

Agricultural Development and Value Chain Enhancement Feed the Future Activity (ADVANCE II)

Pesticide Evaluation Report & Safer Use Action Plan (PERSUAP)



Presented to:

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RELATED DOCUMENTATION:

1. GHANA_FTF_EG_IEE_120611
<http://gemini.info.usaid.gov/egat/envcomp/repository/doc/38018.doc>
2. ADVANCE Approved PERSUAP, 2012.
3. Ghana Commercial Agriculture Project (GCAP): Public Private Partnership, USAID & World Bank co-financing. Pest Management Plan

SUMMARY OF FINDINGS & RECOMMENDATIONS

This PERSUAP addresses the Condition of the ADVANCE IEE Negative Determination regarding amendment and updating of the ADVANCE PERSUAP.

This PERSUAP covers the following:

1. Review of the Ghana Environmental Protection Agency pesticide register, dated 31st December 2013.
2. Diseases, weeds, insects and other pests of each crop and the choice of the registered pesticides;
3. Safer pesticide use action and implementation plan;
4. A guide to training on safe pesticide use
5. A host of useful resources in the Annexes

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

Addressing IPM and crop protection capacity

Guidelines for providing training on IPM are provided in Annex 2. 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 small holder farmers.

Pesticide Choice: Choices 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 (GEPA), and availability on the market.

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 GhEPA, Plant Protection and Regulatory Services Division (PPRSD), Ghana Agri-input Dealers Association (GAIDA) and other partners to conduct training for beneficiaries. The safe use action plan will be a guideline for all training purposes.

Environmental conservation is key to sustainable agricultural production. A number of challenges influencing the choice of pest management approach including application of IPM and use of crop protection products (Agrochemicals) have been identified in the field. 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 river beds, surface water bodies, protected areas, and similar areas have been identified.

Analysis of issues identified in PER and conclusions

| Issues | Analysis and conclusions |
|--|--|
| Reduce reliance on pesticides. | 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, and local Universities. |
| Promote use of PPEs | Small holder 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. |
| 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. |
| Discourage women and children from pesticide application | Women, especially pregnant and nursing mothers, as well as children represent a highly vulnerable group for pesticides poisoning. Experience in 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. |
| 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 small-holder 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. |

| | |
|---|---|
| <p>Minimize ground and surface water contamination.</p> | <p>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 Acquah (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. The possible reasons for pesticides to reach 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 are 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.</p> |
| <p>Minimize potential for using pesticides more than necessary.</p> | <p>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</p> |
| <p>Conduct safe pesticide use training</p> | <p>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 1 of this PERSUAP.</p> |

Summary of recommended active ingredients in this PERSUAP

| No. | Active ingredient/ Chemical formulation | Commercial Product Names in Ghana |
|---------------------|---|--|
| Insecticides | | |
| 1. | Acetamiprid + cypermethrin | Chemiprid 88EC |
| 2. | Acetamiprid + Bifenthrin | Aceta Star 46 EC |
| 3. | Acetamiprid | Golan SL |
| 4. | Fenvalerate | Sanitox 20EC, Fentox 20EC |
| 5. | Imidacloprid | Consider Supa |
| 6. | Imidacloprid | Bastion Extra |
| 7. | Imidacloprid + Thiram | Insector T45 |
| 8. | Lambda-cyhalothrin | Sunhalothrin 2.5EC, Lambda Super 2.5EC, Lambtox 2.5EC |
| 9. | Malathion | EnviGold |
| Fungicides | | |
| 10. | Mancozeb | Kilazeb 80WP, Dizcozeb 80WP, Cotzeb 80WP |
| 11. | Permethrin + Carbendazim + Chlorothalonil | Seedrex WP |
| Herbicides | | |
| 12. | 2,4-D Amine | Bextra 72% SL, Herbextra, Sun-2,4 d Amine 72%, Caliherb 720 SL, Ervextra, Wiper, Select |
| 13. | Atrazine | Sun- Atrazine 80WP, Cotrazine 80WP, Atrazine 500 SC |
| 14. | Atrazine + Nicosulfuron | Herbimais |
| 15. | Bispyribac-sodium | Bounty 40SC |
| 16. | Glyphosate | Nwura wura SL, Kalachi 360SL, Rival, Glyphader, Wynna 360SL, Tackle, Uproot 360 SL, Weedall 41% SL, Weedcot 41% SL, Weedout, Sharp 480 SL, Adom 480 SL, Adwumapa SL, |
| 17. | Glyphosate + Oxyfluorfen | Zoomer 360/30 EC |
| 18. | Metolachlor + Terbutryn | Terbulor 500EC |
| 19. | Nicosulfuron | Arrow 75WDG |
| 20. | Pendimethalin | Stomp, Chemosto mp 500 EC |
| 21. | Propanil + 2, 4 D isobutylate | Propacal plus 480 EC |
| 22. | Propaquizafop | Agil 100EC |

Actions required by Objectives/Issues identified in PERSUAP:

| Objective | Issues | Interventions required | Outputs |
|--|--|--|---|
| A. PESTICIDE RISK AWARENESS | | | |
| A1. Reduce reliance on pesticides. | <ul style="list-style-type: none"> Local pest control options are limited. Pesticides are costly and may not be used safely. | <ul style="list-style-type: none"> Follow GAPs recommendations Use of IPM Practice crop rotation Select resistant varieties | <ul style="list-style-type: none"> Reduced incidence of diseases and pests. More farmers adopt IPM. |
| A2. Promote use of PPEs | <ul style="list-style-type: none"> Farmers do not fully appreciate the importance of PPEs Farmers do not fully appreciate the potential hazards of using pesticides. | <ul style="list-style-type: none"> Continuous education of farmers on the importance of PPEs Promote use of less hazardous agrochemicals | <ul style="list-style-type: none"> Increased use of PPEs by farmers |
| A3. Discourage re-use of pesticide containers | <ul style="list-style-type: none"> Containers are used to store household items including food. Farmers are unaware of the dangers involved. | <ul style="list-style-type: none"> A sustained campaign to discourage re-use of containers. Provide a central point for collecting and disposing containers. | <ul style="list-style-type: none"> Reduced number of people using pesticide containers |
| A4. Discourage women and children from pesticide application | <ul style="list-style-type: none"> Limited farm labour compelling women to apply pesticides. Inability of women to pay for SSP services. | <ul style="list-style-type: none"> Provide special training to women on the effects of pesticides on women and children. | <ul style="list-style-type: none"> Reduced cases of women applying pesticides |
| B. PREVENT ENVIRONMENTAL POLLUTION | | | |
| B1. Promote safe disposal of pesticide containers | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Reduced incidence empty containers littered on farms. |
| B2. Minimize ground and surface water contamination. | <ul style="list-style-type: none"> Pesticide use near water bodies. Pesticide use on wet fields with flowing water. Pesticide use immediately after rainfall. | <ul style="list-style-type: none"> Reduce soil disturbance such as reduced tillage. Leave a buffer of at least 5m to rivers and streams when spraying: <ul style="list-style-type: none"> - Flat land: 5m - Gentle slope: 10m | <ul style="list-style-type: none"> Farmers adopt conservation farming methods. |

| | | | |
|--|---|---|---|
| | | - Slope >30°: 15m | |
| B3. Minimize potential for using pesticides more than necessary. | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Promote GAPs and IPM to reduce over reliance on pesticides. | <ul style="list-style-type: none"> More farmers able to interpret pesticide labels |
| C. ACTIONS TO ENSURE COMPLIANCE | | | |
| C1. Conduct safe pesticide use training | <ul style="list-style-type: none"> Farmers and other persons who handle pesticides have inadequate knowledge of pesticide products and labels. | <ul style="list-style-type: none"> Develop training content targeting specific groups – farmers, women, dealers, partners etc. | <ul style="list-style-type: none"> Training contents developed |
| C2. Promote the services of SSPs | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Work with NFs and FBOs to include spray services in their extension support to out-growers. Provide regular training to SSPs on environmental safety procedures. | <ul style="list-style-type: none"> Training programs for SSPs conducted |
| C3. Avoid the use of highly toxic products | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Train farmers to read and understand the symbols and colours on pesticide labels. Promote use of non-chemical pest control option | <ul style="list-style-type: none"> Farmers adopt IPM approaches |

Implementation of the PERSUAP actions

| Activity | By whom | When |
|---|--------------------------|--|
| 1. Brief ADVANCE staff on the PERSUAP contents. | Environmental Specialist | February 2015 and with subsequent updates of the PERSUAP |
| 2. Detailed training on aspects of the PERSUAP to enable 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 | RCs, EPA and MOFA-PPRSD | Continuous |

APPROVAL OF THE RECOMMENDED ENVIRONMENTAL ACTION:

CLEARANCE:

USAID/Ghana Mission Director: _____ Date: _____

CONCURRENCE:

AFR Bureau Environmental Officer: _____ Date: _____

Approved: _____

Disapproved: _____

Filename:

ADDITIONAL CLEARANCES:

AOR/COR: _____ Date: _____

Mission Environmental Officer: _____ Date: _____

AFR/SD/ Regional Environmental Officer: _____ Date: _____
(Washington, D.C.)

EG Office Director: _____ Date: _____

ACRONYMS

| | |
|-----------|---|
| ACDEP | Association of Church based Projects |
| DVANCE | Agriculture Development and Value Chain Enhancement |
| ACDI/VOCA | An International Development NGO based in Washington with an established presence and activities in Ghana |
| EU | European Union |
| FAO | Food and Agricultural Organization of the United Nations |
| FRE | Fully Registered Pesticides |
| GhEPA | Ghana Environmental Protection Agency |
| GUP | General Use pesticide |
| IEE | Initial Environmental Examination |
| PCL | Provisionally Cleared Pesticides |
| PPRSD | Plant Protection and Regulatory Services Directorate |
| AI | Active Ingredient |
| BMP | Best Management Practice |
| BT | <i>Bacillus thuringiensis</i> (a bacteria that produces a toxin used as a pesticide) |
| CFR | Code of Federal Regulations |
| DDT | <i>Dichloro-Diphenyl-Trichloroethane</i> |
| EC | Emulsifiable Concentrate (pesticide formulation) |
| EMMP | Environmental Mitigation & Monitoring Plan |
| EU | European Union |
| FAO | Food and Agriculture Organization |
| FBO | Farmer Based Organisation |
| GAP | Good Agriculture Practice |
| GW | Ground Water |
| GUP | General Use Pesticide |
| Ha | Hectares |
| HT | Highly Toxic |
| IEE | Initial Environmental Examination |
| IPM | Integrated Pest Management |
| M&E | Monitoring and Evaluation |
| MOFA | Ministry of Food and Agriculture (Ghana) |
| MRL | Maximum/Minimum Residue Level/Limit |

| | |
|-----------|---|
| MSDS | Material Safety Data Sheet |
| MT | Moderately Toxic |
| NAT | Not Acutely Toxic |
| NF | Nucleus Farmer |
| PAN | Pesticide Action Network |
| PER | Pesticide Evaluation Report |
| PERSUAP | Pesticide Evaluation Report and Safe Use Action Plan |
| pH | log of Hydrogen concentration, measure of acidity |
| PHI | Pre-Harvest Interval |
| PIC | Prior Informed Consent (a treaty on toxic pesticides) |
| PMP | Pest Management Plan |
| PNT | Practically Non-Toxic |
| POPs | Persistent Organic Pollutants (a treaty on toxic persistent pesticides) |
| PPE | Personal Protection Equipment |
| R&D toxin | Reproductive and Developmental toxin |
| REI | Re-Entry Interval (safety period after pesticide spraying) |
| RNT | Relatively Non-Toxic |
| RUP | Restricted Use Pesticide |
| S&C | Standards and Certification |
| ST | Slightly Toxic |
| SSP | Spray Service Provider |
| SUAP | Safe Use Action Plan |
| UN | United Nations |
| USAID | United States Agency for International Development |
| USEPA | US Environmental Protection Agency |
| VHT | Very Highly Toxic |
| WHO | World Health Organization |

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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/ADVANCE II.

A desk study was complemented by visits and detailed consultations with pesticide dealers, nucleus farmers (NFs), Ministry of Food and Agriculture (MOFA), Ghana Environmental Protection Agency (GhEPA) and ADVANCE field staff. Field visits were also made to selected farms in the three Regions of the North including Kintampo North District. Field visits brought to the fore disease conditions and pest incidence, pesticide use patterns and actions taken to ensure safer use of pesticides. Specific pesticides being used and areas requiring support for promoting efficient pesticides management and adoption of Integrated Pest Management (IPM) practices were also identified during the field visits. The information gathered through these visits, interviews and observations were reviewed and critically analyzed in the context of existing framework of the national pesticide management efforts. These provided the basis for the development of a comprehensive and sustainable Pesticide Safer Use Action Plan in compliance with the requirements for USAID environmental requirements for ADVANCE II.

The focus of the 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/Ghana's FTF strategy.

This report has screened the pesticides typically recommended by extension agents and used by farmers in the target districts on the target crops based on their United States Environmental Protection Agency (USEPA) registration status as well as the GhEPA registration status as at 31st December 2014. In section 15 of The Pesticide Control and Management Act 490 Part II, pesticides which have not been registered may not 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 IPM approach. The extent to which the proposed pesticides use will be part of an IPM program is given in section 2.3, 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, good agronomic practices is stressed, emphasizing integrated soil management, nursery management, seed selection, appropriate and timely land preparation practices, row and appropriate spaced planting, record keeping, water management, with appropriate control strategy which ensures environmental sustainability and natural resource conservation. Harvesting and post-harvest as well as marketing strategies are all seen as an integral part of the pest management strategy.

The report is presented in 3 major parts with annexes. Part 2 outlines the results of the pesticide evaluation study addressing the major issues concerned with compliance with the USAID pesticide procedures. Based on the findings of the Pesticides Evaluation report, a Safer Use Action Plan is elaborated in Part 3. The annexes of the report contain more detailed and relevant documentation to various aspects covered in the main body of this report.

PART ONE: INTRODUCTION

1.1 Background

The ADVANCE II Project, Cooperative Agreement # Aid-641-A-14-0001, was awarded to ACDI/VOCA on February 5th, 2014 and is scheduled to end on September 30th, 2018. This four-year and eight month program is a follow-on to the Ghana Agricultural Development and Value Chain Enhancement (ADVANCE I) project which ended on March 13th, 2014.

ADVANCE II aims to increase competitiveness of agricultural value chains in northern Ghana to foster economic growth and reduce poverty, in line with USAID/Ghana's FTF strategy. The project's approach is to increase productivity, promote private enterprise development and investment, and ensure that benefits are realized by women and vulnerable groups. ACDI/VOCA and ADVANCE II's sub-recipients, Association of Church-Based NGOs (ACDEP), TechnoServe, and PAB Consult, will support market facilitation with lead firms, and local advocacy, FBO, and nucleus farmer capacity building activities.

The Ghana Advanced Maize Adoption Program (GAMSAP) is also being implemented as part of ADVANCE II. GAMSAP, a GDA initiative supported by DuPont Pioneer, provides a unique opportunity to leverage public and private resources to contribute to improving the competitiveness of the maize value chain and increase incomes for smallholder farmers in Ghana. GAMSAP aims to stimulate hybrid maize seed adoption in Ghana as well as expand the sustainable ADVANCE II nucleus farmer model to value chain actors in the maize belt region of the country – providing strong post-project potential for continued growth in the sector.

According to Regulation 216, all USAID activities are subject to analysis and evaluation via – at minimum – an Initial Environmental Examination (IEE), and – at maximum – an Environmental Assessment (EA). A large part of Regulation 216 – part 216.3 – is devoted to pesticide use and safety. Part 216.3 requires that 12 pesticide factors be analyzed and recommendations be written to mitigate risks to human health and environmental resources, to be followed up with appropriate training, monitoring and reporting for continuous improvement on risk reduction and adoption of international best practices for crop production, protection and pesticide use safety.

It is not anticipated that the ADVANCE II project will be engaged in the direct purchase or distribution of pesticides with project funding, other than for possible limited use on demonstration plots. However, project activities will indirectly

THE 12 PESTICIDE FACTORS

1. USEPA Registration Status of the Proposed Pesticides
2. Basis for Selection of Pesticides
3. Extent to which the proposed pesticide use is, or could be, part of an IPM program
4. Proposed method or methods of application, including the availability of application and safety equipment
5. Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use, and measures available to minimize such hazards
6. Effectiveness of the requested pesticide for the proposed use
7. Compatibility of the proposed pesticide use with target and non-target ecosystems
8. Conditions under which the pesticide is to be used, including climate, geography, hydrology, and soils
9. Availability of other pesticides or non-chemical control methods
10. Host country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide
11. Provision for training of users and applicators.
12. Provision made for monitoring the use and effectiveness of each pesticide

result in increased use of inputs, including pesticides, by farmers and producers through an increase and intensification in agricultural production and the development of a services market for application of agrochemicals. Trainings in GAPs and IPM will also implicitly involve promotion of pesticides, as the controlled application of pesticides in accordance with accepted best practices is an important component of GAPs

The ADVANCE II Pesticide management efforts seek 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 as a result of 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 advocates for the use of PPEs that is appropriate for the specific agrochemical being promoted. 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.

1.2 Response to climate change

Agriculture is not only among the most vulnerable sectors to the impacts of climate change but it is also directly responsible for 14 percent of global greenhouse gas emissions. In addition, the sector is a key driver of deforestation and land degradation, which account for about 17% of global emissions¹. The agricultural sector in Ghana can be an important part of the solution to climate change by capturing synergies that exist among activities to develop more productive food production practices and improve natural resource management. Climate change affects cropping systems, distribution, domestic food mix, livelihood diversification, and migration patterns.

Sustainable crop production intensification (SCPI) is based on agricultural production systems and management practices that include:

- maintaining healthy soil to enhance soil-related ecosystem services and crop nutrition;
- cultivating a wider range of species and varieties in associations, rotations and sequences;
- using quality seeds and planting material of well adapted, high-yielding varieties;
- adopting the integrated management of pests, diseases and weeds; and
- managing water efficiently.

SCPI, and the crop production practices and approaches that it entails, is inherently climate smart. The sustainability of crop production systems presupposes that the risks and vulnerabilities arising from climate change are also addressed (FAO, 2013)².

Under ADVANCE I, interventions which are included in this wider range of agriculture production systems such as; use of quality seeds, use of high yielding varieties and hybrids (Obatampa as OPV Pioneer 30Y87), promotion of early maturing varieties - Abontem and Omankwa, adopting basic integrated management of weeds and crop nutrition, and risk

¹ <http://www.fao.org/docrep/015/an177e/an177e00.pdf>

² Climate Smart Agriculture Source Book 2013

mitigation measures including support for crop insurance and weather forecasting were pursued and achieved. That is a starting point for ADVANCE II Climate Smart Strategy which will include the promotion of the latter and will add to it the practical research and demonstration of Minimum-tillage and, where appropriate, the use of cover crops to improve water conservation.

Preventing and mitigating land degradation

Unsustainable land management practices that are degrading soils include: continuous cropping with reductions in fallow and rotations, repetitive tillage and soil nutrient mining; overstocking, overgrazing and burning of rangelands; and the overexploitation or clearance of wooded and forest lands.

There is a need to promote appropriate production systems and management practices that simultaneously reverse or minimize degradation.

Improving water storage

Water storage in the soil depends on many factors including rainfall, soil depth, soil texture (clay content) and soil structure. (FAO, 2013). Under the dry conditions Northern Ghana confronts, soil management is a tool which can influence rainwater infiltration and the capacity of soil to reduce soil water evaporation and store water in the soil. Groundcover management can have highly beneficial effects on soil conditions, organic matter content, soil structure, porosity and aeration. Improvements in any of these influence infiltration rates, water storage potential and water availability to plants. Above all, these improvements increase effectiveness of rainfall and enhance productivity, and finally reduce erosion. Sandy soils are naturally permeable and in hot, dry areas, evaporation rates are high and organic matter breaks down very quickly. For these reasons in drylands and coarse-textured soils the accumulation rate of organic matter is expected to be lower (Zingore *et al.*, 2005)³. Crop management systems that reduce soil disturbance (e.g. ploughing and hoeing) and bring about a high accumulation of organic matter should be introduced. Mulching is simple techniques that buffers soil temperature and helps the soil-crop system reduce evaporation and the mineralization of organic matter. Mulching also counteracts the nutrient loss.

Improving soil structure with organic matter

Compaction reduces airspaces in the soil and decreases the penetration of plant roots. Under compaction conditions, only stronger roots make it to penetrate the soil, while the lateral roots or fine root hairs, which are important for moisture and nutrient uptake is restricted. Groundcover management increases organic matter content and hence improves soil structure, porosity and aeration and this will be promoted.

No-tillage (maintaining healthy soil to enhance soil-related ecosystem services and crop nutrition

Nitrogenous fertilizers are the most widely used fertilizers and deliver huge benefits in terms of productivity. However they have high potential for environmental damage in terms of Greenhouse Gases (GHG) emissions and nitrate pollution.

³ Zingore, S., Manyame, C., Nyamugafata, P. & Giller, K.E. 2005. Long-term changes in organic matter of woodland soils cleared for arable cropping in Zimbabwe. *European Journal of Soil Science*, 56: 727–736.

GHG emissions can be reduced by many agricultural practices, some of which have been part of GAPs disseminated by ADVANCE like; making changes in the rates and timing of nitrogen fertilizer applications (amount is not generally a problem in the country as low rates are usually applied).

There is common consensus that zero tillage and conservation agriculture systems will considerably reduce nitrate leaching (Macdonald *et al.*, 1989)⁴. This is because, unlike mechanical tilling practices, zero tillage and conservation agriculture leave a soil undisturbed, which decreases mineralization and the subsequent production of nitrates. Cover crops take up the nitrogen and reduce its loss from the soil. At the same time, unused mineralized nitrogen remains distributed within smaller pores and are not washed out of the soil. However, where no-till is used without cover crops and with herbicides to manage weeds, the effects on nitrogen uptake and reduced leaching, as well as on yields, may be less evident.

No-till farming (also called zero tillage or direct drilling) is a way of growing crops from year to year without disturbing the soil through tillage. This technique which may include several practices seeks to maintain a “healthy soil” with living micro flora in the system to balance exchange of nutrients from the lower levels to the first 15-30 cm of soil, where most of the crops’ roots are located. No-till offers a solution to Ghanaian soils which don’t happen to be heavily mechanized (in most instances under mechanization which doesn’t allow for a proper root development of the crops plants). With No-till farming the soil structure might be kept while enhancing the organic matter content, allow for proper aeration of the roots through the “tunnels” left from a dead cover crop and promote the recycling of nutrients and water from subsoil to the topsoil.

No-till farming can be as simple as not doing any mechanization to the land where there was a previous crop and plant on it and step up to include the growing of cover crops (choosing appropriate species depending on the purpose and the environment), rotation, inter-cropping and others.

Ghana has made very little research on Zero-tillage and other methods of maintaining or improving soil quality. Some research efforts are being made by SARI, The Centre for No-till, Renewable Natural Resources of KNUST, and the Forest and Horticultural Crops Research Centre (FOHCREC) to determine species to be used as cover crops and to start the breeding of these.

Up to date available tools or tractor implements (such as roller crimpers) for planting in zero-till in Ghana are very limited. Another limiting factor is the availability in commercial amounts of cover crops seeds. ADVANCE will work with NFs to ensure commercial multiplication of cover crop seeds.

1.3 Methodology

This PERSUAP paid particular attention to field experiences from ADVANCE I and ADVANCE II demonstration plots, noting diseases that have been recorded and the issues that were associated with disease management of demo fields.

