions of Northern Ghana.
22.	Pendimethalin (445g/L)	Stomp SC	GUP	III	GUP	III	Maize	Control of broad leaf weeds in maize.	Registered in Ghana. Protective clothing available.
23.	Propanil (360g/L) +2, 4 D Amin(200g/L)	Propanil Plus	GUP	II-III	GUP	II	Maize Soy	Pre-emergence herbicide for the control of broad leaf weeds	Readily available and used by growers in the Regions of Northern Ghana.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
24.	Propanil (360g/L) +2, 4 D Amin(200g/L)	Orizo Plus	GUP	II-III	GUP	II	Maize Soy	Pre-emergence herbicide for the control of broad leaf weeds	Readily available and used by growers in the Regions of Northern Ghana.
25.	Propanil (360g/L) +2, 4 D Amin (200g/L)	Rainpropaplus	GUP	II-III	GUP	II	Maize Soy	Pre-emergence herbicide for the control of broad leaf weeds	Readily available and used by rice growers in the Regions of Northern Ghana.
26.	Propanil(360g/L) +2, 4 D Amin (200g/L)	PropaGold	GUP	II-III	GUP	II	Maize Soy	Pre-emergence herbicide for the control of broad leaf weeds	Readily available and used by rice growers in the Regions of Northern Ghana.
27.	Propaquizafop(100g/l)	Agil 100EC	GUP		GUP	III	Maize Soy	Post-emergence selective gramicide for controlling grasses in broad leaf crops	Readily available and used by soy farmers in the 3 Regions of Northern Ghana.
28.	Glyphosate (410g/l)	Adom 48 SL	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
29	Glyphosate (480g/l)	Adupa Wura SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
30.	Glyphosate (360g/l)	Adwumaden Ye	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Readily available on the market. Protective clothing available.
31.	Glyphosate (41%)	Adwumapa SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
32.	Glyphosate (410 g/l)	Adwumaye 41 SL	GUP	III	GUP	III		Herbicide for the control of annual perennial and broadleaf weeds and grasses	Readily available on the market. Protective clothing available.
33.	Glyphosate (480g/l)	Adwuma Wura 480 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and Vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
34.	Propaquizafop (100g/l)	Agil 100 EC	GUP	III	GUP	III		Herbicide for the control of grasses in pineapple, cotton, groundnut, soybean, vegetables and yam	Readily available on the market. Protective clothing available.
35.	Oxyfluorfen (120g/l) + Propaquizafop (50g/l)	Agilox 170 EC	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in onion	Readily available on the market. Protective clothing available.
36.	Pendimethalin (500g/l)	Agristomp 500E	GUP	III	GUP	III		Pre-emergent herbicide for the control of weeds in maize, cotton, rice and soybean	Readily available on the market. Protective clothing available.
37.	Pendimethalin (400g/l)	Alligator 400 EC	GUP	III	GUP	III		Herbicide for the control of grasses in rice	Readily available on the market. Protective clothing available.
38.	2, 4-D Amine (720g/l)	Amino 72 SL	GUP	III	GUP	III		Selective herbicide for the control of broad-leaved weeds and sedges in cereals and sugarcane	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
39.	Glyphosate (410g/l)	Aniphosate 41 SL	GUP	III	GUP	III		Herbicide for annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
40.	Butachlor (500g/l)	Butaforce EC	GUP	III	GUP	III		Pre-emergent herbicide for the control of grasses and broadleaf weeds in rice, soybean, cotton and vegetables	Readily available on the market. Protective clothing available.
41.	Glyphosate (360g/l)	Canphosate SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds	Readily available on the market. Protective clothing available.
42.	Haloxyfop-R- methyl (104g/l)	Capizad EC	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
43.	Glyphosate (360g/l)	Chemosate Super EC	GUP	III	GUP	III		Herbicide for the control of annual and perennial weeds in crops	Readily available on the market. Protective clothing available.
44.	Pendimethalin (500g/l)	Chemostorm 500EC	GUP	III	GUP	III		Pre-emergent herbicide for the control of weeds in cereals, cotton and soybean	Readily available on the market. Protective clothing available.
45.	Glyphosate (360g/l)	Destroyer	GUP	III	GUP	III		Herbicide for the control of annual and perennial weeds	Readily available on the market. Protective clothing available.
46.	Amicarbazone (100g/l) + Propisochlor (400g/l)	Dinamic Plus 500EC	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in arable crops	Readily available on the market. Protective clothing available.
47.	Glyphosate (480g/l)	Eduodzi 480SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
48.	Glyphosate (757g/kg)	Eduodzi 757 SG	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in vegetables	Readily available on the market. Protective clothing available.
49.	2, 4-D Amine (720g/l)	Ervextra SC	GUP	III	GUP	III		Selective herbicide for the control of broadleaf weeds in rice, maize, oil palm, coconut, rubber and sugarcane	Readily available on the market. Protective clothing available.
50.	Glyphosate (41%)	ForceUp SL	GUP	III	GUP	III		Herbicide for the control of weeds in crops	Readily available on the market. Protective clothing available.
51.	Fluazifop-p- butyl (150g/l)	Fos-lade Super 15 EC	GUP	III	GUP	III		Selective herbicide for the control of annual, perennial grasses in broadleaf crops	Readily available on the market. Protective clothing available.
52.	2,4-D Amine salts (720g/l)	Franko 2, 4-D	GUP	II	GUP	II		Herbicide for the control of broadleaf weeds and sedges in rice, maize, sorghum,	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								millet and sugarcane	
33.	Glyphosate (410g/l)	Frankosate 41 SL	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds, sedges and grasses in orchards	Readily available on the market. Protective clothing available.
54.	Glyphosate (410g/l)	Glycel 41SL	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
55.	Glyphosate (410g/l)	Glycot 41 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals	Readily available on the market. Protective clothing available.
56.	Glyphosate (757g/kg)	Glyphader 75 SG	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
57.	Glyphosate (480g/l)	Glyphader 480 SC	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
58.	Glyphosate (757g/kg)	Glyphapat	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in soybean, cotton, wheat, beans and cereals	Readily available on the market. Protective clothing available.
59.	Glyphosate (410g/l)	Glyfos 41SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
60.	Glyphosate Ammoniu m Salt (95 % Min)	Glyphosate 95% Technical	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses in maize	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
61.	Glyphosate Ammonium Salt (88 % Min)	Glyphosate 88% Technical	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses in maize	Readily available on the market. Protective clothing available.
62.	Atrazine (750g/kg) Nicosulfuron (40g/kg)	Herbimais WG	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Readily available on the market. Protective clothing available.
63.	Acetachlor (300g/l) + Simazine (200g/l)	Herbisuper S	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in Maize	Readily available on the market. Protective clothing available.
64.	Haloxyfop methyl (108g/l)	Hero Super 108 EC	GUP	III	GUP	III		Herbicide for the control of annual grasses in vegetables and pulses	Readily available on the market. Protective clothing available.
65.	Glyphosate (410g/l)	Kabasate 41SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								and vegetables	
66.	Glyphosate (360g/l)	Kalach 360 SL	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
67.	Glyphosate (700g/kg)	Kalach Extra 70SG	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
68.	Glyphosate (410g/l)	Kondem 41SL	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses	Readily available on the market. Protective clothing available.
69.	Glyphosate (410g/l)	Kumnwura SL	GUP	III	GUP	III		Herbicide for the control of annual and perennial broadleaf weeds and grasses	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
70.	Glyphosate (360g/l)	Kurasate 360 SL	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds	Readily available on the market. Protective clothing available.
71.	Glyphosate (757g/kg)	Ladaba 75 SG	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals, vegetables and plantation crops	Readily available on the market. Protective clothing available.
72.	(Aclonifen 500g/l + Isoxaflutole 75g/l)	Lagon 575SC	GUP	III	GUP	III		Pre-emergent herbicide for the control of grasses and broadleaf weeds in Maize	Readily available on the market. Protective clothing available.
73.	Glyphosate (360g/l)	Landlord 360 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in crops	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
74.	Tembotrione (420g/l) + Isoxadifen-ethyl (210g/l)	Laudis 630SC	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in maize	Readily available on the market. Protective clothing available.
75.	Metolachlor (960g/l)	Maestro 960EC	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize	Readily available on the market. Protective clothing available.
76.	Nicosulfuron (40g/l)	Nico 40OD	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals	Readily available on the market. Protective clothing available.
77.	Nicosulfuron (4%)	Nico Plus OD	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
78.	Nicosulfuron (400g/l)	Nicocal 40 OD	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								cereals and vegetables	
79.	Nicosulfuron (40g/l)	Nicopat Super	GUP	III	GUP	III		Herbicide for the control of annual grasses and broadleaf weeds	Readily available on the market. Protective clothing available.
80.	Nicosulfuron (400g/l)	Nicoking 40SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize, rice and soybean	Readily available on the market. Protective clothing available.
81.	Nicosulfuron (750g/kg)	Nicoking 75WG	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Readily available on the market. Protective clothing available.
82.	Nicosulfuron (40%)	Nicostar 40 SL	GUP	III	GUP	III		Herbicide for the control of weeds in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
83.	Glyphosate (360g/l)	Nwura Wura 360SL	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds	Readily available on the market. Protective clothing available.
84.	Glyphosate (480g/l)	Oboafo 480 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
85.	Glyphosate (410g/l)	Ogyatanaa 41SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals in vegetables	Readily available on the market. Protective clothing available.
86.	Glyphosate (410g/l)	Oyeadieyie 41 SL	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
87.	Penoxsulam (240g/l)	Ricecare 240 SC	GUP	IV	GUP	IV		Herbicide for the control of broadleaf weeds and sedges in field	Readily available on the market. Protective clothing

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								crops	available.
88.	Glyphosate IPA (300g/l) + 2,4-D IPA (210g/l)	Ridmax 510 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial weeds in field crops	Readily available on the market. Protective clothing available.
89.	Glyphosate (480g/l)	Rid Out 480 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds.	Readily available on the market. Protective clothing available.
90.	Glyphosate ammonium (75.7%)	Rid Over 757 SG	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds.	Readily available on the market. Protective clothing available.
91.	Glyphosate (480g/l)	Rondo 48SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
92.	Glyphosate (757g/kg)	Rondo 75.7SG	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in vegetables and cereals	Readily available on the market. Protective clothing available.
93.	Glyphosate (450g/l)	Roundup 450 Turbo	GUP	III	GUP	III		Herbicide for the control of annual grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
94.	Glyphosate (480g/l)	Sharp 480 SL	GUP	III	GUP	III		Herbicide for the control of annual and perennial grasses and broadleaf weeds in cereals	Readily available on the market. Protective clothing available.
95.	Glyphosate (41%)	Shye Nwura SL	GUP	III	GUP	III		Herbicide for the control of annual and perennial broadleaf weeds and grasses	Readily available on the market. Protective clothing available.
96.	Glyphosate (360g/l)	Sikosto 360 SL	GUP	III	GUP	III		Non-selective herbicide for the control of annual, perennial grasses and	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								broadleaf weeds	
97.	Glyphosate (41%)	Sinosate 41 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses	Readily available on the market. Protective clothing available.
98.	Pendimethalin (33%)	Sun Agogo 33EC	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
99.	Atrazine (20%) + Nicosulfuron (3%)	Sun-Anico OF	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses in maize	Readily available on the market. Protective clothing available.
100.	Metribuzin (700g/kg)	Sunbuzin 70WP	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in soybean	Readily available on the market. Protective clothing available.
101.	Nicosulfuron (40g/l)	Sunfuron 40OD	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in maize	Readily available on the market. Protective clothing

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
									available.
102.	Nicosulfuron (750g/kg)	Sunfuron 75WDG	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
103.	Nicosulfuron (800g/kg)	Sunfuron 80WP	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
104.	Haloxyfop-P- methyl (108g/l)	Sun-Gallop	GUP	III	GUP	III		Pre-emergence herbicide for the control of annual broadleaf weeds in cereals and beans	Readily available on the market. Protective clothing available.
105.	Glyphosate (757g/kg)	Sunphosate 757 G	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses in ceteals and	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								vegetables	
106.	Imazethapyr (240g/l)	Target 240 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in soybean and cowpea	Readily available on the market. Protective clothing available.
107.	2, 4-D Amine (720g/l)	Weedcot SL	GUP	II	GUP	II		Selective herbicide for the control of broadleaf weeds in cereals	Readily available on the market. Protective clothing available.
108.	Glyphosate (41%)	Weed Magic 41 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
109.	Glyphosate (410g/l)	Weed Out SL	GUP	III	GUP	III		Herbicide for the control of annual and perennial broadleaf weeds and grasses	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
110.	Glyphosate (41%)	Weed Up	GUP	III	GUP	III		Herbicide for the control of annual and perennial grasses and broadleaved weeds	Readily available on the market. Protective clothing available.
111.	Glyphosate (480g/l)	Weed Well SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
112.	Glyphosate (410g/l)	Winner 41SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals	Readily available on the market. Protective clothing available.
113.	Glyphosate (360g/l)	Wynna 360 SL	GUP	III	GUP	III		Herbicide for the control of grasses and broadleaf weeds and grasses	Readily available on the market. Protective clothing available.
114.	2,4-D Amine (720g/l)	XTRA-D	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in cereals and tree crops	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
115.	Glyphosate (360g/l) + Oxyfluorfen (300g/l)	Zoomer 390 SC	GUP	III	GUP	III		Herbicide for the control of annual and perennial broadleaf weeds and grasses	Readily available on the market. Protective clothing available.
116.	Glyphosate ammonium (757g/l)	Adwuma Boss 48 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
117.	Glyphosate (410g/l)	Adwuma Mmoa 41 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
118.	Glyphosate (410g/l)	Adwumaden 41 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses	Readily available on the market. Protective clothing available.
119.	Bispyribac-sodium (100g/)	Agriforce	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in direct-seeded rice	Readily available on the market. Protective clothing available.
120.	Glyphosate	Agrosate	GUP	III	GUP	III		Herbicide for the	Readily available on

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
	(48%)							control of annual, perennial grasses and broadleaf weeds in field crops	the market. Protective clothing available.
121.	Glyphosate (41%)	Akuafohene 41 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
122.	Glyphosate (360g/l)	Amega 360 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
123.	Atrazine (800g/kg)	Atraking 80WP	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses in maize, sorghum, sugarcane and yam	Readily available on the market. Protective clothing available.
124.	Atrazine (500g/l)	Atraking 500 SC	GUP	III	GUP	III		Herbicide for the control of broadleaf	Readily available on

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								weeds and grasses in maize, sorghum, sugarcane and yam	the market. Protective clothing available.
125.	Nicosulfuron (75%)	Arrow 400 OD	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
126.	Glyphosate (360g/l)	Barizaa 360 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.
127.	Nicosulfuron (40g/l)	Bon Nico	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
128.	Glyphosate (360g/l)	Crownsate	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
129.	Butachlor (50%)	ButaClear 50EC	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in paddy rice, soybean, cotton, groundnut and vegetables	Readily available on the market. Protective clothing available.
130.	Butachlor (500g/l)	Bylor 500EC	GUP	III	GUP	III		Herbicide for the control of annual grasses and broadleaf weeds in groundnut and rice	Readily available on the market. Protective clothing available.
131.	Bispyribac sodium (455g/l)	Degan SC	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds in paddy rice	Readily available on the market. Protective clothing available.
132.	Glyphosate (480g/l)	D-Lion Glyphosate	GUP	III	GUP	III		Herbicide for the control of annual, perennial weeds in arable crops	Readily available on the market. Protective clothing available.
133.	Glyphosate (410g/l)	Dobidi	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
134.	Bispyribac-sodium (40%)	Emoo Aduro	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in rice	Readily available on the market. Protective clothing available.
135.	Glyphosate (480g/l)	Erase 480 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Readily available on the market. Protective clothing available.
136.	Glyphosate (360g/l)	Eserewura	GUP	III	GUP	III		Herbicide for the control of annual and perennial weeds in non-crop lands	Readily available on the market. Protective clothing available.
137.	2,4-D Amine (720g/l)	Fastherb 720SL	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds in rice	Readily available on the market. Protective clothing available.
138.	Glyphosate (41%)	Flysate	GUP	III	GUP	III		Herbicide for the control of annual, perennial weeds in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
139.	Glyphosate Mono-ammonium salt (757g/kg)	ForceUp Granular	GUP	III	GUP	III		Herbicide for the control of annual, perennial weeds in citrus	Readily available on the market. Protective clothing available.
140.	Nicosulfuron (40g/l)	Ganico 40SC	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds in maize, sorghum and millet	Readily available on the market. Protective clothing available.
141.	2, 4-D Amine Salt (720g/l)	Ganorherb SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial weeds in maize	Readily available on the market. Protective clothing available.
142.	Glyphosate (360g/l)	Ganorsate 360 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds in arable crops	Readily available on the market. Protective clothing available.
143.	Glyphosate (480g/l)	King Kong	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds in cereals, vegetables and fruit trees	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
144.	Glyphosate (48%)	Mo Ne Adwuma 48 SL	GUP	III	GUP	III		Herbicide for the control of broadleaf weeds and grasses grasses	Readily available on the market. Protective clothing available.
145.	Quizalofop-p-methyl (35g/l)	Mofarno 160 EC	GUP	III	GUP	III		Herbicide for the control of annual broadleaf weeds in soybean	Readily available on the market. Protective clothing available.
146.	Glyphosate (41%)	Multisate 41SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Readily available on the market. Protective clothing available.
147.	Nicosulfuron (40g/l)	Nicoda 40 OD	GUP	III	GUP	III		Herbicide for the control of weeds in maize	Readily available on the market. Protective clothing available.
148.	Nicosulfuron (4%)	Nicofos 400D	GUP	III	GUP	III		Herbicide for the control of weeds in maize	Readily available on the market. Protective clothing available.
149.	Glyphosate (360g/l)	Phyto-General 360SL	GUP		GUP			Herbicide for the control of annual, perennial broadleaf	Readily available on the market. Protective clothing

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
								weeds and grasses in cereals and vegetables	available.
150.	Glyphosate (410g/l)	Pinup SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial weeds and grasses	Readily available on the market. Protective clothing available.
151.	Glyphosate 757g/kg	Power 75 WSG	GUP	III	GUP	III		Herbicide for the control of annual, perennial weeds and grasses	Readily available on the market. Protective clothing available.
152.	Imazamox (40g/l)	Raptor	GUP	U	GUP	U		Herbicide for the control of annual broadleaf weeds and grasses in groundnut and soybean	Readily available on the market. Protective clothing available.
153.	Propanil (360 g/l) 2,4-D Amine salt (200 g/l)	Pronick Plus 56 EC	GUP	III	GUP	III		Herbicide for the control of broad leaf weeds and grasses grasses, in cereals and vegetables	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
154.	Acetochlor (900g/l)	Sun-Aceto EC	GUP	III	GUP	III		Herbicide for the control of annual and perennial weeds in maize, soybean, cotton and peanut	Readily available on the market. Protective clothing available.
155.	Mesotrione (570g/kg) +Nicosulfuron (230g/kg)	Super Nicogan 800 WDG	GUP	III	GUP	III		Selective herbicide for the control of weeds in maize	Readily available on the market. Protective clothing available.
156.	Imazethapyr (240g/l)	Supremo	GUP	II	GUP	II		Herbicide for the control of annual grasses and broadleaf weeds in soybean	Readily available on the market. Protective clothing available.
157.	Glyphosate (410g/l)	Sunsate 41SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize, soybean and tomatoes	Readily available on the market. Protective clothing available.

No.	Active Ingredient	Commercial Product Name in Ghana	USEPA Registration Status	USEPA Toxicity Class	Gh EPA Registration Status	Gh EPA Toxicity Class	Crops	Pest/ Diseases	Basis for selection
158.	Nicosulfuron (40g/l)	Tumiplus 40 OD	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Readily available on the market. Protective clothing available.
159.	Glyphosate (480g/l)	Tumiwura 48 SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial grasses and broadleaf weeds	Readily available on the market. Protective clothing available.
160.	Glyphosate (480g/l)	Viking 48SL	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Readily available on the market. Protective clothing available.
161.	Glyphosate (41%)	Wadwumanie	GUP	III	GUP	III		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Readily available on the market. Protective clothing available.

