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PESTICIDE EVALUATION REPORT AND SAFER USE ACTION PLAN (PERSUAP)

AVANSA AGRIKULTURA PROJECT IN TIMOR-LESTE

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AVANSA AGRIKULTURA PROJECT IN TIMOR-LESTE

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Acronyms

ADB	Asian Development Bank
ADG	Agriculture Diversification and Growth AI Active Ingredient (pesticide reference)
AI	Active Ingredients
AOR	Agreement Officer's Representative (USAID)
Avansa Ag	Avansa Agrikultura project (USAID project 2015-2019)
BEO	Bureau Environmental Officer
BMP	Best Management Practice
BT	*Bacillus thuringiensis* (a bacteria that produces a toxin used as a pesticide)
CCD	Colony Collapse Disorder
CFR	Code of Federal Regulations
COP	Chief of Party
COR	Contracting Officer's Representative (USAID)
DAC	Dezenvolve Agricultura Comunitária (USAID project 2010-2014)
DS	Powders for dry seed treatment (pesticide formulation)
DSP	Dezenvolve Sector Privado (USAID project 2005-2009)
EA	Environmental Assessment
EC	Emulsifiable Concentrate (pesticide formulation)
EC50	Effective Concentration 50 (acute toxicity measure)
ENSO	El Niño Southern Oscillation
EPA	US Environmental Protection Agency (also known as USEPA)
EU	European Union
FAO	Food and Agriculture Organization (United Nations agency)
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FRAC	Fungicide Resistance Action Committee
FS	Flowable concentrate for Seed treatment (pesticide formulation)
GAP	Good Agriculture Practice
GlobalGAP	Global Good Agriculture Practices, a certification system
GOTL	Government of Timor-Leste
Ha	Hectares
HRAC	Herbicide Resistance Action Committee

HT	Highly Toxic
ID	Identification
IEE	Initial Environmental Examination
IGR	Insect Growth Regulator
IPM	Integrated Pest Management
IR	Intermediate Result
IRAC	Insecticide Resistance Action Committee
LC50	Lethal Concentration 50 (acute toxicity measure)
LD50	Lethal Dose 50 (acute toxicity measure)
MAF	Ministry of Agriculture and Fisheries
M&E	Monitoring and Evaluation
MD	Micro Dispersion (pesticide formulation)
MEO	Mission Environmental Officer
MRL	Maximum/Minimum Residue Level/Limit
MSDS	Material Safety Data Sheet
MT	Moderately Toxic
NAT	Not Acutely Toxic
NCAT	National Center for Appropriate Technology
NEPA	US National Environmental Policy Act
NGO	Non-Governmental Organization
NIFA	National Institute of Food and Agriculture
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
PIC	Prior Informed Consent (a treaty, relates to toxic pesticides)
POPs	Persistent Organic Pollutants (a treaty, relates to toxic persistent pesticides)
PNT	Practically Non-Toxic
PPE	Personal Protection Equipment
REA	Regional Environmental Advisor
Reg 216	Regulation 216 (USAID Environmental Procedures)
RFP	Request for Proposal
RUP	Restricted Use Pesticide

S&C	Standards and Certification
SC	Suspension Concentrate (pesticide formulation)
SOW	Scope of Work
ST	Slightly Toxic
SUAP	Safer Use Action Plan
UN	United Nations
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USEPA	US Environmental Protection Agency (also known as EPA)
VHT	Very Highly Toxic
WHO	World Health Organization
WP	Wettable Powder (pesticide formulation)
WS	Water dispersible powder for Slurry treatment (pesticide formulation)

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Executive Summary

Introduction

22 CFR 216, or USAID's Regulation 216, in section 216.3 (b)(1)(i), asserts "When a project includes assistance for procurement or use, or both, of pesticides registered for the same or similar uses by USEPA without restriction, the Initial Environmental Examination [IEE] for the project shall include a separate section evaluating the economic, social and environmental risks and benefits of the planned pesticide use to determine whether the use may result in significant environmental impact." That 'separate section' referred to above has evolved into a tool named a PERSUAP, Pesticide Evaluation Report and Safer Use Action Plan.

The main purpose of a Pesticide Evaluation Report (PER) and Safe Use and Action Plan (SUAP) is to bring USAID-funded projects into compliance with USAID's environmental regulations (Title 22 of the Code of Federal Regulations (CFR), part 216, or Regulation 216) on pesticide use. Beyond compliance, this document offers best practices and helps ensure that the USAID-funded projects reduce the chances of environmental and health impacts due to pesticide training, promotion or use. USAID projects desiring to promote or use pesticides rejected by this PERSUAP analysis will need to perform an Environmental Assessment (EA) on those chemicals and their use.

Background

To achieve project objectives, the USAID Avansa Agrikultura project (Avansa Ag) in Timor-Leste may need to support the use of pesticides as part of an Integrated Pest Management (IPM) approach. An amended IEE for the project has been produced that recommends the preparation of this PERSUAP in order to analyze pesticide use. This is the first PERSUAP produced for USAID in Timor-Leste.