⁴ Macdonald, A.J., Powlson, D.S., Poulton, P.R. & Jenkinson, D.S. 1989. Unused fertiliser nitrogen in arable soils-its contribution to nitrate leaching. *Journal of the Science of Food and Agriculture*, 46: 407–419

During November and December 2014, consultation visits were conducted to pesticide distributors and shops, farmers and demonstration farms, and field project implementation staff in Wa, Bolgatanga, and Tamale. Information was collected on pests, IPM, pesticide risks, and mitigation of those risks. A detailed desk study and analysis of relevant documents was also done. The documents consulted included the following:-

- List of USEPA, approved suspended, restricted or cancelled pesticides. (http://www.encapafrika.org/pesticide_database.htm)
- Environmental Protection Agency, Accra, Revised Register of Pesticides as at 31st December 2013 under Part II of the Environmental Protection Act, 1994 (Act 490).
- The ADVANCE approved PERSUAP 2012
- Title 22 of the Code of federal regulations Section 216
- The WHO pesticide hazard classification
- Material Safety Data Sheets (MSDS) of Active Ingredients proposed in this PERSUAP.
- The pesticides control and management Act, 1996 (Act 528)
- ATT approved PERSUAP 2014
- MOFA/GCAP Pest Management Plan
- Handbook of crop Protection Recommendations in Ghana: An IPM Approach, vols. 1, 2, 3 & 4
- Chapter 13 of the USAID Environmental Guidelines for Small-Scale Activities in Africa. The information gathered through consultations visits, observations, and literature reviews were critically analyzed in the context of the ADVANCE II project objectives and Ghana's pest management policy following the 12 point pesticide evaluation criteria as provided for in Regulation 216.

1.4 Presentation of this PERSUAP

This report is divided into four Parts made of Parts 1-3 and Annexes. Part one provides general background information to the ADVANCE II project as well as this report. Part two is the Pesticide Evaluation Report which provides an analysis of the results of a pesticide evaluation study based on the 12 factors required by USAID pesticide procedures. Critical issues regarding safer use of pesticides are discussed and recommendations for mitigating them are given. Based on the findings of the pesticides evaluation report, a Safer Use Action Plan is elaborated in Part 3.

The annexes of the report contain more detailed and relevant documentation to various aspects covered in the main body of this report.

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.

Table 2-1 presents USEPA and Ghana-EPA registration status of the proposed pesticides in this report. The GhEPA revised register of pesticides used for this PERSUAP (dated 31st December 2013) is about a year old. The EPA is yet to gazette a new a register. Given the age of the current register it is assumed that all pesticides registered under Preliminary Clearance (PCL) should have lost their registration status by 30th December 2014. Therefore this PERSUAP has avoided pesticides listed as PCL in the GhEPA approved register of pesticides. A new pesticide register is expected to be out within the first quarter of 2015.

A substantial number of pesticides found on the market in the 3 regions of the north are not in the current register of pesticides. It is reasonably assumed that a good number of them will appear in the next register. In the meantime this PERSUAP is unable to recommend them for use on the ADVANCE II Project. While the recommended pesticides in this report will suffice for the next crop season, an update of the list of recommended pesticides in this report would be considered in the first quarter of 2016.

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 Registrati on Status | Gh EPA Toxicity Class | Crops | Pest/ Diseases | Basis for selection |
|---------------------|---|----------------------------------|---------------------------|----------------------|-----------------------------|-----------------------|----------------------|---|--|
| INSECTICIDES | | | | | | | | | |
| 1. | Acetamiprid (16g/L) Cypermithrin (12g/L) | Chemiprid 88EC | GUP | II-III | | II | Rice Maize Soy | Broad spectrum insecticide for control of insects in field crops | Registered in Ghana, readily available and effective |
| 2. | Acetamiprid (16g/L) Bifenthrin (30g/L) | Aceta Star 46 EC | GUP | III | GUP | II | Soy | Control of bollworms, moths, capsids and defoliators | Registered in Ghana, readily available and effective |
| 3. | Acetamiprid (200g/L) | Golan SL | GUP | III | GUP | III | Maize | Aphids and hoppers | Registered in Ghana, readily available and effective |
| 4. | Fenvalerate (200g/L) | Sanitox 20 EC | GUP | III | GUP | II | Soy | Control of insect pests in vegetables, pulses, cowpea and soybean | Registered in Ghana. Protective clothing available. |
| 5. | Fenvalerate (200g/L) | Fentox 20EC | GUP | III | GUP | II | Soy | Broad spectrum insecticide for the control of insect pests. | Registered in Ghana, readily available and effective |
| 6. | Imidacloprid (200g/L) | Consider Supa | GUP | II-III | GUP | II | Maize Soy | Insecticide for the control of sucking insects | Registered in Ghana, readily available and effective |
| 7. | Imidacloprid (30g/kg) | Bastion Extra 3G | GUP | II-III | GUP | II | Maize Soy | Ants and termites | Registered in Ghana, readily available and effective |
| 8. | Imidacloprid | Insector T45 | GUP | II-III | GUP | III | Maize | Insecticide-fungicide | Contact and |

| | | | | | | | | | |
|-------------------|-----------------------------------|---------------------|-----|--------|-----|-----|----------------------|--|--|
| | (350g/kg)+ Thiram (100g/kg) | | | | | | | powder for seed dressing. Effective against aphids, leaf hoppers and fungi. | ingestion, Systemic and broad spectrum; widely used insecticide with relatively low human toxicity |
| 9. | Lambda-cyhalothrin (25g/L) | Sunhalothrin 2.5EC | RUP | I-III | GUP | II | Rice Maize | Insecticide for the control of pests in field crops and vegetables | Available and registered in Ghana. Protective clothing available. |
| 10. | Lambda-cyhalothrin (25g/L) | Lambda Super 2.5 EC | RUP | I-III | GUP | II | Rice Maize | Insecticide for the control of pests in maize, rice, and vegetables | Available and registered in Ghana. Protective clothing available. |
| 11. | Lambda-cyhalothrin (25g/L) | Lambtox 2.5 EC | RUP | I-III | GUP | II | Rice Maize | Insecticide for the control of pests in maize, rice, and vegetables | Available and registered in Ghana. Protective clothing available. |
| 12. | Malathion (700g/L) | EnviGold | GUP | II-III | GUP | III | Rice Maize Soy | Non-systemic insecticide and acaride for storage | Available and registered in Ghana. Protective clothing available. |
| FUNGICIDES | | | | | | | | | |
| 13. | Mancozeb (800G/Kg) | Kilazeb 80 WP | GUP | IV | GUP | II | Rice | Control of leave spots, mildew, leaf blight, and scab in vegetables, fruits, ornamentals and field crops | Available and registered in Ghana. Protective clothing available. |

| | | | | | | | | | |
|-------------------|---|------------------------|-----|-----|-----|--------|---------------|---|---|
| 14. | Mancozeb (800G/Kg) | Dizcozeb 80WP | GUP | IV | GUP | III | Rice | Broad spectrum fungicide with protective properties | Available and registered in Ghana. Protective clothing available. |
| 15. | Mancozeb (800G/Kg) | Cotzeb 80 WP | GUP | IV | GUP | III | Rice | Control of leaf spots, downy mildew, fruit rots in cereals, vegetables and ornamentals | Available and registered in Ghana. Protective clothing available. |
| 16. | Permethrin (33%) + Carbendazim (15%) + Chlorothalonil (12%) | Seedrex WP | GUP | | GUP | III | Maize | Fungicide for seed treatment | Available and registered in Ghana. Protective clothing available. |
| HERBICIDES | | | | | | | | | |
| 17. | 2,4-D Amine (720g/L) | Herbextra | RUP | II | GUP | II | Rice Maize | Selective Herbicide for the control of broadleaf weeds in maize, rice and sorghum, millet and sugarcane | Registered in Ghana. Protective clothing available. |
| 18. | 2,4-D Amine (720g/L) | Sun-2,4 D Amine 720 SL | RUP | II | GUP | II | Rice | Selective herbicide for post emergence weeds control in rice, maize and sorghum | Registered in Ghana. Protective clothing available. |
| 19. | 2,4-D Amine (720g/L) | Ervextra 720 SL | RUP | II | RUP | EPA II | Rice | Broadleaf weeds | Selective herbicide available and registered in Ghana. Protective clothing available. |
| 20. | Atrazine (500g/l) | Atrazine 500 SC | GUP | III | GUP | III | Maize | Selective pre-emergence and early post emergence herbicide | Available and registered in Ghana. Protective clothing available. |

| | | | | | | | | | |
|-----|----------------------------|---------------------|-----|--------|-----|-----|-------|--|---|
| 21. | Atrazine (800g/kg) | Sun- Atrazine 80 WP | GUP | III | GUP | III | Maize | Herbicide for the control of annual perennial grass and broadleaf weeds in maize | Available and registered in Ghana. Protective clothing available. |
| 22. | Atrazine (800g/kg) | Cotrazine 80WP | GUP | III | GUP | III | Maize | Pre-emergence or early post emergence herbicide | Readily available in Ghana. Protective clothing available |
| 23. | Bispyribac-sodium (400g/L) | Bounty 40SC | | | GUP | III | Rice | Post emergence selective herbicide for control of grasses, sedges, and broad leaves in rice fields | Most effective compared to other selective herbicides for rice. |
| 24. | Glyphosate (360g/Kg) | Nwura Wura SL | GUP | II-III | GUP | III | | Annual and perennial broadleaved weeds and grasses | Registered in Ghana. Protective clothing available. |
| 25. | Glyphosate (360g/Kg) | Kalachi 360 SL | GUP | II-III | GUP | III | | Foliar acting non-selective herbicide for control of annual and perennial weeds | Available and registered in Ghana. Protective clothing available. |
| 26. | Glyphosate (360g/Kg) | Rival | GUP | II-III | GUP | III | | Foliar acting non-selective herbicide for control of annual and perennial weeds | Available and registered in Ghana. Protective clothing available. |
| 27. | Glyphosate (360g/Kg) | Glyphader | GUP | II-III | GUP | III | | Foliar acting non-selective herbicide for control of annual and perennial weeds | Available and registered in Ghana. Protective clothing available. |
| 28. | Glyphosate | Wynna 360 SL | GUP | II-III | GUP | III | | Herbicide for the | Registered in Ghana. |

| | | | | | | | | | |
|-----|--|------------------|-----|--------|-----|-----|--|---|---|
| | (360g/L) | | | | | | | control of annual and perennial broad leaf weeds and grasses | Protective clothing available. |
| 29. | Glyphosate (360g/L) | Tackle | GUP | II-III | GUP | III | | Herbicide for the control of annual and perennial broad leaf weeds and grasses | Registered in Ghana. Protective clothing available. |
| 30. | Glyphosate (360g/L) Oxyfluorfen (30g/L) | Zoomer 360/30 SC | GUP | II-III | GUP | III | | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Available and registered in Ghana. Protective clothing available. |
| 31. | Glyphosate (41% w/w) | Weedall 41% SL | GUP | II-III | GUP | III | | Control of annual perennial grasses and broad leaved weeds | Available and registered in Ghana. Protective clothing available. |
| 32. | Glyphosate (41% w/w) | Weedcot SL | GUP | II-III | GUP | III | | Herbicide for the control of annual perennial grasses and broadleaf weeds in cereals and vegetables | Available and registered in Ghana. Protective clothing available. |
| 33. | Glyphosate (41% w/w) | Weedout | GUP | II-III | GUP | III | | Annual & perennial grasses and broadleaved weeds | Available and registered in Ghana. Protective clothing available. |
| 34. | Glyphosate (480g/L) | Sharp 480 SL | GUP | II-III | GUP | III | | Annual & perennial grasses and broadleaved weeds | Registered in Ghana. Protective clothing available. |
| 35. | Glyphosate (480g/L) | Adom 480 SL | GUP | II-III | GUP | III | | Herbicide for the control of annual perennial grasses and broadleaf weeds in cereals and vegetables | Registered in Ghana. Protective clothing available. |
| 36. | Glyphosate | Adwuma wura | GUP | II-III | GUP | III | | Non-selective | Registered in Ghana. |

| | | | | | | | | | |
|-----|--|----------------------|-----|--------|-----|---------|-------|---|--|
| | (480g/L) | SL | | | | | | herbicide for the control of annual and perennial grasses and broad leaf weeds | Protective clothing available. |
| 37. | Metolachlor (333g/L) Terbutryn (167g/L) | Terbulor 500EC | GUP | II-III | GUP | III | Maize | Pre-emergence herbicide for control of weeds in maize, cassava, and cotton. | Registered in Ghana. Protective clothing available. |
| 38. | Nicosulfuron (750g/kg) | Arrow 75WDG | GUP | III | GUP | III | Maize | Post emergence herbicide for control of weeds in maize. | Registered in Ghana. Readily available in Northern Ghana. Protective clothing available. |
| 39. | Pendimethalin (400g/L) | Alligator 400EC | GUP | III | GUP | III | Rice | Selective herbicide for control of broadleaf weeds. | Registered in Ghana. Protective clothing available. |
| 40. | Propanil (360g/L) 2, 4 D Isobutylate (200g/L) | Propacal-Plus 560 EC | RUP | II | GUP | II | Rice | Selective post emergence herbicide for the control of Annual and perennial grasses and Broad leaf weeds | Registered in Ghana. Available in Northern Ghana. Protective clothing available. |
| 41. | Propaquizafop (100g/l) | Agil 100EC | GUP | | GUP | EPA III | Maize | Herbicide for the control of annual grasses | |

Table 2- 2: User and environmental hazards associated with the recommended pesticides

| No. | Active ingredient/ Chemical | Commercial Product Names in Ghana | Acute/Chronic Toxicity (human hazards) | Eco-toxicity | Groundwater Contamination Potential | Other Comments/Crops |
|---------------------|--|---|--|--|---|---|
| INSECTICIDES | | | | | | |
| 1. | 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. | |
| 2. | Acetamiprid (16g/L) Bifenthrin (30g/L) | Aceta Star 46 EC | May cause slight irritation of the eye and skin. Could cause gastrointestinal disorders if swallowed. | Very toxic to aquatic organisms | Insufficient data | Avoid use in aquatic environment |
| 3. | Acetamiprid (200g/L) | Golan SL | Acute toxicity unknown; carcinogen not likely; not cholinesterase inhibitor; not developmental/r eproductive 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. | |
| 4. | Fenvalerate (200g/L) | Sanitox 20EC Fentox 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. |

| No. | Active ingredient/ Chemical | Commercial Product Names in Ghana | Acute/Chronic Toxicity (human hazards) | Eco-toxicity | Groundwater Contamination Potential | Other Comments/Crops |
|-----|--|---|--|---|--|---|
| 5. | Imidacloprid (200g/L) | Consider Supa | 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. |
| 6. | Imidacloprid (30g/L) | Bastion Extra | Minimal irritation to eyes. Prolonged exposure could affect thyroids and liver | Highly toxic to bees and aquatic invertebrates | Insufficient data | Do not apply directly to areas where surface water is present. |
| 7. | Imidacloprid (200g/L) Thiram (30g/L) | Insector T45 | Irritant to eye and skin. Acute oral toxicity. | Very toxic to aquatic organisms. | | |
| 8. | Lambda-cyhalothrin (25g/L) | Sunhalothrin 2.5EC Lambda Super 2.5EC Lambtox 2.5EC | Eye irritant | Highly toxic to fish and aquatic invertebrates | Do not contaminate ponds, waterways or ditches with chemical or used container | Insecticide/ Acaricide. |
| 9. | Malathion (700g/L) | EnviGold | Eye irritation including redness, tearing, and blurred vision. Repeated skin contact may cause irritation. | Malathion is biodegradable. It undergoes rapid degradation in the environment. Toxic to fish, aquatic invertebrates, and aquatic life stages of | | |

| No. | Active ingredient/ Chemical | Commercial Product Names in Ghana | Acute/Chronic Toxicity (human hazards) | Eco-toxicity | Groundwater Contamination Potential | Other Comments/Crops |
|-------------------|---|---|---|--|--|---|
| | | | Aspiration into lungs can cause pneumonitis. This condition may be fatal. | amphibians. Highly toxic to bees. | | |
| FUNGICIDES | | | | | | |
| 10 | Mancozeb (800G/Kg) | Kilazeb 80WP, Dizcozeb 80WP, Cotzeb 80WP | 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. |
| 11 | 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 | | | | | | |
| 12 | 2,4-D 720g Amine | Bextra 72% SL, Herbextra, Sun-2,4 d Amine 72%, Caliherb 720 SL, Ervextra, | 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 | Do not spray crops when under stress. |

| No. | Active ingredient/ Chemical | Commercial Product Names in Ghana | Acute/Chronic Toxicity (human hazards) | Eco-toxicity | Groundwater Contamination Potential | Other Comments/Crops |
|-----|-------------------------------------|---|---|---|--|----------------------|
| | | Wiper | | | accordance with directions for waterweed control | |
| 13 | 2,4-D 722g Amine | Select | 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 directions for waterweed control | |
| 14 | Atrazine (500g/L) | Atrazine 500 SC | Acute toxicity, ST to MT; likely carcinogen, suspected endocrine disruptor | RNT to birds and bees, ST to fish, other aquatic life | Potential ground water contaminant. Insufficient data to provide details. | |
| 15 | Atrazine (800g/kg) | Sun- Atrazine 80WP Cotrazine 80WP | Acute toxicity, ST to MT; likely carcinogen, suspected endocrine disruptor | RNT to birds and bees, ST to fish, other aquatic life | Potential ground water contaminant. Insufficient data to provide details. | |
| 16 | Atrazine (750g/L) + Nicosulfuron | Herbimais | Exposure may cause irritation | | Insufficient data | |

| No. | Active ingredient/ Chemical | Commercial Product Names in Ghana | Acute/Chronic Toxicity (human hazards) | Eco-toxicity | Groundwater Contamination Potential | Other Comments/Crops |
|-----|--|--|--|--|---|--|
| | (40g/kg) | | to skin, eyes, throat, and abnormal liver function. | | | |
| 17 | Bispyribac-sodium (400g/L) | Bounty 40SC | Acute toxicity. Slightly irritant to eye. Non- irritant to skin. | Toxic to fish and earthworms | Insufficient data | |
| 18 | Glyphosate (360g/L) | Nwura wura SL, Kalachi 360SL, Rival Glyphader, Wynna 360SL, Tackle. Uproot 360 SL, | 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 (preferably 24 hours) must follow application. |
| 19 | Glyphosate (41%) | Weedall 41% SL, Weedcot 41% SL, Weedout, | 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 (preferably 24 hours) must follow application. |
| 20 | Glyphosate (480g/L) | Sharp 480 SL, Adom 480 SL, Adwumapa 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 (preferably 24 hours) must follow application. |
| 21 | Glyphosate (360g/L) + Oxyfluorfen (360g/L) | Zoomer 360/30 EC | Irritant to eyes and skin. Harmful if swallowed. | Oxyfluorfen is non- toxic to birds and bees, but HT to aquatic invertebrates, | Oxyfluorfen is practically insoluble in water and has a | Do not apply directly on areas where surface water is present. |

| No. | Active ingredient/ Chemical | Commercial Product Names in Ghana | Acute/Chronic Toxicity (human hazards) | Eco-toxicity | Groundwater Contamination Potential | Other Comments/Crops |
|-----|---|---|---|---|---|-----------------------|
| | | | | aquatic plants and fish. | tendency to absorb to soil. | |
| 22 | Glyphosate (757g/Kg) | 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 (preferably 24 hours) must follow application. Protective clothing required. | Slight acute toxicity |
| 23 | Metolachlor (333g/L) + Terbutryn (167g/L) | Terbulor 500EC | | | | |
| 24 | 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 | |
| 25 | Pendimethalin | Stomp, Chemosto mp 500 EC | Acute toxicity, ST; likely carcinogen, dev/reproductive toxin. | ST to birds, MT to fish, HT to aquatic invertebrates, RNT to bees | Groundwater contaminant | |
| 26 | Propanil (260g/l) + 2, 4 D isobutylate (200g/l) | Propacal plus 480 EC | Not listed | Not listed | | |
| 27 | 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; | |

VHT=very highly toxic, HT=highly toxic, MT=moderately toxic, T=toxic, ST=slightly toxic, RNT=relatively non-toxic.

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.

Recommendations

In consultation with the Ghana EPA and MOFA-PPRSD, pesticide dealers and ADVANCE II field officers the pesticides in Table 1-1, which are typically used in the three Northern regions have been recommended for use on ADVANCE II.

- 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.

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, ADVANCE II will promote the adoption of improved seed, proper fertilization, as well as reduce tillage and use of cover crops to maintain a healthy crop and increase yield.

Under ADVANCE I, training was provided for input dealers in collaboration with EPA and MOFA-PPRSD. 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 2-3 provides 15 general principles adopted in the MOFA/GCAP Pest Management Plan for cereals and pulses.

Table 2- 3: Principles for pest management in cereals and pulses

| Principle | Cereals | Pulses |
|------------------|--|--|
| Principle 1 | Obtain good seeds | Obtain good seeds |
| 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 |
| Principle 14 | Adopt good harvesting methods | Adopt good harvesting methods |
| Principle 15 | Adopt appropriate and clean storage systems | Adopt appropriate and clean storage systems |

Sources: MoFA/GCAP: Pest Management Plan 2011.

2.4 Alternative Pest Management Options for Maize, Soybean and Rice

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, rice and soya pays attention to both pre and post-harvest methods for the management of pests and diseases.

Maize – Table 2-4 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 follow should be observed during harvesting:

- 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%-15.5% moisture content. It is one of the key post-harvest operations since all down-stream operations depend on it. This is particularly so for GAMSAP south where humidity and rainfall remain high at harvesting delaying the harvest and constraining actual drying.

Table 2- 4: Alternative pest management options for maize

| Maize= (<i>Zea mays</i>) | | |
|----------------------------|---|--|
| Num | Major pests and diseases/Stage | Recommended management practices |
| 1 | Armyworms (<i>Spodoptera exempta</i>) (Pre-harvest stage) | <ul style="list-style-type: none"> • 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 |
| 2 | Larger grain borers (<i>Prostephanus truncatus</i>) (Post-harvest) | <ul style="list-style-type: none"> • 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 |

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| 3 | Greater grain weevil (<i>Sitophilus spp.</i>) | <ul style="list-style-type: none"> • Dust with recommended insecticide and/or botanical extracts |
| 4 | Stem borers (<i>Busseola fusca</i> , <i>Sesamia calamistis</i> , <i>Eldana saccharina</i>) (Pre-harvest stage) | <ul style="list-style-type: none"> • Intercropping with pulses • Early sowing and early maturing varieties reduce infestation • Destroy (make compost, burn or feed livestock) crop residues • Apply neem seed cake during planting (4gm/hole) • 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) | <ul style="list-style-type: none"> • Early planting • Observe recommended time of planting to avoid the diseases • Plant certified seeds/tolerant varieties (all certified maize varieties in West Africa are streak virus resistant) |
| 6 | Striga (witchweed) (<i>Striga hermonthica</i> , <i>S. asiatica</i>) and all other weeds (Pre-harvest) | <ul style="list-style-type: none"> • Crop rotation • Proper land preparation • Timely weeding (at 2 and 5 weeks after planting) • Use recommended herbicides when necessary • Witch weed (<i>Striga spp.</i>) - 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 |

Sources: MoFA/GCAP Pest Management Plan 2011.

Rice – Table 2- 5 provides recommended management practices for pests and disease conditions in rice.