Table 2.2: User and environmental hazards associated with the recommended pesticide

No.	Active ingredient/ Chemical	Commercial Product Names in Ghana	Acute/Chronic Toxicity (human hazards)	Eco-toxicity	Groundwater Contamination Potential	Other Comments/Crops
INSECTICIDES						
1.	Abamectin (18g/L	Bomec EC	May cause slight to moderate eye and skin irritation. Not readily absorbed through the skin	HT to crustaceans and bees. ST to fish	Very low potential for groundwater contamination	
2.	Acetamiprid (16g/L) + cypermethrin (12g/L)	Chemiprid 88EC	Unlikely to accumulate in the body when small doses are ingested.	Cypermethrin is highly toxic to fish and bees. Low toxicity to birds	Cypermethrin is unlikely to contaminate groundwater because it binds tightly to soil particles.	
3.	Acetamiprid (20g/L) Lambda-cyhalothrin(15g/L)	K-Optimal	May cause slight irritation of the eye and skin. Could cause gastrointestinal disorders if swallowed.	Very toxic to aquatic organisms		
4.	Acetamiprid (16g/L) Bifenthrin (30g/L)	Aceta Star 46EC	May cause slight irritation skin. Could of the eye and cause	Very toxic to aquatic organisms	Insufficient data	Avoid use in aquatic environments

			gastrointestinal disorders if swallowed.			
5.	Acetamiprid (200g/L)	Golan SL	Acute toxicity unknown; carcinogen not likely; not cholinesterase inhibitor; not developmental/reproductive toxin	MT to fish and wildlife; selective toxicity to insects; MT to bees; minimal risk to non-target plants	Degrades rapidly by aerobic soil metabolism. Does not bio- accumulate in fish and in sediment.	
6.	Dimethoate (400g/L)	Dimeking EC	Moderate to severe skin irritation. Severe irritation of eyes.	Slightly toxic to fish, HT to amphibians and crustaceans and VHT to bees	Potential groundwater contaminant	Do not apply directly to water to areas where surface water is present.
7.	Fenvalerate (200g/L)	Sanitox 20EC	Irritant to skin and eyes.	Harmful to game, wild birds and livestock. Toxic to bees	Not listed	No smoking or drinking when using product.
8.	Imidacloprid (200g/L)	Consider Supa Dimiprid 20SL	Acute MT in humans; not listed as carcinogen; unknown as dev/reproductive toxin	Not acutely toxic to fish; VHT to insects, as a systemic, expressed in pollen and nectar	Potential ground water contaminant	The use of imidacloprid should be avoided when crops are flowering.
9.	Imidacloprid(350g/kg) Thiram (100g/kg)	Insector TDS	Irritant to eye and skin. Acute oral toxicity.	Very toxic to aquatic organisms.	Potential ground water contaminant	
10.	Indoxacarb (30g/L) Acetamiprid (16g/L)	Viper 46EC	Indoxacarb may cause mild eye irritation with tearing, & blurred vision. May cause skin sensitization with allergic rashes.	Moderately toxic to bees, HT to fish and crustaceans.	No data found	
11.	Lambda-	Sunhalothrin	Eye irritant	Highly toxic to fish and	Do not contaminate	Insecticide/ Acaricide.

	cyhalothrin(25g/L)	Lambda Super Lambdacot Striker Lambda Master Rainlambda		aquatic invertebrates	ponds, waterways or ditches with chemical or used container	
12.	Malathion (700g/L)	EnviGold	Eye irritation including redness, tearing, and blurred vision. Repeated skin contact may cause irritation. Aspiration into lungs can cause pneumonitis. This condition may be fatal.	Malathion is biodegradable. It undergoes rapid degradation in the environment. Toxic to fish, aquatic invertebrates, and aquatic life stages of amphibians. Highly toxic to bees.		
FUNGICIDES						
1.	Mancozeb (800G/Kg)	Kilazeb 80WP, Dizcozeb 80WP, Rainmancoz80WP	Acute oral and dermal, toxicity, Probably carcinogen; endocrine disruptor, irritating to respiratory system	HT to fish, aquatic inverts, MT to bees, aquatic plants; RNT to birds	Does not accumulate in soil; moderate potential to contaminate GW	Not listed. Protective clothing required.
2.	Imidacloprid350g/kg)+ Thiram (100g/kg)+ Metalaxyl-M(35g/kg)	Calthio Mix485WS	Irritant to eye and skin, acute oral toxicity Metalaxyl generally is of low acute toxicity but is a moderate eye irritant and has been placed in Toxicity Category II (indicating the second highest degree of acute	VT to aquatic organisms	Insufficient data	

			toxicity) for eye irritation effects			
3.	Permethrin (33%) + Carbendazim (15%)+ Chlorothalonil(12%)	Seedrex WP	Irritant to eye and skin.	Permethrin and Carbendazim are highly toxic to aquatic organisms, bees and birds	Chlorothalonil has limited potential to reach GW, and where it has been detected, concentrations have been low.	Permethrin is a restricted use product.
HERBICIDES						
1.	2,4-D 720g Amine	Herbextra, Sun-2,4 d Amine 72%, Caliherb 720 SL, Ervextra, Wiper Bonamine	Harmful in contact with skin and if swallowed. Irritating to eyes	Practically non-toxic to organic organisms	Potential for mobility in soil is high. May be used to control aquatic weeds in presence of fish if used in strict accordance with	Do not spray crops when under stress.
2.	Atrazine (750g/L) + Nicosulfuron (40g/kg)	Herbimais	Exposure may cause irritation to skin, eyes, throat, and abnormal liver function.	Atrazibe is RNT to birds and bees, ST to fish, other aquatic life	Insufficient data	
3.	Bispyribac-sodium (400g/L)	Bisonrice 400SC	Acute toxicity. Slightly irritant to eye. Non-irritant to skin.	Toxic to fish and earthworms	Insufficient data	
4.	Glyphosate (41%)	Glycot Glycel	Irritation to eyes, skin and respiratory system. Harmful if swallowed	Slightly toxic to amphibians, fish and zooplankton. Moderately toxic to crustaceans	The product is practically immobile in soil and is unlikely to leach.	A rain free period of at least 6 hours (preferably24 hours) must follow application.
5.	Glyphosate (360g/L)	Nwura wura SL Kalach 360SL Rival	Irritation to eyes, skin and respiratory system.	Glyphosate is readily degraded by soil	Glyphosate and AMPA are unlikely	A rain free period of at least 6 hours (preferably24 hours)

		360SL, Wynna 360SL, Sunphosate Afuo Wura,,	Harmful if swallowed	microbes to AMPA (aminomethyl phosphonic acid) that is further degraded to carbon dioxide	to enter ground water due to their strong adsorptive characteristics.	must follow application.
6.	Glyphosate (480g/L)	Power Bonsate 480SL Chemosate480SL Nnoboa Glyphogan Glyphader Weedall SL Sharp 480 SL, Adom 480 SL, Adwuma wura SL,	Slight acute toxicity	Slightly toxic to amphibians, fish and zooplankton. Moderately toxic to crustaceans	The product is practically immobile in soil and is unlikely to leach.	A rain free period of at least 6 hours (preferably24 hours) must follow application.
7.	Glyphosate (360g/L) + Oxyfluorfen (360g/L)	Zoomer 390SC	Irritant to eyes and skin. Harmful if swallowed	Oxyfluorfen is non-toxic to birds and bees, but HT to aquatic invertebrates, aquatic plants and fish.	Oxyfluorfen is practically insoluble in water and has a tendency to absorb to soil.	Do not apply directly on areas where surface water is present.
8.	Glyphosate (757g/Kg)	Arrow 75WDG	Slightly toxic to amphibians, fish and zooplankton. Moderately toxic to crustaceans	The product is practically immobile in soil and is unlikely to leach.	Not likely	A rain free period of at least 6 hours (preferably24 hours) must follow application. Protective clothing required.
9.	Metolachlor (333g/L) + Terbutryn (16g/L)	Terbulor 500EC	No carcinogenic potential	Terbutryn is MT to fish, ST to bees and MT to earthworms	Has the potential to accumulate in GW	
10.	Nicosulfuron (750g/kg)	Arrow 75WDG	Slightly irritant to eye and skin	Non-toxic to fish, aquatic invertebrates, soil microbes, birds, mammals and fish.	Potential GW contaminant	
11.	Nicosulfuron (40g/L)	Nicoking Nicogan Nicoherb Nico 40OD	Slightly irritant to eye and skin	Non-toxic to fish, aquatic invertebrates, soil microbes, birds,	Potential GW contaminant	

		Nicoplus		mammals and fish.		
12.	Oxadiargyl (400g/L)	Topstar 400SC	No skin irritation, slight eye irritation	PNT to fish, aquatic invertebrates and aquatic plants.	Not applicable	For transplanted rice, treat the fluid mud 3 days before transplanting, then water after transplanting. Apply 0.5L per Ha
13.	Pendimethalin(400g/L)	Alligator 400SC	Acute toxicity, ST; likely carcinogen, dev/reproductiv e toxin.	ST to birds, MT to fish, HT to aquatic invertebrates, RNT to bees	Groundwater contaminant	
14.	Pendimethalin(445g/L)	Stomp SC	Acute toxicity, ST; likely carcinogen, dev/reproductive toxin.	ST to birds, MT to fish, HT to aquatic invertebrates, RNT to bees	Groundwater contaminant	
15.	Propanil (240g/l) +2, 4 D isobutylate(200g/l)	Propacal plus480 EC	Low toxicity if swallowed, May cause severe eye irritation with corneal injury, moderate skin irritation	Propanil is HT to aquatic organisms and ST to birds on a dietary basis	Propanil has a moderate bio-concentration potential and medium mobility in soil.	
16.	Propanil (360g/l) +2, 4 D Amin (200g/l)	Propanil Plus Orizo Plus Rainpropaplus PrpaGold	Low toxicity if swallowed, May cause severe eye irritation with corneal injury, moderate	Propanil is HT to aquatic organisms and dietary basis ST to birds on a	Propanil has a moderate bio-concentration potential and medium mobility	
17.	Propaquizafop	Agil 100EC	Eye and skin irritant	Not toxic to bees	Not persistent in soil. Half-life time: 15-26 days Water: Half-life time <1 day;	

WHO Acute Toxicity:

Class O = Obsolete Pesticide; Class Ia = Extremely Hazardous, Class Ib = Highly Hazardous; Class II = Moderately Hazardous; Class III = Slightly Hazardous, Class U = Unlikely to Present Acute Hazard in Normal Use

EPA Acute Toxicity:

Category I = Extremely Toxic, II = Highly Toxic, III = Moderately Toxic, IV = Slightly Toxic

Chronic Toxicity:

KC = Known/Likely Carcinogen; PC = Possible Carcinogen; ED = Potential Endocrine Disruptor; RD = Potential Reproductive or Developmental Toxin; NT = Cholinesterase inhibitors that are Potential Parkinson's Disease Risk Factor and other neurological toxins

Acute Ecotoxicity:

HT = Highly Toxic; MT = Moderately Toxic; ST = Slightly Toxic or LT – Low Toxicity; NT = Not Toxic

Table 2.3: Recommended Active Ingredients (AI) in this PERSUAP II Review, 2019

No.	Active ingredient/Chemical	Trade Name of Product in Ghana
Insecticides		
1.	Abamectin	Bomec EC
2.	Acetamiprid + Emamectin-benzoate	Stricker Super 70EC
3.	Acetamiprid + Cypermethrin	Chemiprid 88EC
4.	Acetamiprid + Lambda-cyhalothrin	K-Optimal, Sauveur 62EC, Sauveur 62EC
5.	Acetamiprid + Bifenthrin	Aceta Star 46EC
6.	Acetamiprid	Golan SL
7.	Alpha-Cypermethrin + Teflubenzuron	Imunit
8.	Azadirachtin	Neem Seed Oil (Gro-Safe), Ozoneem, Neem Azal EC, Neemox Bio, Neem Seed Extract, Ozoneem
9.	*Bacillus thuringiensis* (Bt) + Monosultap	Agoo
10.	*Bacillus thuringiensis* + *Pieris rapae Granulosis Virus*	Bypel
11.	*Beauveria bassiana*	Dynamo WP
12.	Dimethoate	Dimeking EC, Methoate 40EC, Tornado EC
13.	Dimethoate + Lambda-cyhalothrin	Lamsate EC
14.	Dimethoate + Cypermethrin	Lionguard EC
15.	Deltamethrin	Delta Gold 2.5 EC, Zerofly storage bag
16.	Emamectin-benzoate + Acetamiprid	Ema star 112EC,
17.	Emamectin-benzoate	Attack 1.9 EC, Protect 1.9EC, Chemomectin 50SG, Strike 1.9EC, Stricker Super 70EC, Warrior Super 26EC, Control 5WG,
18.	Fipronil	Termidor SC
19.	Ethyl palmitate	Adepa Agro Organic Pesticide
20.	Fenitrothion	Fenitrothion 50EC
21.	Fenvalerate	Sanitox 20EC
22.	Imidacloprid	Consider Supa, Dimiprid 20SL, Seed Shield
23.	Imidacloprid + Thiram	Insector TDS
24.	Imidacloprid + Beta-cyfluthrin	Spartan 300 OD
25.	Indoxacarb + Acetamiprid	Viper Super 80EC
26.	Lambda-cyhalothrin	Sunhalothrin, Lambda Super, Lambdacot, Intact 2.5EC, Striker, Lambda Master, Rainlambda, Bossmate 2.5EC,
27.	Malathion	EnviGold,
28.	Methoxyfenozide + Spinetoram	Uphold 360 S
29.	Maltodextrin	Eradicoat T,
30.	Methomyl + Novaluron	Voraz 475EC
31.	Novaluron	Rimon 10EC
32.	Profenofos + Cypermethrin	Hitcel,
33.	Sophora flavescent plant extract + Emamectin-benzoate	Warrior Super 26EC
34.	Spirotetrament	Movento 100SC

35.	Soybean Oil Extract	Greenline 88
36.	Thiamethoxam	Raintham 350SC, spike 30SC
37.	Teflubenzuron + cypermethrin	Worm Attack EC
Fungicides		
1.	Azoxystrobin + Tebuconazole	Trustar 85WG, Five star 325SC, Amistar Top 325SC
2.	Four atoxigenic Aspergiluss flavus strains	Aflasafe GH01, Aflasafe GH02
Herbicides		
1.	Amicarbazone + Propisochlor	Dinamic Plus 500EC
2.	Acetachlor + Simazine	Herbisuper S
3.	Aclonifen + Isoxaflutole	Lagon 575SC
4.	Atrazine + Nicosulfuron	Herbimais
5.	Bispyribac-sodium	Bisonrice 400SC
6.	Butachlor	Butaforce EC
7.	Glyphosate	Refer to Environmental Protection Agency/CCMC-Revised Register of Pesticides December2018,(Annex 7A and 7B.)
8.	Glyphosate Ammonium Salt	Glyphosate 95% Technical and 88%
9.	Glyphosate + Oxyfluorfen	Zoomer 390SC
10.	Haloxyfop-R- methyl	Capizad EC
11.	Metolachlor	Maestro 960EC
12.	Metribuzin	Sunbuzin 70WP
13.	Metolachlor + Terbutryn	Terbulor 500EC
14.	Nicosulfuron	Arrow 75WDG, Nicoking 40SL, Nicogan, Nicoherb, Nico 40OD, Guardforce OD, Nicoplus, Nicostar 40SL
15.	Oxadiargyl	Topstar 400SC
16.	Oxyfluorfen + Propaquizafop	Agilox 170 EC
17.	Pendimethalin	Alligator 400SC, Stomp SC, Agristomp 500E, Chemostorm 500EC, Sun Agogo 33EC
18.	Propaquizafop	Agil 100EC
19.		
20.	Tembotrione + Isoxadifen-ethyl	Laudis 630SC

2.2 Basis for selecting the recommended pesticides

This procedure generally refers to the practical, economic and environmental rationales for choosing a particular pesticide. In general, best practices require that the least toxic pesticide that is effective is selected. Farmers normally will select a pesticide based on price, effectiveness and availability. Farmers require a pesticide that has rapid knock-down action to satisfy the need to defeat the pest quickly and visibly.

Issue: Farmers do not consider environmental and human safety in choosing pesticides

Farmers are generally aware of the potential dangers associated with using pesticides but are not sure of which products they should avoid.

Farmers depend on pesticide shop operators who recommend pesticides for them to purchase. Pesticide dealers themselves do not often consider the environmental and human safety issues in recommending pesticides to farmers. Most if not all pesticide dealers are not aware of the environmental and human impacts of these pesticides, so they are unable to educate these farmers.

Recommendations

In consultation with the Ghana EPA and MOFA-PPRSD, pesticide dealers and FTF ADVANCE field officers the pesticides which are typically used in the three Northern Regions and the locations below the 8th parallel where FTF ADVANCE is operational, have been recommended for use on the project.

I. Train farmers to choose and use pesticides with low human and environmental risk profiles.

II. During training courses, include training on pesticide selection factors based on findings and recommendations of this PERSUAP. As a backstopping training, pesticide dealers in the project area should be trained on the selection of pesticides based on environmental and human impact so they can help farmers since they are mostly the first point of call for these farmers.

2.3 Extent to which the proposed pesticide use will be part of an IPM Program

The susceptibility of crop plants to pests and diseases is greatly influenced by the general health of the plant. Therefore, good crop management practices can strongly affect IPM, and good agronomic or cultural practices are the most basic and often the most important prerequisites for an effective IPM program. A healthy crop optimizes both capacity to prevent or tolerate pest damage while maintaining or increasing yield potential. Among the methods commonly used in northern Ghana include planting in rows (for some crops), weed control, crop rotation, sanitation, and hand picking.

While encouraging farmers to continue to use the above-mentioned practices for pest control, FTF ADVANCE II review will promote the adoption of improved seed, certified by the Ghana Seed Inspection Division (GSID) of Plant Protection and Regulatory Directorate (PPRSD), proper fertilizer application, as well as reduced tillage and use of cover crops to maintain a healthy crop and increase yield.

Under FTF ADVANCE I, training was provided for input dealers in collaboration with EPA and MOFA-PPRSD. FTF ADVANCE II will continue to work with input dealers who have become the main source of information on pesticide use and application for farmers, to increase their capacity and knowledge to provide appropriate pesticide use advice to farmers who patronize their services. Appropriate training will also be provided to project managers and leaders of organized farmer groups in safe pesticide use and appropriate application techniques. This will provide the farmers easy access to the correct and reliable information on pesticides use and their application techniques. Table 2.4 provides general principles adopted in the MOFA/GCAP Pest Management Plan for cereals and pulses.

Table 2.4: Principles for pest management in cereals (Maize)

Principle	Cereals	Pulses
Principle 1	Obtain good seeds certified by GSID	Obtain good seeds certified by GSID
Principle 2	Select fertile soils and suitable planting sites	Select fertile soils
Principle 3	Plan crop rotation	Plan crop rotation
Principle 4	Adopt appropriate planting distances and planting patterns	Adopt appropriate planting distances and planting patterns
Principle 5	Plant crops at appropriate times	Plant crops at appropriate times so that their growth coincides with low pest and disease incidence
Principle 6	Weed early and regularly	Weed early and regularly
Principle 7	Adopt good soil management practices	Adopt good soil management practices
Principle 8	Adopt suitable water management practices	Adopt good soil management practices
Principle 9	Visit fields regularly	Visit fields regularly
Principle 10	Maintain high levels of sanitation in the field	Maintain high levels of sanitation in the field
Principle 11	Manage pests and diseases efficiently	Manage pests and diseases efficiently
Principle 12	Enhance and protect the populations of natural enemies(e.g. predatory ants, hover flies, ladybirds, spiders, assassin bugs and parasitic wasps)	Enhance and protect the populations of natural enemies(e.g. predatory ants, hover flies, ladybirds, spiders, assassin bugs and parasitic wasps)
Principle 13	Minimize the application of chemical pesticides	Minimize the application of chemical pesticides

2.4 Alternative Pest Management Options for Maize and Soybean.

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 to complement chemical methods for the production and storage of healthy grains. The alternative pest management methods

analyzed below for maize and soya pays attention to both pre and post-harvest methods for the management of pests and diseases.

Maize – Table 2.5 provides recommended management practices for major pests and diseases in maize with more emphasis on pre-harvest pests and diseases. The major concerns of farmers under maize production are losses associated with post-harvest infestation. Farmers are quick to sell their produce partly because of the inability to store grain. If farmers can store grain for longer periods, they will realize better sales in the lean season than immediately after harvest.

Maize can store for a considerable period in unprocessed form without undergoing deterioration. Its shelf life greatly depends on the prevailing ambient temperature and relative humidity, and other factors like the inherent moisture, pests, and diseases. Therefore, recommended post-harvest handling and managing operations involve the manipulation of the above factors in order to obtain high quality maize grains.

Quality control starts with harvesting. Harvesting is the single deliberate action to separate the cob from its grown medium. The optimum time of harvesting maize is when the stalks have dried and moisture of grain as about 20-17%. The following should be observed during harvesting:

- When it reaches physiological maturity (when you can observe the black layer on the grain) or when you see 50% of ears drooping. Harvest maize as soon as it is dry. It could be attacked by weevils if harvest is delayed. Early harvesting also releases the field for early land preparation for areas with two planting seasons.
- Keep the grain as clean as possible. Dry maize on cement floor or use tarpaulin to reduce chance of contamination.
- At home, do not first heap the cobs in any room, kitchen or in the yard because this will expose them to all the dangers that cause post-harvest losses. Transfer them to the drying place immediately.

After harvesting, the greatest enemy of grain is moisture. Wet grains attract insects and mold. Therefore, the grain must be dried as soon as possible after harvesting. Drying is the systematic reduction of crop moisture down to safe levels for storage, usually 12 – 14% moisture content. It is one of the key post-harvest operations since all down-stream operations depend on it. This is particularly so for FTF ADVANCE south where humidity and rainfall remain high at harvesting delaying the harvest and constraining actual drying.

Farmers should be taught how to use traditional methods to determine safe moisture levels of crops, so as to prevent deterioration of crops due to high moisture. Additionally, hand held moisture meters should be provided for lead farmers to help determine moisture levels of crops before harvesting. Good storage practices are adhered to such as :

- Arrangement of produce on pallets,

- Avoid leaking roofs
- Prevent accidental spills
- Storage facilities must be secured to prevent rodent entry
- Storage facility must be well ventilated and illuminated to allow for free movement of air to aid drying.

Table 2.5: Alternative pest management options for maize

No.	Maize (*Zea mays*) Major pests and diseases/Stage	Recommended management practices
1	Armyworms (*Spodoptera exempta*) (Pre-harvest stage)	• Use pheromone traps to detect when adult moths are flying and preparing to lay eggs • During outbreaks immediately contact PPRSD/DAES • Use approved short-term persistence pesticides to spray young caterpillars Scout for the presence of these caterpillars 2 week after germination in order to start control early o avoid heavy infestation
2	Larger grain borers (*Prostephanus truncatus*) (Post-harvest)	• Examples are the PICS storage sacks, Hermetic grain storage bags. These prevent the use of chemicals for storage of grains Use air tight and clean containers for storage • Store in clean, well-aerated stores with low relative humidity • De-husk and thresh after harvest • Ensure grain is properly dried, cleaned before storage
3	Greater grain weevil (*Sitophilus spp.*)	• • Dust with recommended insecticide and/or botanical extracts Place produce on pallets to prevent moisture gain

4	Stem borers (*Busseola fusca, Sesamia calamistis, Eldana saccharina*) (Pre-harvest stage)	• Intercropping with pulses • Early sowing and early maturing varieties such as Bihilifa, abontem, Wang-Basig or Kpari faako reduce infestation • Destroy (make compost, burn or feed livestock) crop residues • Apply neem seed cake during planting (4gm/hole) • Apply neem cake (a 50:50 mixture of neem and sawdust) at the rate of 1g per plant into the funnels in cereal stems • Use the extract botanical pesticides
5	Maize streak virus (virus transmitted by leaf hoppers) (Pre-harvest stage)	• Early planting • Observe recommended time of planting to avoid the diseases • Plant certified seeds/tolerant varieties such as Kpariyura, Kum-Naaya and Bihilifa Uproot and destroy affected plants on the field to avoid spread
6	Striga (witchweed) *(Striga hermonthica, S. asiatica*) and all other weeds (Pre-harvest)	Two year Crop rotation with a soy variety • (Afayak) • Proper land preparation • Timely weeding (at 2 and 5 weeks after planting) • Use recommended herbicides when necessary • Witch weed (Striga spp) - Hand pulling before flowering to avoid seed formation • Use of false host plants e.g. rotation of maize with legumes • • Application of large quantities of farm yard manure Alternatively encourage the use of Push – Pull method to eliminate Striga hermonthica.

Sources: MoFA/GCAP Pest Management Plan 2011.

Table 2.6: Major Insect Pests and Diseases of Maize

No.	**Major Insect pests and Diseases**	**Damage**
1	Armyworms (*Spodoptera exempta)*	Attack leaves
2	Larger grain borers (*Prostephanus truncatus*)	Attack stored maize grain
3	Greater grain weevil (*Sitophilus spp.) –Attack stored maize grain*	
4	Stem borers *(Busseola fusca, Sesamia calamistis, Eldana saccharina)*	Destruction of leaves and boring into stems
5	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
6	Striga (witchweed) (*Striga hermonthica, S. asiatica)*	Is a parasitic weed that grows on the roots of maize and prevents the crop from growing properly
7	Fall Army Worm (Spodoptera frugiperda)	Feeds on leaves,whorls and ears of plants especially maize.

Ministry of Food and Agriculture (MOFA) Ghana Commercial Agriculture Project (GCAP) Pest Management Plan (PMP), 2011.