Table 2- 5: Available pest management options for rice in Ghana

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

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| | dark or reddish margin. Seedlings are often more susceptible. Fungus is seed-borne. Fungus may also attack the grains forming small oval spots on glumes. Heavy attack can result in blackening of the grains, which becomes lightweight with spotted hulls. | |
| Sheath blight, <i>Corticium = Rhizoctonia oryza</i> | Large necrotic lesions, irregular with reddish brown margins. Most common below lingual. Both seedlings and mature plants affected | Field sanitation and stubble management (i.e. burning or feeding of debris after harvest to livestock). Ensure balanced nutrition. Avoid close planting to reduce humidity. Spray appropriate fungicides. |
| Sheath rot | Graying brown spots with grayish centers on uppermost leaf sheath that encloses youngest panicle. Common in irrigated sites | Field sanitation and stubble management (i.e. burning or feeding of debris after harvest to livestock). Balance nutrition. Avoid close planting to reduce humidity. Use appropriate fungicides. |
| Rice blast, <i>Pyricularia oryzae</i> | The most widespread and destructive disease of rice. Can affect all aerial parts of rice. Spots appear on leaves and coalesce resulting in whitening. | Time of planting influence blast development (do not plant too early nor too late). Avoid application of excessive amounts of nitrogenous fertilizers. Avoid close planting in the nurseries. Use resistant varieties. Burn stubbles after harvest (stubble management). Foliar spray of a recommended antibiotic or fungicides. |
| False green smut, <i>Ustilaginoides virens</i> | The head becomes filled with orange colored masses of spores. Spores replace grains. Common in irrigated sites. | Field sanitation and stubble management (i.e. burning or feeding of debris after harvest to livestock). Seed treatment or use hot water treatment if disease occurred already in earlier seasons. |
| White tip, <i>Aphelenchoides besseyi</i> | Minor disease. Tips of leaves become light yellow to white, then darker and die off. Plants are stunted. Panicles poorly formed and smaller. Nematode live on aerial parts of the | Avoid the use of infected seeds. Hot water treatment of seeds. Burn stubbles after harvest. |

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| | plants invading the grain as it matures. The nematode becomes dormant under the husk. | |
| Virus, Rice Yellow Mottle virus | Minor disease. Chlorosis and stunting leading to reduction in yield. | Use resistant varieties. |
| African rice gall midge, <i>Orseolia oryzivora</i> | Occasional pest. Borers into buds during seedling to panicle initiation causing swelling of infected parts. Tillers do not produce panicles. Serious attacks result in stunted growth and the production of more tillers which do not produce panicles. | Plant resistant and early maturing varieties. Remove rotten crop before land preparation. Embark on early and synchronized planting. Seed dress with suitable pesticide. |
| Stalk-eyed shoot fly, <i>Diapsis spp.</i> | Occasional pests. Maggots feed on the stem tissues below the growing zone. Central whorl does not unfold and dries up, resulting in "dead hearts". Excessive tillering possibly apply a fast acting chemical soon as flying | In general do not apply any insecticide in the valleys, where natural enemies can build up. Where good weed management is practiced, scatter or heap cleared weeds to provide cover for increased natural enemy activity. Use moderate amounts of fertilizer, split doses over the main growth stages to discourage rapid development and multiplication of flies. Avoid panicle harvesting (leaving tall stems and destroy stubbles to get rid of dapausing larvae. Water management: keep bases of stems always under water. |
| Leaf and stem suckers: Green leafhopper <i>Nephotettix spp.</i> , White leaf hopper, <i>Cofana spp.</i> , Spittle bugs, <i>Locris spp.</i> | Occasional pests. Both nymphs and adults suck plant sap. High populations cause wilting and drying resulting in "hopper burn". | Practice good cultural and agronomic practices, i.e. early planting, using early maturing varieties. Keep farm weed free. Judicious use of fertilizers, especially nitrogen, keeps populations of plant suckers low. |
| Rice bugs, <i>Stenocoris spp.</i> <i>Mirperus spp.</i> <i>Aspavia spp.</i> <i>Riptortus spp.</i> <i>Nezara spp.</i> | Occasional pests. The bugs invade rice fields during flowering stage and lay eggs on leaves. Both adults and nymphs suck developing grains during milk and dough stages. Adults live long and are very mobile. | Grassy weeds should be eliminated from the farm and surrounding areas and staggered planting should be avoided. Encourage predatory assassin bugs by creating refugia, i.e. good weed management with scattering or heaping cleared weeds to provide cover for increased natural enemy activity. |
| Rice beetle, <i>Lagria villosa</i> | Chew growing tips and flowers. Minor pest. | Chemical control not necessary. |

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| Hispid beetles, <i>Trichispa spp.</i> | Occasional, but then destructive pest. Attack rice panicles and eat the grains. Suspected to be vector for Rice Yellow Mottle Virus (RYMV). | Use close spacing. Keep bunds and surroundings free of grass weeds. Destroy stubbles and avoid rotting. Top the tips of leaves of seedlings before transplanting to destroy egg masses. Ensure balance nutrition (avoid excessive nitrogen application) |
|--|---|---|

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

Soya – Alternative pest and disease control methods for Soybeans in Ghana are captured in Table 2- 6 below.

Table 2- 6: Available pest management options for soybeans in Ghana

| SOYBEANS (<i>Glycine max</i> = soy) | | |
|--|--|--|
| Pest Name | Symptom or Damage | Cultural Practices and Direct Interventions |
| Seed decay, Damping off, <i>Pythium sp.</i> , <i>Corticium</i> = <i>Rhizoctonia solani</i> | Occasional diseases. Poor germination. Poor stand. Seeds rot in soil. Symptoms appear on hypocotyls as reddish collar region at which point seedling topples (<i>Corticium sp.</i>). <i>Pythium</i> infects the whole hypocotyls giving it a grey-green wet appearance leading to watery collapse. | <ul style="list-style-type: none"> • Use healthy seeds. • Treat seeds with appropriate fungicides as seed treatment and PCNB drench in limited areas (spot treatment). |
| Sclerotium blight <i>Sclerotium rolfsii</i> | Occasional disease. Infection occurs at or just below the soil surface, causing light-brown lesions, which quickly darken and enlarge until the hypocotyls or stem is girdled. Plant then wilts. Mycelium forms around the stem bases, leaf debris and the soil around infected plants. Numerous tan to brown sclerotia form in the mycelium, on soil surface, in plan material. | <ul style="list-style-type: none"> • 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 | Minor diseases. Characteristic are | <ul style="list-style-type: none"> • Pathogen is soil-borne and seed transmitted. |

| | | |
|---|--|---|
| <i>Fusarium oxysporum f. sp tracheiphilum</i> | browning or blackening of vascular system in roots and stems. Seedlings emergence is slow and poor, affected seedlings are slanted and weak later sudden wilting/death occur. Older plants are stunted, leaves yellow and fall, the plant gradually dies. Pod infection may result in seed transmission of the pathogen. | <ul style="list-style-type: none"> • Don't use seeds from infested crops. Grow cultivars resistant to 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 <i>Rhizoctonia solani</i> | Occasional disease, potentially serious. Symptoms appear on leaves, stems, and pods. Infected leaves are water soaked, and then become greenish-brown. Old lesions fall off in dry weather, creating a ragged shot-hole effect. Total defoliation with severe infections. | <ul style="list-style-type: none"> • Use resistant varieties where available. • Treat seeds with appropriate fungicide to limit early season disease development. • Apply a foliar fungicide at first sight of the disease. |
| Leaf rust <i>Uromyces sp.</i> | Minor disease. Open pustules with rusty masses of spores on leaf blades. | <ul style="list-style-type: none"> • No direct control is required. • Use resistant varieties, where available. |
| Anthrachnose <i>Colletotrichum truncatum</i> <i>C. glycines</i> | Major disease. All stages can be affected. In early stages it appears on stems, pods and petioles as irregularly shaped brown areas. Later, infected tissues are covered with black fruiting bodies. Necrosis occurs on foliage and laminar veins after pro-longed periods of high humidity. Leaf rolling, petiole canker-ring and premature defoliation occur. Early pod infection results in pod blackening, no seed or fewer shriveled seeds. Mycelia mat fill pod cavity and seeds become moldy. | <ul style="list-style-type: none"> • Sow seeds free of the pathogen. • Treat infected seed with recommended fungicide. • Plough crop residue under, burn or feed trash to livestock. • Rotate soybean with non-host crops (e.g. cereals, rot and tubers, vegetables). • Spray with appropriate fungicide when conditions favoring infection occurs between bloom and pod-fill (humidity). Use fungicides on foliage when disease symptoms appear. |
| Cotton Aphid <i>Aphis gossypii</i> | Major pest. Small, soft insects, found in clusters | <ul style="list-style-type: none"> • Observe build-up of aphid populations and of natural enemies (predators like |

| | | |
|--|--|--|
| | (colonies) around stems, young shoots and pods and underside of leaves. | lady bird beetles, hover flies, lacewings, parasitic wasps like <i>Aphidius</i> spp.) <ul style="list-style-type: none"> • Use recommended pesticides and/or Neem seed or leaf extracts. |
| Sucking bugs <i>Anoplocnemis curvipes</i> , <i>Clavigralla tomentosicollis</i> , <i>C. shadabi</i> , <i>Riptortus dentipes</i> , <i>Mirperus jacundus</i> , <i>Aspavia</i> sp. <i>Nezara viridula</i> | Major pests. Such the contents of pods and soft growing parts. Inject poison into pods/seeds causing necrosis. | <ul style="list-style-type: none"> • Control weeds to destroy roosting sites. • Limited control occurs in nature by <i>Trissolus basalis</i> a biological control agent as well as assassin bugs (Reduviids). • Scout and at the rate of 2 bugs/ meter row and spray with Organophosphate or other recommended pesticides. |
| Storage moths <i>Ephestia cantella</i> , <i>Corcyra cephabonica</i> | Larvae feed on grains causing extensive webbing of grains | <ul style="list-style-type: none"> • Solar disinfection, thorough drying of harvested 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)

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

The World Health Organization (WHO) has 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 small holder 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. ADVANCE II 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.

Table 1-2 contains 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)⁵ and Prior Informed Consent (PIC)⁶ Treaties are avoided.

2.6 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.

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

⁵ <http://www.pops.int>

⁶ <http://www.pic.int>

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 do 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

Wumbei (2013)⁷ studied 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

⁷ Abubakri Wumbei, 2013. Risk Assessment of Applicator Exposure to Pesticides on Cotton Farms in Ghana. Journal of Environment and Earth Science, ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online) Vol. 3, No.1, 2013

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.

2.7 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 break-down, 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 the environment they will be used in.

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

The 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 over 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 coarse 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 will, from 2015, promote reduced tillage and the use of cover crops using 30 demo plots. This will, among other benefits, reduce water stress on crops during dry spells.

2.9 Availability of other products and non-chemical methods

Non-chemical options for pest management are recommended in Tables 2- 3 to 2- 6 of this PERSUAP. ADVANCE II 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 ADVANCE II 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.

2.10 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 and use 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 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 is a very dangerous trend that needs urgent attention.

Recommendations

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.

2.11 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 1 of this PERSUAP.

2.12 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. ADVANCE II 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 4 provides a monitoring tool for documenting all activities on demo plots relating to pesticide use while Annex 1 outlines details for safer use measures.

PART 3: SAFER USE ACTION PLAN

The challenges revealed in Part II of this report are not very different from those the ADVANCE approved PERSUAP 2012 worked to address in the past 4 years. Significant progress was made in addressing these challenges under specific actions (See Annex 5). 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 ADVANCE approved PERSUAP 2012

The 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 ADVANCE program. The program will also ensure that highly toxic and banned pesticides are not promoted by the 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, and local Universities.

Small holder 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 Zimbabwe⁸ and India⁹ 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 small-holder farmers 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)¹⁰, Darko and Acquah (2008)¹¹ and Laary (2012)¹² 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 NPASP¹³ 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.

⁸ <http://www.ncbi.nlm.nih.gov/pubmed/1790553>

⁹ <http://www.nrdc.org/breastmilk/hch.asp>

¹⁰ Fianko, J.R., Donker, A., Lowor, S.T., and Yeboah, P.O. (2011) Agrochemicals and the Ghanaian Environment, a Review, *Journal of Environmental Protection*, 2, 221-230

¹¹ Darko, G., and Acquah, S.O. (2008) Levels of organochlorine pesticides residues in dairy products in Kumasi, Ghana, *Chemosphere*, 71(2), 294-298

¹² Laary, J.K. (2012) Dry-Season Farming and Agrochemical Misuse in Upper East Region of Ghana: Implication and Way Forward, *Journal of Agricultural, Food, and Environmental Sciences*, 5(1)

¹³ NPASP (Northern Presbyterian Agricultural Service and Partners) (2012) *Ghana's Pesticide Crisis: A Need for Further Government Action* [Available online]<http://www.christianaid.org.uk/images/ghanas-pesticide-crisis.pdf> [14-2-2014]

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:

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

Refer to Annex 1 for a more detailed training program for SSPs.

Table 3- 1: Actions by Objectives/Issues Identified in PERSUAP

| Objective | Issues | Interventions required | Outputs |
|------------------------------------|--|---|---|
| A. PESTICIDE RISK AWARENESS | | | |
| A1. Reduce reliance on pesticides. | <ul style="list-style-type: none"> • Local pest control options are limited. • Pesticides are costly and may not be used safely. | <ul style="list-style-type: none"> • Follow GAPs recommendations • Use of IPM • Practice crop rotation • Select resistant varieties | <ul style="list-style-type: none"> • Reduced incidence of diseases and pests. • More farmers adopt IPM. |
| A2. Promote use of PPEs | <ul style="list-style-type: none"> • Farmers do not fully appreciate the importance of PPEs • Farmers do not fully appreciate the potential hazards of using | <ul style="list-style-type: none"> • Continuous education of farmers on the importance of PPEs • Promote use of less hazardous agrochemicals | <ul style="list-style-type: none"> • Increased use of PPEs by farmers |

| | | | |
|--|---|--|---|
| | pesticides. | | |
| A3. Discourage re-use of pesticide containers | <ul style="list-style-type: none"> Containers are used to store household items including food. Farmers are unaware of the dangers involved. | <ul style="list-style-type: none"> A sustained campaign to discourage re-use of containers. Provide a central point for collecting and disposing containers. | <ul style="list-style-type: none"> Reduced number of people using pesticide containers |
| A4. Discourage women and children from pesticide application | <ul style="list-style-type: none"> Limited farm labor compelling women to apply pesticides. Inability of women to pay for SSP services. | <ul style="list-style-type: none"> Provide special training to women on the effects of pesticides on women and children. | <ul style="list-style-type: none"> Reduced cases of women applying pesticides |
| B. PREVENT ENVIRONMENTAL POLLUTION | | | |
| B1. Promote safe disposal of pesticide containers | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Reduced incidence empty containers littered on farms. |
| B2. Minimize ground and surface water contamination. | <ul style="list-style-type: none"> Pesticide use near water bodies. Pesticide use on wet fields with flowing water. Pesticide use immediately after rainfall. | <ul style="list-style-type: none"> Reduce soil disturbance such as reduced tillage. Leave a buffer of at least 5m to rivers and streams when spraying: <ul style="list-style-type: none"> - Flat land: 5m - Gentle slope: 10m - Slope >30°: 15m | <ul style="list-style-type: none"> Farmers adopt conservation farming methods. |
| B3. Minimize potential for using pesticides more than necessary. | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> Promote GAPs and IPM to reduce over reliance on pesticides. | <ul style="list-style-type: none"> More farmers able to interpret pesticide labels |
| C. ACTIONS TO ENSURE COMPLIANCE | | | |
| C1. Conduct safe pesticide use training | <ul style="list-style-type: none"> Farmers and other persons who handle pesticides have inadequate knowledge of pesticide products and labels. | <ul style="list-style-type: none"> Develop training content targeting specific groups – farmers, women, dealers, partners etc. | <ul style="list-style-type: none"> Training contents developed |
| C2. Promote the | <ul style="list-style-type: none"> Farmers may do their | <ul style="list-style-type: none"> Work with NFs and | <ul style="list-style-type: none"> Training |

| | | | |
|--|---|---|--|
| services of SSPs | <p>own spraying because they have no access to trained spray service providers.</p> <ul style="list-style-type: none"> • Farmers who do their own spraying often do not wear PPEs and may apply more chemical than needed. | <p>FBOs to include spray services in their extension support to out-growers.</p> <ul style="list-style-type: none"> • Provide regular training to SSPs on environmental safety procedures. | programs for SSPs conducted |
| C3. Avoid the use of highly toxic products | <ul style="list-style-type: none"> • 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. | <ul style="list-style-type: none"> • Train farmers to read and understand the symbols and colors on pesticide labels. • Promote use of non-chemical pest control option | <ul style="list-style-type: none"> • Farmers adopt IPM approaches |

Table 3- 2: Implementation of the SUAP actions

| Activity | By whom | When |
|---|--------------------------|--|
| 1. Brief ADVANCE staff on the PERSUAP contents. | Environmental Specialist | February 2015 and with subsequent updates of the PERSUAP |
| 2. Detailed training on aspects of the PERSUAP to enable 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 | RCs, EPA and MOFA-PPRSD | Continuous |

ANNEXES

Annex 1: Guidelines for training on Safer Use of Pesticides

PART ONE: Developing a Training Curriculum

A. Training purpose

The training program is designed to:

- Provide an overview of the crop protection system and the environmental factors that constrain sustainable crop production in an ecologically sound environment.
- Explain the justification for and the economics of introducing crop protection measures.
- Create awareness of the environment and health implications of crop protection measures, particularly the use of chemical pesticides.
- Promote the adoption of integrated pest management practices for sustainable agricultural production

B. Training Mode

The preferred mode of training to be adopted is fully participatory mode with considerable time allocated to practical hands-on skills development sessions. Formal lectures will be minimum while extensive discussions, exchange of experiences and feedback from training participants will be strongly encouraged. Such sessions will provide excellent opportunities for participants to correct wrong beliefs and hazardous pesticide handling practices. Training events will also include communication skills and the use of role plays for communicating pesticide management messages.

C. General Training Content

The general training content will be organized into 4 major interrelated groups as follows:

C1. Generalities

- Topic 1 Overview of the crop production system, ecological requirements for high yields
- Topic 2 Environmental factors influencing crop yields in the different ecological zones in Ghana
- Topic 3 Patterns of crop losses and the economic aspects of pest/disease damage to crops.

C2. Principles of Crop Protection

- Topic 4 Economic and social consequences of yield losses caused by crop pests/diseases
- Topic 5 Elements of Good Agricultural Practices
- Topic 6 Fundamentals of decision making on crop protection
- Topic 7 Economics of crop protection methods
- Topic 8 Principles of Integrated Pest Management

C3. Safety in Pesticide Use and other Crop Protection practices

- Topic 9 Pesticide use in crop protection
- Consideration of criteria for choice and use of pesticides,
 - National legislation and regulations governing the importation, distribution, marketing, transportation, storage, selection and use of pesticides

- Topic 10 Pesticide application - techniques and application efficiency; protective clothing and safe use of pictograms
- Topic 11 Hazards of pesticide use- Briefs on WHO hazard classification of pesticides, FAO activities in pesticide management, International Conventions and agreements (PIC, POPs etc.); Pesticide residues in harvested crops and international requirements for Maximum Residue Levels.
- Topic 12 Environmental effects of pesticide application; risks in pesticide use
- Effects on target organisms
 - Effects on beneficial and other non-target organisms
 - Effect on the health of spray operators
 - Effect on the health of farm workers
 - Environmental pollution
- Topic 13 Methods of monitoring and evaluation of pesticide use
- Planning for monitoring and evaluation
 - Building capacities for monitoring and evaluation of pesticide use and management on ADVANCE.

D. Recommended pattern for implementing Training in safe use of pesticides

The following steps would be adopted:

Step 1 Specific training need and purpose of maize, rice and soya farmers will be identified

Step 2 A training coordinator, from GhEPA or MOFA-PPRSD, should be appointed to coordinate the activities in the training cycle.

Step 3 Possibly, a 2-3 day training planning workshop would be organized to consider and make decisions on the:

- What – the purpose of the training
- Why - the need for training
- Who - needs to be trained
- How- will the training be conducted
- When - will the training be implemented
- Where - in which location will the training be conducted?

The output from this planning workshop will include:

- Detailed outline of training content
- Partners to collaborate in the training
- Pattern of training to be adopted
- Resource persons to participate in the training
- Pattern of evaluating the training
- List of materials required
- Facilities required for the training (classrooms, field plots, equipment, audio-visuals, etc.)
- Time table for training sessions and schedule for preparation and implementation of training
- Realistic budget

Step 4 Implement training:

- Conduct training
- Evaluate training

Step 5 Reporting

- The training will be evaluated and a report including recommendations to improve future training written up.

PART TWO: Guidelines for training Spray Service Providers (SSPs)

Pesticides are designed to be toxic and can be dangerous if they are misused or wrongly handled. The safe and effective use of pesticides would therefore be the concern of everyone. A toxic pesticide poses a potential danger to man and the environment. But it is the combination of toxicant and exposure that creates risks and real hazards. Thus pesticides would be probably handled and used.

Safe handling of pesticides involves serious attempt to minimize the risk of exposing oneself and the environment to the unwanted effects of these poisons. The following guidelines would assist in reducing pesticide risk:

Safety: - The Applicator

- The operator/applicator would have access to appropriate training/instructions.
- Would follow the recommendations in the manufacturer's leaflets and product labels.
- Would understand and comply with all current legislation.
- Would wear the required or recommended protective clothing.
- Keep a register of all chemical applications.

Crop/targets

The size and shape of crop plants vary not only between crops but also within the same crop over the growing season. Careful attention will therefore be required to adjust the spraying machine to the different conditions and growth stages of the plant. In this way wastage from drift and possible contamination would be avoided.

The Spray Equipment

On taking delivery or purchase of a new spray equipment or removing a used sprayer from storage, the following details would be checked. In case of used sprayers protective clothing would be used.

Tank: Check that it is empty; free from leaks and that the surface is clean. If used sprayer and was not cleaned before storage, the tank will be filled with clean water and some household liquid detergent (1 ml detergent per 2 liters water depending on capacity of tank) added and thoroughly agitated half the load and sprayed out through the nozzle. Afterwards, the nozzle tips and filters will be removed and placed in a bucket of water. The rest of the cleaning mixture will be pumped out from the tank refilled with clean water only and allowed to stand overnight and drain completely.

Nozzles: Nozzle parts will be checked to ensure valves and filters are clean and in good condition

Spares: Adequate spares would be made available.

Calibrate Equipment: Sprayer equipment would be calibrated to determine the amount of spray delivered or its discharge rate per minute. This figure is needed for calculating the application rate and the amount of pesticide formulation required per sprayer tank. It also helps to detect faulty sprayers especially nozzle wear, etc.

Before Spraying

The appropriate pesticides would be used by contacting local Project Manager, Extension Agent or Pesticide Adviser. The following points regarding the choice of pesticide would be checked.
Operator Safety: - Can a less toxic alternative be used?

Consumer Safety: - Can the chemical be applied in time to leave the necessary interval before harvest?

Environmental Safety: - Is the chemical harmless to livestock, bees, wildlife, aquatic organisms, including fish?

Rate of Application: -Manufacturers' published information about the volume requirements, the recommended rate and any particular characteristics of the spray for best results would established

The Day of Spraying

The weather forecast will be found out. Windy conditions are not appropriate for spraying so wind speed will be checked by observing the movement of trees, or using a simple anemometer (if available).

Wind Speed Guide

| Beaufort Scale | | Description | Visible Signs |
|----------------|--|-----------------|--|
| Force 1 | | Light air | Direction shown by smoke drift |
| Force 2 | | Light breeze | Leaves wrestle wind felt on face |
| Force 3 | | Gentle breeze | Leaves and small twigs in constant motion |
| Force 4 | | Moderate breeze | Small branches moved. Raises dust and loose paper. |

Source: *Guidelines for applying crop protection chemicals MAFF, UK*

The safest condition is when there is steady force 2, light breeze blowing or there is little or no wind, force 1 and below. Applying chemicals in intense mid-day heat leads to many health problem for sprayer. Spraying will be done only during the cooler parts of the day (i.e. 6 am – 9 am; 3:30 pm – 6:30 pm) this reduces the vaporization and inhalation of chemical fumes.

Spraying-Precautions to be taken:

Before

Filling the sprayer; pesticide concentrate should not be put into an empty sprayer tank. First the tank should be filled to about half or three-quarters full with clean water before the pesticide (the correct dosage) is added to the bulk of water and agitated to mix the water-pesticide mixture. The rest of the water should then be added to fill the tank.