Table 2.7: Major Insect Pests and Diseases of Soya Bean

No.	**Major Insect pests and Diseases**	**Damage**
1	Aphids (*Aphis craccivora 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
2	Storage mothss *(Ephestia*	Two species of moths attack soybean seeds in storage. The caterpillars of these moths feed on

	cantella, Corcyra cephabonica)	the grains, causing extensive damage by weaving threads around the grains, reducing their quality.
3	Storage weevils (*Callosobruchus maculates)*	Storage weevils attack soybean during storage
4	Sucking bugs (*Anoplocnemis spp., Clavigralla spp. and other species)*	Same group of six insect species that attack cowpea also attack soybean plants
5	Anthracnose disease (*Colletotrichum truncatum)*	Disease affects all the growth stages of soybean. Attacks from stem and later appears on pods and petioles as irregularly shaped brown areas. The infected areas then become covered with a black dust and necrosis occurs in the leaves.

Ministry of Food and Agriculture (MOFA) Ghana Commercial Agriculture Project (GCAP) Pest Management Plan (PMP), 2011.

2.5 Pest Problems and Control Practices

2.5.1 General Pest Problems and their Management

Common pests 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 control practice/measure that can provide acceptable control of the target pest.

Rodents

Rodents, particularly the field rats (*Rattus rattus*), the small house mice (*Rattus norwegicus*), Greater cane rats (*Thryonomys swinderianus*) and multi-mammate shamba rat, (*Mastomys natalensis*) are key pests of food crops. The most affected crops are maize, millets, paddy and cassava. The damage caused by rodents starts at early booting and continues through the mature grain stage as well as the storage stage.

Maize is the most susceptible of all the crops. At the pre-harvest stage, maize is attacked at planting (the rodents retrieve sown seeds from the soil causing spatial germination). The rodents cut and eat the fresh stems and parts of the panicle.

Farmers are strongly advised to do the following to reduce potential damage to crops and the environment:

- Weeding control for fields and sorrouding areas
- Regular surveillance. The earlier the presence of rodents is observed, the cheaper and simpler any subsequent action will be, and losses will remain negligible

- Sanitation. It is much easier to notice the presence of rodents if the store is clean and tidy
- Proofing i.e. making the store rat-proof in order to discourage rodents from entering
- Trapping. Place the traps in strategic positions
- Use recommended rodenticide. However, bait poisons should be used only if rats are present. In stores or buildings, use single-dose anticoagulant poisons, preferably as ready-made baits.
- Encourage team approach for effectiveness. The larger the area managed or controlled with poison, the more effective the impact
- Predation. Keep cats in stores and homesteads.

Locust

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

Grasshopper

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

African Armyworm

The African armyworm (*Spodoptera exempta*) is a major threat to cereal production in a number of African countries. It is a major pest of cereal crops (maize, rice, sorghum and millets) as well as pasture (grass family) and therefore a threat to food security and livestock. The problem with armyworms is that they are highly migratory so that larval outbreaks can appear suddenly at alarming densities, catching farmers unawares and unprepared.

Armyworm (Spodoptere exempta) outbreak has occurred in Ghana twice in the last ten years. The first outbreak in the last ten years occurred in 2002 and the second in 2006. Large expanses of farmlands were destroyed in such instances.

In the 2002, the outbreak was largely concentrated in the Upper East Regions, and a total of 790 (Ha) were affected in four communities. In 2006, the outbreak occurred in five regions namely Brong Ahafo, Ashanti, Volta, Northern and Eastern regions.

The worms destroyed crops in the grass family like maize, rice and sugar cane etc. In addition, animals that feed on infested pasture got bloated and die. The caterpillar outbreak is a threat to health and environmental sustainability, both of which are among the eight UN Millennium Development Goals. According to UNEP experts, African armyworms were responsible for destroying over 30,000 hectares of maize around the Mount Kenya region in 2008.

Due to its economic significance, management and control is centrally co-ordinated by PPRSD. Its control combines monitoring in identified breeding areas, forecasting and early warning of potential outbreaks.

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

The information about potential outbreaks is passed to the regions and districts from where it is further passed to farming communities through the extension systemBoth ULV and knapsack sprayers can be used depending on available formulation in the outbreak areas.

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

Fall Armyworm (*Spodoptera frugiperda*)

The fall armyworm (FAW): It is an invasive tropical migratory insect pest native of the western hemisphere from United States of America to Argentina

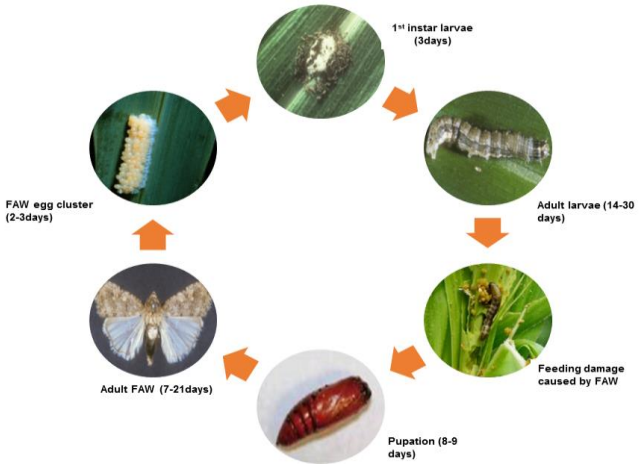
Presence in Africa: FAW was first reported in Sao Tome in 2013. In January 2016 it was detected in Nigeria followed by Benin and Togo. In Ghana the pest initial report was received in April 2016 and was confirmed in November 2016. It is now reported in several African countries.

Host Plants:

FAW has a wide host range with over 80 plants and attacks several important field and vegetable crops. In Ghana, it has been found mainly on maize, but was also reported on groundnut, cowpea, sugarcane, onion, millet, chili pepper.

Life Cycle

Eggs: Eggs are laid in masses of 100 - 200 deposited in layers or spread over a single layer attached to the leaves. they can also be found on non-plant materials such as cups, vehicle mirrors etc. They are usually covered with a layer of greyish scales giving it furry or mouldy appearance. Total eggs per female ranges from 1500-2000. Duration of the egg stage is 2-3 days



Larvae: The larvae goes through six (6) instars (stages). The 1st instar larvae are greenish with a black head which turns orange-coloured in the 2nd instar. The adult larvae has three yellow/white lateral lines at the back and dark raised spots with spines on each segment of the body. The spots on the last-but-one segment formed a square. Each side of the body has a wider dark and wavy-yellow stripes. The face of the matured larva is marked with a white inverted "Y". Larval stage takes 14-30days. First instar caterpillars from a batch of egg mass usually hatch out at same time. Newly hatched larvae are dispersed to new crops through wind current. Larvae feeds on vegetative and fruiting structures before moving into the soil to pupate.

PUPA: Pupation usually takes place in the soil, at a depth 2-8cm in loose oval cocoon. In hard soils, pupation occurs on the soil surface in cocoon from web of leaf debris and other materials. The pupa is reddish brown in colour. **Pupal duration is 8-9 days** in the tropics and cannot withstand protracted periods of cold weather.

Adult: Adults are nocturnal, and are active during warm humid evenings. The female normally deposits most of the eggs during the first 4-5 days of life but may continue up to three weeks. Adult live between 7-21days. The forewings are dark grey, mottled with light and dark patches and visible white spot near the extreme of the wings.

Key Characteristics of Fall Armyworm

- Light green to brown larva with distinct spots along body. Spots on penultimate segment of the body formed a square
- Three thin yellowish white stripes down the back and a distinct white inverted "Y" on head
- Larvae are usually found deep in the whorl often below a "plug" of yellowish brown frass which protect it from insecticide applications and adverse weather.
- Unlike the true armyworm, fall armyworm damage occur in patches throughout the field

Damage

The larval stage is the destructive stage of the pest. On maize it attacks all stages of the crop (vegetative and fruiting structures

- The larvae feed inside whorls on young plants and actively feed early in the morning or late in the afternoon
- Small shot holes "windowpane" to large ragged and elongated holes in the leaves emerging from the whorl
- Severe adult feeding results in ragged appearance of leaves, tassels and/or ears
- Deep feeding in whorl destroys developing tassel
- Defoliation reduces photosynthetic area, which may stunt plants and reduce yield
- Larvae may enter through the side of the ear and feed on developing kernels, reducing grain quality and yield

Fall armyworm feeding in the whorl

Fall armyworm damage on developing tassel

Fall armyworm damage on leaves

Monitoring /scouting for early Detection.

Regular monitoring/scouting is essential for effective control of FAW. FAW larvae are very sensitive to insecticides during the first two stages and therefore is effective to control when detected early. Late stages of FAW larvae tend to escape or are resistant to insecticide application

- Start scouting/monitoring for FAW one week after germination
- Damage is generally distributed in patches across the field therefore important to move through the field
- Scout in N, W, X or Z patterns
  Randomly select and examine 20 plants per row. Examine every part of the plant for the following: Estimate damage proportion by dividing affected plants by total plants examined.
- Take immediate control action if damage is 10% or more
- Continue scouting until silk begin to dry (in maize)

Management Options

Cultural

- Gather and burn all stubbles after harvest
- Practices early planting or plant early maturing varieties
- Rotate with non-host crops (e.g. Cassava, yam)
- Deep plough to bury the pupae or Harrow to expose the pupae
- Treat seeds with systemic insecticides such as Acetamiprid etc.
- Use of light traps to trap adult moth
- Hand pick and destroy egg masses and caterpillars

- Regularly weed the farm and its surroundings

Chemical

Table 2.8: ***Current Recommended insecticides for FAW management in Ghana***

No.	Trade Name	Concentration of Active Ingredient	Hazard Class	Dosage / 15 litres of water
	Conventional synthetic insecticides			
1	Chemomectin 50SG	Emamectin-benzoate (50g/kg)		30g
2	Delta Gold 2.5 EC	Deltamethrin (2.5 g/l)	II	10 ml
3	Imunit	Alpha-Cypermethrin(75g/l) + Teflubenzuron (75g/l)	II	
4	Sauveur 62EC	Acetamiprid (32g/l) + Lambda-cyhalothrin (30g/l)	II	60 ml
5	Stricker Super 70EC	Acetamiprid (50g/l) + Emamectin-benzoate (20g/l)	II	20 ml
6	Strike	Emamectin-benzoate (19.2 g/l)	II	20 ml
7	Uphold 360 S	Methoxyfenozide (300g/l) +Spinetoram(60g/l)	III	
8	Viper 46 EC	Acetamiprid (16g/l) + Indoxacarb (30g/l)	II	40 ml
9	Warrior Super 26EC	Sophora flavescent plant extract (25%) + Emamectin-benzoate (1%)	II	20 ml
10	Worm Attack EC	Teflubenzuron (50g/l) + cypermethrin (20g/l)	III	50 ml
11	Ema Star 112EC	Emamectin benzoate + Acetamiprid	II	30 ml
12	Supertop	Lambda cyhalothrin + Acetamiprid	II	30 ml
	Biorational insecticides			

13	Agoo	*Bacillus thuringiensis* (55%) + Monosultap (45%)	III	50 g
14	Bypel	*Bacillus thuringiensis* + *Pieris rapae Granulosis Virus* (5%)	II	15 g
15	Adepa Agro Organic Pesticide	Ethyl palmitate	U	100 ml
16	Dynamo WP	*Beauveria bassiana* (1%)	U	75 g
17	Eradicoat T	Malthodextrin (282g/l)	III	50 ml
18	Neem Seed Oil (Gro-Safe)	Azadirachtin (3%)	U	50 ml + 10ml soap solution
19	Ozoneem	Azadirachtin (1%)	II	30 ml

Note: Alternate insecticides of different active ingredients after 2-3 successive applications to avoid resistance build up. Direct the nozzle into the funnel leaves or whorl of the plant for effective control. For effective control, spraying should be done early in the morning **5:30am-9:30am or 4:00pm-6:00pm**.

Classical Biological Control

Though not currently in use, the ministry is working on introducing the bioagents *Trichogramma* sp. and *Telenomus remus* for long term sustainable management of the pest.

Factors that Affect Effectiveness of Control Measures

- Lack of monitoring to determine correct time to take control action
- Spraying without taking into account plant and pest size, quality and quantity of water and nozzle type
- Incorrect product choice
- Lack of knowledge on natural enemies
- Incorrect adjustment of sprayer/nozzle
- Resistant to applied insecticides

Why is FAW difficult to control?

- High reproductive potential (1500-2000 eggs per single female)
- Wide host range (more than 80 plant species)
- Caterpillar hides in whorls of cereal crops and covered with frass (excrement) and in unfurled leaves (e.g. onions)

- Moths are active at night and difficult to hit when pesticides are applied mostly during the day.
- Ability to build up resistance to insecticides
- Ability to fly over long distance (about 100km/day)

2.5.2 Management of post-harvest pests of cereal crops

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

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

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

Cowpea pests and diseases

Cowpea is probably the most important legume in the farming systems of Northern Ghana. It is usually grown in association with cereal crops, notably millet, sorghum and maize. In Ghana, the most damaging pests are flower bud thrips, the legume pod borer, and the pod sucking bug (PSB) complex.

Chemical control via the use of synthetic insecticides remains the most popular control tactic. The development of integrated approaches to managing the cowpea pest complex so as to guarantee increased and sustainable production of this important crop in Ghana has been explored. One combination is the use of host plant resistance alongside reduced insecticide application.

2.6 Key Pests and Recommended Management Practices

2.6.1 Major Natural Enemies and Enhancing Natural Enemy Populations

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

Table 2.9: Major natural enemies and the pests they feed upon

Natural Enemy Groups	Examples	What they feed upon
Predators	Predatory mites	Pest mites and thrips
	Spiders	A wide range of insects, such as flies, aphids, caterpillars, butterflies, moths, plant hoppers
	Mantids	A wide range of insects, such as flies, aphids, moths, caterpillars
	Assassin bugs	Other bugs, aphids, leafhoppers, maggots, caterpillars
	Predatory ants	Insect eggs, caterpillars, grubs, maggots, termites
	Ladybirds (larva and adult)	Aphids, scale insects, mealy bugs, white flies, mites
	Lacewings (Larvae only)	Aphids and other soft-bodied insects, as well as insect eggs and mites

.	Ground beetles (larva and adult)	Caterpillars, grubs, bugs, beetles, maggots
	Hover fly (larvae only)	Aphids, thrips and other soft-bodied insects
	Robber fly	Caterpillars and small insects
Parasites	Parasitic wasps	Caterpillars, aphids, scale insects, maggots, mealy bugs, white flies, insect eggs, beetles
	Parasitic flies	Caterpillars

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

2.6.2 Management of post-harvest pests of pulses.

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

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

2.6.3 Pesticide applications –cereals, pulses and vegetables - In line with IPM approaches

A decision to use chemical pesticides should be taken as the very last resort and should also be based on conclusions reached from an agro-ecosystem analyses (AESA).

1. All pesticides should be EPA approved and PPRSD recommended.
2. If it is absolutely necessary to spray crops with pesticides, use selective rather than broad-spectrum pesticides.
3. All herbicides should be applied using knapsack sprayers.
4. All the insecticides for storage pests of cereals/pulses are in dust form and therefore used as supplied without mixing with anything else.
5. The list of pesticides can change as new products are recommended and/or some of the chemicals are withdrawn. Therefore always consult the retailer/stock list, the nearest PPRSD extension worker if in doubt and/read the label.

2.7 Controlling Pesticides use in Crop Protection:

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

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

In order to ensure the efficient use of the pesticides for the fight against crop pests/diseases, the maximum residues limits (MRL) have been defined by European markets/EU standards, if not it is the codex alimentarus that is considered. Indeed Ghana is required to comply with sanitary and phytosanitary measures in international trade.

2.8 Acute and long-term toxicological hazards associated with the proposed use, and measures available to minimize such hazards

The World Health Organization (WHO) reported in 2012 that of the 20,000 fatalities that occur every year from pesticide poisoning, about 80% of these deaths occur in Africa. Even more alarming is the growing dependency on pesticides by African smallholder farmers, despite very weak country regulatory capacity for pesticides amidst rising costs. The Food and

Agricultural Organization (FAO) through its International Code of conduct on the distribution and use of pesticides also recognized the potential and actual harm that can occur as a result of reliance on pesticides. FTF ADVANCE recognizes the serious risks associated with pesticide use to both human health and the environment. Pesticides are poisons, and nearly all of them present acute and/or long-term toxicological hazards, especially if they are used incorrectly.

Information on acute and chronic human and environmental toxicological risks for every pesticide Active Ingredient (AI) recommended in this PERSUAP. In the analysis of AIs for acute and chronic toxicological hazards care was also taken to ensure that banned and highly regulated pesticides as listed by the Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC) Treaties are avoided.

2.9 Proposed methods of application, including availability of appropriate application and safety equipment

Pesticides enter the body through the nose and mouth as vapors, through the skin and eyes by leaky sprayers, mixing splashing and spray drift, and mouth by accidental splashing or ingestion on food or cigarettes. Most pesticides are applied on smaller farms, by hand-pumped backpack sprayers. In general, PPEs are available and used on larger farms. However, it is not generally used on smaller farms.

Issue: Leaky back-pack sprayers

Hand-pump backpack sprayers can and do eventually develop leaks at the junctions (filler cap, pump handle entry, exit hose attachment, lance attachment to the hose and at the lance handle). These leaks come into contact with exposed skin. Some farmers over fill the knapsack sprayers to the brim. This also results in leaks.

Recommendations

The project will support sprayer service providers (SSPs) under its small grants scheme to procure competent spray equipment that meet standards recommended by the Ghana EPA. Trainings organized for SSPs will include the training curriculum a session for spray equipment maintenance and servicing. Similar training and support will be provided for FBOs

Issue: Pesticide granules and treated seed applied by hand

In general, very toxic soil pesticides like carbofuran are formulated as Granules in order to make them safer by lessening the risk of inhalation from spraying, and hold the pesticide near the soil. Also, most seed promoted by the project on demonstration sites may be treated with

a chemical. If farmers do not use gloves when applying these, as they most often do not, they compromise the safety factor. Gloves should be used for these applications.

Recommendations

Agric Production Officers and other field officers leading demonstrations will ensure that all persons handling granular or powdered pesticides, and treated seed wear appropriate gloves.

To ensure sustainability, field officers will also teach farmers how to improvise hand gloves using plastic bags and empty water sachets. These materials are very common and in many cases have become environmental pollutants. Improvising them into hand gloves will therefore serve a dual purpose.

Issue: Many applicators do not use PPEs

The reasons farmers provided for not using PPEs to reduce pesticide exposure risks include:

Cost: PPEs are generally available on the market and it is common to find farmers using nose masks, and a few others using gloves. Most farmers are however unable to buy carbon cartridge respirators, overalls and knee boots because they are too expensive.

Most farmers either do not have an appreciable appreciation of the potential health risks of pesticides or they not associate human disease conditions with the use of pesticides.

Most smallholder farmers are not literate and may not understand either the warning labels or pictograms provided on the pesticide labels.

Ghana is generally warm, and northern Ghana is even warmer. It can be uncomfortable to have all parts of your body covered for extended periods, even as spraying is recommended for early hours of the day or late in the evening.

Recommendations

Studies on safety of pesticide applicators on cotton farms in northern Ghana and concluded among others, that safety can be improved by switching from a spraying method where spray nozzles are held in front of the applicator to a method where the nozzles are held behind the applicator. The latter method is known to have little operator contamination since at the time the solution is sprayed the applicator is no longer in direct contact with the plants.

Training should include advice on minimizing discomfort from wearing PPE, like spraying in early morning before it becomes hot, or late in the afternoon.

CropLife International, in its training manual for training housewives, provides very easy ways of making alternative PPEs using plastic bags to make aprons and plastic bottles to make face shields. These improvised equipment are not perfect but surely minimize the risk of pesticide exposure substantially. They also help in promoting the culture of wearing PPEs among farmers.

The project will adopt such methods to increase the number of people using protection against pesticide exposures.

Having personal protective equipment is one part of the solution and using them properly is another part. The project will continue to provide training to SSPs and FBOs on proper use of PPEs in collaboration with the Ghana EPA and MOFA-PPRSD.

2.10 Compatibility of the Proposed Pesticides with target and non-target ecosystems

As part of the requirements of registration process by Ghana EPA, all pesticides approved for used in Ghana are screened to ensure that they have no or minimal effects on non-target organisms. The project will however take additional steps to further minimize possible effects on non-target organisms.

Water runoff associated with heavy rainfall can transport pesticides and their metabolites to distant places located downstream, resulting in the contamination of surface and ground water as outlined in the Eco toxicity section in table 2- 1. All project implementation sites are strictly for agricultural purposes, however the project will continue to take precautions to avoid drift to non-target areas and organisms by observing the use of appropriate equipment and application rates. This will minimize the adverse effects on target organisms and ecosystems.

Field officers will also support farmers in observing the right buffer zones for farms located near waterways and conservation areas to ensure that pesticides do not contaminate ponds, waterways or ditches.

The effect of each pesticide on non-target ecosystems will also depend on how long it stays in the environment, or rather its rate of breakdown, or half-life. Half-life is defined, as the time (in days, weeks or years) required for half of the pesticide present after an application to break down into degradation products. The rate of pesticide breakdown depends on a variety of factors including temperature, soil pH, soil microbe content and whether or not the pesticide is exposed to light, water, and oxygen.

Many pesticides breakdown into products that are themselves toxic and each may also have a significant half-life. The pesticides recommended in this report took into consideration the half-life of the chemical products and their mobility in their usage environment.

2.11 Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology and soils

FTF ADVANCE II project's implementation area is above the 8th parallel. GAMSAP activities however extend below the 8th parallel but only for the production of DuPont maize hybrid. The area above parallel 8 is largely savanna. The dominant vegetation type is savanna woodland

with a grass layer that can reach up to 2m in height. Smaller communities such as swamps, flood-plain grasslands, narrow bands of riverine forests and or low open grasslands growing in shallow soils and iron pans also exist.

Annual rainfall is about 1000 – 1100mm, occurring from April to October. This is followed by a prolonged dry season from November to March, characterized by the harmattan winds, when a steady desiccating wind blows from the North-East. There are wide temperature variations in the dry season. Minimum night temperatures occur below 20°C while maximum day temperatures reach 40°C.

Annual bushfires occur between December and February with significant areas affected. The only areas spared are waterlogged vegetation and vegetation in wet valleys, and some micro areas along escarpments.

Most crops are grown either during the rainy season or under irrigation, the possibility of using chemicals at seasons when crops are under stress is not very likely (Afreh-Nuamah & Youdeowei, 2002). However, crops grown in valley bottoms may suffer water stress during dry spells due to accumulation of course materials with poor water holding abilities. In the 2014 crop season the project observed that rice grown on land with reduced tillage survived dry spells much better than those that were grown on tilled grounds. The project has since 2015promoted reduced tillage and the use of cover crops through establishment of 30 demonstration plots.

This has, among other benefits, reduced water stress on crops during dry spells.

2.12 Availability of other products and non-chemical methods

Non-chemical options for pest management are recommended in this PERSUAP. FTF ADVANCE II CE field officers will emphasize non-chemical use of pest management as a first option to beneficiary farmers as necessary.

A greater majority of chemicals used on FTF ADVANCE II CE demonstration plots are glyphosates and a few other herbicides. Alternative methods of weed control are therefore the major non-chemical consideration at field level. The use of cover crops as part of the projects climate smart agriculture approach will help reduce the buildup of weeds as biomass accumulated from cover crop could be dense enough to suppress weed growth.

2.13 Ghana's ability to regulate or control the distribution storage, use and disposal of the recommended pesticides

The objective of regulating pesticides is to protect society from the adverse effects of pesticides without denying access to the benefits of their use.

In 1965 the PPRSD was established under the Prevention and Control of Pests and Diseases of Plants Act (Act 307) now replaced by the 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 needed for the country in support of sustainable growth and development of Agriculture.

The Pesticide and Fertilizer Regulatory Division (PFRD) of the PPRSD supervises and trains regulatory inspectors, publishes information materials, registers and trains pesticide and fertilizer dealers and applicators. It keeps records as well as statistics of pesticides and fertilizers, manages pesticides and fertilizer stocks in the country, supervises bio-efficacy trials on pesticides and fertilizers carried out by research institutions and facilitate the removal of obsolete and unwanted chemicals (pesticides and fertilizers).

Part II of the Environmental Protection Agency Act, 1994 (Act 490) provides the EPA the legal authority for the registration of pesticides, licensing of pesticides dealers, enforcement and penalties for failure to comply with the provisions of the law as well as a variety of general provisions. To enforce this law, a number of regulations and guidelines have been passed to guide prospective pesticide dealers in all aspects of pesticide management including registration of pesticides and licensing of pesticide dealers. The EPA has offices in all Regional capitals, and has recently taken steps to post officers to every district capital to improve pesticide inspection.

The work of EPA is supported by a National Pesticides Technical Committee and the Pesticide Management Division of PPRSD. Quality control and residue analysis laboratories have been established at the Ghana Standards Board, and the Cocoa Research Institute of Ghana (CRIG).

Issues

Despite these general regulatory measures to ensure legal authority for the registration, licensing, distribution of pesticides, there are still serious weaknesses in the capabilities of the regulatory systems and agencies assigned responsibilities for regulating pesticides distribution and use in Ghana, primarily due to financial and logistic constraints. EPA does not have the full complement of 200 pesticides inspectors required for effective work at post. This makes it difficult for efficient supervision of the input dealers. Eleven pesticide shops visited as part of the process of developing this PERSUAP all reported that EPA officials have visited them within one week before our visit. However, a few expired products and products marked "NOT FOR SALE" were seen in some of the shops. This could be due to the fact that pesticides inspectors have to visit many shops at a time and therefore are not able to thoroughly conduct inspection.

In addition, due to limited number of MoFA extension staff with adequate knowledge in pesticides use and management, input dealers have become the main source of information on pesticides use and application to farmers. Though the EPA and other projects including FTF ADVANCE II conduct training for pesticide dealers there are many instances where the persons who turn up for the training is not the one who operates the pesticide shop on a daily basis.

Improper container disposal is probably the biggest challenge in the pesticide management effort in Ghana. It is common to find empty pesticide containers left on farms, and in villages containers are washed and used for other purposes such as storage of kitchen items, serving pito (local drink), and performance of ablution by Muslims. This very dangerous trend needs urgent attention.

Recommendations

Out grower Businesses and input dealers have a great deal of influence on farmers. Each OB should be organized to provide a central point for their outgrowers to return empty pesticide containers after use. These can then be disposed of collectively in a safe manner with the supervision of specialists from the Gh EPA. Similar arrangements should be made with input dealers.

The project should develop a radio jingle in various local languages targeting farmers and housewives to bring the message of the dangers of re-using pesticide containers much closer to families in remote villages and the need for proper disposal of containers.

GAP trainings at demo plots should include safe pesticide handling at all times as recommended in the project EMMP.

2.14 Provisions for training of users and applicators

It is important that anyone who uses a pesticide product should not use that pesticide or give instruction to others on its use unless they have received adequate instruction, training and guidance in its correct use. In northern Ghana, many farmers are not literate. They are not likely to understand the pesticide labels on their own without any form of training. Even in situations when some training is provided it may take a while for farmers to appreciate the importance of adhering to the label advice on pesticide containers. The need for intensive and repeated training is therefore important for farmers and pesticide dealers. A standardized training program for pesticide applicators has been elaborated in Annex 4 of this PERSUAP.

2.15 Monitoring use and effectiveness of pesticides

Successful monitoring ensures that pesticides are used only when really needed and that the wrong kind of pesticide is never used. Evaluating the risks, impacts and benefits of pesticide use should be an ongoing, dynamic process. Pest resistance is one of the risks for which monitoring is intended, as well as human health and safety and environmental effects. FTF ADVANCE field officers are on the field at least 4 days in a week. Pesticide use monitoring will be done as part of all other activities that are monitored on demo plots. Annex 8provides a monitoring tool for

documenting all activities on demo plots relating to pesticide use while Annex 4 outlines details for safer use measures.

Table 2.10: Management of Insect Pests and Diseases of Soybean

Soybeans (*Glycine max* = soy)		
Plant protection problem		**Control recommendation**
Pest Name	**Symptom or Damage**	**Cultural Practices and Direct Interventions**
Seed decay, Damping off, *Pythium sp.* *Corticium = Rhizoctonia solani*	Occasional diseases. Poor germination. Poor stand. Sees rot in soil. Symptoms appear on hypocotyls as reddish collar region at which point seedling topples (*Corticium sp.*). *Pythium* 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 *Sclerotium rolfsii*	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 *Fusarium oxysporum f. sp tracheiphilum*	Minor diseases. Characteristic are browning or blackening of vascular systems in roots and stems. Seedling emergence is slow and poor, affected seedlings are stunted and	• Pathogen is soil-borne and seed transmitted. • Don't use seeds from infested crops. Grow cultivars resistant to

	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.	*Fusarium* 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 *Rhizoctonia solani*	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 *Uromyces sp.*	Minor disease. Open pustules with rusty masses of spores on leaf blades.	• No direct control is required. • Use resistant varieties, where available.
Anthracnose *Colletotrichum truncatum* *C, glycines*	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	• Sow seeds free of the pathogen. • Treat infected seed with recommended fungicide. • Plough crop residue under,

	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.	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 *Aphis gossypii*	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 *Aphidius spp.*) • Use recommended pesticides and/or Neem seed or leaf extracts.
Sucking bugs *Anoplocnemis curvipes,* *Clavigralla tomentosicolis,* *C. shadabi,* *Riptortus dentipes,* *Mirperus jacundus,* *Aspavia sp.* *Nezara viridula*	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 *Trissolus basalis* a biological control agent as well as assassin bugs (*Reduviids*). • Scout and at the rate of 2 bugs/ meter row and spray with Organophosphate or other recommended pesticides.
Storage moths	Larvae feed on grains causing	• Solar disinfection, thorough

Ephestia cantella, *Corcyra cephabonica*	extensive webbing of grains	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)

PART 3: SAFER USE ACTION PLAN

The challenges revealed in Part II of this report are not very different from those the FTF ADVANCE approved PERSUAP II worked to address in the past 4 years. Significant progress was made in addressing these challenges under specific actions. The Safer Use Actions proposed in this PERSUAP are based on a combination of the challenges identified in the Pesticide Evaluation Report and shortcomings in the implementation of the FTF ADVANCE approved PERSUAP 2012

The FTF ADVANCE II Pesticide management efforts are 3 fold; (i)To ensure compliance with Title 22 of the Code of Federal Regulations section 216, (ii) promote safe use of agrochemicals and (iii) Prevent environmental pollution as a result of improper pesticide applications and disposal. The recommendations here for the Safer Use Action Plan are in line with these objectives.

The program seeks to achieve the main objectives by implementing programs that reduce the reliance on agrochemicals through an Integrated Pesticide Management (IPM) approach to program implementation, when the use of pesticides is unavoidable, the program advocates for the use of personal protective equipment (PPE) that is appropriate for the specific agrochemical being promoted. The program also takes precautions to prevent the re-use of empty pesticide containers by promoting safe disposal methods such as destruction and burial of used containers. Women and children are strictly prohibited from pesticide applications supported by the FTF ADVANCE program. The program will also ensure that highly toxic and banned pesticides are not promoted by the FTF ADVANCE program. The program will also incorporate safe use training in any pesticide promotion activities as follows:

A. Pesticide Risk Awareness and Mitigation

Farmers do not normally select crop varieties on the basis of pesticide need but more on expected economic returns. However, in order to minimize the potential losses from pests and diseases, a useful starting point is to obtain appropriate planting materials of crop varieties that have been proven, through local field trials, to demonstrate acceptable levels of resistance or tolerance to major pests and diseases. These may be obtained by working in collaboration with SARI, CRI, local Universities and Seed Producers Association of Ghana.

Smallholder farmers do not view investments in personal protective equipment (PPEs) as an economically useful venture. Farmers are aware of the potential hazards when spraying pesticides but are not fully appreciative of the need to be protected. The project has been working to support the set of commercial SSPs that are linked to either input dealers or NFs. This way, outgrowers who are associated to an NF can access the services of SSPs from a centralized and coordinated point at a fee that does not match with the initial investment of PPEs. This approach has the advantage of reducing the number of inexperienced and casual users exposed to pesticides.

In addition, this market-driven approach does not only help ensure effective and efficient application and safe handling, but provides a medium for the dealers to promote their products and gain respect of customers under the premise that judicious application of pesticides will maximize crop yields and can convince farmers of the need to continue purchasing the product.

Preventing re-use of pesticide containers is still a big challenge among farmers and their families. Empty pesticide containers are used to store water, salt, pito and many other activities in local villages. A regular program of public awareness, education and training of all categories of farm

workers on the risks associated with reuse of pesticide containers is needed. These should include radio jingles and training topics during GAPs dissemination and field day trainings.

Women, especially pregnant and nursing mothers, as well as children represent a highly vulnerable group for pesticides poisoning. Experience Zimbabwe and India shows that high levels of pesticides residues can be found in human breast milk where pesticides management has been very poor. In line with the United Nations Convention on the Rights of the Child, the project will as much as possible discourage women from pesticide applications and rather seek the services of SSPs.

B. Prevent Environmental Pollution

The Ghana EPA recommends that empty pesticide containers are punctured/destroyed and buried. Burning is not recommended. There have been programs that encouraged farmers to return empty containers to a central point for collection and re-use, but these have suffered the challenges of sustainability. Proper disposal of pesticide containers therefore continues to be a big challenge among smallholder famers in northern Ghana. It is easier to have trained SSPs do proper disposal than individual farmers. Therefore the project will promote proper disposal of containers through the promotion and strengthening of SSPs through regular training.

Water bodies in Ghana, including the large Lake Volta, have been found to be contaminated with multiple pesticides such as DDT and lindane. This has a secondary contamination effect on lake sediments and freshwater fish.

Contamination in food produce includes, for example, lettuce in Kumasi in which levels of DDT have been recorded at 400 micrograms per kilogram (or 400 parts per billion). Fianko et al (2011), Darko and Acquaah (2008) and Laary (2012) all report pesticide contamination in multiple areas of the food chain and natural environment. Water samples from rivers in the intensive cocoa growing areas in the Ashanti and Eastern Regions of Ghana have been found to contain lindane and endosulfan. Water samples from Akumadan, a vegetable farming community in the Ashanti Region and different areas of Ghana revealed the presence of significant levels of pesticide residues (Fianko et al, 2011). The possible reasons for pesticides to reach these aquatic environments are through direct runoff, leaching, careless disposal of empty containers, equipment washing, and use of toxic products. In the Upper East Region of Ghana, a 2012 report by NPASP stated that 15 farmers died from suspected pesticide poisoning in 2010. A quarter of farmers surveyed had recently suffered health problems from inhaling pesticides because no protective clothing or masks are used when spraying (NPASP, 2012). Farmers using agro-chemicals are most at risk of poisoning and contamination, but because these chemicals are also making their way into the environment and food produce, the general public is also at risk. Every precaution would be taken to minimize spraying near standing water bodies or streams, and wells. In particular, spray operators would be trained on the risks associated with (a) pouring excess pesticide mixtures in rivers, streams or ponds, (b) washing pesticide application equipment in rivers, streams, ponds and other water bodies and (c) discarding empty pesticide containers in rivers, streams and ponds.

A basic principle of IPM is judicious use of pesticides. This means that chemical pesticides will be used only as a last resort, for example, in the case of unexpected pest invasion by migratory pests such as armyworms and grasshoppers or grain eating birds. Pesticides would also only be used when it is economic to do so, on a needs basis, after detailed field surveys and assessment of the extent of the pest distribution schedule to prevent pest incidence and damage

C. Ensure compliance with Regulation 216

It is important to ensure that beneficiary farmers do not use locally-available pesticides containing banned substances and unregistered products. All field staff will be trained on how to apply this PERSUAP to their work. All trainings for SSPs and other project beneficiaries will include the following general topics:

1. Pests and diseases of maize and soybean
2. Types of Pesticides and Pesticide formulations
3. Steps in selecting appropriate pesticides for specific pests and diseases
4. Safety for spray service providers and non-target environments in pesticide application
5. Residual effects of pesticides on food stuffs and non-target organisms
6. GHANA EPA regulations on pesticides
7. Safe use of agrochemicals was widely covered in the training curriculum.
8. Appropriate use and maintenance of spraying equipment (Knapsack)
9. Proper measurements and mixing of pesticides
10. Transportation and storage of pesticides
11. Identification of counterfeit and banned chemicals

Table 3.1: Actions by Objectives/Issues Identified in PERSUAP

Objective	Issues	Interventions required	Outputs
A. PESTICIDE RISK AWARENESS			
A1. Reduce reliance on pesticides.	• Local pest control	• Follow GAPs recommendations	• Reduced incidence of

	options are limited. • Pesticides are costly and may not be used safely.	• Use of IPM • Practice crop rotation • Select resistant varieties	diseases and pests. • More farmers adopt IPM.
A2. Promote use of PPEs	• Farmers do not fully appreciate the importance of PPEs. • Farmers do not fully appreciate the potential hazards of using pesticides.	• Continuous education of farmers on the importance of PPEs Encourage the use of local readily available and less costly materials to sew PPEs which will be affordable for farmers. • Promote use of less hazardous agrochemicals	• Increased use of PPEs by farmers
A3. Discourage re-use of pesticide containers	• Containers are used to store household items including food. • Farmers are unaware of the dangers involved.	• A sustained campaign to discourage re-use of containers. • Provide a central point for collecting and disposing containers.	• Reduced number of people using pesticide containers
A4. Discourage women and children from pesticide application	• Limited farm labor compelling women to apply pesticides. • Inability of women to pay for SSP services.	• Provide special training to women on the effects of pesticides on women and children.	• Reduced cases of women applying pesticides
B. PREVENT ENVIRONMENTAL POLLUTION			
B1. Promote safe disposal of pesticide containers	• Empty pesticide containers are either left on farms or re-used for domestic purposes. • Some farmers are not aware of the proper methods of disposal.	• Set up container collection centers with NFs where all containers used by out-growers will be collected. • Destroy and bury containers or return to manufacturers for re-use.	• Reduced incidence empty containers littered on farms.
B2. Minimize ground and surface water	• Pesticide use near water bodies.	• Reduce soil disturbance such as	• Farmers adopt

contamination.	• Pesticide use on wet fields with flowing water. • Pesticide use immediately after rainfall.	reduced tillage. • Leave a buffer of at least 5m to rivers and streams when spraying: - Flat land: 5m - Gentle slope: 10m - Slope >30°: 15m	conservation farming methods.
B3. Minimize potential for using pesticides more than necessary.	• Farmers may apply pesticides, especially for storage grain, without actually encountering the threat of a pest invasion leading sometimes to avoidable high cost of agrochemicals and over application of pesticides.	• Promote GAPs and IPM to reduce over reliance on pesticides. •	• More farmers able to interpret pesticide labels
C. ACTIONS TO ENSURE COMPLIANCE			
C1. Conduct safe pesticide use training	• Farmers and other persons who handle pesticides have inadequate knowledge of pesticide products and labels as well as observing pre-harvest and Re-entry intervals	• Develop training content targeting specific groups – farmers, women, dealers, partners etc.	• Training contents developed
C2. Promote the services of SSPs	• Farmers may do their own spraying because they have no access to trained spray service providers. • Farmers who do their own spraying often do not wear PPEs and may apply more chemical than needed.	• Work with NFs and FBOs to include spray services in their extension support to out-growers. • Provide regular training for SSPs on environmental safety procedures.	• Training programs for SSPs conducted
C3. Avoid the use of highly toxic products	• Farmers do not appreciate the short and long term consequences of very toxic products on their health and the environment. • Some farmers simply do not know the toxic levels of the products they use	• Train farmers to read and understand the symbols and colors on pesticide labels. • Promote use of non-chemical pest control option. Stakeholders such as PPRS and EPA must ensure that	• Farmers adopt IPM approaches

	and the need to avoid them.	very highly toxic chemicals do not make their way onto the Ghanaian market	

Table 3.2: Implementation of the SUAP actions

No.	Activity	By whom	When
1.	Training of staff on application of the PERSUAP.	Environmental Specialist	
2.	Detailed training on aspects of the PERSUAP to enable FTF ADVANCE field staff to have a better understanding of the PERSUAP contents and application in the field.	Environmental Specialist	Annually
3.	Training of farmers on topics identified in the PERSUAP	APOs and RCs	Field days at demonstration sites
4.	Training SSPs on Pesticide toxicology, Pesticides and the human health, safe use and handling of Pesticides.	RCs, EPA and MOFA-PPRSD	Continuous
5.	Pesticide use monitoring	Environmental Specialist and P&CBO	Production season

TABLE 3.3: SAFER USE MONITORING PLAN

Monitoring the recommended Safer Use Actions						
Objective	**Issues**	**Interventions required**	**Responsible party**	**Indicators**	**Means of verification**	**Frequency**
A. PESTICIDE RISK AWARENESS						
A5. Reduce reliance on pesticides.	☐Local pest control options are limited. ☐Pesticides are costly and may not be used safely.	☐Follow GAPs recommendations ☐Use of IPM ☐Practice crop rotation ☐Select resistant varieties	☐ Agric Production Officers	☐ No. of farmers adopting IPM.	Proportion of farmers using improved seed and recommended fertilizers from Gross Margin reports	Yearly
A6. Promote use of PPEs	☐Farmers do not fully appreciate the importance of PPEs ☐Farmers do not fully appreciate the potential hazards of using pesticides.	☐Continuous education of farmers on the importance of PPEs ☐Promote use of less hazardous agrochemicals	☐ Agric Production Officers ☐ Environmental Specialist	☐ Proportion of farmers using PPEs	☐ Pesticide use monitoring report. ☐ Inventory of pesticides used on demos.	Yearly
A7. Discourage re-use of	☐Containers are used to store household items	☐A sustained campaign to discourage re-	☐ Agric Production Officers	☐ Number of communities using	☐ Radio jingle reports	Yearly

Monitoring the recommended Safer Use Actions						
Objective	**Issues**	**Interventions required**	**Responsible party**	**Indicators**	**Means of verification**	**Frequency**
pesticide containers	including food. ☐Farmers are unaware of the dangers involved.	use of containers. ☐ Provide a central point for collecting and disposing containers.	☐ Environmental Specialist	pesticide containers	☐ Pesticide use monitoring report	
A8. Discourage women and children from pesticide application	☐Limited farm labour compelling women to apply pesticides. ☐Inability of women to pay for SSP services.	☐ Provide special training to women on the effects of pesticides on women and children.	☐ APOs ☐ Environmental Specialist ☐ Gender Specialist ☐ Outreach Specialist	☐Reduced cases of women applying pesticides	☐ Radio jingle reports ☐ Pesticide use monitoring report	Yearly
B. PREVENT ENVIRONMENTAL POLLUTION & DANGER TO HUMAN HEALTH						
B5. Promote safe disposal of pesticide containers	☐Empty pesticide containers are either left on farms or re-used for domestic purposes. ☐Some farmers are not aware of	☐ Set up container collection centers with NFs where all containers used by out-growers will be collected. ☐ Destroy and bury	☐ Agric Production Officers ☐ Environmental Specialist ☐ Nucleus Farmers	☐Reduced incidence of empty containers on farms.	☐ Radio jingle reports ☐ Pesticide use monitoring	Yearly

Monitoring the recommended Safer Use Actions						
Objective	**Issues**	**Interventions required**	**Responsible party**	**Indicators**	**Means of verification**	**Frequency**
	the proper methods of disposal.	containers or return to manufacturers for re-use.			report	
B6. Minimize ground and surface water contamination .	☐Pesticide use near water bodies. ☐Pesticide use on wet fields with flowing water. ☐Pesticide use immediately after rainfall.	☐ Reduce soil disturbance such as reduced tillage. ☐ Leave a buffer of at least 5m to rivers and streams when spraying: - Flat land: 5m - Gentle slope: 10m - Slope >30º: 15m	☐Agric Production Officers ☐Environmental Specialist	☐ No. of farmers exposed to conservation farming methods.	☐Demo log sheets ☐Demo report	Yearly
B7. Minimize potential for using pesticides more than necessary.	☐Farmers may apply pesticides, especially for storage grain, without actually encountering the threat of a pest invasion leading	☐ Promote GAPs and IPM to reduce over reliance on pesticides.	☐Agric Production Officers ☐Environmental Specialist	☐ More farmers able to interpret pesticide labels	GAPs training attendance sheets	Yearly

Monitoring the recommended Safer Use Actions						
Objective	**Issues**	**Interventions required**	**Responsible party**	**Indicators**	**Means of verification**	**Frequency**
	sometimes to avoidable high cost of agrochemicals and over application of pesticides.					
C. ACTIONS TO ENSURE COMPLIANCE						
C4. Conduct safe pesticide use training	☐ Farmers and other persons who handle pesticides have inadequate knowledge of pesticide products and labels.	☐ Develop training content targeting specific groups – farmers, women, dealers, partners etc.	☐Environmental Specialist ☐ATT project ☐EPA	☐ Training contents developed	☐Training materials	Once
C5. Promote the services of SSPs	☐ Farmers may do their own spraying because they have no access to trained spray service	☐ Work with NFs and FBOs to include spray services in their extension support to out-growers. ☐ Provide regular	☐Environmental Specialist ☐Agric Production Officers	☐ Training programs for SSPs conducted	☐Training reports ☐SSP records	Yearly

Monitoring the recommended Safer Use Actions						
Objective	**Issues**	**Interventions required**	**Responsible party**	**Indicators**	**Means of verification**	**Frequency**
	providers. ☐Farmers who do their own spraying often do not wear PPEs and may apply more chemical than needed.	training to SSPs on environmental safety procedures.				
C6. Avoid the use of highly toxic products	☐Farmers do not appreciate the short and long term consequences of very toxic products on their health and the environment. ☐Some farmers simply do not know the toxic levels of the products they use and the need to avoid them.	☐ Train farmers to read and understand the symbols and colours on pesticide labels. ☐ Promote use of non-chemical pest control option	☐Environmental Specialist ☐Regional Coordinators ☐Snr Agric Production Specialist ☐Agric Production Officers	☐ Farmers adopt IPM methods	☐ Training reports	Yearly

Annex 1: Pests and Diseases of Target Crops and Available and Recommended Control Methods

Annex 1A: Fall Armyworm Pest Management Decision Guide (12/2016), by Ghana MOFA PPRSD & CABI Plantwise.