Measuring the amount of pesticide; do not guess the amount. If using more than one formulation, do not mix the concentrates together. Add them separately to the water in the tank in the correct order. The manufacturer's mixing instructions must be followed. If chemical is in the powered form, mix into a paste and add water to dilute before adding to the tank.

During

When pouring pesticide from cans or bottles, care should be taken to avoid splashing.

When spraying, do not eat or smoke.

Wash any spilt pesticide off the sprayer and containers. A tank or container in which any pesticide is stored should be closed or covered when not in use.

After Spraying

- Return unused chemicals to safe storage.
- Dispose off empty containers.
- Dispose off any spray liquid in the tank.
- Dispose off the tank washings.
- Wash the sprayer thoroughly prior to changing the pesticide or before leaving the sprayer overnight. The operator must always remember to wash his protective clothing and pay particular attention to personal hygiene and cleanliness following spraying.

Storage

Chemicals are usually purchased before they are needed and must be stored between the time of purchase and use. Store them properly to prevent possible damage or hazard to people, especially children, the environment and domestic animals.

Containers (moisture can cause corrosion; extreme temperatures can deform or burst containers)

Store chemicals in a separate purpose-built pesticide store away from other offices, houses and other buildings. Pesticides should not be stored with other store items e.g. tools, paper goods, tires, repair parts. The store should be well-ventilated. Lock the storage area securely to keep children, pets and irresponsible adults out. Expensive and sometimes scarce chemicals are also a target of some thieves, thus, they need to keep the storage area under lock. Post warning signs.

Storage tips

- Always store pesticides in the original tightly-closed containers. Labels must remain attached and legible. Pesticides should never be stored in bottles used for drinks.
- Stack containers only if the bottom ones are strong enough to support the stack without splitting open and spilling the material.
- Store pesticides on wooden pallets or on shelves, not on the floors. Do not store materials unnecessarily.
- Dispose off materials that are no longer required; empty or unlabeled containers and leaking containers.
- Empty or unlabeled containers.
- Leaking containers
- Keep fire away from the storage area. Do not permit smoking in or near the pesticide storage area.

Pesticide Disposal

Use care when disposing off pesticides to avoid contaminating soil, air and water and to ensure that other potential hazards are minimized. Plan for the disposal of four kinds of materials:

- Left-over pesticides
- Spilled materials
- Empty containers
- Left-over containers.

Left-over spray mixtures should not be left on the farm. Storing them in odd containers is hazardous particularly to children and domestic animals. Calculate requirements carefully and mix only enough to cover the required area. Spread any remaining mixture on the ground, if

possible, but avoid over application on the crop. Use approved landfills for disposals of left-over pesticides.

Spilled materials – Keep a liquid spill from spreading by surrounding it with a ring of absorbent material such as dry dirt. Then clean it up and decontaminate the area.

Empty Containers – Simply pouring the contents from pesticides containers will never remove all the pesticides. A residue of pesticide always remains that may be hazardous. Dispose off used containers in a hazardous pesticide disposal area with a pit inside a fenced area which has a locked gate to prevent containers from being taken and used for food items e.g. cooking oil. All empty pesticide containers should be punctured or crushed before they are disposed to prevent their re-use for food or water.

Protective clothing

People handling pesticides should;

- Understand the reason for wearing protective clothing
- Know the various kinds of protective clothing available
- Know which type of pesticide and which tasks in handling and application require the use of each protective item.
- Read the safety instruction on the label
- Realize that dirty contaminated or defective protective equipment is a source of contamination.
- Clean or wash safety equipment each day after use

Clothing suitable for tropical conditions

As a general principle for tropical conditions, materials should be as light as possible and provide maximum respiration in correspondence with hazards of the job. The more suitable minimum protection for persons working with pesticides is a pair of light durable cotton overalls. If “overalls” are not available, shirts (long sleeves) and trousers that cover the full length of the arms and legs and fastened at the wrist and neck should be worn. These should be washed immediately after use and kept separately from other clothing. Professional applicators store and transport personnel and laborers working on manufacturing formulation factories may need even better protection than the spray man in the field. Thus, employers should supply all workers with “overalls” and demand that they wash and change into their own cloth before going home. Also, they should provide gloves and boots and other pieces of protective equipment according to the hazards created by the toxicity of the pesticide and the degree of exposure involved with the particular task to be done.

PART THREE: Safety Guidelines for Storage, Input dealers, large chemical shops

All personnel working in a pesticide store should receive proper instruction and on the job training before they begin the work in the storage area. Knowledge and skills need to be tested periodically.

- a. Appropriate protective clothing must be worn and a respirator must be used whenever recommended.
- b. Protective apparel and instruction in its proper use must be provided by the employer.
- c. Farmers should not work alone when handling very dangerous pesticide.

- d. Do not permit smoking, eating or drinking in pesticide ware houses and storage area.
- e. Good personal hygiene must be practiced. Wash work clothing frequently (clean water and soap should always be made available for this purpose).
- f. Inspect pesticide containers for leakages first before handling them. Avoid leaving containers open.
- g. Should a leakage or spill occur, keep people and animals away from the area and give priority to thorough decontamination of area.
- h. Always keep material on hand for dealing with spillage and decontamination. For longer warehouses, have this equipment available at strategic point.
- i. In order to prevent damage, never handle containers roughly or carelessly.
- j. Have available throughout the storage areas dry-powder fire extinguishers or substitutes such as sand buckets for fighting small fires. Further, all personnel should be trained in dealing with small fires.

Design of Building of Pesticide Store or Shop

- a. The building should be cool, well ventilated, and inaccessible to children, unauthorized persons and animals.
- b. The store should be designed to ensure that handling pesticide containers is minimized, yet access to older stocks is not impeded.
- c. The store should have direct access to the outside (not through some other store or building). There should be sufficient emergency exits in relation to the size and layout of the store.
- d. Provision should be made for washing facilities and separate storage of protective clothing and respiratory masks.
- e. If the store is to be continuously occupied, proper office accommodation for the storekeeper should be provided separately from the main storage area.
- f. Sufficient space should be allowed for strong out-of-date stocks and empty containers awaiting disposal.

Safety Pesticide in Shops

Because pesticide shops are often located near the center of towns, attention should always be given to fire prevention.

- a. Do not display pesticides near food stuff, pharmaceuticals and other consumer goods.
- b. Display a 'DANGER POISON' notice on the outside and on the inside of the shop so that it can be seen immediately.
- c. All containers, packs and bottles carry a complete label, preferably in the major national language (s) which can be understood at least by the shop manager.
- d. Pesticide container and bottles should not be piled up on the sales counter where they can be easily knocked over.

- e. Customers should not be allowed to open containers to smell contents to avoid being poisoned through inhalation. .
- f. Ensure that pesticides taken by customers from the shop to the farm are wrapped adequately and carried separately from food, drinks and other consumer articles. Pesticides are not to be sold in leaking containers.
- g. Do not hand over dangerous pesticides to children sent by parents or others to collect such products.
- h. Store adequate supplies of water, soap and towels and ready for use by customers in case of contamination.
- i. Do not allow consumers to use a pesticide shop as a place for lengthy conversations or friendly gatherings.

Transportation of Pesticides

The downstream distribution of pesticides from larger depots to retail stock-points, shops and finally applicators is frequently carried out by insufficiently trained people and under little or no supervision. Furthermore, because the means of transport are often not adequate and road conditions are deteriorating, extra attention should be given to training and safe transport procedures. When a driver is well aware of the hazards associate with transporting these poisons, he will take the necessary precautions required in loading and driving. Hazard data and emergency instructions on dealing with accidents during the transportation of chemicals should be given to the transport personnel. For example, drivers should be provided with a transport emergency (TREM) card. The card provides essential data, in case of accident. Such data include the following:

- The name of the dispatching company, including its address and emergency telephone number;
- Type of product being carried;
- Basic hazards posed by those products and the safety precautions to be followed in case of an accident.

Special care should be taken during the loading and unloading of pesticides to prevent damage to or breakage of containers. Boxes should be placed with the proper side up according to signs on the outside. Never transport open or leaky containers.

Keep an eye on workers so that discipline is maintained during loading and unloading;

Load carefully to prevent containers from falling off the transport vehicle;
Pesticides should never be transported with food, animal feed, beverages or clothing because of the danger of contamination. Also, drivers should not take passengers.

If it becomes necessary to transport small quantities of pesticides in a van, station wagon, or in the boot of a car, it is necessary that the load be secured and vehicle kept well ventilated. At no time should pesticides be in the driver's cab. Extra attention should also be given to parking the vehicle, which should never be left unattended to.

When pesticides have been unloaded from a vehicle, inspect the body of the vehicle, the tarpaulins and the rest of the cargo to be sure there are no leaks and spills. If spills have

occurred, immediately decontaminate the vehicle and do not dispatch the vehicle, until it has been completely cleaned. In case of accident, i.e., crash, fire or spillage, the driver should act rapidly by:

- Switching off the engine, and putting off all open fires including cigarettes;
- Calling the police emergency lines and the pesticide company, and warning other traffic users to keep away;
- Staying with the vehicle, but up-winding the spilled chemical and keeping people away;
- Collecting the absorbed spill, broken containers and all contaminated waste for disposal in a safe place.

If there is any possibility that food, animal, foodstuffs, clothing or general consumer goods have been contaminated, these goods should be destroyed by burning under supervised conditions. Many people have died because of eating poisoned food that had been transported together with pesticide.

Annex 2: Elements of an IPM program

Integrated Pest Management (IPM) is a systematic decision-making process that supports a balanced approach to managing crop production systems for the effective, economical and environmentally-sound suppression of pests.

IPM has evolved in response to problems caused by an over-reliance on chemical pesticides. Some of these problems are development of pesticide resistance, elimination of natural enemies of pests, outbreaks of formerly suppressed pests, hazards to non-target species, and environmental contamination.

IPM requires knowledge of how to identify pests and evaluate their damage, how to identify natural control agents, and how to select effective control methods that minimize undesirable side effects. Selection of controls for individual pests must be made with the entire crop management system in mind. Many cultural control methods are carried out as part of normal crop production operations.

Although farmers are likely using numerous IPM tactics, without really calling them that, IPM planning is not generally an active part of crop production on farms; thus, a basic understanding of the steps or elements needed in an IPM program is needed.

Step 1: Learn and value farmers' local IPM tactics. Most farmers are already using their own forms of GAPs and IPM, many of which are novel, self-created, adapted for local conditions, and many of which work well. These local tools and tactics need to be well understood and taken into account when making PMPs. Accurate assessments of farmers' GAPs and IPM technologies, as well as an understanding of actual losses due to different constraints in farmers' fields are required before designing a crop production and pest management program.

Step 2: Identify key pests for each target crop. Although perhaps up to ten species of pests may impact a crop and yields at different plant growth stages, generally only two or three are considered serious enough to spend money controlling. Farmers should be encouraged to monitor their population size, their life cycle, the kind of damage they cause and actual losses. Note that crop loss figures based on farmers' perceptions of damage and loss can often be overestimated.

Step 3: Evaluate all management options. Use of best management practices, preventive measures, and organic options to control pest impacts may eliminate the need for synthetic pesticides.

Step 4: Choose IPM methods, identify Needs and Establish Priorities.

Consult farmers when choosing methods to be used. Consider the feasibility of attractive methods, including the availability of resources needed, farmers' perceptions of pest problems, their abilities to identify pests, their predators, diseases and parasites, and to act upon their observations.

Step 5: Do effective activities and training to promote IPM.

Identify strategies and mechanisms for fostering the transfer of the needed IPM technology. Define what is available for immediate transfer and what may require more adaptation and validation research. Set up an initial planning meeting with your team including farmers to help define and orient implementation activities, and begin to assign individual responsibilities.

Learning-by-doing/discovery training programs

The adoption of new techniques by small-, medium- and large-holder farmers occurs most readily when program participants acquire knowledge and skills through personal experience, observation, analysis, experimentation, decision-making and practice. Conduct frequent (weekly) sessions for 10–20 farmers during the cropping season in farmers' farm (or on demo plots)

Smallholder support and discussion groups

Weekly meetings of smallholders, held during the cropping season, to discuss pest and related problems can be useful for sharing the success of various control methods. However, maintaining attendance can be a challenge except when there is a clear financial incentive.

Educational material

Photographic guides to pest identification and crop-specific management techniques may be obtained from MOFA-PPRSD. Videos featuring graphic pictures of the effects of acute and chronic pesticide exposure, and interviews with poisoning victims can be particularly effective.

Step 6: Partner successfully with other IPM implementers.

The following design steps are considered essential.

Articulate the vision of the IPM

Organizations may forge partnerships based on a common commitment to "IPM" – only to discover too late that their visions of IPM differ considerably. It is therefore highly important that partners articulate a common, detailed vision of IPM, centered on the crops and conditions the project will encounter.

Confirm partner institutions' commitment

The extent of commitment to IPM integration into project, design, and thus implementation depends strongly upon the following key variables:

IPM integration into ADVANCE II. The IPM will be part of the larger ADVANCE II project. The IPM program must fit the overall goals of ADVANCE II. The extent of this integration should be clearly expressed in the annual work plan.

Cost sharing. The extent of funds (or in-kind resources) is a good measure of a genuine partner commitment.

Participation of key IPM personnel. Organizations should have staff with expertise in IPM. In strong partnerships, these staff members are actively involved in the partnership.

Step 7: Monitor fields regularly.

During the farming season, farmers are virtually on their fields on a daily basis, but may not consciously be monitoring for pests and diseases. At minimum twice a week, farmers should monitor their fields for pests, as some pest populations increase rapidly and unexpectedly; this increase is usually related closely to the stage of crop growth and weather conditions, but it is difficult to predict the severity of pest problems in advance.

Step 8: Select an appropriate blend of IPM tools.

A good IPM program draws from and integrates a variety of pest management techniques, like those presented in the above list. Flexibility to fit local needs is a key variable. Pesticides should be used only if no practical, effective, and economic non-chemical control methods are available. Once the pesticide has been carefully chosen for the pest, crop, and environment, it should be applied only to keep the pest population low, not necessarily eliminate it.

Step 9: Develop education, training, and demonstration programs APOs.

Implementation of IPM depends heavily on education, training, and demonstration to help farmers and field workers develop and evaluate the IPM methods. Hands-on training conducted in farmers' fields (as opposed to a classroom) is a must. Special training for APOs and educational programs for farmers are important.

Step 10: Monitoring, Record-Keeping and Evaluation (M&E).

Develop data collection forms and checklists, collect baseline GAP/IPM data at the beginning of the project, and set targets.

For the use and maintenance of GAPs (that include safe pesticide storage, use and disposal), maintain farm or project files of: farmer and farm employee training records; farm soil, water, biodiversity, cropping and pesticide use maps; pesticide purchase and stock records; chemical application instructions including target pest, type of chemical applied, dosage, time of spray, rates at which pesticides were applied, harvest interval days, application machinery, PPE required and used, and any special instructions on mixing, exposure to children or dangers.

Further, for project staff, beneficiaries, produce processing facilities, food warehouses, seed multipliers, or farmers that store seed or food and deal with stored seed and food pests, there are warehouse Best Management Practices (BMPs) and monitoring reports that incorporate some IPM tactics. These monitoring forms track, by location or warehouse, use of pallets, stacking, general hygiene and sanitation, damaged packages, actual infestations or signs of rodents, molds, insects, drainage, locks and security measures, use of IPM tactics including least toxic chemicals and strict BMPs for use of common but hazardous fumigants like aluminum phosphide.

Annex 3: Toxicity of Pesticides: USEPA and WHO Classifications

General Toxicity

Pesticides, by necessity, are poisons, but the toxicity and hazards of different compounds vary greatly. Toxicity refers to the inherent intoxicating ability of a compound whereas hazard refers to the risk or danger of poisoning when the pesticide is used or applied. Pesticide hazard depends not only on toxicity but also on the chance of exposure to toxic amounts of the pesticide. Pesticides can enter the body through oral ingestion, through the skin or through inhalation. Once inside the body, they may produce poisoning symptoms, which are either acute (from a single exposure) or chronic (from repeated exposures or absorption of smaller amounts of toxicant).

USEPA & WHO Classifications

Basically, there are two systems of pesticide toxicity classification. These are the USEPA and the WHO systems of classification. It is important to note that the WHO classification is based on the active ingredient only, whereas USEPA uses product formulations to determine the toxicity class of pesticides. So, WHO classification shows relative toxicities of all pesticide active ingredients, whereas EPA classification shows actual toxicity of the formulated products, which can be more or less toxic than the active ingredient alone and are more representative of actual dangers encountered in the field. The tables below show classification of pesticides according to the two systems.

- a) **USEPA classification** (based on formulated product = active ingredient plus inert and other ingredients)

| Class | Descriptive term | Mammalian LD ₅₀ | | Mammalian Inhalation LC ₅₀ | Irritation | | Aquatic invert/fish (LC ₅₀ or EC ₅₀) ² | Honey bee acute oral (LD ₅₀) |
|-------|-----------------------|----------------------------|------------|---------------------------------------|--------------------|--------------------|--|--|
| | | Oral | Dermal | | Eye ¹ | Skin | | |
| I | Extremely toxic | ≤50 | ≤200 | ≤0.2 | Corrosive | Corrosive | < 0.1 | |
| II | Highly toxic | 50-500 | 200-2000 | 0.2-2.0 | Severe | Severe | 0.11-1.0 | < 2 µg/bee |
| III | Moderately toxic | 500-5000 | 2000-20000 | 2.0-20 | No corneal opacity | Moderate | 1.1-10.0 | 2.1-11 µg/bee |
| IV | Slightly toxic | ≥5000 | ≥20000 | ≥20 | None | Moderate or slight | 10.1-100 | |
| | Relatively non-toxic | | | | | | 101-1000 | |
| | Practically non-toxic | | | | | | 1001-10,000 | > 11 µg/bee |

| | | | | | | | | |
|--|-----------|--|--|--|--|--|----------|--|
| | Non-toxic | | | | | | > 10,000 | |
|--|-----------|--|--|--|--|--|----------|--|

¹ Corneal opacity not reversible within 7 days for Class I pesticides; corneal opacity reversible within 7 days but irritation persists during that period for Class II pesticides; no corneal opacity and irritation is reversible within 7 days for Class III pesticides; and Class IV pesticides cause no irritation

² Expressed in ppm or mg/l of water

b) WHO classification (based only on active or 'technical' ingredient)

| Class | Descriptive term | Oral LD ₅₀ for the rat (mg/kg body wt) | | Dermal LD ₅₀ for the rat (mg/kg body wt) | |
|-------|--|---|---------|---|----------|
| | | Solids | Liquids | Solids | Liquids |
| Ia | Extremely hazardous | ≤5 | ≤20 | ≤10 | ≤40 |
| Ib | Highly hazardous | 5-50 | 20-200 | 10-100 | 40-400 |
| II | Moderately hazardous | 50-500 | 20-2000 | 100-1000 | 400-4000 |
| III | Slightly hazardous | ≥501 | ≥2001 | ≥1001 | ≥4001 |
| U | Unlikely to present acute hazard in normal use | ≥2000 | ≥3000 | - | - |

Annex 4. Pesticide use monitoring sheet for demo plots

1. Name of APO responsible for monitoring demo plot: _____

2. Name of Farmer: _____

3. Crop: Maize_____ Soya_____ Rice_____

4. Date: _____

5. What are the pests/diseases encountered by the farmer?

| Insects | Bacterial | Fungal | Viral |
|---------|-----------|--------|-------|
| | | | |

6. Are pesticides used by demo farmer? Yes_____ No_____

7. How are pesticides applied? backpack sprayer_____ other (specify)_____

8. What are the names of the pesticides used?

| Active Ingredient | Product Name | Comments |
|-------------------|--------------|----------|
| | | |

9. Which PPE does farmer have and use?

| PPE | gloves | overalls | boots | mask | goggles | Other |
|--------|--------|----------|-------|------|---------|-------|
| Number | | | | | | |

10. Has the farmer received Safe Pesticide Use training? Yes____ No____
11. Is there any empty pesticide containers scattered in the field? Yes____ No____
12. Does the farmer understand the pesticide label information? Yes____ No____
13. What time of the day were the pesticides applied?

14. Are women or children taking part in pesticides application? Yes____ No____
15. Is there any evidence that empty pesticide containers are used to store water or other items? Yes____ No____
16. Does the farmer wash their clothes after applying pesticides? Yes____ No____
17. How does the farmer dispose of empty pesticide containers?
Puncture/bury____ burn____ Waste bin____ Return to shop____
18. Is there evidence that pesticides are becoming less effective? Yes____ No____

Annex 5. PERSUAP implementation progress under ADVANCE I

| Issues | Action deeded | Progress under ADVANCE I |
|--|---|--|
| <p>Reduced Reliance on Pesticides To produce maize, rice and soybean, it is necessary to use agrochemicals to some extent to combat pests and diseases of these commodities and in land preparation.</p> | <p>The choice of pest control method and products available will start from the selection of appropriate planting material based on levels of resistance and tolerance to major pests. The program will therefore promote planting materials that have a high tolerance to pests with limited reliance on pesticides through collaborations with research institutions.</p> | <p>ADVANCE project management collaborated with the Crop Research Institute (CRI) to conduct trials on new varieties of seeds that have not yet been released. In collaboration with major input dealers the program has also made available certified seeds and seed dressings as a preventive measure to farmers for this planting season. The project will continue its efforts in ensuring that farmers have access to improved certified seeds that are pest resistant to minimize pesticide reliance.</p> |
| <p>Access and utilization of Personal Protective Equipment Small holder farmers in the Northern sector so not view the use of personal protective equipment (PPEs) as essential. Farmers are aware of the potential hazards when spraying pesticides but usually chose not to wear protective clothing.</p> | <p>To address the issue of poor use of PPEs, field officers will recommend and promote the use of PPEs specifically designed for the hot weather conditions which is the main cause of poor use of PPEs. Additionally the program will work with local service providers to develop a services market for certified pesticide applicators to reduce the number of untrained persons exposed to pesticides</p> | <p>The project set up a group of 26 trained Spraying Service Providers. These service providers were trained in pesticide handling safeguards and spray service provisioning and have provided services to over 2,000 small holder farmers this cropping season. By these trained professionals providing services to smallholder farmers the incidence of misapplication and wearing improper clothing during spraying is reduced. Prior to this period, ADVANCE field officers demonstrated the use of PPE during all field days in collaboration with MOFA, EPA and major input dealers. Input dealers collaborating with the ADVANCE program have promoted PPE for purchase by small holder farmers.</p> |
| <p>Avoiding Re-use of Pesticide Containers Small holder farming communities generally re-use pesticide containers for the storage of food items and do not believe any harm can come to them if they are</p> | <p>ADVANCE field officers will make recommendations for the destruction and burial of used containers on the farm and avoid bringing them back to the homestead to prevent the temptation of re-use. ADVANCE will also maintain regular programs of public</p> | <p>ADVANCE field officers demonstrated the methods of disposal of used pesticide containers during 15 field days and training sessions last year. Smallholder farmers have also been advised by MOFA extension agents on the importance of destruction and burial of the used containers. During the current reporting period, the project continued to educate farmers on proper</p> |

| Issues | Action deeded | Progress under ADVANCE I |
|--|--|--|
| clean. | awareness, education and training programs for small holder farmers | disposal of pesticide containers and encouraged NFs and the out-growers to use the services of the SSPs. |
| <p>Pre-harvest and Storage chemical interval violations The risk of high levels of pesticide residue in harvested produce has been identified throughout the operational areas</p> | ADVANCE outreach team will maintain regular public awareness programs on the effects of violations of pre-harvest and storage chemical residues. Pesticide training programs will also cover handling practices that reduce unacceptably high levels of residue. | ADVANCE continues to maintain awareness through the electronic and print media on the hazards of chemical residues on crops. The project has trained farmers on post-harvest handling, especially on storage of grains using safe methods; including using the right chemicals, correct doses as well proper application methods. |
| <p>Unsafe storage, transport and handling Poor storage, transport and handling of agrochemicals can pose high risk to those directly handling the chemical and other passersby.</p> | The program will support the training of input retailers and small holder farmers on precautionary measure when transporting, storing and handling agrochemicals | Eighty three (83) input retailers were trained on storage, transportation and handling of agrochemicals and the project has continued to monitor how the knowledge is being applied and transferred. Also, environmental, health and safety procedures have been developed for two agro-input retailers, Antika and 18th April. Monitoring of these retailers has shown that they continue to abide by these procedures. |
| <p>Applications by Women and Children Minors that support parents on the farm are often saddled with the task of pesticide application, Women sometimes also apply pesticides , oblivious of the health implications to them and even children yet unborn</p> | ADVANCE will develop outreach programs that promote the elimination of women and children in pesticide application programs whilst encouraging their involvement in other aspects of the farm that do not deal with pesticides. | There was no instance in which women and children were allowed to apply agrochemicals. However, to avoid any such situation from occurring, the project introduced the concept of SSPs to provide professional spraying services. |
| <p>Potential for using pesticides more than Necessary Farmers normally apply agrochemicals by calendar without actually encountering the threat of a pest invasion leading sometimes to avoidable high cost of agrochemicals and over</p> | Through training programs, farmers will be encouraged to practice good agronomic practices to avoid the over utilization of pesticides. A cost benefit analysis toll will be used to discourage over-utilization and IPM methods will be encouraged. | Good Agronomic Practices (GAPS) have been the major focus of ADVANCE demonstration plots. With the support of a volunteer consultant, small holder farmers were also introduced to pest scouting prior to pesticide application to avoid over application of pesticides. Also the SSPs were trained on effective application methods as well as the correct dosage |

| Issues | Action deeded | Progress under ADVANCE I |
|---|--|--|
| application of pesticides. | | |
| Use of lower-toxicity products The study revealed farmers inclination towards pesticides recommended by other users and retailers without necessarily considering toxicity levels | ADAVNCE will implement awareness campaigns targeted at small holder farmers and retailers to use agrochemicals in toxicity class III whenever possible and toxicity class II will be used under very strict safety measures. | The program continued to use the ERSUAP recommended agrochemicals as a guide for farmers to choose the least toxic products available on the market. All ADVANCE demonstration plots used the PERSUAP-recommended agrochemicals and also encouraged input dealers working with the project to sell only pesticides approved by the EPA. |
| Avoid contamination of water resources Small holder farmers tend to have farms close to the homestead and water resources that most often serve as their drinking source as well as that of livestock | Through outreach and awareness programs, farmers will be encouraged to avoid spraying around the home and water bodies. | This activity was incorporated in the 15 minute farmer's digest supported by the ADVANCE program on 14 radio stations across the three Northern regions. Farmers have been trained on appropriate disposal of used agro-chemical containers including the destruction of containers before burying them, and also avoiding farming close to streams and other bodies of water. |
| Safer Use of Pesticides | Paramount in the routine actions of ADVANCE will be the establishment of a monitoring program for safe and effective use of pesticides. | The program demonstrated safe and effective use of agrochemicals during all field days at demonstration sites and through on-going training programs on GAPs. |