Opensource link: http://www.plantwise.org/FullTextPDF/2017/20177800275.pdf

PEST MANAGEMENT DECISION GUIDE: GREEN AND YELLOW LIST

plantwise

Fall armyworm on maize

Spodoptera frugiperda

Fall armyworm larva and frass on maize tassle (J. Crozier, CABI)

Damage cause to cob by larva (J. Crozier, CABI)

Top - Damage on maize leaves (J Crozier, CABI); Bottom - Egg mass on cotton leaf (©Ronald Smith/Auburn University/ Bugwood.org - CC BY 3.0 US)

Prevention	Monitoring	Direct Control	Direct Control	Restrictions
• Avoid late planting. Plant early to avoid peak immigration of adults • Remove and destroy all crop residues after harvest • Deep plough the soil to bury the larvae and the pupae • Regularly weed the field and surroundings • Ensure optimum fertilization is used for your maize crop: Recommended fertilizer rates (4 bags or 200kg of NPK 15:15:15 per ha) to increase the growth vigour	• Start monitoring for presence of the pest or symptoms from the 2-3 week stage • Look for cream or grey egg masses on the underside of leaves covered in a felt-like layer of grey-pink scales from the female moth • Check for light green to dark brown larvae with 3 thin yellowish white stripes down the back and a distinct white inverted "Y" on head • Monitor the whorl for larvae covered with a plug of yellowish brown frass • Look for patches of small shot holes "window pane" to large ragged and elongated holes in the leaves emerging from the whorl • Monitor damage on 10 consecutive plants in 10 randomly selected sites. Take control measures if 20% of plants are infested with larvae	• On small-scale farms, handpick and destroy the egg masses and larvae • Put a handful of sand (mixed with lime or ash), sawdust or soil in the whorl of the attacked plants to kill the larvae • Apply biopesticides Ecopel or Bypel1 2x at three week intervals. Apply 1 sachet/15ltr knapsack	• When using a pesticide or botanical, always wear protective clothing and follow the instructions on the product label. • Do not use chemicals with the same mode of action year after year as this can lead to resistance. • Always consult the most recent list of registered pesticides of MOFA, Ghana	
			• Apply Acetamiprid (20g/l) + Lambda-cyhalothrin (16g/l) (E.g. K-Optimal, Blast 60EC). Acetamiprid: systemic neonicotinoid IRAC group 4A. Lambda-cyhalothrin: contact, ingestion pyrethroid IRAC group 3A	• WHO class II (moderately harzardous). Apply 60-80mls per 15 litre knapsack. REI is 24hours. Stop application when the cobs are well formed. Apply 3 times at 2 week intervals
			• Apply Atom Super (Thiamethoxam (30g/l) + Deltamethrin (20g/l)). Thiamethoxam: systemic neonicotinoid IRAC group 4A. Deltamethrin: contact, ingestion pyrethroid IRAC group 3A	• WHO class II (moderately harzardous). Apply 60-80mls per 15 litre knapsack. REI is 24hours. Stop application when the cobs are well formed. Apply 3 times at 2 week intervals
			• Apply Betallic Super (Pirimiphos methyl (400g/l) + Permethrin (75g/l)) Pirimiphos methyl: organophosphate IRAC group 1B. Deltamethrin: contact, ingestion pyrethroid IRAC group 3A	• WHO class II (moderately harzardous). Apply 60-80mls per 15 litre knapsack. REI is 24hours. Stop application when the cobs are well formed. Apply three times at two week intervals. Pirimiphos methyl is an organophosphate and persistant in the environment

Ghana

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LOSE LESS, FEED MORE
Plantwise is a CABI-led global initiative www.plantwise.org

Annex 1B: African Armyworm Pest Management Decision Guide (March 2016), by Ghana MOFA PPRSD & CABI Plantwise.

Opensource link: http://www.plantwise.org/FullTextPDF/2017/20177800134.pdf

PEST MANAGEMENT DECISION GUIDE: GREEN AND YELLOW LIST

African Armyworms on maize

Spodoptera exempta Sankobi (Akan)

Adult female armyworm (©Georg Goergen/IITA Insect Museum, Cotonou, Benin)

Larva of armyworm feeding on maize leaves (©Rikus Kloppers/PANNAR Seed (Pty) Ltd, Greytown, South Africa)

Prevention	Monitoring	Direct Control	Direct Control	Restrictions
• Remove weeds such as Amaranthus and wild grass species that harbour armyworm larvae • Avoid planting close to overgrazed grasslands which provide food and refuge for caterpillars • Grow low value grain crops such as finger millet as trap crops to attract armyworms • Remove alternate host plants such as millet, sorghum, rice, leafy vegetables etc.	• Start monitoring immediately after germination. • Visit farm daily to inspect for defoliation (chewed leaves), feeding frass and caterpillars (which are grey-green with yellow stripes along the back). Examine soft stems, and developing shoots for hidden caterpillars • Take direct control action when eggs are present on 2 to 5% of seedlings or when 10 to 25% of plants show signs of feeding damage • Set pheromone traps (placed 20m apart) and examine pheromone traps weekly	• Pick egg masses when you see them on the underside of the leaves, and destroy them • Pick and destroy colonies of widely dispersed caterpillars if possible. • Plough deep trench around field and fill with water to stop the movemet of the armyworms from field to field	• When using a pesticide or botanical, always wear protective clothing and follow the instructions on the product label.	
			• Do not use chemicals with the same mode of action year after year as this can lead to resistance; always consult the most recent list of registered pesticides of MOFA, Ghana	
			• Spray crop with Lambda-cyhalothrin product (eg.Pawa 2.5 EC at 40mls/15L of water). It is a synthetic Pyrethroid (IRAC, 3A). It is a contact insecticide	• WHO Class II (Moderately hazardous); Maximum 3 applications per season in the morning and later in the day. PHI 3 days. REI 24 hours. Eye and skin irritant. Highly toxic to bees and other non target arthropods.Toxic to aquatic organisms. Avoid using near water ways.
			• Spray with Cymethoate (Cypermethrin (36g/l) + Dimethoate (400g/l). 1-1.5Lit/ha. Cypermethrin is a synthetic Pyrethroid (IRAC,3A). It is contact. Dimethoate is an Organophosphate (IRAC,1B).	• WHO Class II (Moderately hazardous); Maximum 3 applications per season in the morning and later in the day. PHI 7-14 days. REI 24 hours. Eye and skin irritant. Highly toxic to bees and other non target arthropods.Toxic to aquatic organisms. Avoid using near water ways.

Ghana

CREATED/UPDATED: March 2016
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Annex 2: Pesticide Toxicity

USEPA SYSTEM OF CLASSIFICATION OF ACUTE TOXICITY				
TOXICITY CATEGORIES	CATEGORY I	CATEGORY II	CATEGORY III	CATEGORY IV
Acute Oral	Up to and including 50 mg/kg	> 50 thru 500 mg/kg	> 500 thru 5000 mg/kg	> 5000 mg/kg
Acute Dermal	Up to and including 200 mg/kg	> 200 thru 2000 mg/kg	> 2000 thru 5000 mg/kg	> 5000 mg/kg
Acute Inhalation1	Up to and including 0.05 mg/liter	> 0.05 thru 0.5 mg/liter	> 0.5 thru 2 mg/liter	> 2 mg/liter
Primary Eye Irritation	Corrosive (irreversible destruction of ocular tissue) or corneal involvement or irritation persisting for more than 21 days	Corneal involvement or other eye irritation clearing in 8-21 days	Corneal involvement or other eye irritation clearing in 7 days or less	Minimal effects clearing in less than 24 hours
Primary Skin Irritation	Corrosive (tissue destruction into the dermis and/or scarring)	Severe irritation at 72 hours (severe erythema or edema)	Moderate irritation at 72 hours (moderate erythema)	Mild or slight irritation at 72 hours (no irritation
Signal Word	DANGER	WARNING	CAUTION	None Required

WHO SYSTEM OF CLASSIFICATION OF ACUTE TOXICITY					
WHO TOXICITY CLASSIFICATION		RAT LD50 (MG OF CHEMICAL PER KG OF BODY WEIGHT)			
CLASS	DESCRIPTION	SOLIDS (ORAL)	LIQUIDS (ORAL)	SOLIDS (DERMAL)	LIQUIDS (DERMAL)
Ia	Extremely hazardous	‹ 5	‹ 20	‹ 10	‹ 40
Ib	Highly hazardous	5-50	20-200	10-100	40-400
II	Moderately hazardous	50-500	200-2,000	100-1,000	400-4,000
III	Slightly hazardous	› 500	›2,000	›1000	› 4,000

U	Unlikely to present acute hazard in normal use	› 2,000	› 3,000	---	---
	Not classified: believed obsolete				
	Pesticides subject to the Rotterdam Convention				

Annex 3: Approved Active Ingredients Human Toxicity and Ecotoxicology

No.	Active ingredient/ Chemical	Commercial Product Names in Ghana	Acute/Chronic Toxicity (human hazards)	Eco-toxicity	Groundwater Contamination Potential	Other Comments/Crops
			INSECTICIDES			
27	Abamectin (18g/L	Bomec EC	May cause slight to moderate eye and skin irritation. Not readily absorbed through the skin	HT to crustaceans and bees. ST to fish	Very low potential for groundwater contamination	
28	Acetamiprid (16g/L) + cypermethrin (12g/L)	Chemiprid 88EC	Unlikely to accumulate in the body when small doses are ingested.	Cypermethrin is highly toxic to fish and bees. Low toxicity to birds	Cypermethrin is unlikely to contaminate groundwater because it binds tightly to soil particles.	
29	Acetamiprid (20g/L) Lambda-cyhalothrin(15g/L)	K-Optimal	May cause slight irritation of the eye and skin. Could cause gastrointestinal disorders if swallowed.	Very toxic to aquatic organisms		
30	Acetamiprid (16g/L) Bifenthrin (30g/L)	Aceta Star 46EC	May cause slight irritation skin. Could of the eye and cause gastrointestinal disorders if swallowed.	Very toxic to aquatic organisms	Insufficient data	Avoid use in aquatic environments
31	Acetamiprid (200g/L)	Golan SL	Acute toxicity unknown; carcinogen not likely; not	MT to fish and wildlife; selective toxicity to insects; MT to bees;	Degrades rapidly by aerobic soil metabolism. Does not bio-	

			cholinesterase inhibitor; not developmental/reproductive toxin	minimal risk to non- target plants	accumulate in fish and in sediment.	
32	Dimethoate (400g/L)	Dimeking EC	Moderate to severe skin irritation. Severe irritation of eyes.	Slightly toxic to fish, HT to amphibians and crustaceans and VHT to bees	Potential groundwater contaminant	Do not apply directly to water to areas where surface water is present.
33	Fenvalerate (200g/L)	Sanitox 20EC	Irritant to skin and eyes.	Harmful to game, wild birds and livestock. Toxic to bees	Not listed	No smoking or drinking when using product.
34	Imidacloprid (200g/L)	Consider Supa Dimiprid 20SL	Acute MT in humans; not listed as carcinogen; unknown as dev/reproductive toxin	Not acutely toxic to fish; VHT to insects, as a systemic, expressed in pollen and nectar	Potential ground water contaminant	The use of imidacloprid should be avoided when crops are flowering.
35	Imidacloprid(350g/kg) Thiram (100g/kg)	Insector TDS	Irritant to eye and skin. Acute oral toxicity.	Very toxic to aquatic organisms.	Potential ground water contaminant	
36	Indoxacarb (30g/L) Acetamiprid (16g/L)	Viper 46EC	Indoxacarb may cause mild eye irritation with tearing, & blurred vision. May cause skin sensitization with allergic rashes.	Moderately toxic to bees, HT to fish and crustaceans.	No data found	
37	Lambda-cyhalothrin(25g/L)	Sunhalothrin Lambda Super	Eye irritant	Highly toxic to fish and aquatic	Do not contaminate	Insecticide/ Acaricide.

		Lambdacot Striker Lambda Master Rainlambda		invertebrates	ponds, waterways or ditches with chemical or used container	
38	Malathion (700g/L)	EnviGold	Eye irritation including redness, tearing, and blurred vision. Repeated skin contact may cause irritation. Aspiration into lungs can cause pneumonitis. This condition may be fatal.	Malathion is biodegradable. It undergoes rapid degradation in the environment. Toxic to fish, aquatic invertebrates, and aquatic life stages of amphibians. Highly toxic to bees.		
FUNGICIDES						
39	Mancozeb (800G/Kg)	Kilazeb 80WP, Dizcozeb 80WP, Rainmancoz80 WP	Acute oral and dermal, toxicity, Probably carcinogen; endocrine disruptor, irritating to respiratory system	HT to fish, aquatic inverts, MT to bees, aquatic plants; RNT to birds	Does not accumulate in soil; moderate potential to contaminate GW	Not listed. Protective clothing required.
40	Imidacloprid350g/kg)+ Thiram (100g/kg)+ Metalaxyl-M(35g/kg)	Calthio Mix485WS	Irritant to eye and skin, acute oral toxicity Metalaxyl generally is of low acute toxicity but is a moderate eye irritant and has been placed in Toxicity Category	VT to aquatic organisms	Insufficient data	

			II (indicating the second highest degree of acute toxicity) for eye irritation effects			
41	Permethrin (33%) + Carbendazim (15%)+ Chlorothalonil(12%)	Seedrex WP	Irritant to eye and skin.	Permethrin and Carbendazim are highly toxic to aquatic organisms, bees and birds	Chlorothalonil has limited potential to reach GW, and where it has been detected, concentrations have been low.	Permethrin is a restricted use product.
	HERBICIDES					
42	2,4-D 720g Amine	Herbextra, Sun-2,4 d Amine 72%, Caliherb 720 SL, Ervextra, Wiper Bonamine	Harmful in contact with skin and if swallowed. Irritating to eyes	Practically non-toxic to organic organisms	Potential for mobility in soil is high. May be used to control aquatic weeds in presence of fish if used in strict accordance with	Do not spray crops when under stress.
43	Atrazine (750g/L) + Nicosulfuron (40g/kg)	Herbimais	Exposure may cause irritation to skin, eyes, throat, and abnormal liver function.	Atrazibe is RNT to birds and bees, ST to fish, other aquatic life	Insufficient data	
44	Bispyribac-sodium (400g/L)	Bisonrice 400SC	Acute toxicity. Slightly irritant to eye. Non- irritant to skin.	Toxic to fish and earthworms	Insufficient data	

45	Glyphosate (41%)	Glycot Glycel	Irritation to eyes, skin and respiratory system. Harmful if swallowed	Slightly toxic to amphibians, fish and zooplankton. Moderately toxic to crustaceans	The product is practically immobile in soil and is unlikely to leach.	A rain free period of at least 6 hours (preferably24 hours) must follow application.
46	Glyphosate (360g/L)	Nwura wura SL Kalach 360SL Rival 360SL, Wynna 360SL, Sunphosate Afuo Wura,,	Irritation to eyes, skin and respiratory system. Harmful if swallowed	Glyphosate is readily degraded by soil microbes to AMPA (aminomethyl phosphonic acid) that is further degraded to carbon dioxide	Glyphosate and AMPA are unlikely to enter ground water due to their strong adsorptive characteristics.	A rain free period of at least 6 hours (preferably24 hours) must follow application.
47	Glyphosate (480g/L)	Power Bonsate 480SL Chemosate480SL Nnoboa Glyphogan Glyphader Weedall SL Sharp 480 SL, Adom 480 SL, Adwuma wura SL,	Slight acute toxicity	Slightly toxic to amphibians, fish and zooplankton. Moderately toxic to crustaceans	The product is practically immobile in soil and is unlikely to leach.	A rain free period of at least 6 hours (preferably24 hours) must follow application.
48	Glyphosate (360g/L) + Oxyfluorfen (360g/L)	Zoomer 390SC	Irritant to eyes and skin. Harmful if swallowed	Oxyfluorfen is non-toxic to birds and bees, but HT to aquatic invertebrates, aquatic plants and	Oxyfluorfen is practically insoluble in water and has a tendency to absorb to soil.	Do not apply directly on areas where surface water is present.

				fish.		
49	Glyphosate (757g/Kg)	Arrow 75WDG	Slightly toxic to amphibians, fish and zooplankton. Moderately toxic to crustaceans	The product is practically immobile in soil and is unlikely to leach.	Not likely	A rain free period of at least 6 hours (preferably24 hours) must follow application. Protective clothing required.
50	Metolachlor (333g/L) + Terbutryn (16g/L)	Terbulor 500EC	No carcinogenic potential	Terbutryn is MT to fish, ST to bees and MT to earthworms	Has the potential to accumulate in GW	
51	Nicosulfuron (750g/kg)	Arrow 75WDG	Slightly irritant to eye and skin	Non-toxic to fish, aquatic invertebrates, soil microbes, birds, mammals and fish.	Potential GW contaminant	
52	Nicosulfuron (40g/L)	Nicoking Nicogan Nicoherb Nico 40OD Nicoplus	Slightly irritant to eye and skin	Non-toxic to fish, aquatic invertebrates, soil microbes, birds, mammals and fish.	Potential GW contaminant	
53	Oxadiargyl (400g/L)	Topstar 400SC	No skin irritation, slight eye irritation	PNT to fish, aquatic invertebrates and aquatic plants.	Not applicable	For transplanted rice, treat the fluid mud 3 days before transplanting, then water after transplanting. Apply 0.5L per Ha
54	Pendimethalin(400g/L)	Alligator 400SC	Acute toxicity, ST; likely carcinogen, dev/reproductiv e toxin.	ST to birds, MT to fish, HT to aquatic invertebrates, RNT to bees	Groundwater contaminant	
55	Pendimethalin(445g/L)	Stomp SC	Acute toxicity, ST; likely carcinogen, dev/reproductive toxin.	ST to birds, MT to fish, HT to aquatic invertebrates, RNT to bees	Groundwater contaminant	
56	Propanil (240g/l) +2, 4 D	Propacal plus480 EC	Low toxicity if swallowed, May	Propanil is HT to aquatic organisms	Propanil has a moderate bio-	

	isobutylate(200g/l)		cause severe eye irritation with corneal injury, moderate skin irritation	and ST to birds on a dietary basis	concentration potential and medium mobility in soil.	
57	Propanil (360g/l) +2, 4 D Amin (200g/l)	Propanil Plus Orizo Plus Rainpropaplus PrpaGold	Low toxicity if swallowed, May cause severe eye irritation with corneal injury, moderate	Propanil is HT to aquatic organisms and dietary basis ST to birds on a	Propanil has a moderate bio-concentration potential and medium mobility	
58	Propaquizafop	Agil 100EC	Eye and skin irritant	Not toxic to bees	Not persistent in soil. Half-life time: 15-26 days Water: Half-life time <1 day;	

WHO Acute Toxicity:

Class O = Obsolete Pesticide; Class Ia = Extremely Hazardous, Class Ib = Highly Hazardous; Class II = Moderately Hazardous; Class III = Slightly Hazardous, Class U = Unlikely to Present Acute Hazard in Normal Use

EPA Acute Toxicity:

Category I = Extremely Toxic, II = Highly Toxic, III = Moderately Toxic, IV = Slightly Toxic

Chronic Toxicity:

KC = Known/Likely Carcinogen; PC = Possible Carcinogen; ED = Potential Endocrine Disruptor; RD = Potential Reproductive or Developmental Toxin; NT = Cholinesterase inhibitors that are Potential Parkinson's Disease Risk Factor and other neurological toxins

Acute Ecotoxicity:

HT = Highly Toxic; MT = Moderately Toxic; ST = Slightly Toxic or LT – Low Toxicity; NT = Not Toxic

Annex 4: Training in Pesticide Safer Use

Pesticide safer use training for Project staff addressed the following minimum elements.

- Definition of pesticides
- Pesticide risks, the understanding that pesticides are bio-poisons
- Risks associated with release of pesticides into the environment and avoiding harmful effects.
- Concepts of AIs vs. formulated products.
- Classes of pesticides and the concept of broad spectrum vs. narrow spectrum, target specific pesticides
- Concept of proper application rates and pesticide resistance and techniques for avoiding misapplication.
- Practice-focused training in the core elements of Safer Pesticide Use:
- IPM (Training in IPM)
- Reading and interpreting pesticide labels and MSDS -- including understanding PPE requirements and other precautions, dosage rates, and to identify AIs and expiration dates. (Understanding Pesticide Labels and Material Safety Data Sheet)
- Use of proper PPE and its treatment and maintenance (Protective Clothing and Equipment)
- Proper use and maintenance of equipment including calibration of sprayers. Safer mixing and application of pesticides including ensuring compliance with Reentry and Pre-harvest intervals specified by the label/MSDS (Proper Spray Technique: Protecting Against Pesticide Spray Drift)
- Safer Purchase, Transport, and Storage of pesticides (Pesticide Transport and Storage)
- Pesticide first aid and spill response. (First Aid for Pesticide Poisoning)
- Clean-up and Disposal (Proper Pesticide Container Disposal)
- Record keeping and monitoring. (Monitoring and Data Record Keeping)

1. **What are Pesticides?**
Pesticides are substances that are meant to inhibit, retard, interfere with growth or kill directly or indirectly a pest, including weeds. The term pesticides includes: herbicides (controls weeds), insecticides (controls insects), nematicides (controls nematodes), molluscicides (controls snails and slugs), rodenticides (controls rodents), avicides (controls birds) and fungicides (controls fungi).

When pesticides are made from plants, they are referred to as ***Botanicals***. When chemically prepared in the laboratory, it is referred to as synthetic. Most pesticides manufactured these days are Synthetic.

2. **In what form do pesticides come?**
Pesticides comes in different forms, namely:
- Emulsifiable concentrates
- Wettable powders
- Oil solutions
- Dusts
- Fumigants
- Baits

By formulation, chemicals are put into two broad groups: 1. Solid and 2. Liquid formulations.

3. **How do you select the right pesticide?**
   a. Identify the pest to be controlled
   b. Determine if the control is needed
   c. The pesticide should not have negative effect on crops, animals, human and the environment
   d. Can be used with the application equipment you have
   e. Must be labelled for use on the pest
   f. Look out for EPA registration number

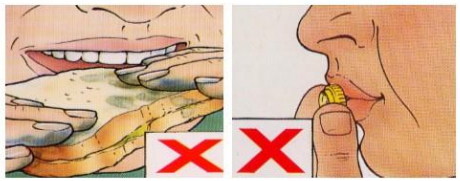
4. **Are Pesticides also poisons?**
Pesticides are also referred to as economic poison Fatalities from pesticide poisoning results only from accidents and ignorance.