Annex 6: List of Pesticides from ADVANCE Approved PERSUAP 2012 that have lost their registration status in Ghana

| No. | Active ingredient/Chemical; crop requested for | Commercial Product Name in Ghana | USEPA Registration Status | USEPA Toxicity Class | GEPA Registration Status | GEPA Toxicity Class | Crops | Pest/ Diseases | Basis for selection |
|---------------------|--|----------------------------------|---------------------------|----------------------|--------------------------|---------------------|----------------|--|--|
| INSECTICIDES | | | | | | | | | |
| 1. | Acetamiprid | Titan (25g/L Acetamiprid) | GUP | R EPA III | GUP | R EPA III | Mz | Insect pest, aphids | Registered in Ghana, readily available and effective |
| 2. | Chlorpyrifos (480g/l) | M-Fos 48% | | | GUP | II | Mz Ri | Insecticide for the control of scale, borers, in cereals, vegetables ornamentals and for public health | Registered in Ghana, readily available and effective |
| 3. | *Dimethoate (400g/l) + Cypermethrin (36/lg) | Cydim Super | RUP | EPA II | GUP | EPA II | Mz Ri Sb | Aphids, whitefly, leafminer, caterpillar, grasshoppers, bollworms, etc. | Systematic and contact insecticide. Protective clothing available. |
| 4. | Fipronil (50g/l) | Regent 50 SC | | | GUP | II | Ri | Insecticide for the control of worms and termites in cabbage, maize and rice | Registered in Ghana. Protective clothing available. |
| 5. | Anthraquinone +Imidacloprid+ Metalaxyl | Seedstar 440 DS | | | GUP | II | Mz Ri | Insecticide for treating seeds | Registered in Ghana. Protective clothing available. |
| 6. | Pirimiphos methyl (400g/l)+ Permethrin (75g/l) | Betallic Super | | | GUP | II | Sb | Control of insect pests in stored produce such as maize and cowpea | Available and registered in Ghana. Protective clothing available. |
| FUNGICIDES | | | | | | | | | |
| 7. | *Mancozeb | Dithane M 45 | GUP | EPA IV | GUP | EPA III | | Leaf spots, mildew, | Protective action and |

| | | | | | | | | | |
|-------------------|--------------------|-----------------|-----|---------|-----|-----------|-------|--|--|
| | (800G/Kg) | | | | | | | leaf blight and scab in vegetables, fruits and ornamentals | controls a wide spectrum of fungal diseases. Available and registered in Ghana. Protective clothing available. |
| 8. | Mancozeb (800G/Kg) | CW Cozeb 80WP | GUP | EPA IV | GUP | III | Ri | Control of leaf spots, Mildew, leaf blight and scab | Available and registered in Ghana. Protective clothing available. |
| 9. | Mancozeb (800G/Kg) | Manzeb 800 WP | GUP | EPA IV | GUP | III | Ri | Control of leave spots, mildew, leaf blight, and scab in vegetables, fruits, ornamentals and field crops | Available and registered in Ghana. Protective clothing available. |
| 10. | Maneb (80%) | Trimangol 80 WP | | | GUP | III | Mz Ri | Control of leaf spots, downy mildew, fruit rots in cereals, vegetables and ornamentals | Available and registered in Ghana. Protective clothing available. |
| HERBICIDES | | | | | | | | | |
| 11. | Pendimethalin | Stomp | GUP | RPA III | GUP | R EPA III | Ri | <i>Gramineae</i> , broadleaf weeds, <i>cyperus</i> | Registered by GEPA |
| 12. | Glyphosate (41%) | Power 41% SL | GUP | EPaII | | III | Ri | Herbicide for the control of annual perennial grasses and broadleaf weeds in cereals and vegetables | Available and registered in Ghana. Protective clothing available. |
| 13. | Glyphosate (41%) | Komanda 41% SC | GUP | EPaII | | III | Ri | Herbicide for the control of annual and perennial broad leaved weeds and grasses | Available and registered in Ghana. Protective clothing available. |

| | | | | | | | | | |
|-----|----------------------|------------------|-----|-------------|-----|---------|----------|---|---|
| 14. | Glyphosate (41%) | Ceresate 41% SL | GUP | EPaII | GUP | III | Ri | Herbicide for the control of annual perennial grasses and broadleaf weeds in cereals and vegetables | Available and registered in Ghana. Protective clothing available. |
| 15. | Glyphosate (41%) | Touch down | GUP | EPaII | GUP | III | Ri | Herbicide for the control of annual and perennial broad leaf weeds and grasses | Available and registered in Ghana. Protective clothing available. |
| 16. | Glyphosate (41% w/w) | Adupa Wura SL | GUP | EPaII | GUP | III | Ri | Control of annual perennial grasses and broad leaved weeds | Available and registered in Ghana. Protective clothing available. |
| 17. | Glyphosate (41% w/w) | Destroyer SL | GUP | EPaII | GUP | III | Ri | Herbicide for the control of annual perennial grasses and broadleaf weeds in cereals and vegetables | Available and registered in Ghana. Protective clothing available. |
| 18. | Glyphosate (41% w/w) | Weed King SL | GUP | EPaII | GUP | III | Ri | Annual & perennial grasses and broadleaved weeds | Available and registered in Ghana. Protective clothing available. |
| 19. | Glyphosate (360g/Kg) | Chemosate 360 SL | GUP | EPA II, III | GUP | EPA III | Ri | Annual and perennial broadleaved weeds and grasses | Available and registered in Ghana. Protective clothing available. |
| 20. | Glyphosate (480g/L) | Adom 480 SL | GUP | EPA II, III | GUP | III | Ri Sb | Herbicide for the control of annual perennial grasses and broadleaf weeds in cereals and vegetables | Registered in Ghana. Protective clothing available. |
| 21. | Glyphosate | Adwumapa SL | GUP | EPA II | GUP | III | Ri | Herbicide for the | Registered in Ghana. |

| | | | | | | | | | |
|-----|------------------------|-------------------|-----|---------|-----|---------|----|--|---|
| | (480g/L) | | | | | | Sb | control of annual perennial grasses and broadleaf weeds in cereals and vegetables | Protective clothing available. |
| 22. | Glyphosate (360g/L) | Sarosate 360 SL | GUP | EPA II | GUP | III | Ri | Herbicide for the control of annual and perennial broad leaf weeds and grasses | Registered in Ghana. Protective clothing available. |
| 23. | Glyphosate (360g/L) | Roundup 360 | GUP | EPA II | GUP | III | Ri | Herbicide for the control of annual and perennial broad leaf weeds and grasses | Registered in Ghana. Protective clothing available. |
| 24. | Glyphosate (360g/L) | Sunphosate 360 SL | GUP | EPA II | GUP | EPA III | Ri | Annual and perennial grasses and broadleaf weeds in cereals and vegetable | Available and registered in Ghana. Protective clothing available. |
| 25. | 2,4-D Amine (720g/L) | Calliherb 720 SL | RUP | EPA II | GUP | II | Ri | Selective Herbicide for the control of broadleaf weeds in maize. Rice and sorghum | Registered in Ghana. Protective clothing available. |
| 26. | Pendimethalin (500g/L) | Chemosto mp 500 E | GUP | EPA III | GUP | II | Mz | Herbicide for the control of broadleaf weeds and grasses in maize, cotton and tomatoes | Available and registered in Ghana. Protective clothing available. |
| 27. | *Propanil 360 SL | Stam F 34 | RUP | EPA II | GUP | EPA II | Ri | Post-emergence herbicide to control broad leaved and grass weeds | Selective, contact herbicidal activity and gives excellent result when used in a tank mixed with 2-4D at recommended dosage, available in Ghana. Protective |

| | | | | | | | | | |
|-----|---|-------------------|-----|-------|-----|-----|----|--|--|
| | | | | | | | | | clothing available. |
| 28. | Propanil (360g/l) +2,4 D Amine (200g/l) | Propal-Plus 36 EC | RUP | EPaII | GUP | II | Ri | Selective Herbicide for the control of Annual and perennial grasses and Broad leaf weeds | Selective, contact herbicide, available in Ghana. Protective clothing available. |
| 29. | Propanil (35%w/w) | Propanil 36 EC | RUP | EPaII | GUP | III | Ri | Herbicide for the control of grasses and weeds in rice | Selective, contact herbicide, available in Ghana. Protective clothing available. |

Annex 7: Environmental Protection Agency, Accra, Revised Register of Pesticides as at 31st December 2013 under Part II of the Environmental Protection Agency Act, 1994 (Act 490)

(A) FULLY REGISTERED PESTICIDES (FRE)

(A1) Insecticides

| No. | Trade Name | Registration No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|--------------------|-----------------------------------|--|--------------|--|------------------------------------|
| 1 | Abate 50EC | FRE/1198/00397G October 2011 | Temephos (500g/l) | III | Larvicide for the control of mosquitoes and guinea worm | Cama Agro Consultancy, Accra |
| 2 | Aceta Star EC | FRE/12100/00494G August 2012 | Bifenthrin (30g/l) + Acetamiprid (16g/l) | II | Insecticide for the control of capsids in cocoa | Makhteshim Agan West Africa, Accra |
| 3 | Actellic 300CS | FRE/1206/00406G September 2012 | Pirimiphos-methyl (300g/l) | III | Insecticide for public health purposes | Calli Ghana Co. Ltd., Tema |
| 4 | Agro Blaster EC | FRE/1176/00343G August 2011 | Pyrethrum (1%) | II | Insecticide for stored produce | Equatorial Healthcare, Tema |
| 5 | Agro-thoate 40 EC | FRE/1310/00602G June 2013 | Dimethoate (400g/l) | II | Insecticide for the control of insect pests in vegetables | Reiss & Co. Ghana Ltd., Accra |
| 6 | Akape 20 SC | FRE/1202/00520G November 2012 | Imidacloprid (200g/l) | II | Insecticide for the control of insects pest in vegetables | Agrimat Limited, Accra |
| 7 | Alphacep 10 SC | FRE/1202/00443G February 2012 | Alpha-Cypermethrin (100 g/l) | III | Insecticide for the control of insect pest in vegetables and fruit crops | Agrimat Limited, Accra |
| 8 | Alti-pyrifos 48 EC | FRE/13121/00663G November 2013 | Chlorpyrifos ethyl (480g/l) | II | Insecticide for the control of insect pests of field crops and | Altimate Agrochemicals |

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| | | | | | for public health | Company Limited, Accra |
| 9 | Aquatain AMF | FRE/1308/00621G September 2013 | Polydimethylsiloxane (754g/l) | IV | Insecticide for the control of larvae and pupal stages of mosquitoes | Dizengoff Ghana Limited, Accra |
| 10 | Antuka EC | FRE/1243/00511G September 2012 | Pirimiphos-methyl (350g/l) + Permethrin (100g/l) | III | Insecticide for the control of insect pests in stored produce | Loius Dreyfus Commodities Ghana Ltd, Tema |
| 11 | Ateco Super 25 EC | FRE/1243/00417G January 2012 | Pirimiphos- methyl (250g/l) | II | Insecticide for the control of insect pests in stored cereals, cowpea and soybean | Kumark Company Limited, Kumasi |
| 12 | Atom Super 50 SC | FRE/1308/00619G September 2013 | Thiamethoxam (30g/l) + Deltamethrin (20g/l) | II | Insecticide for the control of insects and mites pests in vegetables and fruit crops | Dizengoff Ghana Limited |
| 13 | Bastion Extra 3G | FRE/1255/00507G September 2012 | Imidacloprid (3%) | II | Insecticide for the control of insect pests in vegetables | Loius Dreyfus Commodities Ghana Ltd, Tema |
| 14 | Blast 60 EC | FRE/1308/00582G April 2013 | Acetamiprid (3%) + Lambda-cyhalothrin (3%) | IV | Insecticide for the control of insect pest in vegetables and fruit crops | Dizengoff Ghana Ltd, Accra |
| 15 | Buffalo Supa 40EW | FRE/1323/00593G April 2013 | Acetamiprid (400g/l) | III | Insecticide for the control of insect pests in vegetables and fruit crops | Thomhcof Company Limited, Kumasi |
| 16 | Bypel 1 | FRE/13133/00648G October 2013 | Perisrapae Granulosis Virus + Bacillus thuringiensis | II | Biological insecticide for the control of white butterfly and other worms in vegetables, fruits and other crops | Abnark Agro Services, Kumasi |
| 17 | Campaign | FRE/1201/00470G February 2012 | <i>Metarhizium anisopliae</i> , ICIFE 69(3% w/v) | U | Biological insecticide for the control of mealybug in pawpaw | Wienco Ghana Limited, Accra |

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| 18 | Cardinal WS | FRE/1224/00478G March 2012 | Imidacloprid (5g/kg)+ Terbuconazole (4g/kg) | III | Insecticide / fungicide for the control of insect pests in vegetables and cereals | Saro Agrosiences Ghana, Accra |
| 19 | Carbodan 3% | FRE/1243/00416G November 2012 | Carbofuran (3%) | Ib | Insecticide / nematocide for the control of nematodes in vegetables | Kumark Company Limited, Kumasi |
| 20 | Celphos P | FRE/1310/00601R June 2013 | Aluminium Phosphide (57%) | Ib | Insecticide for the control of insect pests in stored grains | Reiss & Co. Ghana Ltd, Accra |
| 21 | Chemaprid 88EC | FRE/1305/00595G June 2013 | Acetamiprid (16g/l) + Cypermethrin (72g/l) | II | Insecticide for the control of insect pests in vegetables and horticultural crops | Agrimat Limited, Accra |
| 22 | Clear 2.5EC | FRE/1250/00471G March 2012 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables | Ransfum Enterprise, Kumasi |
| 23 | Cocoprid 20 SL | FRE/1205/00432G June 2012 | Acetamiprid (20g/l) | II | Insecticide for the control of capsid bugs and insect pests in cocoa | Chemico Limited, Tema |
| 24 | Combicot 505 EC | FRE/1258/00454G February 2012 | Chlorpyrifos-ethyl (500g/l) + Cypermethrin (50g/l) | II | Insecticide for the control of scale, borers in cereals, vegetables, ornamentals and for public health purposes | Afcott Ghana Limited, Accra |
| 25 | Conquer Super 2.5 EC | FRE/1365/00560G March 2013 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and | Kofamob Agro Services Ltd, |

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| | | | | | pulses | Kumasi |
| 26 | Consider Super 200 SL | FRE/1390/00548G March 2013 | Imidacloprid (200g/l) | II | Insecticide for the control of insect pests in vegetables | Thomas Fosu Enterprise, Accra |
| 27 | Contihalothrin 2.5EC | FRE/1278/00446G February 2012 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and pulses | Five Continents, Accra |
| 28 | Conpyrifos 48 EC | FRE/1278/00447G February 2012 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of scale and borers in cereals, vegetables, and for public health purposes | Five Continents, Accra |
| 29 | Cydim EC | FRE/1116/00340G August 2011 | Dimethoate (250g/l) + Cypermethrin (35g/l) | II | Insecticide for the control of aphids, caterpillars, whiteflies, bollworms in vegetables and cotton | Kurama Company Limited, Accra |
| 30 | Cypadem 43.6% EC | FRE/1357/00635G September 2013 | Cypermethrin (36g/l) + Dimethoate (400g/l) | II | Insecticide for the control of insect pests of vegetables and field crops | Wynca Sunshine Agric Products & Trading Co. Ltd |
| 31 | Cypasect 43.6EC | FRE/1264/00441G February 2012 | Dimethoate (40%) + Cypermethrin (3.6%) | II | Insecticide for the control of aphids, caterpillars, whiteflies, grasshoppers, bollworms in vegetables and cotton | Bentronic Productions, Kumasi |
| 32 | Cypercot 10EC | FRE/1258/00440G February 2012 | Cypermethrin (10%) | II | Insecticide for the control of aphids, worms and borers in vegetables | Afcott Ghana Limited, Kumasi |
| 33 | Cyperdicot 300EC | FRE/1258/00453G February 2012 | Cypermethrin (30g/l) + Dimethoate (250g/l) | II | Insecticide for the control of aphids, worms and borers in vegetables | Afcott Ghana Limited, Kumasi |
| 34 | Cypertex 10EC | FRE/1224/00524G November 2012 | Cypermethrin (10%) | II | Insecticide for the control of insect pests in vegetables | Saro AgroSciencesKumasi |

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| 35 | Dean 62EC | FRE/1355/00571G March 2013 | Emamectin benzoate (12g/l) + Imidacloprid (50g/l) | II | Insecticide for control of insect pest in vegetables | Louis Dreyfus Commodities Ghana Ltd, Tema |
| 36 | Decis 100 EC | FRE/13137/00671G December 2013 | Deltamethrin (100g/l) | II | Insecticide for the control of insect pests in fruits and vegetables | Bayer S.A, Ghana |
| 37 | Delete 2.5 SC | FRE/1352/00629G September 2013 | Deltamethrin (25%) | II | Insecticides for public health | Newlife Medical Centre |
| 38 | Deltapaz 1.25EC | FRE/11100/00390G October 2011 | Deltamethrin (12.5g/l) | II | Insecticide for the control of insect pests in various crops | Makhteshim Agan West Africa, Accra |
| 39 | Deltamost ULV | FRE/1201/00405G January 2012 | Deltamethrin (2.5%) + D-allethrin (0.3%) + Piperonyl butoxide (11%) | III | Insecticide for the control of insect pests in stored cocoa beans and for public health purposes | Wienco Ghana Limited, Accra |
| 40 | Devaxam 25WG | FRE/1310/00649G October 2013 | Thiamethoxam (15%) | II | Insecticide for the control of insect pests of vegetables and pulses | Reiss & Co. Ghana Limited |
| 41 | Diazol 50EW | FRE/11100/00391G October 2011 | Diazinon (500g/l) | II | Insecticide for the control of insect pests in vegetables | Makhteshim Agan West Africa, Accra |
| 42 | Direx 7.5G | FRE/13100/00573G March 2013 | Chlorpyrifos-ethyl (7.5%) | II | Insecticide for the control of insect pests in vegetables and field crops | Makhteshim Agan West Africa, Accra |
| 43 | Dimex 400EC | FRE/1155/00345G August 2011 | Dimethoate (400g/l) | II | Insecticide / acaricide for the control of aphids, plant bugs, fruit flies and leaf miners | Louis Dreyfus Commodities Ghana Ltd, Tema |
| 44 | Dimiprid 20 | FRE/1310/00598G | Imidacloprid | II | Insecticide for the control of | Reiss & Co. |

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| | SL | June 2013 | (200g/l) | | insect pests in vegetables | Ghana Ltd., Accra |
| 45 | Dufos 480 EC | FRE/1225/00420G February 2012 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests in field crops and for public health purposes | Bentronics Productions, Kumasi |
| 46 | Dursban 4 E | FRE/1205/00427G February 2012 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of scale, borers, cockroaches and mosquitoes | Chemico Ltd Tema |
| 47 | Efforia 45EC | FRE/1301/00534G March 2013 | Thiamethoxam (3%) + Lambda- cyhalothrin (25%) | II | Insecticide for the control of insect pests in vegetables | Wienco Ghana Limited, Accra |
| 48 | Ekuapa 2.5EC | FRE/1390/00550G March 2013 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and pulses | Thomas Fosu Enterprise, Accra |
| 49 | Ema 1.92EC | FRE/13100/00575G March 2013 | Emamectin benzoate (1.92%) | II | Insecticide for control of pests in vegetables and pulses | Makhteshim Agan West Africa, Accra |
| 50 | Envigold 70SL | FRE/1224/00475G March 2012 | Malathion (700g/l) | III | Insecticide / acaricide for the control of insect pests in stored grains | Saro Agrosiences Ghana, Accra |
| 51 | Eradicoat T | FRE/13125/00615G September 2013 | Maltodextrin (282g/l) | III | Insecticides for the control of insect and mite pests of vegetables and fruit crops | Positiveware Trading Company Limited, Accra |
| 52 | Evisect S 50WP | FRE/1206/00501/G September 2012 | Thiocyclam oxalate (500g/kg) | II | Insecticide for the control of leaf miners in oil palm | Calli Ghana Co Ltd Accra |
| 53 | Fam-O-thrine 2.5 EC | FRE/13128/00655G October 2013 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests of vegetables | Multi Heif Company Limited, |