5. **What are the possible routes through which pesticides enter our body?**
Pesticides enter our body through:
- The skin (hands, arms and feet)
- The respiratory organ (through inhalation : nose, throat and lung tissues).
- The mouth (eating, smoking or drinking while mixing or applying the pesticide).

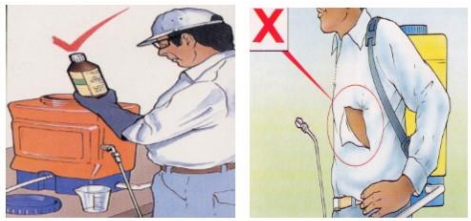
6. **Symptoms of pesticide poisoning on human**
Headaches, dizziness, skin irritation, convulsion, stomach upset, nausea, chest pain, cough, difficulty in breathing, excessive sweating etc.

7. **Environmental effect of pesticides**
- Pollution of land and water bodies
- Killing of beneficial insects or natural enemies.
- Air pollution.

8. **How to avoid pesticide poisoning**
- Do not eat, drink or smoke while handling or using pesticides
- Always eat or drink before application
- Avoid blowing into blocked knapsack nozzle
- Always wear personal protective equipment before mixing or applying pesticides



9. **What to consider before applying Pesticide**
   a) Read the label instruction before use.
   b) Check for expiry date of product, pre harvest, re entry interval and dosage before using the product.
   c) Choose the right pesticide for the target pest
   d) Use appropriate measuring and application equipment
   e) Wear proper personal protective equipment whenever you want to spray or mix chemical
   f) Do not measure or mix pesticides inside or close to dwellings or animal enclosures
   g) Keep away from animals and children
   h) Take care not to contaminate water bodies.



Type of Product / Direction of application	Reflex nozzle	Flat fan	Hollow cone
Herbicide, Systemic Fungicide	✓	✓	⛔
Contact Fungicide, Insecticide	✓	✓	✓
Contact Fungicide, Insecticide	⛔	✓	✓
Drift Risk	Low	Medium	High

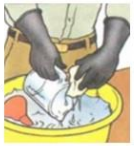
Use the right nozzle

10. **Precautions to take when Measuring or Mixing Pesticides**
    a) Wear protective clothing when measuring, mixing or applying a pesticide
    b) Use appropriate measuring equipment
    c) Use the recommended doses
    d) Never use your bare hand to mix pesticides
    e) Never siphon mixture by sucking with your mouth
    f) Avoid splashes.
    g) Never re use containers or measuring equipment for preparing pesticides for other purposes.
    h) Keep animals and children away when measuring or mixing pesticides.



11. **Precautions when spraying**
    - Spray early in the morning or late in the evening to target pest
    - Check wind direction (do not spray against wind)

12. **Things to do after Spraying**
    a) Never pour left over spray into water bodies as this kills marine life.
    b) Wash all equipment after use and use the rinsing water to fill the sprayer
    c) Carefully rinse empty container after use (at least three times)
    d) Never reuse empty pesticide containers for foodstuff or water
    e) Destroy empty pesticide containers to make them unusable.
    f) Do not leave empty pesticide cans and containers lying on the ground in your farm




Pictograms for Safe Handling

SAFE USE AND PROPER HANDLING OF PESTICIDES

Annex 5: Training in IPM

INTEGRATED PEST MANAGEMENT (https://pesticidestewardship.org/ipm/)

Integrated Pest Management, or IPM, combines appropriate methods to reduce pests such as weeds, insects, diseases, and rodents to acceptable levels while causing the least impact on the environment and public health. IPM is based on taking preventive measures, monitoring the crop or site for the level of the pest(s), assessing the potential for pest damage, and choosing appropriate actions. Many different tactics may be available, including cultural practices, biological control agents, pesticides, pest-resistant varieties, mechanical methods and physical barriers. In IPM, these tactics may be combined into a plan that best suits the particular situation. It is a comprehensive approach dedicated to removing causes rather than just treating symptoms. IPM practitioners determine whether intervention is needed and:

1. **When it is needed,**
2. **Where it is needed, and**
3. **Which pest management intervention(s) will be appropriate.**

Defining IPM

Since the 1930's, over 60 definitions of IPM have been published. Here is a basic definition which will be used on this website.

Integrated Pest Management (IPM) is the coordinated use of pest and environmental information along with available pest control methods, including cultural, biological, genetic and chemical methods, to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to people, property, and the environment.

Integrated means that all feasible types of control strategies are considered and combined as appropriate to solve a pest problem.

Pests are unwanted organisms that are a nuisance to man or domestic animals, and can cause injury to humans, animals, plants, and property. Pests reduce yield and/or quality in plants ranging from field crops, fruits and vegetables, to lawns, trees, and golf courses.

Management is the process of making decisions in a systematic way to keep pests from reaching intolerable levels. Small populations of pests can often be tolerated; total eradication is often not necessary, or feasible.

The Basics of IPM

All of the components of an IPM approach can be grouped into three activities. The first is monitoring; the second is assessing the pest situation; and the third is taking action. Trace these steps through this web site by reading through these pages. For more information follow the links on each page.

IPM is information intensive and relies on scouting and monitoring programs for the collection of field data about key factors such as:

- Pest population identification
- Disease pressure
- Weather conditions and degree-days
- Pest date of first occurrence of biological events in their annual cycle
- Crop growth stage
- Presence, reliance and preservation of beneficial organisms

IPM uses decision support systems for determining if control measures are necessary and what measures are most appropriate. Such as:

- Economic thresholds – the pest population level that inflicts crop damage greater than the cost of control
- Availability of selective pesticides

- Action levels – pest level when action should be applied to prevent pest from reaching injurious levels
- Environmental risk measurements (i.e. impacts on pollinators)
- Disease forecasting systems

IPM programs seek to avoid pest damage through practices such as:

- Use of field sanitation and reduction of pest habitat
- Crop rotations
- Selection of pest/disease tolerant or resistant seeds and varieties
- Judicious use of pesticides that prevent pest infestations
- Resistance management

Why Practice IPM?

You might be wondering why you should even consider IPM when pesticides so often succeed at controlling pests. Here are some reasons for using a broader approach to pest management than just the use of pesticides.

- **Many IPM practices** are used before a pest problem develops to prevent or hinder the buildup of pests.
- **Keep a Balanced Ecosystem.** Every ecosystem, made up of living things and their non-living environment, has a balance; the actions of one creature in the ecosystem usually affect other, different organisms. Many of our actions in an ecosystem can change this balance, destroying certain species and allowing other species (sometimes pests themselves) to dominate. Beneficial insects, such as the ladybird beetle and lacewing larvae, both of which consume pests, can be killed by pesticides, leaving fewer natural mechanisms of pest control.

- **Reliance on Pesticides can be Problematic.** Pesticides are not always effective when used as a singular control tactic. Pests can become resistant to pesticides. In fact, some 600 cases of pests developing pesticide resistance have been documented to date, including populations of common lamb-quarters, house flies, Colorado potato beetle, Indian meal moth, Norway rats, and greenhouse whitefly.
- **IPM Is Not Difficult.** You will have done much of the "work" for an IPM approach if you've figured out the problem (the pest), determined the extent of the pest population, and decided on the best combination of actions to take.
- **Maximize Effectiveness of Control Tactics**. Pest control practitioners, following traditional programs, sometimes apply pesticide treatments on a calendar based schedule regardless of the stage of development of the target pest and the number of pests present. Using an IPM approach will ensure that all control tactics, including pesticides, are used at the proper time and only to reduce pest damage to acceptable levels. This will reduce costs from unnecessary pesticide applications and insure that control tactics are used when they will be most effective.
- **Promote a Healthy Environment.** The definition of IPM promotes a careful consideration of all pest control options with protection of the environment a key goal.
- **Natural Enemies Conserved**. Parasites and predators are part of the natural control mechanism for some pest populations. These natural controls are considered and protected in an IPM program
- **Maintain a Good Public Image.** A thoughtful approach to pest control, which protects the environment and provides an abundant, affordable crop and safe living conditions, is a basic goal of IPM.

Once a pest manager has taken precautions to prevent pest infestations, it is important to watch regularly for the appearance of insects, weeds, diseases, and other pests. This is called monitoring.

The primary goals are to locate, identify, and rank the severity of pest infestations. These data may also be used to project future populations through pest management models. In addition to giving solid data for making a management decision, regular monitoring works well for checking the success or failure of a control strategy. Pest populations vary from field to field, building to building, and

year to year. Managing pests requires flexibility and an absolute commitment to pest monitoring. Pest monitoring is site-, crop-, and pest-specific. Each situation will require specialized knowledge and tools.

Monitoring *pests involves:*

Regular checking of a crop field, garden, greenhouse, golf course, warehouse, bakery, restaurant, field, greenhouse, golf course, or other areas and **early detection of pests** function together like an early warning system for pests, helping to prevent or minimize a pest outbreak.

Proper identification of pests is an extremely important prerequisite to handling problems effectively. For example, the brown banded and German cockroach can be easily confused with each other. Identification is important because certain management practices may control only one species and not the other. Correct identification enables you to manage the real source of the problem and avoid merely treating the symptoms (or controlling organisms that are not pests). Some pests cause similar damage. Unless the pest is identified, the control program may have the wrong pest as its target. Identification enables you to cure the pest problem and avoid injury to non-target organisms, particularly if you:

- use a pesticide that is specific to the pest;
- control the pest effectively during the most susceptible stage of its life cycle;
- consider the use of a non-chemical control.
- **Identifying the effects of naturally-present biological control agents** means knowing which organisms are beneficial and determining if pests have been affected by them. Sometimes pests are kept in check naturally, and at other times the pest populations increase sharply.
- **Assessing the efficacy of pest management actions that have been taken** is a very important part of monitoring. The scout must know the "what," and "where" of the management actions taken and report successes or failures.

Monitoring tools and techniques:

The IPM Scout or technician is the most important part of a professional monitoring program. The scout works in a variety of situations, each requiring specific knowledge and tools. However, diligent growers, golf course superintendents, homeowners, etc. can also monitor successfully for pests:

Tools

- Flashlight
- Black light (detect rodent urine)
- Video camera
- Screwdriver
- Putty knife
- Spatula
- Tracking patches or powders]
- Double-sided transparent tape (tree and shrub insects)
- Shovel or spade

Monitoring pest populations with traps. The use of monitoring traps is highly recommended for certain insects, rodents and diseases. Practically speaking, these devices are a must. They extend the eyes of the pest manager to places they cannot see and provide ongoing coverage.

Insect Monitoring Traps

Plastic bucket traps appear to be very efficient and economical.

Light traps are attractive to some insects, but pheromone traps offer increased flexibility in deployment and are much less expensive.

Sticky Traps: Some insects are attracted to bright yellow or other colors so they can be caught on colored sheets of plastic or cardboard that has been coated with glue. Sticky traps are usually used as a monitoring tool in greenhouses and orchards, although they can also be used as a control on indoor plants. By regularly checking the sticky traps a grower can find out when the first of the adult insects are present among the plants.

- **Yellow sticky traps** attract adult whiteflies, flower thrips, fungus gnats, leafminers and cabbage loopers.
- **Bright blue traps** are also available for flower thrips.

Pheromone Traps: Individually packaged pheromone attractant traps are available for monitoring some species of moths. The traps are baited with a lure that mimics the odor given off by female moths to attract males for mating. The traps are used to find out when the main flights of adult moths occur so that sprays can be put on at the right time to have the greatest effect. Orchard growers use traps to time codling moth sprays so that they are used when the most moth eggs are hatching into caterpillars.

Plastic pitfall traps are used for crawling pests in the field as well as in stored grain bins. The species and number of insects found in a trap should be recorded and charts constructed so that changes in population size can be easily noticed.

Vertebrate Monitoring Traps Small secretive and sometimes nocturnal vertebrate pests are difficult to monitor. Traps are very important when checking on domestic rodent populations, mice and rats.

- Snap trap (single catch),
- Automatic trap (multiple catch),
- Sticky trap (glue boards),

- Single catch live box traps.

Digital monitoring tools:

Computers and other electronic tools are very much a part of IPM monitoring. Geographic Information Systems and Global Positioning Systems allow very precise mapping of areas. These devices, when used with soil mapping and yield monitors are part of a system called "Precision Agriculture".

Precision agriculture has a lot to offer IPM, by identifying many crop yield- or quality-reducing factors using technology such as remote sensing and geo-referenced crop scouting (to measure crop vigor, quality and disease), yield monitors (to show yield variation), and crop and pest modeling. Precision applications of products to control pests are often more effective than conventional methods, and require less pesticide. Yield monitors and site-specific crop quality data provide a report card on how effective the crop production products and management tactics were. For example, a predicted disease level can then be used as the basis for a variable rate fungicide application and provide decision support for various production practices, such rootstock selection, fertilization, and irrigation.

Geographic Information Systems (GIS) are databases that store the relationship between data collected and their locations. Locations may be in real-earth coordinates Universal Transverse Mercator (UTM) coordinate system, longitude/latitude, or on a grid (i.e. X, Y coordinates). A GIS combines digital mapping, database functions, and spatial analysis.

Global Positioning Systems (GPS) is a U.S. space-based system that provides reliable positioning, navigation, and timing service worldwide.

An example of a practical IPM use of these devices is as follows.

- The GPS system is used to map blacklight trap locations in agricultural areas used to monitor for crop pests. (The GPS units are accurate to within 10 feet.)
- The trap counts are collected and entered into an Excel database which is linked to the GIS software.
- The GIS software is used to create a map of the counts.
- The maps are shared with growers in the community by sending a newsletter, fax, email or an internet web page.

Mapping the trap counts is useful for predicting where and when a pest will be arriving. Additionally, the pest maps can be overlaid with weather maps that will help predict pest movement and the likelihood of damage to crops.

Assessment

Within an IPM program, assessment is the process of determining the potential for pest populations to reach an action threshold. The art and science of this approach is what makes IPM different from other pest management strategies. The process merges biology, ecology, and economics with the results of monitoring and identification of the pests. Is a grower likely to suffer financially? Will the disease vector transmit the infection? Those are some of the questions this process is trying to forecast.

- **Forecasting.** Pest models can help determine if weather conditions will be favorable for the development of diseases and insect pests. For example, by entering weather facts (such as the number of rainy days and the temperatures for those days), growers can predict outbreaks and spray only when conditions are favorable for diseases. Growers who have kept good records of pests in previous years can use these records to help determine if problems such as weeds, insects, and diseases will reoccur. They might be able, for example, to apply the most effective herbicides at the proper time for early control of a specific weed problem.
- **Thresholds.** Before any pest control action is taken, the IPM approach considers if the pest has exceeded a pre-set threshold; the point at which the pest population or environmental condition indicate that pest control action must be taken.

Thus, finding a single pest or even very low numbers of pests does not always result in taking action. Conversely, some pests in a field may be below the threshold while others are above it. Keep in mind that thresholds are crop- and pest-specific, as well as weather-related.

Important terms:

- **Economic threshold:** The pest density at which a control tactic must be implemented to avoid an economic loss.
- **Action threshold:** A pest or damage level at which control is initiated to avoid significant damage or loss of property. Usually, a lower level than the Economic threshold.
- **Economic damage:** The amount of injury which will justify the cost of control action.
- **Economic injury level:** The lowest population density that will cause economic damage.

There are five basic factors considered when setting action thresholds; economics, health and safety concerns, aesthetic concerns, public opinion, and legal requirements.

1. **Economics.** Economic thresholds for many pests and crops have been carefully determined. The grower would not treat the crop unless the pest threshold is exceeded and there is risk of economic loss. Once the pest density (number of pests per unit area) has reached threshold, action is justified. The costs of control (i.e. applying a pesticide) will be less than or equal to the estimated losses that the pests would cause if left uncontrolled.
2. **Health and safety concerns.**When the pest creates a health or safety concern, the action threshold is set low. For example, if Lyme disease is prevalent in near a playground, and if the ticks that transmit the disease are found, then this would trigger the action threshold

3. **Aesthetic concerns.** When the appearance of something is degraded, then that triggers an aesthetic concern, for example, bird droppings on statues and monuments, or defoliation of landscape plants or high value horticulture crops. Thresholds for horticulture crops are usually set low because damaged goods are difficult to sell.
4. **Public opinion.** It may be less obvious, but public opinion will often result in an action threshold being set very low. The pest could be perceived as scary or disgusting, but whatever the reason, social, cultural, or psychological, some creatures are pests because people will not tolerate them. Spiders are a good example. There are also those who are unwilling to accept pests at any level.
5. **Legal requirements.** Pest levels are regulated under federal, state, and county health regulations. Therefore, action levels are being set by regulation. For example, there is virtually no tolerance for mice, rats, flies, cockroaches or any other pests in food facilities. If a public health emergency is declared, government agencies may mandate pest control in the event of a rabies or encephalitis outbreak. Building codes and standards may determine action to control termites, rats or flies on private or commercial properties and public areas, including parks or schools.

Taking Action (Control Measures)

Once a pest has reached either an economic threshold, or intolerable level, action should be taken. Pesticides are used as a control measure when other strategies will not bring the pest population under the threshold, when other strategies are too expensive or time-consuming, or when the quality or yield effects are unacceptable to the grower. In fact, the success of waiting until a pest reaches threshold usually hinges on the availability of a pesticide that will bring the pest populations down quickly.

Management tactics

Management tactics can be preventative, curative, or both and are sometimes combined to provide the best possible program. Control tactics include cultural, biological, chemical, genetic and physical. Preventative measures taken before planting, or before the

pest appears, can result in fewer rescue-treatments. Each crop and situation will require management options tailored to that situation. A general list of actions is provided below

Cultural Controls are those that disrupt the environment of the pest, and/or prevent its movement. Plowing, crop rotation, removal of infected plant material, cleaning of greenhouse and tillage equipment, and effective manure management are all cultural practices that are employed to deprive pests of a comfortable habitat or prevent their spread. The management of urban and industrial pests has improved with proper sanitation and elimination of pest harborages, more frequent garbage pickup, or installation of lights that do not attract insects.

- Rotate crops to reduce the buildup of weeds, disease, and insect pests. Crop rotation is useful for those pests that do not move far from their overwintering sites.
- Remove overwintering sites, such as cull piles, damaged, and volunteer plants, and alternate hosts, to minimize damage by insects and diseases.
- Use techniques that expose pests to natural enemies or environmental stress, or that make the crop less susceptible to insects or diseases.
- Adjust planting times to avoid periods of peak pest abundance.
- Plant disease-free seed and transplants.
- Promote vigorous crop growth with proper nutrition and weed removal to avoid stress that may weaken crops and make them more susceptible to attack by insects, diseases, or physiological disorders.
- Manage irrigation schedules to avoid long periods of high relative humidity. Wet, highly humid conditions encourage disease pests to develop.
- Arrange fields for the best air drainage and circulation to promote low humidity.
- Where crops are planted in rows use cultivation, where practical, in combination with banding of herbicides over the row for weed control. This could reduce herbicide costs while achieving good weed control.

Physical Barriers such as netting over small fruits and screening in greenhouses can prevent insects that cause crop loss, and mulch can inhibit weed germination beneath desirable plants. Physical barriers are important in termite, house fly, and rodent control.

Biological Controls — conserving or releasing natural enemies (biological control agents) can prevent the rise of certain pests. Examples of biological control agents are beneficial mites that feed on mite pests in orchards, the milky spore disease that kills harmful soil grubs, and *Encarsia formosa*, a wasp that parasitizes the greenhouse whitefly. Many biological control agents are commercially available.

- Purchasing and releasing predators and parasites of pests, if available, can be effective in reducing pest populations.
- Develop refuges for natural enemies of the pest by establishing areas of flowering plants and shrubs to supply nectar, alternative hosts , and shelter.
- Choose and use pesticides wisely so you can conserve indigenous or released natural enemies of insect and mite pests.

Pheromones (natural insect scents) can be used in pest management. Sometimes a manufactured "copy" of the pheromone that a female insect emits to attract mates can be used to confuse males and prevent mating. This technique is used in curbing damage from many different species pest species, such as the oriental fruit moth, codling moth, the grape berry moth pink bollworm, tomato pinworm.

Pest-resistant cultivars are less susceptible than other varieties to certain insects and diseases. Planting disease resistant crops is one of the simplest methods of reducing disease management actions during the growing season. Use of resistant varieties often means that growers do not need to apply as many pesticides as with susceptible varieties. Potato growers control the golden nematode by planting resistant cultivars. Apple growers can save up to eight fungicide applications a year by growing Liberty and Freedom cultivars, which resist diseases. Farmers growing alfalfa and wheat keep several pests at bay by planting resistant varieties.

Chemical control

- Use pesticides when monitoring, economic thresholds, or disease forecasts indicate a need.
- Select pesticides according to efficacy, previous use patterns, the potential for and incidence of resistance, and the possible impact on the environment and natural enemies.
- Be certain to achieve uniform spray coverage with your equipment, applying recommended spray rates with accurately calibrated equipment which targets the pest, or crop surfaces to be protected.