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| 54 | Fastrack 10 SC | FRE/1202/00444G February 2012 | Alpha-cypermethrin (100 g/l) | III | Insecticide for the control of insect pest in vegetables and fruit crops | Agrimat Limited, Accra |
| 55 | Fenitrothion 50EC | FRE/1202/00514G November 2012 | Fenitrothion (50%) | II | Insecticide for the control of insect pest in vegetables and for public health purposes | Agrimat Limited, Accra |
| 56 | Fentox 20EC | FRE/1233/00504G September 2012 | Fenvalerate (200g/l) | II | Insecticide for the control of insect pests in vegetables | Adu &Yeboah, Enterprise, Kumasi |
| 57 | Ficam VC 80WP | FRE/13114/00555G March 2013 | Bendiocarb (80%) | II | Insecticide for public health purposes | Drugmat Limited, Accra |
| 58 | Fipro 50% EC | FRE/1308/00586G April 2013 | Fipronil (500g/l) | II | Insecticide for the control of insect pests in vegetables and cereals | Dizengoff (Ghana) Limited, Accra |
| 59 | Frankocylon 2.5 EC | FRE/1239/00522/G November 2012 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and pulses | Frankatson Limited, Accra |
| 60 | Frankofen 20EC | FRE/1239/00521/G November 2012 | Fenvalerate (200g/l) | II | Insecticide for the control of insect pests in vegetables | Frankatson Limited, Accra |
| 61 | Furadan 3G | FRE/1205/00429R February 2012 | Carbofuran (3%) | II | Insecticide/ nematicide for the control of insect pests in rice, vegetables and oil palm | Chemico Ltd., Tema |

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| 62 | Golan 20% SP | FRE/1308/00587G April 2013 | Acetamiprid (200g/Kg) | III | Insecticide for the control of insect pests in vegetables and fruit crops | Dizengoff (Ghana) Limited, Accra |
| 63 | Goliath Gel | FRE/1198/00379G August 2011 | Fipronil (0.05%) | II | Insecticide for public health purposes | Cama Agro Consultancy, Accra |
| 64 | Hercules 50SC | FRE/1002/00328G November 2010 | Fipronil (50g/l) | II | Insecticide for public health purposes | Agrimat Limited, Madina, Accra |
| 65 | Hercules Extra SC | FRE/1002/00329G November 2010 | Fipronil (200g/l) | II | Insecticide for public health purposes | Agrimat Limited, Madina, Accra |
| 66 | Hockli Combi 40EC | FRE/1202/00515G November 2012 | Fenithrothion (30%) + Fenvalerate (10%) | II | Insecticide for the control of insect pests in fruits and vegetables | Agrimat Limited, Accra |
| 67 | Holy Black Mosquito Coil | FRE/13116/00559G March 2013 | Dimefluthrin (0.03%) | III | Insecticide for the control of mosquitoes | Bon Arrive Supermarket, Accra |
| 68 | Icon 10 CS | FRE/1161/00360G August 2011 | Lambda- cyhalothrin (100g/l) | II | Insecticide for public health purposes | Huge Limited, Accra |
| 69 | Inesfly 5A IGR NG Paint | FRE/13104/00626G September 2013 | Pyriproxyfen (0.063) + Diazinon (1.5%) + Chlorpyrifos (1.5%) | III | Insecticide for the control of mosquitoes | Inesfly Africa Limited, Accra |
| 70 | Insecta TDS | FRE/1355/00562G March 2013 | Imidacloprid (350g/kg) + Thiram (100g/kg) | III | Insecticide/ Fungicide for seed treatment | Louis Dreyfus Commodities, Ghana Ltd, Tema |

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| 71 | Insta 2.5 EC | FRE/1159/00382G October 2011 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and flowers | West African Cotton Co. Ltd., Accra |
| 72 | Kakalika Gel | FRE/1308/00618G September 2013 | Fipronil (0.05%) | III | Insecticide for the control of cockroaches | Dizengoff Ghana Limited |
| 73 | Konka Phosphide T | FRE/1365/00612R August 2013 | Aluminium Phosphide (56%) | Ib | Insecticide for the control of insect pests in stored grains | Jem Inter Continental Services, Tema |
| 74 | Karto 2.5EC | FRE/1310/00603G June 2013 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and flowers | Reiss & Co. Ghana Ltd., Accra |
| 75 | Kamotrine 2.5EC | FRE/13123/00597G June 2013 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and flowers | Anichesvin Ventures, Kumasi |
| 76 | KD 415EC | FRE/1205/00460G February 2012 | Chlorpyrifos (400g/l) + Lambda-cyhalothrin (15g/l) | II | Insecticide for the control of scale and borers in cereals, vegetables, ornamentals and for public health purposes | Chemico limited, Tema |
| 77 | K-Lambda 2.5 EC | FRE/1286/00495G September 2012 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and flowers | Joyful AgroServices, Kumasi |
| 78 | K-Optimal EC | FRE/1155/00347G August 2011 | Lambda-cyhalothrin (16g/l) + Acetamiprid (20g/l) | II | Insecticide for the control of insect pests in vegetables | Louis Dreyfus Commodities, Ghana Ltd, Tema |

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| 79 | K-Orthrine 250WG | FRE/13114/00554G March 2013 | Deltamethrin (250g/kg) | II | Insecticide for public health purposes | Drugmat Limited, Accra |
| 80 | Lambda best 2.5 EC | FRE/1333/00539G March 2013 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and flowers | Adu & Yeboah Enterprise, Kumasi |
| 81 | Lambda Boss 2.5 EC | FRE/13131/00642G September 2013 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and pulses | K. Adu Enterprise, Kumasi |
| 82 | Lambda Master 2.5 EC | FRE/1382/00624G September 2013 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and pulses | Cropstar Enterprise, Kumasi |
| 83 | Lambda Max 2.5 EC | FRE/13111/00664G November 2013 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and pulses | Elvisco Farms Company Limited, Kumasi |
| 84 | Lambda Super 2.5EC | FRE/1243/00413G January 2012 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables | Kumark Company Limited, Kumasi |
| 85 | Lambdacot EC | FRE/1258/00455G February 2012 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables | Afcott Ghana limited, Accra |
| 86 | Lambtox 2.5EC | FRE/1248/00497G November 2012 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables | Yawussma Ventures, Kumasi |
| 87 | Lanju Black Mosquito Coil | FRE/1341/00556G March 2013 | Dimefluthrin (0.03%) | III | Insecticide for the control of mosquitoes | AD&R Enterprise, Accra |

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| 88 | Levo 2.4SL | FRE/1308/00583G April 2013 | Oxymatrin (2.4%) | III | Insecticide for the control of insect pest in vegetables and fruit crops | Dizengoff Ghana Ltd, Accra |
| 89 | Marshal 480EC | FRE/1205/00430G February 2012 | Carbosulfan (480g/l) | II | Insecticide for the control of scale, nematodes and symphilids in pineapple | Chemico Ltd Tema |
| 90 | Mektin 1.8EC | FRE/1308/00588G April 2013 | Abamectin (18g/l) | II | Insecticide for the control of insect pest and mites of ornamentals and vegetables | Dizengoff Ghana Ltd, Accra |
| 91 | Methoate 40 EC | FRE/1325/00608G August 2013 | Dimethoate (400g/l) | III | Insecticide for the control of insect pests in vegetables and fruit crops | Bentronic Productions, Kumasi |
| 92 | M-Guard EC | FRE/1305/00596G June 2013 | Pirimiphos-methyl (80g/l) + Permethrin (15g/l) | II | Insecticide for the control of insect pests in stored produce | Chemico Ltd, Tema |
| 93 | Miricon EC | FRE/1214/00493G July 2012 | Deltamethrin (6g/l) + Pyrethrum (6g/l) | II | Insecticide for the control of flying and crawling insect pests in cocoa beans | Afropa (GH) Ltd, Accra |
| 94 | Moschamp WP | FRE/1191/00335G August 2011 | Alpha-cypermethrin (8%) | II | Insecticide for the control of mosquitoes | Neptumus Co. Ltd, Accra |
| 95 | Mosquiron 10EC | FRE/11100/00387G October 2011 | Novaluron (100g/l) | III | Insecticide for public health purposes | Makhteshim Agan West Africa, Accra |

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| 96 | Movento 100SC | FRE/13137/00670G December 2013 | Spirotetramat (100g/l) | III | Insecticide for the control of insect pests in fruits and vegetables | Bayer S.A, Ghana, Accra |
| 97 | Nutrel SL | FRE/11103/00400G October 2011 | Hydrolysed Protein (24%) | U | Insecticide for the control of insect pests in citrus and cereals | Tropical 2000 Ghana Limited, Accra |
| 98 | Oro Insecticide Spray | FRE/1197/00361G August 2011 | Permethrin (0.25%) + Tetramethrin (0.20%) | III | Insecticide for public health purposes | Marina Market Limited, Accra |
| 99 | Pali 250 WG | FRE/13125/00610G August 2013 | Deltamethrin (25%) | II | Insecticides for public health purposes | West Africa Environmental Science Limited, Accra |
| 100 | Pawa 2.5EC | FRE/1205/00428G February 2012 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables | Chemico Ltd, Tema |
| 101 | Perfekthion EC | FRE/1198/00365G August 2011 | Dimethoate (400g/l) | II | Insecticide for the control of insect pest and borer larvae in vegetables and pineapples | Cama Agro Consultancy, Accra |
| 102 | Phosphinon P | FRE/1255/00509R September 2012 | Aluminium Phosphide (57%) | Ib | Insecticide for the control of insect pests in stored grains | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 103 | Phostoxin T | FRE/1301/00538R March 2013 | Aluminium Phosphide (56%) | Ib | Insecticide for the control of insect pests in stored grains | Wienco Ghana Limited, Accra |

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| 104 | Plan D 2.5 EC | FRE/1302/00627G September 2013 | Lambda-cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables and pulses | Agrimat Limited, Accra |
| 105 | Plustoxin P | FRE/1286/00463G February 2012 | Aluminium Phosphide (57%) | Ib | Insecticide for the control of insect pests in stored grains | Joyful Agro Services, Kumasi |
| 106 | Polythrine C336EC | FRE/1201/00523G November 2012 | Cypermethrin (36g/l)+ Profenofos (300 g/l) | II | Insecticide for the control of sucking insects and mites in vegetable crops | Wienco Ghana Limited, Accra |
| 107 | Proguard 80WP | FRE/1302/00594G April 2013 | Propoxur (800g/Kg) | II | Insecticide for the control of mosquitoes and other household insect pests | Agrimat Limited, Accra |
| 108 | Protecta CCA-Oxide Type C SL | FRE/13132/00632R September 2013 | Cupric oxide (11.3%)+ Arsenic acid (24.6%) + Chromium trioxide (27.9%) | II | Insecticide for wood treatment | Byes & Ways Company Limited, Accra |
| 109 | Protect 1.9EC | FRE/1308/00585G April 2013 | Emamectin benzoate (1.9%) | II | Insecticide for the control of insect pests in vegetables and pulses | Dizengoff (Ghana) Limited, Accra |
| 110 | Protex 57TB | FRE/1326/00544R March 2013 | Aluminium Phosphide (56%) | Ib | Insecticide for the control of insect pests in stored grains | The Candel Company Limited, Accra |
| 111 | Pyrical 480EC | FRE/1106/00358/G August 2011 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests in pineapples | Calli Ghana Co. Ltd., Tema |

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| 112 | Pyrinex 48EC | FRE/11100/00389/G October 2011 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests in vegetables and for public health | Makhteshim Agan West Africa, Accra |
| 113 | Pyrinex Quick 256EC | FRE/13100/00572G March 2013 | Chlorpyrifos (250g/l) + Deltamethrin (6g/l) | II | Insecticide for the control of insect pests in vegetables and for public health | Makhteshim Agan West Africa, Accra |
| 114 | Rainabam 18EC | FRE/1299/00506/G September 2012 | Abamectin (18g/l) | II | Insecticide for the control of insect pests in vegetables and cereals | Rainbow Agrosciences Co Ltd, Accra |
| 115 | Rainaceph 75SP | FRE/1299/00505/G September 2012 | Acephate (750g/kg) | III | Insecticide for the control of insect pests in vegetables and cereals | Rainbow Agrosciences Co Ltd, Accra |
| 116 | Rainchlorpyr 480 EC | FRE/1399/00540G March 2013 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests in vegetables and field crops | Rainbow Agrosciences Co Ltd, Accra |
| 117 | Raindimeth | FRE/1299/00483G March 2012 | Dimethoate (240g/l) | II | Insecticide for the control of insect pest and borer larvae in vegetables, pineapples and ornamentals | Rainbow Agrosciences Company Ltd, Accra |
| 118 | Rainimidac | FRE/1299/00482G March 2012 | Imidacloprid (350g/l) | II | Insecticide for the control of insect pest in vegetables. | Rainbow AgroSciences Co Ltd, Accra |
| 119 | Rainlamda 2.5EC | FRE/1399/00543G March 2013 | Lambda- cyhalothrin (25g/l) | II | Insecticide for the control of insect pests in vegetables | Rainbow AgroSciences Co Ltd, Accra |
| 120 | Rainlamda Plus | FRE/1299/00481G March 2012 | Lambda- cyhalothrin (15g/l) + Dimethoate (300g/l) | II | Insecticide for the control of insect pests in vegetables | Rainbow AgroSciences Co Ltd, Accra |
| 121 | Raintham 350 SC | FRE/1399/00605G | Thiamethoxam (350g/l) | III | Insecticide for the control of insect pests in vegetables and | Rainbow AgroSciences |

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| | | July 2013 | | | fruit crops | Company Limited, Accra |
| 122 | Regent 50SC | FRE/1198/00366G August 2011 | Fipronil (50g/l) | II | Insecticide for the control of worms and termites in cabbage, maize and rice | Cama Agro Consultancy, Accra. |
| 123 | Rimon 10EC | FRE/11100/00388G October 2011 | Novaluron (100g/l) | III | Insecticide for the control of insect pests in cabbage, tomato and pepper | Makhteshim Agan West Africa, Accra |
| 124 | Rimon Star EC | FRE/12100/00495G August 2012 | Bifenthrin (30g/l) + Novaluron (35g/l) | II | Insecticide for the control of capsids in cocoa | Makhteshim Agan West Africa, Accra |
| 125 | Rubi 5 WP | FRE/13125/00611G August 2013 | Alpha-cypermethrin (5%) | II | Insecticide for public health | West Africa Environmental Science Limited, Accra |
| 126 | Sanitox 20EC | FRE/1122/00380G August 2011 | Fenvalerate (200g/l) | II | Insecticide for the control of insect pest in vegetables and cowpea | Annoh and Sons, Accra |
| 127 | Sarocide 28% SL | FRE/1224/00478G March 2012 | Oxamyl (280 g/l) | II | Insecticide/ Nematicide for the control of insects/ nematodes in vegetables | Saro Agrosiences, Kumasi |
| 128 | Shocker 20EC | FRE/1233/00498G September 2012 | Fenvalerate (200g/l) | II | Insecticide for the control of insect pests in vegetables and cowpea | Yawwussma Ventures, Kumasi |
| 129 | Sicoban 48EC | FRE/1366/00669G December 2013 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests in vegetables and field crops | Sidalco Ltd, Accra |

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| 130 | Sinoban EC | FRE/1122/00381G August 2011 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests in vegetables and field crops | Annoh and Sons, Accra |
| 131 | Siricon10 EC | FRE/1366/00668G December 2013 | Cypermethrin (10%) | II | Insecticide for the control of insect pests in vegetables and fruit crops | Sidako Ltd, Accra |
| 132 | Solignum Exterior | FRE/13127/00630G September 2013 | Permethrin (0.2%) | III | Insecticide for wood treatment | Premier Steel Limited, Accra |
| 133 | Stop Mating Block | FRE/1192/00338G August 2011 | Malathion (10%) | III | Insecticide for the control of <i>Bactrocera sp.</i> | Splendid Agro Product, Accra |
| 134 | Striker EC | FRE/1355/00570G March 2013 | Lambda- cyhalothrin (2.5%) | II | Insecticide for the control of insect pest in vegetables and fruit crops | Louis Dreyfus Commodities Ghana Ltd, Tema |
| 135 | Sumitex 40EC | FRE/1243/00410G January 2012 | Dimethoate (400g/l) | II | Insecticide for the control of mealybugs, mites, thrips, greenflies and borer larvae in vegetables and pineapples | Kumark Company Limited, Kumasi |
| 136 | Sumitex 20EC | FRE/1243/00414G January 2012 | Dimethoate (200g/l) | II | Insecticide for the control of mealybugs, mites, thrips, greenflies and borer larvae in vegetables and pineapples | Kumark Company Limited, Kumasi |
| 137 | Super Agro Blaster | FRE/1176/00344G August 2011 | Pyrethrum (1%) | II | Insecticide for the control of insect pests in stored produce | Equatorial Healthcare, Tema |

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| 138 | Super Guard 50EC | FRE/1202/00512G November 2012 | Pirimiphos-methyl (400g/l) + Permethrin (100g/l) | III | Insecticide for the control of insect pests in stored produce | Agrimat Limited Accra |
| 139 | Suncombi 30% EC | FRE/1357/00634G September 2013 | Fenitrothion (25%) + Fenvalerate (5%) | II | Insecticide for the control of insect pests of field crops and public health | Wynca Sunshine Agric Products & Trading Company Limited |
| 140 | Sunhalothrin 2.5% EC | FRE/1357/00656G October 2013 | Lambda- cyhalothrin (25%) | II | Insecticide for the control of insect pests in vegetables and pulses | Wynca Sunshine Agric Products & Trading Company Limited, Accra |
| 141 | Sunpyrifos 48 EC | FRE/1357/00633G September 2013 | Chlorpyrifos ethyl (480g/l) | II | Insecticide for the control of insect pests of field crops and public health | Wynca Sunshine Agric Products & Trading Company Limited, Accra |
| 142 | Tanalith C3310 | FRE/1332/00631R September 2013 | Cupric oxide (11.29) + Arsenic pentoxide (17.3) + Chromium trioxide (30.29%) | II | Insecticide for wood treatment | Dupaul Wood Treatment Ghana Limited |
| 143 | Termicot 20EC | FRE/1258/00451G February 2012 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests of field crops and for public health purposes | Afcott Ghana Limited, Kumasi |
| 144 | Termidor 25EC | FRE/1198/00396G October 2011 | Fipronil (25g/l) | II | Broad spectrum insecticide for control of insect pests in cabbage, onion, egg plant, maize, and for termite control | Cama Agro Consultancy, Accra. |
| 145 | Temaphos B | FRE/1205/00492R July 2012 | Aluminium Phosphide (57%) | Ib | Insecticide for the control of insect pests in stored grains | Chemico Limited, Tema |
| 146 | Thomaxin P | FRE/1390/00548R | Aluminium | Ib | Insecticide for the control of | Thomas Fosu |

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|-----|----------------|------------------------------------|---|-----|--|----------------------------------|
| | | March 2013 | Phosphide (57%) | | insect pests in stored grains | Enterprise, Accra |
| 147 | Thunder OD-145 | FRE/1301/00536G March 2013 | Imidacloprid (100g/l) + Beta-cyfluthrine (45g/l) | III | Insecticide for the control of insect pests on cotton | Wienco Ghana Limited, Accra |
| 148 | Tihan 175-OTEQ | FRE/1301/00537G March 2013 | Flubendiamide (100g/l) + Spirotetramat (75g/l) | III | Insecticide for the control of insect pests on cotton | Wienco Ghana Limited, Accra |
| 149 | Topstoxin | FRE/1243/00415R January 2012 | Aluminium Phosphide (57%) | Ib | Insecticide for the control of insect pests in stored grains | Kumark Company Limited, Kumasi |
| 150 | Trigger 10CS | FRE/1308/00584G April 2013 | Lambda-cyhalothrin (100g/kg) | II | Insecticide for the control of insect pest in vegetables and horticulture | Dizengoff (Ghana) Limited, Accra |
| 151 | Trusban 48 EC | FRE/13128/00638G September 2013 | Chlorpyrifos ethyl (480g/l) | II | Insecticide for the control of insect pests of field crops and for public health | Multi Heif Company Limited |
| 152 | ULV 810-IC | FRE/1214/00404G January 2012 | Pyrethrum (12g/l) +Alpha-cypermethrin (24g/l) | III | Insecticide for the control of flying and crawling insect pests in cocoa, stored produce and for public health | Afropa (Ghana) Limited, Accra |
| 153 | ULV 900-IC | FRE/1214/00403G January 2012 | Pyrethrum (12g/l) +Alpha-cypermethrin (24g/l) | II | Insecticide for the control of flying and crawling insect pests in cocoa beans | Afropa (Ghana) Limited, Accra |
| 154 | VectoBac WDG | FRE/1180/00362G August 2011 | <i>Bacillus thuringiensis</i> subsp. <i>Israelensis</i> 3000 ITU/mg | IV | Insecticide for the control of larvae of mosquitoes | Challux Limited, Accra |
| 155 | VectoBac | FRE/1102/00363G | <i>Bacillus</i> | IV | Insecticide for the control of | Agrimat Limited, |

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| | 12AS | August 2011 | <i>thuringiensis</i> , serotype H-14, 3000 <i>Aedes aegypti</i> Units/mg | | larvae of mosquitoes and blackflies | Accra |
| 156 | Vector 30%WP | FRE/1224/00479G March 2012 | Imidacloprid (210g/kg) + Beta-cyfluthrin (90g/kg) | III | Insecticide for the control of insect pest in vegetables | Saro Agrochemicals, Kumasi |
| 157 | Vectolex WG | FRE/1102/00364G August 2011 | <i>Bacillus sphaericus</i> 3000 ITU/mg | IV | Insecticide for the control of larvae of mosquitoes | Agrimat Limited, Accra |
| 158 | Vedette 240SL | FRE/1155/00349G August 2011 | Oxamyl (240g/l) | II | Insecticide/nematicide for the control of insect/nematode pests in vegetables | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 159 | Vestaguard 40WP | FRE/1202/00517G November 2012 | Pirimiphos-methyl (400g/l) | III | Insecticide for public health purposes | Agrimat Limited, Accra |
| 160 | Vinyamat Ultra Paint | FRE/13115/00558G March 2013 | Bifenthrin (0.8%) + cypermethrin (1.6%) | II | Paint containing insecticide for the control of flies and spiders | M&K (Ghana) Limited, Accra |
| 161 | Wonderex 24 SC | FRE/1310/00650G October 2013 | Thiamethoxam (24%) | II | Insecticide for the control of insect pests in vegetables and pulses | Reiss & Co. Ghana Limited, Accra |
| 162 | Wreko 2.5EC | FRE/1223/00467G February 2012 | Lambda-cyhalothrin (2.5%) | II | Insecticide for the control of insect pests in vegetables | Thomhcof Enterprise, Kumasi |
| 163 | Zap 2.5EC | FRE/1326/00553G March 2013 | Lambda-cyhalothrin (2.5%) | II | Insecticide for the control of insect pests in vegetables | The Candel Company Limited, Accra |
| 164 | Zerofly | FRE/1273/00438G February 2012 | Deltamethrin (4g/kg) | II | Insecticide treated residual wall lining for animal health | Vestergaard Frandsen West |

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| | | | | | | Africa, Accra |
| 165 | Zerovector | FRE/1273/00437G February 2012 | Deltamethrin (4.4g/kg) | II | Insecticide treated residual wall lining for animal health | Vestergaard Frandsen West Africa, Accra |

A2): Fungicides

| No. | Trade Name | Registration No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|----------------------|-------------------------------------|--|-----------------|--|---|
| 1 | Agrithane 80 WP | FRE/1302/00628G September 2013 | Mancozeb (800g/kg) | III | Fungicides for the control of leaf spots, mildew, leaf blight and scab in vegetables | Agrimat Limited, Accra |
| 2 | Agro-Comet 72WP | FRE/1110/00337G August 2011 | Metalaxyl (12%) + Copper (I) oxide (60%) | III | Fungicide for the control of fungal diseases on cocoa | Reiss & Co Ghana Limited, Accra |
| 3 | Athelete 80WP | FRE/1355/00567G March 2013 | Fosetyl-aluminium (800g/kg) | III | Fungicide for the control of mildew and <i>Phytophthora</i> diseases of vegetables, fruits tree crops and pineapples | Louis Dreyfus Commodities Ghana Ltd, Tema |
| 4 | Amistar Top 325SC | FRE/1301/00535G March 2013 | Azoxystrobin (200g/l) + Difenoconazole (125g/l) | III | Systemic fungicide for the control of early blight, late blight, powdery mildew, leaf spot, anthracnose and rust in vegetables | Wienco Ghana Limited, Accra |
| 5 | Atracol 70WP | FRE/13137/00672G December | Proppineb 700g/kg) | III | Fungicide for the control of fungal diseases in vegetables | Bayer S.A, Ghana, Accra |
| 6 | Carbendazim 50WP | FRE/1302/00552G March 2013 | Carbendazim (500g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Agrimat Limited, Accra |
| 7 | Calliete 80WP | FRE/1106/00357G August 2011 | Fosetyl-aluminium (800g/kg) | III | Systemic fungicide for the control of <i>Phytophthora</i> diseases in pineapple | Calli Ghana Company Limited, Tema |