Annex 6: Rejected, Prohibited and Banned Pesticides

No	Name of Pesticide
1.	2,4,5-T and its salts and esters
2.	Aldrin
3.	Binapacryl
4.	Captafol
5.	Chlordane
6.	Chlordimeform
7.	Chlorobenzilate
8.	Dichlorodiphenyltrichloroethane (DDT)
9.	Dieldrin

10.	Dinoseb and its salts and esters
11.	Dinitro-*ortho*-cresol (DNOC) and its salts (such as ammonium salt, potassium salt and sodium salt)
12.	Endrin
13.	HCH (mixed isomers)
14.	Heptachlor
15.	Hexachlorobenzene
16.	Parathion
17.	Pentachlorophenol and its salts and esters
18.	Toxaphene
19.	Mirex
20.	Methamidophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)
21.	Methyl-parathion (emulsifiable concentrates (EC) with at or above 19.5% active ingredient and dusts at or above 1.5% active ingredient)
22.	Monocrotophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)
23.	Parathion (all formulations - aerosols, dustable powder (DP), emulsifiable concentrate (EC), granules (GR) and wettable powders (WP) - of this substance are included, except capsule suspensions (CS))
24.	Phosphamidon (Soluble liquid formulations of the substance that exceed 1000 g active ingredient/l)
25.	Dustable powder formulations containing a combination of Benomyl at or above 7%, Carbofuran at or above 10% and Thiram at or above 15%
26.	Methyl Bromide
27.	Chlordecone
28.	Alpha hexachlorocyclohexane
29.	Beta hexachlorocyclohexane
30.	Lindane
31.	Pentachlorobenzene
32.	Technical Endosulfan and its related isomers

Annex 7: Fully Registered Pesticides (FRE) and (A3) Herbicides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	Adom 48 SL	FRE/1767/1258G December 2017	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Jakess Agro Company Ltd, Kumasi
2.	Adupa Wura SL	FRE/1825/1288G January 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Bentronic Productions, Kumasi
3.	Adwumaden Ye	FRE/17166/1182G September 2017	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Dasimah Enterprise, Adum-Kumasi
4.	Adwumapa SL	FRE/1771/1191G September 2017	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Chinese Woman Agrochemical, Kumasi
5.	Adwumaye 41 SL	FRE/1682/1128G December 2016	Glyphosate (410 g/l)	III	Herbicide for the control of annual perennial and broadleaf weeds and grasses	Cropstar Enterprise, Kumasi
6.	Adwuma Wura 480 SL	FRE/1843/1344G July 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
7.	Agil 100 EC	FRE/17100/1236G November 2017	Propaquizafop (100g/l)	III	Herbicide for the control of grasses in	Adama West Africa Ltd.,

					pineapple, cotton, groundnut, soybean, vegetables and yam	Accra
8.	Agilox 170 EC	FRE/16100/00995G August 2016	Oxyfluorfen (120g/l) + Propaquizafop (50g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in onion	Adama West Africa Ltd., Accra
9.	Agro 2,4-D 72 SL	FRE/1710/1230G October 2017	2, 4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds and sedges in cereals and sugarcane	Reiss & Co. Ghana Ltd., Accra
10.	Agro-Ametryn 500SC	FRE/1710/1234G October 2017	Ametryn (500g/l)	II	Herbicide for the control of annual broadleaf weeds and grasses in fruits and sugarcane	Reiss & Co. Ghana Ltd., Accra
11.	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
12.	Alligator 400 EC	FRE/17202/1195G October 2017	Pendimethalin (400g/l)	III	Herbicide for the control of grasses in rice	Macrofertil Gh. Ltd., Tema
13.	Amino 72 SL	FRE/1805/1380G August 2018	2, 4-D Amine (720g/l)	III	Selective herbicide for the control of broad-leaved weeds and sedges in cereals and sugarcane	Chemico Limited, Tema
14.	Aminespray 720SL	FRE/1899/1433G December 2018	2,4-D Amine (720g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds in cereals,	Rainbow AgroSciences Co. Ltd., Tema

					sugarcane and citrus	
15.	Aminoforce 72SL	FRE/18145/1320G May 2018	2,4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds and sedges in cereals and tree crops	Jubaili Agrotec Ltd., Kumasi
16.	Anna	FRE/ 1822/1414G November 2018	2,4D Amine (720g/l)	II	Selective herbicide for control of weeds in rice, maize, sorghum	Annoh and Sons Enterprise, Accra
17.	Anigramo Super 20 SL	FRE/18122/1278R January 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses	Asantepon Farms, Kade
18.	Aniphosate 41 SL	FRE/18122/1277G January 2018	Glyphosate (410g/l)	III	Herbicide for annual, perennial broadleaf weeds and grasses in cereals and vegetables	Asantepon Farms, Kade
19.	Arsenal Gen 2SL	FRE/18206/1266G January 2018	Imazapyr (250g/l)	II	Selective post emergence herbicide for the control of grasses in cereals	Josann Agro Consult (J.A.C) Ltd., Accra
20.	Basagran 480 SL	FRE/18206/1265G January 2018	Bentazon (480g/l)	II	Herbicide for the control of broadleaf weeds in beans, groundnut and maize	Josann Agro Consult (J.A.C) Ltd., Accra
21.	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

22.	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
23.	Benapa 460 SL	FRE/1899/1326G May 2018	Bentazone (400g/l) + MCPA (60g/l)	II	Contact and selective post-emergence herbicide for the control of grasses in rice, maize, sorghum and sugarcane	Rainbow Agrosciences Co. Ltd., Tema
24.	Benaxone	FRE/1825/1334G July 2018	Paraquat (276g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Bentronics Productions. Kumasi
25.	Betallic Super	FRE/1825/1337G July 2018	Pirimiphos methyl (400g/l) + Permethrin (75g/l)	II	Insecticide for the control of insect pests in maize and cowpea	Bentronic Productions. Kumasi
26.	Bextra 72SL	FRE/1825/1289G January 2018	2, 4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in maize, rice and sorghum	Bentronic Productions, Kumasi
27.	Bisonrice 400SC	FRE/1899/1375G August 2018	Bispyribac sodium (400g/l)		Selective herbicide for the control of grasses and broadleaf weeds in rice	Rainbow Agro Sciences Co. Ltd., Tema
28.	Butaforce EC	FRE/18145/1322G May 2018	Butachlor (500g/l)	III	Pre-emergent herbicide for the control of grasses and broadleaf weeds in rice, soybean,	Jubaili Agrotec Ltd., Kumasi

					cotton and vegetables	
29.	Butaplus EC	FRE/1843/1354G July 2018	Butachlor (50%)	II	Pre-emergence herbicide for soyabean, cotton, rice, groundnuts and vegetable	Kumark Co. Ltd., Kumasi
30.	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
31.	Canphosate SL	FRE/18147/1292G January 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Errands4u, C4 - 68, DTD, Madina, Accra
32.	Canquat Super SL	FRE/18147/1293R January 2018	Paraquat dichloride (20%)	II	Herbicide for control of grasses and broadleaf weeds in cereals and vegetables	Errands4u, C4 - 68, DTD, Madina, Accra
33.	Capizad EC	FRE/17202/1209G October 2017	Haloxyfop-R-methyl (104g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema
34.	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
35.	Chemosate Super EC	FRE/1705/1143G July 2017	Glyphosate (360g/l)	III	Herbicide for the control of annual and perennial weeds in	Chemico Ltd., Tema

					crops	
36.	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
37.	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
38.	Chemoxone SL	FRE/1805/1391G August 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Chemico Limited, Tema
39.	Chemuron 80 WP	FRE/1805/1392G August 2018	Diuron (800g/kg)	III	Herbicide for the control of grasses in pineapples, citrus and mangoes	Chemico Limited, Tema
40.	Chemovar 80 WP	FRE/1805/1393G August 2018	Bromacil (800g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in pineapples	Chemico Limited, Tema
41.	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.
42.	Condax WP	FRE/1678/00925G October 2016	Bensulfuron-methyl (30%)	III	Systemic herbicide for the control of annual and perennial broadleaf weeds in rice	Five Continents, Accra

43.	Cotbond 560 SL	FRE/1758/1256G November 2017	Propanil (360g/l) + 2, 4-D Amine salt (200g/l)	II	Herbicide for the control of grasses and weeds in rice	Afcott Ghana Ltd., Accra
44.	Conti-sul WP	FRE/1865/1274G January 2018	Acetolachlor (25%) + Bensulfuron-methyl (5%)	III	Herbicide for the control of annual, perennial weeds in rice	Five Continents Imports & Exports, Accra
45.	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
46.	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
47.	Destroyer	FRE/1718/1125G January 2017	Glyphosate (360g/l)	III	Herbicide for the control of annual and perennial weeds	Rhemaco Enterprise, Kumasi
48.	Dinamic Plus 500EC	FRE/1606/1007G August 2016	Amicarbazone (100g/l) + Propisochlor (400g/l)	III	Herbicide for the control of grasses and broadleaf weeds in arable crops	Calli Ghana Limited, Tema
49.	Diuron 80WP	FRE/1602/1044G August 2016	Diuron (80%)	III	Herbicide for the control of grasses in cotton and sugarcane	Agrimat Limited, Madina
50.	Diuron Plus	FRE/1843/1356G July 2018	Diuron (80%)	III	Herbicide for the control of annual and perennial grasses and	Kumark Co. Ltd

					broadleaf weeds in pineapples, citrus and mangoes	
51.	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
52.	Diutop 80WP	FRE/1626/1051G September 2016	Diuron (800g/kg)	II	Herbicide for the control of grasses and broadleaf weeds in pineapple	The Candel Company Limited, Accra
53.	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
54.	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
55.	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
56.	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	Macro Fertil , Ghana Ltd, Tema

57.	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
58.	ForceUp SL	FRE/18145/1319G May 2018	Glyphosate (41%)	III	Herbicide for the control of weeds in crops	Jubaili Agrotec Ltd., Kumasi
59.	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
60.	Forpine 80 WP	FRE/1899/1364G August 2018	Bromacil (80%)	III	Herbicide for the control of weeds in pineapples and citrus	Rainbow Agro Sciences Co.Ltd., Tema
61.	Fos-lade Super 15 EC	FRE/1890/1300G February 2018	Fluazifop-p- butyl (150g/l)	III	Selective herbicide for the control of annual, perennial grasses in broadleaf crops	Thomas Fosu Enterprise, Kumasi
62.	Franko 2, 4-D	FRE/1739/1177G September 2017	2,4-D Amine salts (720g/l)	II	Herbicide for the control of broadleaf weeds and sedges in rice, maize, sorghum, millet and sugarcane	Frankatson Limited, Accra
63.	Frankosate 41 SL	FRE/1739/1175G September 2017	Glyphosate (410g/l)	III	Herbicide for the control of broadleaf weeds, sedges and grasses in orchards	Frankatson Limited, Accra
64.	Gallant Super	FRE/1805/1390G	Haloxyfop (108g/l)	III	Post emergence herbicide for the	Chemico Limited

		August 2018			control of broadleaf weeds in vegetables	
65.	Garlon 4E	FRE/1805/1389G August 2018	Triclopyr (480g/l)	III	Herbicide for use as tree killer and the control of broadleaf weeds	Chemico Limited. Tema
66.	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
67.	Glycot 41 SL	FRE/1758/1253G November 2017	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals	Afcott Ghana Limited, Accra
68.	Glyphader 75 SG	FRE/17202/1197G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema
69.	Glyphader 480 SC	FRE/17202/1202G October 2017	Glyphosate (480g/l)	III	Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Macrofertil Gh. Ltd., Tema
70.	Glyphapat	FRE/17166/1190G September 2017	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in soybean, cotton, wheat, beans and cereals	Dasimah Enterprise, Adum-Kumasi

71.	Glyfos 41SL	FRE/1802/1403G August 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Agrimat Limited., Accra
72.	Glyphosate 95% Technical	FRE/1857/1397G August 2018	Glyphosate Ammonium Salt (95 % Min)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric Products & Trading, Accra
73.	Glyphosate 88% Technical	FRE/1857/1398G August 2018	Glyphosate Ammonium Salt (88 % Min)	III	Herbicide for the control of broadleaf weeds and grasses in maize	Wynca Sunshine Agric Products & Trading, Accra
74.	Grammosharp 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
75.	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
76.	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	RMG Ghana Ltd., Sccra
77.	Guardforce OD	FRE/18145/1429G December 2018	Nicosulfuron (4%)	III	Herbicide for the control of annual grass weeds	Jubaili Agrotec Ltd, Kumasi
78.	Herbacut 72 SL	FRE/1682/1132G	2,4-D Amine Salt (720g/l)	II	Herbicide for the control of broadleaf	Cropstar Enterprise, Adum-

		December 2016			weeds and sedges	Kumasi
79.	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
80.	Herbextra 72 SL	FRE/1843/1340G July 2018	2,4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in rice, maize, sorghum,	Kumark Co. Ltd., Kumasi
					millet and sugarcane	
81.	Herbimais WG	FRE/17202/1198R October 2017	Atrazine (750g/kg) Nicosulfuron (40g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Macrofertil Gh. Ltd., Tema
82.	Herbisuper S	FRE/17202/1199G October 2017	Acetachlor (300g/l) + Simazine (200g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Macrofertil Gh. Ltd., Tema
83.	Hero Super 108 EC	FRE/1843/1373G August 2018	Haloxyfop methyl (108g/l)	III	Herbicide for the control of annual grasses in vegetables and pulses	Kumark Co. Ltd., Kumasi
84.	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

85.	Kabaherb SL	FRE/1881/1409G October 2018	2,4-D Amine Salts (720g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in rice	B. Kaakyire Agrochemical Co. Ltd., Kumasi
86.	Kabasate 41SL	FRE/1881/1416G October 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	B. Kaakyire Agrochemical Co. Ltd., Kumasi
87.	Kalach 360 SL	FRE/1706/1249G November 2017	Glyphosate (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Calli Ghana Co. Ltd., Tema
88.	Kalach Extra 70SG	FRE/1706/1250G November 2017	Glyphosate (700g/kg)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Calli Ghana Co. Ltd., Tema
89.	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
90.	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
91.	Kumnwura SL	FRE/1825/1284G January 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Bentronic Productions, Kumasi

92.	Kurasate 360 SL	FRE/1816/1271G January 2018	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Kurama Company Limited, Accra
93.	Kwatrikwa 20 SL	FRE/1802/1404G August 2018	Paraquat (20%)	II	Herbicide for the control of annual, perennial grass and broadleaf weeds	Agrimat Limited. Accra
94.	Ladaba 75 SG	FRE/17202/1200G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals, vegetables and plantation crops	Macrofertil Gh. Ltd., Tema
95.	Lagon 575SC	FRE/16183/1025G August 2016	(Aclonifen 500g/l + Isoxaflutole 75g/l)	III	Pre-emergent herbicide for the control of grasses and broadleaf weeds in maize	RMG Ghana Limited, Accra
96.	Landlord 360 SL	FRE/18185/1317G April 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in crops	RMG Ghana Ltd., Accra
97.	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
98.	Maestro 960EC	FRE/1699/00981G March 2016	Metolachlor (960g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in	Rainbow AgroSciences Company Limited,

					maize	Tema
99.	Nico 40OD	FRE/18139/1421G November 2018	Nicosulfuron (40g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals	Jingbo Agrochemicals Tech. Gh. Co. Ltd., Accra.
100.	Nico Plus OD	FRE/1843/1353G July 2018	Nicosulfuron (4%)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
101.	Nicocal 40 OD	FRE/1825/1338G July 2018	Nicosulfuron (400g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Bentronic Productions. Kumasi
102.	Nicopat Super	FRE/17166/1187G September 2017	Nicosulfuron (40g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds	Dasimah Enterprise, Adum-Kumasi
103.	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
104.	Nicoking 75WG	FRE/1899/1326G August 2018	Nicosulfuron (750g/kg)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Rainbow AgroSciences Co. Ltd., Tema

105.	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
106.	Nwura Wura 360SL	FRE/1757/1218G October 2017	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds	Wynca Sunshine Agric Prod & Trading Co. Ltd., Accra
107.	Oboafo 480 SL	FRE/17202/1208G October 2017	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema
108.	Odyssey 70 WG	FRE/1798/1101G February 2017	Imazamox (35%) + Imazethapyr (35%)	II	Herbicide for the control of annual and perennial broadleaf weeds, grasses in groundnuts and soybeans	CAMA Agro Consult, Accra
109.	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
110.	Ogyefo 72 SL	FRE/1890/1301G February 2018	2,4-D Amine (720g/l)	II	Herbicide for the control of post emergent annual weeds in rice	Thomas Fosu Enterprise, Kumasi
111.	Oyeadieyie 41 SL	FRE/1739/1176G September 2017	Glyphosate (410g/l)	III	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Frankatson Limited, Accra

112.	Orizo Plus SL	FRE/1826/1323G May 2018	Propanil (360g/l) + 2,4-D Amine salts (200g/l)	II	Selective herbicide for the control of grasses and broadleaf weeds in rice	The Candel Company Limited, Accra
113.	Panicummax Cleaner 100EC	FRE/18139/1422G November 2018	Quizalofop-P-Ethyl (100g/l)	II	Systemic herbicides for control of Panicum maximum, annual and perennial weeds	Jingbo Agrochemical s Technology, Gh. Ltd., Accra
114.	Paracot SL	FRE/1758/1254R November 2017	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of grasses and broadleaf weeds in maize, sorghum, yam, cassava and sugarcane	Afcott Ghana Ltd., Accra
115.	Pendigan 400 CS	FRE/18100/1276G January 2018	Pendimethalin (400g/l)	II	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Adama West Africa Ltd., Accra
116.	Pronil Plus SL	FRE/1825/1335G July 2018	Propanil (360g/l) + 2, 4 D Amine Salt (200g/l)	III	Selective herbicide for the control of annual and perennial grasses and broadleaf weeds in rice	Bentronics Productions. Kumasi
117.	Propacal- Plus 480EC	FRE/1843/1342G July 2018	Propanil (240g/l) + 2, 4- D isobutylate	II	Selective herbicide for the control of annual and perennial	Kumark Co. Ltd., Kumasi
			(240g/l)		grasses and broadleaf weeds in rice	

118.	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
119.	Propa Super 36EC	FRE/1623/00988G March 2016	Propanil (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses in corn, sugarcane, sorghum and pineapple	Thomhcof Company Limited, Kumasi
120.	Propaforce Plus EC	FRE/18145/1321G May 2018	Propanil (36%) + 2, 4-D Isobutyl Ester (20%)	III	Herbicide for the control of weeds in rice	Jubaili Agrotec Ltd., Kumasi
121.	Propapat Plus	FRE/17166/1186G September 2017	Propanil (360g/l) + 2, 4- D Amine (200g/l)	III	Herbicide for the control of annual, perennial weeds in arable crops	Dasimah Enterprise, Adum-Kumasi
122.	Ricetop	FRE/1899/1425G December 2018	Propanil (360g/l) + 2,4 D Amine (200g/l)	III	Herbicide for the control of Amaranthus retroflexus,Digitaria spp. Echinochloa spp., Panicum spp. in rice	Rainbow AgroSciences Company Limited, Tema
123.	Ricecare 240 SC	FRE/1899/1327G May 2018	Penoxsulam (240g/l)	IV	Herbicide for the control of broadleaf weeds and sedges in field crops	Rainbow Agrosciences Co. Ltd., Tema
124.	Ricenice 360EC	FRE/1699/00982G March 2016	Propanil (360g/l)	III	Herbicide for the control of Amaranthus retroflexus, Digitaria spp., and Echinochloa spp.in rice	Rainbow AgroSciences Co. Ltd., Tema

125.	Ricestar 300 WP	FRE/1705/1170G September 2017	Bensulfuron-methyl (120g/kg) + Bispyribac- sodium (180g/kg)	III	Herbicide for the control of annual grasses, broadleaf weeds and sedges in rice	Chemico Limited, Tema
126.	Ridmax 510 SL	FRE/1899/1325G May 2018	Glyphosate IPA (300g/l) + 2,4-D IPA (210g/l)	III	Herbicide for the control of annual, perennial weeds in field crops	Rainbow Agrosciences Co. Ltd., Tema
127.	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
128.	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
129.	Rigold 432 EC	FRE/17202/1207G October 2017	Propanil (360g/l) + Triclopyr (72g/l)	III	Herbicide for the control of grasses and broad leaf weeds in rice	Macrofertil Gh. Ltd., Tema
130.	Rondo 48SL	FRE/1710/1232G October 2017	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Reiss & Co. Ghana Ltd., Accra
131.	Rondo 75.7SG	FRE/1710/1231G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in vegetables and	Reiss & Co. Ghana Ltd., Accra

					cereals	
132.	Roundup 450 Turbo	FRE/17202/1201G October 2017	Glyphosate (450g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds in cereals and vegetables	Macrofertil Gh. Ltd., Tema
133.	Sharp 480 SL	FRE/1843/1341G July 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual and perennial grasses and broadleaf weeds in cereals	Kumark Co. Ltd., Kumasi
134.	Shye Nwura SL	FRE/1825/1287G January 2018	Glyphosate (41%)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Bentronic Productions, Kumasi
135.	Sikosto 360 SL	FRE/1816/1270G January 2018	Glyphosate (360g/l)	III	Non-selective herbicide for the control of annual, perennial grasses and broadleaf weeds	Kurama Company Limited, Accra
136.	Sinosate 41 SL	FRE/1825/1291G January 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses	Natosh Enterprise, Kumasi
137.	Special 30 WP	FRE/17202/1206G October 2017	Diuron (560g/kg) + Bromacil (240g/kg)	II	Herbicide for control of weeds in pineapple	Macrofertil Gh. Ltd., Tema
138.	Solito 320EC	FRE/16185/1021G	Pretilachlor (30%) +	III	Selective herbicide for the control of broadleaf	RMG Ghana Limited, Accra

		August 2016	Pyrebenzoxim (2%)		weeds and grasses in rice	
139.	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
140.	Starm Plus 36EC	FRE/1602/1043G August 2016	Propanil (36%)	III	Herbicide for the control of grass weeds in cotton	Agrimat Limited, Madina
141.	Stellar Star	FRE/1698/1034G August 2016	Dicamba (160g/l) + Topramezone (50g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize	Cama Agro Consult, Accra
142.	Stomp 445 CS	FRE/18206/1267G January 2018	Pendimethalin (445g/l)	II	Herbicide for the control of broadleaf weeds and grasses in maize, cotton and tomatoes	Josann Agro Consult (J.A.C) Ltd., Accra
143.	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.
144.	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.