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| 8 | Callis 400-OL | FRE/1106/00355G September 2011 | Thiophanate-methyl (400g/l) | III | Fungicide for the control of yellow and black sigatoka in bananas | Calli Ghana Company Limited, Tema |
| 9 | Contizeb 80WP | FRE/1278/00445G February 2012 | Mancozeb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables and fruits | Five Continents, Accra |
| 10 | Cotzeb 80WP | FRE/1258/00456G February 2012 | Mancozeb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight, scab in vegetables and fruits. | Afcott Ghana Limited, Accra |
| 11 | Creosote Substitute | FRE/1231/00439G February 2012 | Dichlofluanid (3.96g/l) | IV | Fungicide and algaecide for wood preservation | TM3, Accra |
| 12 | Dizcozeb 80 WP | FRE/1308/00620G September 2013 | Mancozeb (800g/kg) | III | Fungicides for the control of leaf spots, mildew, leaf blight and scab in vegetables | Dizengoff Ghana Limited, Accra |
| 13 | Fantic Plus 69WP | FRE/1306/00557G March 2013 | Benalaxyl-M (9%) + Cuprous oxide (60%) | III | Fungicide for the control of <i>Phytophthora megakarya</i> in cocoa | Calli Ghana Co. Ltd., Tema |
| 14 | Foko 80%WP | FRE/1223/00466G February 2012 | Mancozeb (800g/kg) | III | Fungicide for the control of fungal diseases in vegetables | Thomhcof Enterprise, Kumasi |
| 15 | Foko Super 80%WP | FRE/1390/00546G March 2013 | Mancozeb (800g/kg) | III | Fungicide for the control of fungal diseases in vegetables | Thomas Fosu Enterprise, Accra |
| 16 | Folpan 50WP | FRE/11100/0393/G October 2011 | Folpet (500g/l) | III | Broad spectrum fungicide for the control of diseases in vegetables and field crops | Makhteshim Agan West Africa, Accra |

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|----|------------------|------------------------------------|--------------------------------|-----|--|--|
| 17 | Fungikill 50WP | FRE/1205/00491G July 2012 | Copper (35%) + Metalaxyl (15%) | III | Fungicide for the control of <i>P. palmivora</i> and <i>P. megakarya</i> in cocoa | Chemico Ltd, Tema |
| 18 | Funguran-OH 50WP | FRE/1205/00491G July 2012 | Copper hydroxide (77%) | III | Fungicide for the control of <i>Phytophthora sp.</i> in cocoa | Dizengoff Ghana Limited, Accra |
| 19 | Goldazim WP | FRE/1116/00341G August 2011 | Carbendazim (500g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Kurama Company Limited, Accra |
| 20 | Ivory 80WP | FRE/1306/00530G March 2013 | Mancozeb (800g/kg) | III | Fungicide for control of diseases in vegetables, fruits, and field crops | Calli Ghana Company Limited, Tema |
| 21 | Kadmaneb 80WP | FRE/1233/00503G September 2012 | Maneb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Adu & Yeboah Enterprise, Kumasi |
| 22 | Kenmaneb 80 WP | FRE/13131/00644G September 2013 | Maneb (80%) | III | Fungicide for the control of leaf spots, downy mildew and fruit rot in vegetables | K. Adu Enterprise, Kumasi |
| 23 | Kentan 40 WG | FRE/1306/00641G September 2013 | Copper Hydroxide (400g/kg) | III | Fungicide for the control of <i>Phytophthora megakarya</i> | Calli Ghana Company Limited, Tema |
| 24 | Kilazeb 80WP | FRE/1243/00418G January 2012 | Mancozeb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables and fruits | Kumark Company Limited, Kumasi |
| 25 | Kocide 2000 | FRE/1206/00245G February 2012 | Cupric hydroxide (53.8%) | III | Fungicide for the control diseases in cocoa | Calli Ghana Limited, Accra |
| 26 | Kofazeb 80 WP | FRE/1364/00613G August 2013 | Mancozeb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Kofamob Agro Services Ltd, Kumasi |
| 27 | Mancozan 80WP | FRE/1255/00503G September 2012 | Mancozeb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables and fruits | Louis Dreyfus Commodities, Ghana Ltd, Tema |

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| 28 | Mancozan Super WP | FRE/1355/00569G March 2013 | Mancozeb (640g/kg) + Metalaxyl (80g/kg) | III | Fungicide for the control of diseases in vegetables, fruits, and field crops | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 29 | Merpan | FRE/11100/00395G October 2011 | Captan (500g/kg) | III | Broad spectrum fungicide for the control of diseases in fruits, coffee and vegetables | Makhteshim Agan West Africa, Accra |
| 30 | Navito 300SC | FRE/13137/00673G December 2013 | Terbuconazole (200g/l) + Trifloxystrobin (100g/l) | III | Fungicide for the control of fungal diseases in vegetables | Bayer S.A, Ghana, Accra |
| 31 | Rainmancoz 80WP | FRE/1399/00542G March 2013 | Mancozeb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables and fruits | Rainbow Agrosiences Co Ltd, Accra |
| 32 | Raintebzol 430 SC | FRE/1399/00606G July 2013 | Tebuconazole (430g/l) | III | Fungicide for the control of rust, leaf spots, mildew, leaf blight in fruit crops and vegetables | Rainbow AgroSciences Company Limited, Accra |
| 33 | Raintop-M 70 WP | FRE/1399/00607G July 2013 | Thiophanate methyl (700g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Rainbow AgroSciences Company Limited, Accra |
| 34 | Sarozeb 80WP | FRE/1224/00525G November 2012 | Mancozeb (800g/kg) | III | Fungicide for control of leaf spots, mildew, leaf blight and scab in vegetables and fruits | Saro Agro Sciences, Kumasi |
| 35 | Seedrex WP | FRE/1355/00589G April 2013 | Permethrin (33%) + Carbendazim (15%) + Chlorothalonil (12%) | III | Fungicide for seed treatment | The Candel Company Limited, Accra |
| 36 | Shavit F 715WP | FRE/11100/00394G October 2011 | Folpet (700g/kg) + Triadimenol (1.5g/kg) | III | Broad spectrum fungicide for the control of diseases in vegetables, field crops and ornamentals | Makhteshim Agan West Africa, Accra |
| 37 | Skyrobin 50 | FRE/1399/00646G | Azoxystrobin | III | Fungicide for the control of leaf | Rainbow |

| | | | | | | |
|----|----------------|-----------------------------------|---|-----|--|---|
| | WG | September 2013 | (500g/kg) | | spots, mildew, leaf blight, scab and Anthracnose in vegetables | AgroSciences Company Limited, Accra |
| 38 | Skystar 280 SC | FRE/1399/00645G September 2013 | Azoxystrobin (20%) + Propiconazole (8%) | III | Fungicide for the control of leaf spots, mildew, leaf blight, scab and anthracnose in vegetables | Rainbow AgroSciences Company Limited, Accra |
| 39 | Sulphur 80WP | FRE/1202/00518G August 2012 | Sulphur (800g/kg) | III | Fungicides for the control of fungal diseases in crops and ornamentals | Agrimat Limited, Accra |
| 40 | Suncozeb 80 WP | FRE/1357/00637G September 2013 | Mancozeb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Wynca Sunshine Agric Products & Trading Co Ltd, Accra |
| 41 | Sustain | FRE/1201/00469G March 2012 | <i>Trichoderma asperellum</i> TRC 900, 3% w/v | IV | Fungicide for the control of black pod disease in cocoa | Wienco Ghana Limited, Accra |
| 42 | Thiopsin 70WP | FRE/1381/00551G March 2013 | Thiophanate-methyl (70%) | III | Fungicide for the control of fungal diseases in crops | Badu Kaakyire Agrochemical Co. Ltd., Kumasi |
| 43 | Tilt | FRE/1106/00359G August 2011 | Propiconazole (250g/l) | III | Fungicide for the control of fungal diseases in banana | Calli Ghana Company Limited, Tema |
| 44 | Top Cop | FRE/1205/00436G February 2012 | Sulphur (50%) + Copper (8%) | III | Fungicide / miticide for the control of diseases in vegetables | Chemico Limited, Tema |
| 45 | Topsect 70WP | FRE/1225/00442G February 2012 | Thiophanate-methyl (70%) | III | Fungicide for the control of fungal diseases in crops | Bentronic Productions, Kumasi |
| 46 | Trimaneb 80WP | FRE/1155/0040G August 2011 | Maneb (800g/kg) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 47 | Victory 72 WP | FRE/1308/00616G | Metalaxyl (8%) + | III | Fungicide for the control of | Dizengoff Ghana |

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|----|---------------------|-----------------------------------|------------------------|-----|---|-----------------------------------|
| | | September 2013 | Mancozeb (64%) | | fungal diseases in vegetables, fruits, ornamentals and field crops | Limited, Accra |
| 48 | Volley 880-OL | FRE/1198/00371G August 2011 | Fenpropimorph (880g/l) | III | Fungicide for the control of black and yellow sigatoka in banana | Cama Agro Consultancy, Accra |
| 49 | Zerofly Storage Bag | FRE/13125/00659G November 2013 | Mancozeb (800kg/g) | III | Fungicide for the control of leaf spots, mildew, leaf blight and scab in vegetables | Kofamob Agro Services Ltd, Kumasi |

A.3) Herbicides

| No. | Trade Name | Registration No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|---------------------|------------------------------------|------------------------------------|--------------|--|------------------------------------|
| 1 | Adwuma Wura 480SL | FRE/1243/00419G January 2012 | Glyphosate (480g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Kumark Company Limited, Kumasi |
| 2 | Adwuma Wura 75.7WSG | FRE/1243/00419G January 2012 | Glyphosate (75.7%) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Kumark Company Limited, Kumasi |
| 3 | Agazone 20SL | FRE/12107/00500R September 2012 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Agabusco Enterprise, Accra |
| 4 | Agil 100EC | FRE/11100/00386G October 2011 | Propaquizafop (100g/l) | III | Herbicide for the control of grasses | Makhteshim Agan West Africa, Accra |
| 5 | Agro 2,4-D 72 SL | FRE/1310/00604G June 2013 | 2, 4-D Amine (720g/l) | II | Selective herbicide for the control of broad-leaved weeds and sedges in cereals and sugarcane | Reiss & Co. Ghana Ltd., Accra |
| 6 | Agristomp | FRE/1202/00519G | Pendimethalin | III | Pre-emergence herbicide for | Agrimat Limited |

| | | | | | | |
|----|-------------------|------------------------------------|--|-----|--|--|
| | 500 E | November 2012 | (500g/l) | | the control of weeds in cereals, cotton and soybean | Accra |
| 7 | Alligator 400EC | FRE/1115/00351G August 2011 | Pendimethalin (400g/l) | III | Herbicide for the control of grasses and weeds in rice | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 8 | Amino 72SL | FRE/1205/00423G February 2012 | 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 |
| 9 | Arsenal Gen 2SL | FRE/1198/00370G August 2011 | Imazapyr (250g/l) | II | A selective post emergence herbicide for the control of grasses in cereals. | Cama Agro Consultancy, Accra. |
| 10 | Arrow 75WDG | FRE/1308/00580G April 2013 | Nicosulfuron (75%) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Dizengoff Ghana Ltd, Accra |
| 11 | Asomu 72 SL | FRE/13128/00640G September 2013 | 2, 4-D Amine salt (720g/l) | II | Herbicide for the control of broad-leaved weeds and sedges | Multi Heif Company Limited |
| 12 | Asomu Plus 560 EC | FRE/13128/00639G September 2013 | Propanil (360g/l) + 2,4-Isotyl ester (200g/l) | II | Post-emergence herbicide against annual and perennial grasses | Multi Heif Company Limited, |
| 13 | Ballistic 700 SC | FRE/1308/00581G April 2013 | Acetachlor (250g/l) + Atrazine (225g/l) + Terbutylaxine (225g/l) | IV | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Dizengoff Ghana Ltd, Accra |
| 14 | Basagran 480SL | FRE/1198/00368G August 2011 | Bentazon (480g/l) | II | Herbicide for the control of broadleaf weeds in beans, groundnut and maize | Cama Agro Consultancy, Accra. |
| 15 | Bounty 40SC | FRE/1224/00474G March 2012 | Bispyribac sodium (400g/l) | III | Herbicide for the control of emerged annual and perennial broadleaf weeds and grasses | Saro Agrosiences, Kumasi |

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|----|------------------|----------------------------------|------------------------------------|-----|--|---|
| 16 | Calliherbe 720SL | FRE/1306/00531G March 2013 | 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 |
| 17 | Capizad EC | FRE/1355/00661G November 2013 | Haloxfop-R-methyl (104g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Louis Dreyfus Commodities, Tema |
| 18 | Caritek 80WP | FRE/1399/00592G April 2013 | Diuron (80%) | III | Herbicide for the control of grasses in pineapples, avocados, citrus and mangoes | Rainbow Agrosiences Co Ltd, Accra |
| 19 | Chemovar 80WP | FRE/1205/00425G February 2012 | Bromacil (800g/kg) | III | Herbicide for the control of annual and perennial grasses and broadleaf weeds in pineapples | Chemico Limited, Tema |
| 20 | Chemopax 500 SC | FRE/1305/00600G June 2013 | Ametryn (485g/l) + Trazine (15g/l) | II | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Chemico Limited, Tema |
| 21 | Chemuron 80WP | FRE/1205/00426G February 2012 | Diuron (80%) | III | Herbicide for the control of grass weeds in pineapples, avocados, citrus and mangoes | Chemico Limited, Tema |
| 22 | Chemostorm 500EC | FRE/1305/00599G June 2013 | Pendimethalin (500g/l) | III | Pre-emergent herbicide for the control of weeds in cereals, cotton and soybean | Chemico Limited, Tema |
| 23 | Chemoxone SL | FRE/1258/00458R February 2012 | Paraquat dichloride (200g/l) | II | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Chemico Limited, Tema |
| 24 | Corta 480EC | FRE/1355/00561G March 2013 | Trichlopyr (480g/l) | III | Selective herbicide for the control of broadleaf weeds in oil palm | Louis Dreyfus Commodities Ghana Ltd, Tema |
| 25 | Condax WP | FRE/1278/00449G February 2012 | Bensulfuron-methyl (30%) | III | Systemic herbicide for the control of annual and perennial broad leaved and sedges weeds in rice | Five Continents, Accra |

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| 26 | Conti-quat SL | FRE/1278/00448R February 2012 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Five Continents, Accra |
| 27 | Cotbond 560SL | FRE/1258/00472G March 2012 | Propanil (360g/l) + 2,4-D Amine salt (200g/l) | II | Herbicide for the control of grasses and weeds in rice | Affcot Ghana Limited, Accra |
| 28 | Dextra 72 SL | FRE/13135/00657G October 2013 | 2, 4- D Amine salt (720g/l) | II | Herbicide for the control of broad-leaved weeds and sedges | Sefa & Jane Agrochemicals, Kumasi |
| 29 | Diurex 80 WDG | FRE/13100/00577G March 2013 | Diuron (800g/kg) | II | Herbicide for control of broad and grassy weeds in cereals | Makhteshim Agan West Africa, Accra |
| 30 | Diuron 80WP | FRE/1202/00516G November 2012 | Diuron (82.5%) | II | Herbicide for the control of weeds in pineapples | Agrimat Limited, Accra |
| 31 | Eureka 36EC | FRE/1255/00508G September 2012 | Propanil (360g/l) | II | Herbicide for the control of grasses and weeds in rice | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 32 | Ervextra 72SL | FRE/1355/00568G March 2013 | 2, 4-D Amine (720g/l) | III | Selective herbicide for control of broadleaf weeds in rice, maize, sorghum, millet and sugarcane | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 33 | Focus Ultra 100EC | FRE/1198/00369G August 2011 | Cycloxydim (100g/l) | IV | Herbicide for the control of annual and perennial grasses | Cama Agro Consultancy, Accra |
| 34 | Fos-lade 15EC | FRE/1123/00399G October 2011 | Fluazifop-p-butyl (150g/l) | III | Selective herbicide for the control of annual and perennial grasses in broadleaf crops | Thomhcof Enterprise, Kumasi |
| 35 | Fos-lade Super 15EC | FRE/1390/00546G March 2013 | Fluazifop-p-butyl (150g/l) | III | Selective herbicide for the control of annual and perennial grasses in broadleaf crops | Thomas Fosu Enterprise, Accra |
| 36 | Gallant Super | FRE/1205/00421G June 2012 | Haloxypop (108g/l) | III | Post emergence herbicide for the control of broadleaf weeds | Chemico Limited, Tema |

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| | | | | | in vegetables | |
| 37 | Garlon 4 | FRE/1205/00422G June 2012 | Triclopyr (480g/l) | III | Herbicide for the control of woody brush and as tree killer and broad leaf weeds | Chemico Limited, Tema |
| 38 | Grammapack Super 20 SL | FRE/1364/00614R August 2013 | Paraquat dichloride (20%) | II | Herbicide for the control of grasses and other weeds | Kofamob Agro Services Ltd, Kumasi |
| 39 | Gramofarm Super 20SL | FRE/13111/00591R April 2013 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Elvisco Farms Company Limited, Kumasi |
| 40 | Gramofast Super 20SL | FRE/1271/00490R July 2012 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Chinese Woman Agro, Kumasi |
| 41 | Gramoquat Super | FRE/1243/00412R January 2012 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Kumark Company Limited, Kumasi |
| 42 | Grammoshar p Super 20 SL | FRE/1382/00625R September 2013 | Paraquat dichloride (20%) | II | Herbicide for the control of grasses and other weeds | Cropstar Enterprise, Kumasi |
| 43 | Gramotox Super 20SL | FRE/1248/00499R September 2012 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Yawussma Ventures, Kumasi |
| 44 | Herbestra | FRE/1271/00489G July 2012 | 2,4-D Amine (720g/l) | II | Selective herbicide for the control of broadleaf weeds in rice | Chinese Woman Agrochemicals, Kumasi |
| 45 | Herbextra | FRE/1243/00409G January 2012 | 2,4-D Amine (720g/l) | II | Selective herbicide for the control of broadleaf weeds in rice, maize, sorghum, millet and sugarcane | Kumark Company Limited, Kumasi |

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| 46 | Herbisuper S | FRE/1355/00563G March 2013 | Acetachlor (300g/l) + simazine (200g/l) | III | Herbicide for control of annual and perennial grasses and broadleaf weeds | Louis Dreyfus Commodities Ghana, Tema |
| 47 | Hyvar X 80WP | FRE/1306/00532G March 2013 | Bromacil (800g/kg) | III | Herbicide for control of weeds in pineapple | Calli Ghana Company Limited, Tema |
| 48 | Kumnwura SL | FRE/1225/00487G March 2012 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Bentronic Productions, Kumasi |
| 49 | Kurazone SL | FRE/1116/00342G August 2011 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Kurama Company limited, Accra |
| 50 | Lagon 575 SC | FRE/1301/00651G October 2013 | Isoxaflucole (50g/l) + Aclonifene (333g/l) | III | Pre-emergent herbicide for the control of annual grasses and broadleaf weeds in maize | Wienco Ghana Limited, Accra |
| 51 | Meshye Nwura 41 SL | FRE/13135/00654G October 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Sefa & Jane Agrochemicals Kumasi |
| 52 | Nicocal 40 OD | FRE/1325/00609G August 2013 | Nicosulfuron (400g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Bentronic Productions, Accra |
| 53 | Nicoking 40SL | FRE/13102/00590G April 2013 | Nicosulfuron (400g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Rachans Enterprise, Accra |
| 54 | Nicomais Plus | FRE/1364/00653G October 2013 | Nicosulfuron (400g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Kofamob Agro Services Ltd, Kumasi |

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| 55 | Nicoskonka 75WDG | FRE/1365/00529G March 2013 | Nicosulfuron (75g/kg) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Jem Intercontinental Services, Tema |
| 56 | Nicostar 40 SL | FRE/1382/00623G September 2013 | Nicosulfuron (400g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Cropstar Enterprise, Kumasi |
| 57 | Ogyefo 72SL | FRE/1390/00547G March 2013 | 2,4-D Amine (720g/l) | II | Herbicide for the control of post emergent annual weeds in rice | Thomas Fosu Enterprise, Accra |
| 58 | Paracot SL | FRE/1258/00450R February 2012 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Afcott Ghana Ltd, Kumasi |
| 59 | Pendicot 50EC | FRE/1258/00473G March 2012 | Pendimethalin (500g/l) | III | Herbicide for the control of pre-emergence weeds in cereals, cotton and soybean | Affcot Ghana Limited, Accra |
| 60 | Pendimax 34% EC | FRE/1224/00476G March 2012 | Pendimethalin (200g/l) + Oxyfluorfen (140g/l) | III | Herbicide for the control of pre-emergence weeds in vegetables | Saro Agrosiences (Gh) Ltd, Accra |
| 61 | Propa 36SL | FRE/1123/00398G October 2011 | Propanil (360g/l) | III | Herbicide for the control of grasses and weeds in rice | Thomhcof Enterprise, Kumasi |
| 62 | Propa Gold EC | FRE/1355/00566G March 2013 | Propanil (360g/l) + 2,4-D Amine (200g/l) | II | Systemic broad spectrum contact herbicide for the control of broadleaf weeds in rice | Louis Dreyfus Commodities Ghana, Tema |
| 63 | Propacal-Plus 480EC | FRE/1243/00411G January 2012 | Propanil (240g/l) + 2, 4-D isobutylate (240g/l) | II | Selective herbicide for the control of annual and perennial grasses and broadleaf weeds in rice | Kumark Company Limited, Kumasi |

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| 64 | Propanil 36EC | FRE/1202/00513G November 2012 | Propanil (360g/l) | II | Post-emergence herbicide against grasses and broadleaf weeds | Agrimat Limited Accra |
| 65 | Rainamine 72SL | FRE/1399/00541G March 2013 | 2,4-D Amine (720g/l) | II | Herbicide for the control of post emergent annual weeds in rice | Rainbow Agrosiences Co Ltd, Accra |
| 66 | Rainpendim 500EC | FRE/1299/00480G March 2012 | Pendimethalin (500g/l) | III | Pre-emergence herbicide for the control of weeds in maize, rice, cotton and soybean | Rainbow Agrosiences Co Ltd, Accra |
| 67 | Rainpropa plus | FRE/1299/00479G March 2012 | Propanil (360g/l) + 2,4-D Amine (200g/l) | III | Herbicide for the control of post emergent annual weeds in rice | Rainbow Agrosiences Co Ltd, Accra |
| 68 | Rigold 432 EC | FRE/1355/00662G November 2013 | Propanil (360g/l) + Triclorpyr (72g/l) | III | Herbicide for the control of grasses and broad leaf weeds in rice | Louis Dreyfus Commodities, Tema |
| 69 | Rival 360SL | FRE/1108/00336/G August 2011 | Glyphosate (360g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Dizengoff Ghana Limited, Accra |
| 70 | Rival 360SL | FRE/1101/00383G October 2011 | Glyphosate (360g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Wienco Ghana Ltd, Accra |
| 71 | Roundup 360SL | FRE/1155/00384G October 2011 | Glyphosate (360g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 72 | Roundup 450 Turbo | FRE/1155/00385G October 2011 | Glyphosate (450g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Louis Dreyfus Commodities Ghana Ltd, Tema |
| 73 | Semanhya 41SL | FRE/1265/00526G October 2012 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Kofamob Agro Services Ltd, Kumasi |
| 74 | Sharp 480SL | FRE/1243/00408G January 2012 | Glyphosate (480g/l) | III | Herbicide for the control of annual and perennial grasses and broadleaf weeds in cereals | Kumark Company Limited, Kumasi |

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| 75 | Solito 320EC | FRE/1301/00533G March 2013 | Pretilachlor (30%) + Pyrebenzoxim (2%) | III | Selective herbicide for the control of annual and perennial grasses and broadleaf weeds in rice | Wienco Ghana Limited, Accra |
| 76 | So Far 41SL | FRE/1233/00502G September 2012 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Adu & Yeboah Enterprise, Kumasi |
| 77 | Special 30WP | FRE/1355/00564G March 2013 | Bromacil (240g/l) + Diuron (560g/l) | II | Herbicide for control of weeds in pineapple | Louis Dreyfus Commodities Ghana, Tema |
| 78 | Swift SL | FRE/1224/00477G March 2012 | Nicosulfuron (40g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Saro Agrosiences (Gh) Ltd, Accra |
| 79 | Sniper 72SL | FRE/1253/00528G November 2012 | 2,4-D Amine (720g/l) | II | Herbicide for the control of post emergent annual weeds in rice | L'espoir Company Limited |
| 80 | Stam F34 | FRE/1205/00424G February 2012 | Propanil (360g/l) | II | Herbicide for the control of post emergent annual weeds in rice | Chemico Limited, Tema |
| 81 | Sun 2,4-D Amine 72 SL | FRE/1357/00636G September 2013 | 2, 4- D Amine (720g/l) | II | Herbicide for the control of broad-leaved weeds and sedges | Wynca Sunshine Agric Products & Trading Company Limited, Accra |
| 82 | Sun- Bromacil 80 WP | FRE/1257/00461G February 2012 | Bromacil (800g/kg) | III | Herbicide for the control of emerging and young broadleaf weeds and grasses in pineapples | Wynca Sunshine Agric Products & Trading Co., Limited, Accra |
| 83 | Sun-Diuron 80WP | FRE/1257/00462G February 2012 | Diuron (800g/kg) | III | Selective herbicide for the control of weeds in pineapples, mangoes and cashew | Wynca Sunshine Agric Products & Trading Co., Limited, Accra |

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| 84 | Sunford 2,4-D SL | FRE/13131/00643G September 2013 | 2, 4-D Amine salt (720g/l) | II | Herbicide for the control of broad-leaved weeds and sedges | K. Adu Enterprise, Kumasi |
| 85 | Sun-Paraquat 200SL | FRE/1257/00459R February 2012 | 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 |
| 86 | Supraxone | FRE/1155/00350R August 2011 | Paraquat dichloride (200g/l) | II | Non-selective herbicide for the control of annual and perennial broadleaf weeds and grasses | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 87 | Thomabest Super 200SL | FRE/1223/00464R February 2012 | Paraquat dichloride (200g/l) | II | Non-selective herbicide for the control of annual and perennial broadleaf weeds and grasses | Thomhcof Enterprise, Kumasi |
| 88 | Topstar 400 SC | FRE/1301/00652G October 2013 | Oxadiargyl (400g/l) | III | Pre-emergent herbicide for the control of annual grasses and broadleaf weeds in rice | Wienco Ghana Limited, Accra |
| 89 | Terbutor 200EC | FRE/13100/00576G March 2013 | Metalachlor (333g/l) + Terbutryn (167g/l) | III | Non-selective, systemic and pre-emergent herbicide for the control of weeds in cereals | Makhteshim Agan West Africa, Accra |
| 90 | Ultrachlor 5SL | FRE/1159/00375/G August 2011 | Butachlor (500g/l) | III | Herbicide for the control of annual and perennial grasses and broadleaf weeds | West African Cotton Co. Ltd, Accra |
| 91 | Ultramin 72SL | FRE/1159/00376G August 2011 | 2,4-D Amine (720g/l) | II | Selective herbicide for the control of broadleaf weeds in cereals and tree crops | West African Cotton Co. Ltd, Accra |

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| 93 | Ultranil 36SL | FRE/1159/00377/G August 2011 | Propanil (360g/l) | II | Selective herbicide for the control of weeds in rice | West African Cotton Co. Ltd, Accra |
| 94 | Weedall 41SL | FRE/1265/00527G November 2012 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Kofamob Agro Services Ltd, Kumasi |
| 95 | Weedcot SL | FRE/1258/00457G February 2012 | 2,4-D Amine (720g/l) | II | Selective herbicide for the control of broadleaf weeds in cereals | Afcott Ghana Limited, Kumasi |
| 96 | Weed Magic 41 SL | FRE/1125/00378G November 2011 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Bentronic Productions, Kumasi |
| 97 | Weedout SL | FRE/1225/00378G March 2012 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Bentronic Productions, Kumasi |
| 98 | Zoomer 300/30 SC | FRE/12100/00407G January 2012 | Oxyfluorfen (300g/l)+ Glyphosate (360g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Makhteshim Agan West Africa Limited, Accra |

(A4): Plant Growth Regulators

| No. | Trade Name | Registration No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|-----------------|----------------------------------|------------------------------------|--------------|---|--|
| 1 | Callel 480SL | FRE/1106/00356/G August 2011 | Ethephon (480g/l) | III | Plant growth regulator for degreening of pineapple | Calli Ghana Co. Ltd., Tema |
| 2 | Callel 5%PA | FRE/1206/00496/G August 2011 | Ethephon (5%) | III | Plant growth regulator for degreening of pineapple | Calli Ghana Co. Ltd., Tema |
| 3 | Chemophon 480SL | FRE /1205/00435G June 2013 | Ethephon (480g/l) | III | Plant growth regulator for degreening of pineapples | Chemico Ltd, Tema |
| 4 | Hervextra PA | FRE/1355/00565G March 2013 | Ethephon (10%) | IV | Plant growth regulator for degreening of pineapples | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 5 | Mat 480SL | FRE/1155/00346G | Ethephon (480g/l) | III | Plant growth regulator for de- | Louis Dreyfus |

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| | | August 2011 | | | greening of pineapples | Commodities Ghana Ltd, Tema |
| 6 | RyzUp 40SG | FRE/1180/00339G August 2011 | Gibberellic acid 1.279 billion ITU/L | U | Plant Growth Regulator for banana | Challux Ltd, Accra |

(A5): Rodenticides

| No. | Trade Name | Registration No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|---------------------------|----------------------------------|---|--------------|--|------------------------------------|
| 1 | Brody Fresh Bait | FRE/13100/00578G March 2013 | Brodifacoum (0.005g/kg) + Denatonium benzoate (0.001g/kg) | II | Rodenticide for the control of rodents and mites | Makhteshim Agan West Africa, Accra |
| 2 | Brody Pillow-shaped block | FRE/13100/00579G March 2013 | Brodifacoum (0.005g/kg) + Denatonium benzoate (0.001g/kg) | II | Rodenticide for the control of rodents and mites | Makhteshim Agan West Africa, Accra |
| 3 | Storm BB | FRE/1198/00367G August 2011 | Flocoumafen (0.005%) | Ib | Rodenticide for the control of rodents | Cama Agro Consultancy, Accra |

(A6): Molluscicide

| No. | Trade Name | Registration No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|------------|----------------------------------|---|--------------|--|------------------------------------|
| 1 | Carakol P | FRE/13100/00574G March 2013 | Acetic metaldehyde (50g/kg) + Donatonium benzoate (0.3g/kg) | III | Molluscicide for the control of snails, slugs and other gastropods | Makhteshim Agan West Africa, Accra |

(A7): Nematicides

| No. | Trade Name | Registration No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|----------------|-----------------------------------|--|--------------|--|--|
| 1 | Agrocelhone NE | FRE/13136/00665G November 2013 | Dichloropropene (60.8%) + Chloropicrin (33.3%) | II | Nematicide for control of nematodes | Spica Ghana Limited |
| 2 | Compact 10% GR | FRE/1308/00622G September 2013 | Ethoprophos (10%) | II | Nematicide for control of nematodes in pineapples and vegetables | Dizengoff Ghana Limited, Accra |
| 3 | Mocap 15GR | FRE/1155/00348R August 2011 | Ethoprophos (15g/kg) | Ib | Nematicide for control of nematodes in pineapples and vegetables | Louis Dreyfus Commodities, Ghana Ltd, Tema |
| 4 | Rugby 10G | FRE/1205/00431G February 2012 | Cadusafos (10%) | II | Insecticide for the control of insect pests and nematodes | Chemico Ltd., Tema |

B): PROVISIONALLY CLEARED PESTICIDES (PCL)

(B1): Insecticides

| No. | Trade Name | Provisional Clearance Permit No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|-----------------|--|------------------------------------|--------------|---|-------------------------------------|
| 1 | Rainfen 20EC | PCL/1399/00392G March 2013 | Fenvalerate (200g/l) | II | Insecticide for the control of insect pests in vegetables and public health | Rainbow Agrosocieties Co Ltd, Accra |
| 2 | Termicide 480EC | PCL/1326/00376G March 2013 | Chlorpyrifos-ethyl (480g/l) | II | Insecticide for the control of insect pests in vegetables | The Candel Co Ltd, Accra |

(B2): Fungicides

| No. | Trade Name | Provisional Clearance Permit No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
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| 1 | Sphinx Star 480WDG | PCL/13100/00383G March 2013 | Dimethomorph (80g/l) + Chlorothalonil (400g/l) | III | Fungicide for the control of diseases in vegetables | Makhteshim Agan West Africa, Accra |
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(B3): Herbicides

| No. | Trade Name | Provisional Clearance Permit No. / Date of Issue | Concentration of Active Ingredient | Hazard Class | Crops/Uses | Company |
|-----|---------------------|--|------------------------------------|--------------|--|---------------------------------|
| 1 | Aboboyaa 41SL | PCL/13113/00371G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Aboboyaa Enterprise, Kumasi |
| 2 | Aboquat 20SL | PCL/13113/00372G March 2013 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Aboboyaa Enterprise, Kumasi |
| 3 | Adom Wura 41SL | PCL/13117/00368G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Ergie Enterprise, Kumasi |
| 4 | Aduro Wura 41SL | PCL/13123/00398G June 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Anichesvin Ventures, Kumasi |
| 5 | Adwumaye 41 SL | PCL/1382/00414G October 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Cropstar Enterprise, Kumasi |
| 6 | Adwumapaye SL | PCL/1333/00342G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Adu & Yeboah Enterprise, Kumasi |
| 7 | Adwuma Wowuram 41SL | PCL/1390/00357G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Thomas Fosu Enterprise, Accra |
| 8 | Agaherb SL | PCL/13107/00394G June 2013 | 2,4- D Amine salt (720g/l) | II | Selective herbicide for control of broadleaf weeds in rice, maize, sorghum, millet and | Agabusco Enterprise, Accra |

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| | | | | | sugarcane | |
| 9 | Asopa 41SL | PCL/13118/00360G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Gabriel Sarpong Enterprise, Kumasi |
| 10 | Akuafu Anidaso SL | PCL/13118/00364G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Ahenase Trading Enterprise, Accra |

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| 12 | Anigramo Super 20 SL | PCL/13122/00429G October 2013 | (Paraquat dichloride (200g/l) | II | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Asantepon Farms, Kade |
| 13 | Aniphosate 41SL | PCL/13122/00393G June 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Asantepon Farms, Kade |
| 13 | Atralex 50WP | PCL/1364/00388G March 2013 | Atrazine (500g/kg) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Kofamob Agro Services Ltd, Kumasi |
| 14 | Atralex 50SC | PCL/1364/00389G March 2013 | Atrazine (500g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Kofamob Agro Services Ltd, Kumasi |
| 15 | Bentrazine 80WP | PCL/138100345G March 2013 | Atrazine (800g/kg) | II | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Badu Kaakyire Agro. Kumasi |
| 16 | Cotrazine 80 WP | PCL/1358/00408G October 2013 | Atrazine (800g/kg) | III | Herbicide for the control of annual, perennial grass and broadleaf weeds | Afcott Ghana Limited, Accra |
| 17 | Delsate 41 | PCL/1326/00358G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | The Candel Co. Ltd, Accra |
| 18 | Delzine 80WP | PCL/1326/00359G March 2013 | Atrazine (800g/kg) | II | Herbicide for the control of annual, perennial grasses and broadleaf weeds | The Candel Co. Ltd, Accra |

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| 19 | Diutop 80SC | PCL/1326/00377G March 2013 | Diuron (80g/l) | III | Herbicide for the control of weeds in pineapple | The Candel Co. Ltd, Accra |
| 20 | Diurex 80WP | PCL/13100/00382G March 2013 | Diuron (80g/kg) | III | Herbicide for the control of broad and grassy weeds in cereals | Makhteshim Agan West Africa, Accra |
| 22 | Extra 2,4- D SL | PCL/1364/00390G March 2013 | 2, 4-D Amine (720g/l) | II | Selective herbicide for control of broadleaf weeds in rice, maize, sorghum, millet and sugarcane | Kofamob Agro Services Ltd, Kumasi |
| 23 | Frankosate 41SL | PCL/1339/00363G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of emerged annual and perennial broadleaf weeds, sedges and grasses | Frankatson Limited, Accra |
| 24 | Glycel 41 SL | PCL/1310/00424G October 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Reiss & Co, Accra |
| 25 | Glycot 41 SL | PCL/1358/00409G October 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Afcott Ghana Limited, Accra |
| 26 | Glyfos 41 SL | PCL/1302/00407G October 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Agrimat Limited, Accra |
| 27 | Glyking 48SL | PCL/13102/00354G March 2013 | Glyphosate (480g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Rachans Enterprise, Accra |
| 28 | Glyphader 480SC | PCL/1355/00380G March 2013 | Glyphosate (480g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Louis Dreyfus Commodities Gh. Ltd, Tema |
| 29 | Glyphader 750G | PCL/1355/00380G March 2013 | Glyphosate (750g/kg) | III | Herbicide for the control of annual and perennial broadleaf | Louis Dreyfus Commodities Gh. |

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| | | | | | weeds, sedges and grasses | Ltd, Tema |
| 30 | Gramoall Super20SL | PCL/1333/00343R March 2013 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Adu & Yeboah Enterprise, Kumasi |
| 31 | Gramobest Super 20SL | PCL/1390/00356R March 2013 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Thomas Fosu Enterprise, Accra |
| 32 | Herbacut 72SL | PCL/1382/00379G April 2013 | 2, 4-D Amine (720g/l) | III | Selective herbicide for the control of broadleaf weeds | Crop Star Enterprise, Kumasi |
| 33 | Herbixone 20SL | PCL/13123/00397R June 2013 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Anichesvin Ventures, Kumasi |
| 34 | Kabasate 41SL | PCL/1381/00346G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Badu Kaakyire Agro, Kumasi |
| 35 | Kalach 360SL | PCL/1306/00328G March 2013 | Glyphosate (360g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, cereals and grasses | Calli Ghana Co. Ltd, Tema |
| 36 | Kalach Extra 70SG | PCL/1306/00239G March 2013 | Glyphosate (700g/kg) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Calli Ghana Co. Ltd, Tema |
| 37 | Katrazine 80WP | PCL/1333/00344G March 2013 | Atrazine (800g/kg) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Adu & Yeboah Enterprise, Kumasi |
| 38 | Kodwooto 41 SL | PCL/13129/00417 October 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Akwees Man Agrochemicals Enterprise, Kumasi |
| 39 | Kwatriqua 20 SL | PCL/1302/00406G October 2013 | Paraquat dichloride (200g/l) | II | Herbicide for the control of annual and perennial broadleaf | Agrimat Limited, Accra |

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|----|----------------------|-----------------------------------|------------------------------|-----|--|--|
| | | | | | weeds and grasses | |
| 40 | Manazone Super 20 SL | PCL/13129/00418G October 2013 | Paraquat dichloride (200g/l) | II | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Akwees Man Agrochemicals Enterprise, Kumasi |
| 41 | Medal 41SL | PCL/13120/00367G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Jenaka Limited, Accra |
| 42 | Multisate 41SL | PCL/1327/00395G June 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Multivet (Ghana) Ltd, Accra |
| 43 | M-Quat 20 SL | PCL/1327/00396R June 2013 | Paraquat dichloride (200g/l) | II | Non-selective broad spectrum herbicide for the control of annual and perennial broadleaf weeds and grasses | Multivet (Ghana) Ltd, Accra |
| 44 | Nwura Tamfo SL | PCL/13118/00365G March 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Ahenase Trading Enterprise, Accra |
| 45 | Nwura Wura 360g/l | PCL/1357/00411G October 2013 | Glyphosate (360g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Wynca Sunshine Agric Products & Trading, Accra |
| 46 | Paraking 20SL | PCL/13102/00375G March 2013 | Paraquat dichloride (200g/l) | II | Non-selective herbicide for the control of annual and perennial broadleaf weeds and grasses | Rachans Enterprise, Accra |
| 47 | Pendimight 330 EC | PCL/13134/004028G October 2013 | Pendimethalin (330g/l) | III | Herbicide for the control of grasses and weeds in rice | Casico Limited, Tema |
| 48 | Rainatraz 50SC | PCL/1399/00351G March 2013 | Atrazine (500g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Rainbow Agrosiences Co Ltd, Accra |
| 49 | Rainatraz 80WP | PCL/1399/00352G March 2013 | Atrazine (800g/kg) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds | Rainbow Agrosiences Co Ltd, Accra |
| 50 | Rainatraz | PCL/1399/00391G | Atrazine | III | Herbicide for the control of | Rainbow |

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| | 90WG | March 2013 | (900g/kg) | | annual, perennial grasses and broadleaf weeds | Agrosiences Co Ltd, Accra |
| 51 | Rainglyph 480SL | PCL/1399/00349G March 2013 | Glyphosate (480g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Rainbow Agrosiences Co Ltd, Accra |
| 52 | Rainglyph 757SG | PCL/1399/00350G March 2013 | Glyphosate (757g/kg) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Rainbow Agrosiences Co Ltd, Accra |
| 53 | Rainquat 276SL | PCL/1399/00353G March 2013 | Paraquat dichloride (276g/l) | II | Non-selective herbicide for the control of annual and perennial broadleaf weeds and grasses | Rainbow Agrosiences Co Ltd, Accra |
| 54 | Rambo 2, 4-D | PCL/13119/00365G March 2013 | 2, 4-D Amine (720g/l) | III | Selective herbicide for the control of broadleaf weeds | Natibongo Enterprise, Accra |
| 55 | Relux P 36%WP | PCL/1353/00378G March 2013 | Bensufuron (3g/kg) + quinclorac (33g/l) | III | Herbicide for control of annual and perennial grasses and broadleaf weeds | L'espoir Enterprise, Accra |
| 56 | Rondo 48SL | PCL/1310/00399G June 2013 | Glyphosate (480g/l) | III | Non –selective herbicide for the control of annual and perennial broadleaf weeds in cereals and vegetables | Reiss & Co Ghana Limited, Accra |
| 57 | Rondo 75.7% SG | PCL/1310/00425G October 2013 | Glyphosate (757g/kg) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Reiss & Co., Accra |
| 58 | Rondo 48 SL | PCL/1310/00423G October 2013 | Glyphosate (480g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Reiss & Co, Accra |
| 59 | RoundUp Biosec 725G | PCL/1355/00355G March 2013 | Glyphosate (725g/kg) | III | Herbicide for the control of annual and perennial broadleaf weeds, sedges and grasses | Louis Dreyfus Commodities Ghana Ltd, Tema |

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| 60 | Sunphosate 75SG | PCL/1357/00340G March 2013 | Glyphosate (360g/l) | III | Non –selective herbicide for the control of annual and perennial broadleaf weeds in cereals and vegetables | Wynca Sunshine Agric Products & Trading Co. Ltd, Accra |
| 61 | Sun- 2, 4-D Pro 560 EC | PCL/1357/00386G March 2013 | Propanil (360g/l) + 2, 4-D Isobutylate (200g/l) | III | Selective herbicide for the control of annual and perennial broadleaf weeds and grasses in rice | Wynca Sunshine Agric Products & Trading Co. Ltd, Accra |
| 62 | Sun- Atrazine 500 SC | PCL/1357/00412G October 2013 | Atrazine (500g/l) | III | Non- selective Herbicide for the control of annual and perennial grasses and broadleaf weeds | Wynca Sunshine Agric Prdts & Trading Co. Ltd, Accra |
| 63 | Sun- Atrazine 80 WP | PCL/1357/00421G October 2013 | Atrazine (800g/kg) | III | Non- selective Herbicide for the control of annual and perennial grasses and broadleaf weeds | Wynca Sunshine Agric Prdts & Trading Co. Ltd, Accra |
| 64 | Sunkosate 41 SL | PCL/1348/00404G August 2013 | Glyphosate (410g/l) | III | Herbicide for the control of annual, perennial grasses and broadleaf weeds in cereals and vegetables | Yawwussma Ventures, Kumasi |
| 65 | Sunphosate 360 SL | PCL/1357/00410G October 2013 | Glyphosate (360 g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | Wynca Sunshine Agric Products & Trading, Accra |
| 66 | Sunfuron 75WDG | PCL/1357/00384G March 2013 | Nicosulfuron (750g/kg) | III | Herbicide for the control of annual and perennial broadleaf weeds in cereals and vegetables | Wynca Sunshine Agric Products & Trading Co. Ltd, Accra |
| 67 | Sunfuron 80WP | PCL/1357/00385G March 2013 | Nicosulfuron (800g/kg) | III | Herbicide for the control of annual and perennial broadleaf | Wynca Sunshine Agric Products & |

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|----|---------------------|---------------------------------|------------------------------|-----|---|--|
| | | | | | weeds, cereals and vegetables | Trading Co. Limited, Accra |
| 68 | Tackle 36 EC | PCL/1326/00427G October 2013 | Glyphosate (360g/l) | III | Herbicide for the control of annual and perennial broadleaf weeds and grasses | The Candel Company Limited, Accra |
| 69 | Ultisate 41SL | PCL/13121/00369G March 2013 | Glyphosate (410g/l) | III | Non-selective herbicide for the control of annual and perennial broadleaf weeds in cereals and vegetables | Ultimate Agro Chemicals, Accra |
| 70 | Ultizone Super 20SL | PCL/13121/00370G March 2013 | Paraquat dichloride (200g/l) | II | Herbicide for control of annual and perennial grasses and broadleaf weeds | Ultimate Agro Chemicals, Accra |
| 71 | Wynna SL | PCL/1357/00341G March 2013 | Glyphosate (410g/l) | III | Non-selective herbicide for the control of annual and perennial broadleaf weeds in cereals and vegetables | Wynca Sunshine Agric Products & Trading Co. Ltd, Accra |

(C) BANNED PESTICIDES

1. 2,4,5-T and its salts and esters
2. Aldrin
3. Binapacryl
4. Captafol
5. Chlordane
6. Chlordimeform
7. Chlorobenzilate
8. 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

Summary of Register of Pesticides as at 31st December 2013

| Category | FRE | PCL | Banned | Total |
|-------------------------|------------|------------|---------------|--------------|
| Insecticides | 165 | 2 | 26 | 193 |
| Fungicides | 49 | 1 | 0 | 50 |
| Herbicides | 98 | 71 | 0 | 169 |
| Plant Growth Regulators | 6 | 0 | 0 | 6 |
| Rodenticides | 3 | 0 | 0 | 3 |
| Molluscicide | 1 | 0 | 0 | 1 |

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|--------------|------------|-----------|-----------|------------|
| Nematicides | 4 | 0 | 0 | 4 |
| Total | 326 | 74 | 26 | 426 |

Legend to Register of Pesticide

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