145.	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 Co. Ltd., Accra
146.	Sun 2,4-D PRO 560 EC	FRE/1757/1222G October 2017	2, 4-D Amine (360g/l) + Propanil (200g/l)	II	Herbicide for the control of broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
147.	Sun- Bromacil 80WP	FRE/1857/1359G July 2018	Bromacil (800g/kg)	III	Herbicide for the control of broadleaf weeds and grasses in pineapples	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
148.	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.
149.	Sun- Diuron 80WP	FRE/1857/1360G July 2018	Diuron (800g/kg)	III	Herbicide for the control of weeds in pineapples, mangoes and cashew	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
150.	Sunfuron 40OD	FRE/1657/1055G September 2016	Nicosulfuron (40g/l)	III	Herbicide for the control of broadleaf weeds in maize	Wynca Sunshine Agric Prdts & Trading Co. Ltd, Accra
151.	Sunfuron 75WDG	FRE/1757/1224G October 2017	Nicosulfuron (750g/kg)	III	Herbicide for the control of broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra

152.	Sunfuron 80WP	FRE/1757/1223G October 2017	Nicosulfuron (800g/kg)	III	Herbicide for the control of broadleaf weeds in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
153.	Sun-Gallop	FRE/1657/1056G September 2016	Haloxyfop-P-methyl (108g/l)	III	Pre-emergence herbicide for the control of annual broadleaf weeds in cereals and beans	Wynca Sunshine Agric Prdts & Trading Co. Ltd, Accra
154.	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.
155.	Sunphosate 360 SL	FRE/1757/1220G October 2017	Glyphosate (360g/l)	III	Herbicide for the control of broadleaf weeds and grasses in cereals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
156.	Sunphosate 757 G	FRE/1757/1221G October 2017	Glyphosate (757g/kg)	III	Herbicide for the control of broadleaf weeds and grasses in ceteals and vegetables	Wynca Sunshine Agric Products & Trading Co., Ltd., Accra
157.	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

158.	Sunphosate Ultra SL	FRE/1657/1057G September 2016	Glufosinate Ammonium (200g/l)	III	Non-selective systemic herbicide for the control of weeds in rubber and citrus plantations	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
159.	Sun- Paraquat 200 SL	FRE/1857/1361G July 2018	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of annual and perennial broadleaf weeds and grasses	Wynca Sunshine Agric. Products & Trading Co. Ltd., Accra.
160.	Supraxone SC	FRE/17202/1203R October 2017	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of broadleaf weeds and grasses	Macrofertil Gh. Ltd., Tema
161.	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
162.	Target 240 SL	FRE/1899/1312G April 2018	Imazethapyr (240g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in soybean and cowpea	Rainbow Agrosciences Co. Ltd., Tema
163.	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
164.	Topstar 400SC	FRE/16183/1026G August 2016	Oxadiargyl (400g/l)	III	Pre-emergent herbicide for the control of annual grasses and broadleaf	RMG Ghana, Limited, Accra

					weeds in rice	
165.	Voila EC	FRE/18202/1378G August 2018	Pretilachlor (225g/l) + Pyribenzoxim (15g/l)	III	Herbicide for the control of grasses and broadleaf weeds and sedges in rice	Macrofertil Gh. Ltd., Tema
166.	Weedcot SL	FRE/1758/1257G November 2017	2, 4-D Amine (720g/l)	II	Selective herbicide for the control of broadleaf weeds in cereals	Afcott Ghana Ltd., Accra
167.	Weed Magic 41 SL	FRE/1825/1295G January 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Bentronic Productions, Kumasi
168.	Weed Out SL	FRE/1825/1286G January 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Bentronic Productions, Kumasi
169.	Weed Up	FRE/1822/1415G November 2018	Glyphosate (41%)	III	Herbicide for the control of annual and perennial grasses and broadleaved weeds	Annoh and Sons Agro-chem, Accra

170.	Weed Well SL	FRE/1843/1343G July 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Kumark Company Limited, Kumasi
171.	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
172.	Wynna 360 SL	FRE/1857/1318G April 2018	Glyphosate (360g/l)	III	Herbicide for the control of grasses and broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading, Accra
173.	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
174.	Zoomer 390 SC	FRE/18100/1394G August 2018	Glyphosate (360g/l) + Oxyfluorfen (300g/l)	III	Herbicide for the control of annual and perennial broadleaf weeds and grasses	Adama West Africa Ltd., Accra

Annex 7A: (A) Provisionally Cleared Pesticides (PCL) (B3) Herbicides

No.	Trade Name	Registration No. / Date of Issue	Concentration of Active Ingredient	Hazard Class	Uses	Local Distributor
1.	AB-Xtra 72SL	PCL/18233/1225G November 2018	2, 4-D Amine Salt (720g/l)	II	Herbicide for the control of broadleaf weeds in rice	AB Benaldo Trading Co., Kumasi
2.	Adwuma Boss 48 SL	PCL/18199/1153G August 2018	Glyphosate ammonium (757g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Chemyda Co. Ltd., Accra
3.	Adwuma Mmoa 41 SL	PCL/1850/1076G April, 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Ransfum Enterprise, Kumasi
4.	Adwumaden 41 SL	PCL/18144/1095G May 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses	S.O. Ansah Enterprise, Kumasi
5.	Agriforce	PCL/18145/1186G September 2018	Bispyribac-sodium (100g/)	III	Herbicide for the control of broadleaf weeds in direct-seeded rice	Jubaili Agrotec Ltd., Kumasi
6.	Agrosate	PCL/18214/1067G March, 2018	Glyphosate (48%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in field crops	Alexboat Agro Services, Kumasi
7.	Akuafohene 41 SL	PCL/18218/1080G April, 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Sodap Enterprise, Kumasi

8.	Amega 360 SL	PCL/1843/1144G July 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Kumark Co. Ltd., Kumasi
9.	Atraforce 50SC	PCL/18145/1036R January, 2018	Atrazine (500g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize, yam, sugarcane, orchards, oil palm and citrus	Jubaili Agrotec Ltd., Kumasi
10.	Atraforce 80WP	PCL/18145/1035R January, 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in maize and sugarcane	Jubaili Agrotec Ltd., Kumasi
11.	Atraherb 80 WP	PCL/1845/1141R July 2018	Atrazine (80%)	II	Herbicide for the control of annual and perennial grasses and broadleaf weeds	J.K. Duku Enterprise, Kumasi
12.	Atraking 80WP	PCL/1899/1148R July 2018	Atrazine (800g/kg)	III	Herbicide for the control of broadleaf weeds and grasses in maize, sorghum, sugarcane and yam	Rainbow Agrosciences., Tema
13.	Atraking 500 SC	PCL/1899/1149R July 2018	Atrazine (500g/l)	III	Herbicide for the control of broadleaf weeds and grasses in maize, sorghum, sugarcane and yam	Rainbow Agrosciences., Tema
14.	Atrazine 80WP	PCL/1805/1182R September 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual grasses and broadleaf weeds in maize, sorghum and pineapple	Chemico Limited, Tema

15.	Atrazine 500SC	PCL/1805/1183R September 2018	Atrazine (500g/l)	II	Herbicide for the control annual grasses and broadleaf weeds in maize, sorghum, sugarcane and pineapple	Chemico Limited, Tema
16.	Arrow 400 OD	PCL/1808/1156G August 2018	Nicosulfuron (75%)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Dizengoff Ghana Ltd., Accra
17.	Balton SL	PCL/1808/1081G April, 2018	2, 4 D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds in cereals	Dizengoff Ghana Ltd., Accra
18.	Barizaa 360 SL	PCL/18184/1109G June 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Ganorma Agrochemicals Ltd., Tamale
19.	Batrazine 80WP	PCL/1881/1176R September 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	B. Kaakyire Agrochemicals, Kumasi
20.	Bellazine 500SC	PCL/1805/1181R September 2018	Atrazine (250g/l) + Cyanazine (250g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in maize and sugarcane	Chemico Limited, Tema
21.	Bonbuta	PCL/18149/1157G August 2018	Butachlor (50%)	II	Herbicide for the control of annual, perennial broadleaf weeds in rice, groundnut and	Bon Agro Co. Ltd., Kumasi

					carrots	
22.	Bon Nico	PCL/18149/1241G November 2018	Nicosulfuron (40g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Bon Agro Company Ltd., Kumasi
23.	Bonquat 276SL	PCL/18149/1237R November 2018	Paraquat dichloride (276g/l)	II	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Bon Agro Company Ltd., Kumasi
24.	Bonzine 80WP	PCL/18149/1239R November 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds cereals	Bon Agro Co. Ltd., Kumasi
25.	Butasem 50EC	PCL/18238/1230G November 2018	Butachlor (500g/l)	II	Herbicide for the control annual and perennial in soybean.	Asembe Merchant Link, Accra
26.	Council Activ 30 WG	PCL/ 18183/1254G Novemebr 2018	Triafamone (15%) + Ethoxysulfuron (15%)	II	Herbicide for the control of grasses, sedges and broadleaf weeds in rice	Bayer West- Central Africa SA
27.	Crownsate	PCL/18229/1159G August 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Agrocrown West Africa Limited. Kumasi
28.	Crownquat	PCL/18229/1160R August 2018	Paraquat dichloride (276g/l)	II	Herbicide for the control of grasses and broadleaf weeds in cereals and vegetables	Agrocrown West Africa Limited. Kumasi

29.	ButaClear 50EC	PCL/18184/1106G June 2018	Butachlor (50%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in paddy rice, soybean, cotton, groundnut and vegetables	Ganorma Agrochemicals Ltd., Tamale
30.	Bylor 500EC	PCL/1899/1113G June 2018	Butachlor (500g/l)	III	Herbicide for the control of annual grasses and broadleaf weeds in groundnut and rice	Rainbow AgroSciences Co. Ltd., Tema
31.	Degan SC	PCL/18184/1103G June 2018	Bispyribac sodium (455g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in paddy rice	Ganorma Agrochemicals Ltd., Tamale
32.	Diuron Super 80WP	PCL/18199/1192G September 2018	Diuron (80%)	II	Herbicide for the control of broadleaf weeds in sugarcane	Chemyda Co. Ltd., Accra
33.	Diz-Paraquat 20SL	PCL/1808/1268R December 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial weeds and grasses in cereals and fruits	Dizengoff Ghana Ltd., Accra
34.	D-Lion Atrazine 80WP	PCL/1869/1046R February, 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses in maize, sorghum and pineapple	Dorakt Enterprise Ltd., Accra
35.	D-Lion Dequat Super	PCL/1869/1051R February, 2018	Paraquat (200g/l)	II	Herbicide for the control of annual, perennial weeds in arable crops	Dorakt Enterprise Ltd., Accra
36.	D-Lion Glyphosate	PCL/1869/1052G February, 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial weeds in arable crops	Dorakt Enterprise Ltd., Accra

37.	D-Lion Megazine 3030	PCL/1869/1047R February, 2018	Atrazine (250g/l) + Cynazine (250g/l)	II	Herbicide for the control of annual, perennial grass weeds in maize, sorghum and pineapple	Dorakt Enterprise Ltd., Accra
38.	Dobidi	PCL/1835/1091G May 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	K. Badu Agrochemicals, Kumasi
39.	Emoo Aduro	PCL/1825/1074G April, 2018	Bispyribac- sodium (40%)	III	Herbicide for the control of broadleaf weeds in rice	Bentronic Productions, Kumasi
40.	Erase 480 SL	PCL/18213/1065G March, 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Crop Doctor, Kumasi
41.	Eserewura	PCL/1808/1075G April, 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual and perennial weeds in non-crop lands	Dizengoff Ghana Ltd., Accra
42.	Fastherb 720SL	PCL/18199/1193G September 2018	2,4-D Amine (720g/l)	III	Herbicide for the control of broadleaf weeds in rice	Chemyda Co. Ltd., Accra
43.	Flysate	PCL/18145/1030G January, 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial weeds in cereals and vegetables	Jubaili Agrotec Ltd., Kumasi
44.	ForceUp Granular	PCL/18145/1031G January, 2018	Glyphosate Mono-ammonium salt (757g/kg)	III	Herbicide for the control of annual, perennial weeds in citrus	Jubaili Agrotec Ltd., Kumasi

45.	Frankozine 80 WP	PCL/1839/1142R July 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds in maize, sugarcane, pineapple, sorghum and yam	Frankatson Ltd., Accra
46.	Ganico 40SC	PCL/18184/1107G June 2018	Nicosulfuron (40g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in maize, sorghum and millet	Ganorma Agrochemicals Ltd., Tamale
47.	Ganorherb SL	PCL/18184/1110G June 2018	2, 4-D Amine Salt (720g/l)	III	Herbicide for the control of annual, perennial weeds in maize	Ganorma Agrochemicals Ltd., Tamale
48.	Ganorsate 360 SL	PCL/18184/1104G June 2018	Glyphosate (360g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in arable crops	Ganorma Agrochemicals Ltd., Tamale
49.	Ganoquat super	PCL/1830/1137R July 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grass and broadleaf weeds	Natosh Enterprise, Kumasi
50.	Ganorzine 80WP	PCL/18184/1105R June 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial broadleaf weeds in maize, sugarcane, pineapple, sorghum and yam	Ganorma Agrochemicals Ltd., Tamale
51.	Gramobest Super 20 SL	PCL/1790/1009R December 2017	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grass and broadleaf weeds	Thomas Fosu Ent. Kumasi
52.	Gramocat Super SL	PCL/1750/1021R December 2017	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Ransfum Enterprise, Kumasi

53.	Gramoking 276 SL	PCL/1899/1151R July 2018	Paraquat (276g/l)	II	Contact herbicide for the control of annual, perennial grasses and broadleaf weeds in arable crops	Rainbow Agrosciences, Tema
54.	Grammopak 20SL	PCL/18243/1204R December 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Sharkings Company Ltd., Kumasi
55.	Gramopat Super	PCL/18166/1135R July 2018	Paraquat (42%)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Dasimah Enterprise
56.	Gramotouch Super SL	PCL/18144/1096R May 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in banana, rubber, coconut, oil palm, mango, corn and soybean	S.O. Ansah Enterprise, Kumasi
57.	Groquat Super 27.6 SL	PCL/18175/1064G March, 2018	Paraquat dichloride (20%)	II	Herbicide for the control of broadleaf weeds and grasses in cereals, vegetables and fruit trees	Wamwus Agropharm, Kumasi
58.	Herbacrown	PCL/18229/1161G August 2018	2, 4-D Amine (720g/l)	II	Herbicide for the control of broadleaf weeds in rice and maize	Agrocrown West Africa Limited
59.	Intrri	PCL/18234/1205G September 2018	Triclopyr	II	Herbicide for the control of woody shrubs in eucalyptus	Miro Forestry Ltd., Agogo
60.	KB Agro 2,4-D	PCL/1835/1077G April, 2018	2,4-D Amine (720g/l)	III	Herbicide for the control of broadleaf weeds in rice	K. Badu Agrochemicals, Kumasi

61.	KB Agro Super Traz 500 SC	PCL/1835/1078R April, 2018	Atrazine (500g/l)	II	Herbicide for the control of broadleaf weeds and grasses in maize, sorghum, sugarcane and pineapple	K. Badu Agrochemicals, Kumasi
62.	KB Agro Super Traz 80WP	PCL/1835/1079R April, 2018	Atrazine (800g/kg)	II	Herbicide for the control of broadleaf weeds and grasses in maize, sorghum, sugarcane and pineapple	K Badu Agrochemicals, Kumasi
63.	King Kong	PCL/18149/1236G November 2018	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in cereals, vegetables and fruit trees	Bon Agro Company Ltd., Kumasi
64.	Mo Ne Adwuma 48 SL	PCL/18237/1228G November 2018	Glyphosate (48%)	III	Herbicide for the control of broadleaf weeds and grasses grasses	K. K. Rich Trading Enterprise
65.	Mofarno 160 EC	PCL/1808/1263G December 2018	Quizalofop-p- methyl (35g/l)	III	Herbicide for the control of annual broadleaf weeds in soybean	Dizengoff Ghana Ltd., Accra
66.	Multisate 41SL	PCL/1827/1124G June 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Multivet (Gh) Ltd., Accra
67.	M-Quat 20SL	PCL/1827/1125R June 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops and non-cropland	Multivet (Gh) Ltd., Accra
68.	Nicoda 40 OD	PCL/18199/1195G September 2018	Nicosulfuron (40g/l)	III	Herbicide for the control of weeds in maize	Chemyda Co. Ltd., Accra

69.	Nicofos 400D	PCL/1830/1136G July 2018	Nicosulfuron (4%)	III	Herbicide for the control of weeds in maize	Natosh Co. Ltd., Kumasi
70.	Nicotop 4% OD	PCL/18213/1066G March, 2018	Nicosulfuron (40g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in maize	Crop Doctor, Kumasi
71.	OMNI 2,4-D	PCL/18239/1235G November 2018	2,4-D Amine Salt (500g/l)	II	Herbicide for the control ogf broadleaf weeds in rrice.	OmniFert Ltd., Accra
72.	Panida	PCL/18137/1222G November 2018	Pendimethalin (33%)	II	Herbicide for the control of grasses and broadleaf weeds in soybean and rice	Miqdadi Ghana Ltd., Accra
73.	Paraeforce 20SL	PCL/18145/1032R January, 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice and vegetables	Jubaili Agrotec Ltd., Kumasi
74.	Paraking 20 SL	PCL/1899/1150R July 2018	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of annual and perennial broadleaf weeds and grasses	Rainbow Agrosciences, Tema
75.	Paraq SL	PCL/1826/1093R May 2018	Paraquat dichloride (24%)	II	Herbicide for the control broadleaf weeds and grasses	The Candel Company Limited, Accra
76.	Phyto-General 360SL	PCL/1826/1094G May 2018	Glyphosate (360g/l)		Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	The Candel Company Limited, Accra

77.	Pingrazone	PCL/17205/1013R December 2017	Paraquat dichloride (200g/l)	II	Herbicide for the control of annual, perennial grass and broadleaf weeds	Qiaochang Gh. Ltd., Kumasi
78.	Pintrazine 80 WP	PCL/17205/1014R December 2017	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grass weeds in maize, sorghum and pineapple	Qiaochang Gh. Ltd., Kumasi
79.	Pinup SL	PCL/17205/1015G December 2017	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial weeds and grasses	Qiaochang Gh. Ltd., Kumasi
80.	Power 75 WSG	PCL/1845/1154G August 2018	Glyphosate 757g/kg	III	Herbicide for the control of annual, perennial weeds and grasses	J.K Duku Enterprise
81.	Raptor	PCL/18206/1120G June 2018	Imazamox (40g/l)	U	Herbicide for the control of annual broadleaf weeds and grasses in groundnut and soybean	Josann Agro Consult Ltd., Accra
82.	Pronick Plus 56 EC	PCL/1818/1158G August 2018	Propanil (360 g/l) 2,4-D Amine salt (200 g/l)	III	Herbicide for the control of broad leaf weeds and grasses grasses, in cereals and vegetables	Rhemaco Enterprise
83.	Raze 20 SL	PCL/17186/1016R December 2017	Paraquat Dichloride (200g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Ivorychem Co. Ltd., Kumasi
84.	Rezim 80WP	PCL/1899/1147R July 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Rainbow Agrosciences., Company Tema

85.	Ricecare Super 60 OD	PCL/1899/1116G June 2018	Cyhalofop-butyl (60g/l) + Penoxsulam (10g/l)	IV	Herbicide for the control of annual broadleaf weeds in transplanting and direct seeding rice fields	Rainbow AgroSciences Company Ltd., Tema
86.	Ricestar 320 EC	PCL/1899/1115G June 2018	Pretilachlor (300g/l) + Pyribenzoxim (20g/l)	II	Herbicide for the control of annual weeds in rice (paddy and transplanting fields)	Rainbow AgroSciences Company Ltd., Tema
87.	Rice Mega 400SC	PCL/18199/1197G September 2018	Bispyribac- sodium (400g/l)	III	Herbicide of rthe control of grass weeds in rice	Chemyda Co. Ltd., Accra
88.	Ridmax 75SG	PCL/1899/1114G June 2018	Glyphosate (750g/kg)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses	Rainbow AgroSciences Company Ltd., Tema
89.	Riz-Diz	PCL/1808/1262G December 2018	Bispyribac- sodium (100g/l)	III	Herbicide for the control of annual broadleaf weeds and grasses in rice	Dizengoff Ghana Ltd., Accra
90.	Rhemazone Super SL	PCL/1818/1140R July 2018	Paraquat dichloride (200g/l)	II	Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses	Rhemaco Enterprise, Kumasi
91.	Sidal 2, 4-D	PCL/1866/1224G November 2018	2, 4-D Amine Salt (720g/l)	II	Herbicide for the control of broadleaf weeds in rice	Sidalco Gh. Ltd., Accra
92.	Sun-Aceto EC	PCL/1857/1217G October 2018	Acetochlor (900g/l)	III	Herbicide for the control of annual and perennial weeds in maize, soybean, cotton and peanut	Wynca Sunshine Agric Prdt & Trad. Co. Ltd, Accra.

93.	Sun-Paraquat 200SL	PCL/1857/1132R July 2018	Paraquat dichloride (200g/l)	II	Non-selective herbicide for the control of annual and perennial broadleaf weeds and grasses	Wynca Sunshine Agric Products & Trading Co., Limited, Accra
94.	Super Nicogan 800 WDG	PCL/18100/1082G April, 2018	Mesotrione (570g/kg) +Nicosulfuron (230g/kg)	III	Selective herbicide for the control of weeds in maize	Adama West Africa Ltd., Accra
95.	Supremo	PCL/18149/1232G November 2018	Imazethapyr (240g/l)	II	Herbicide for the control of annual grasses and broadleaf weeds in soybean	Bon Agro Company Ltd., Kumasi
96.	Sunsate 41SL	PCL/1825/1274G December 2018	Glyphosate (410g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize, soybean and tomatoes	Bentronic Productions Kumasi
97.	Tradazine 80WP	PCL/18199/1200R September 2018	Atrazine (800g/kg)	II	Herbicide for the control of annual, perennial grasses and broadleaf weeds in maize	Chemyda Co. Ltd., Accra
98.	Tumiplus 40 OD	PCL/17205/1011G December 2017	Nicosulfuron (40g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables	Qiaochang Gh. Ltd., Kumasi
99.	Tumiwura 48 SL	PCL/17205/1012G December 2017	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial grasses and broadleaf weeds	Qiaochang Gh. Ltd., Kumasi
100.	United Force	PCL/18145/1039G January, 2018	Glyphosate isopropylamine (240g/l) + 2,4-D Amine (120g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds in oil palm, rubber, coffee, tea and cashew	Jubaili Agrotec Ltd., Kumasi

101.	Vandazone 276 SL	PCL/18218/1092R May 2018	Paraquat dichloride (276g/l)	II	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals, vegetables and fruit trees	Sodap Enterprise, Kumasi
102.	Viking 48SL	PCL/17186/1017G December 2017	Glyphosate (480g/l)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in arable crops	Ivorychem Co. Ltd., Kumasi
103.	Wadwumanie	PCL/18175/1155G August 2018	Glyphosate (41%)	III	Herbicide for the control of annual, perennial broadleaf weeds and grasses in cereals and vegetables	Wamwus Agrochem. Ltd, Kumasi
104.	Weedcut 20 SL	PCL/18145/1033R January, 2018	Paraquat dichloride (200g/l)	II	Herbicide for the control of grasses and broadleaf weeds in rice and vegetables	Jubaili Agrotec Ltd., Kumasi
105.	Xtra Force SC	PCL/18145/1038G January, 2018	Atrazine (250g/l) + Metolachlor (250g/l)	II	Herbicide for control of annual, perennial broadleaf weeds and grasses in maize, yam, sugarcane, oil palm and citrus plantations	Jubaili Agrotec Ltd., Kumasi

Annex 8: Pesticide use monitoring sheet for demo plots

1 Date / / 2Name of community _____

Day Month Year

3 Name of farmer _____ 4 Name of Officer _____

5 Crop ☐ Maize ☐ Soya ☐ Rice

6 Pests and diseases encountered

Insects	Bacterial	Fungal	Viral	Parasitic plants	Animal pests

7 Pesticides used

Active ingredient(s)	Commercial Product Name	Purpose of application

8 Did farmer patronize the services of a Spray Service Provider? ☐ Yes ☐ No

9 What time of day were pesticides applied? ☐ Morning ☐ Afternoon ☐ Evening

10 How are pesticides applied? ☐ backpack sprayer ☐ Other _____
[Specify]

11 Which PPEs does farmer have?

PPE	Gloves	Overalls	Boots	face shield	Goggles	Nose mask	Helmet	Other
Number								

12 Has farmer ever received safe pesticide use training? ☐ Yes ☐ No

13 Are there any empty pesticide containers in the field? ☐ Yes ☐ No

14 Did women take part in pesticide application? ☐ Yes ☐ No ☐ Not sure

15 Did children take part in pesticide application? ☐ Yes ☐ No ☐ Not sure

16 Is there evidence that empty pesticide containers are used to store water or food items?

☐ Yes ☐ No ☐ Not sure

17 How does farmer dispose of empty pesticide containers? ☐ Bury ☐ Burn ☐ Re-used

☐ Return to shop ☐ Thrown away ☐ Waste bin

18 Does farmer wash clothes after applying pesticides? ☐ Yes ☐ No ☐ Not applicable

19 Is there any evidence that the pesticide(s) applied is/are becoming less effective?

☐ Yes ☐ No

if more than one pesticide was used indicate which one shows ineffectiveness and why you think so