Purpose and Scope

In compliance with USAID's Pesticide Procedures (22 CFR 216.3(b)), this 2015 Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) for the USAID/Timor-Leste Avansa Agrikultura project.

- Establishes the subset of pesticides for which support is authorized on the Avansa Ag project.
- Establishes requirements attendant to support for these pesticides to assure that pesticide use/support (1) embodies the principles of safer pesticide use and, (2) per USAID policy, is within an Integrated Pest Management (IPM) framework.

These requirements come into effect for the Avansa Ag project in Timor-Leste upon approval of the PERSUAP.

Pesticide Regulation and Use in Timor-Leste

Pesticide regulation, technical knowledge and safe practices are very limited in Timor-Leste:

- There is no pesticide law in Timor-Leste and therefore no entity has the authority to regulate pesticide imports, use, or disposal in Timor-Leste.

- Knowledge and experience of crop protection products, whether organic, biological, or synthetic is extremely low throughout the agricultural value chains in Timor-Leste. Academic training in crop protection and Integrated Pest Management is almost entirely theoretical, very basic, and out of date.
- Timor-Leste is one of the few Asian countries that has not signed any of the international treaties or protocols on pesticide use or transport.
- A wide range of pesticides are now available at several agricultural suppliers in Timor-Leste, mainly in Dili. Pesticide availability in rural areas is much more limited. Many of the pesticides available in Timor-Leste are imported from Indonesia or China, and about one-third have active ingredients that are not registered with the USEPA.
- Information at agricultural suppliers regarding appropriate pesticide choice, application, and safe use practices was usually very limited. PPE equipment and instruction was also very limited.
- About 55% of farmers surveyed use homemade botanical extracts, 42% use biological/microbial pesticides, and 79% use synthetic pesticides, fungicides, and herbicides. Over 12% report using only homemade botanical extracts as pesticides. The remaining farmers surveyed use a mix of botanicals, biological, and synthetic crop protection products.
- 73% of farmers applying synthetic pesticides noted some illness (headaches, nausea, and dizziness) at some time from pesticide use, with 42% wearing no PPE and under 5% wearing fully-recommended PPE. Use of some PPE to protect the hands (27%) and the face (26%) are also low.

Results of the Pesticide Evaluation Report (PER) 12-Factor Analyses

Factor A: USEPA Registration Status of the Proposed Pesticides

USAID activities are limited to promoting, recommending, buying, subsidizing, financing, or permitting pesticides that contain the same active ingredients (AIs) as products registered by the USEPA for the same or *similar* uses.

In the USA, some specific commercial pesticide products are labeled as Restricted Use Pesticides (RUPs) due to inordinate risks, usually under specific circumstances of use, such as formulation or crop. Only pesticide formulations or their equivalents that do not have RUP status are approved for use on the Avansa Ag project.

Annex 1 provides USEPA registration status for each AI found in pesticides that are available in Timor-Leste. The column in Annex 1 labeled "USEPA Registered" has a "yes" if the AI is registered by USEPA in pesticides for same or similar uses. If the column has a "no" it is not registered by USEPA and is it is not approved for use on the Avansa Ag project. Pesticide AIs that pass this registration factor, and all following pertinent factor analyses, are given a "Yes" in the 'Approved for Avansa' column.

- The monitoring plan described in the SUAP will include monitoring criteria to ensure that only PERSUAP-approved pesticides are used on the Avansa Ag project.
- Grantees financed by the Avansa Ag project should be mandated to certify in writing that only PERSUAP approved pesticides will be purchased or used with loan money.

Factor B: Basis for Selection of Pesticides

Farmers often choose pesticides based upon price, availability, and anecdotal efficacy (their belief about how effective the pesticide is), and recommendations from neighbors or agricultural suppliers. This PERSUAP, however, uses additional criteria for selection of pesticides based upon safety and acute toxicity ratings, chronic toxicity issues, groundwater safety and relative ecotoxicological safety.

Pesticides selected for use through the development of this PERSUAP for the Avansa Ag project went through a multiple-tiered screening process. First, a list of pesticides available in Timor-Leste was compiled based on visits to local suppliers, experience on previous projects, interviews with farmers, and MAF representatives. Second, the pesticides were screened and those that were not registered with the USEPA (Factor A), had RUP designation, or had other acute toxicity or other health concerns (Factor E criteria, see below) were eliminated from the list. Third, IPM plans were developed for the different crops promoted through Avansa Ag with non-pesticide treatments, natural controls, and the least toxic pesticides prioritized. Finally, the SUAP portion of the PERSUAP was developed to promote safe use of the pesticides approved for use on the Avansa Ag project.

> The Avansa Ag project encourages use of pesticides with the lowest human and environmental risk profiles (based on this document, MSDSs, and pesticide labels), as practical.
> Encourage the GOTL to pass the Law of Pesticides and increase regulation of or ban Class Ia and Ib pesticides and promote less toxic alternatives.
> Provide educational materials, training, and appropriate PPE for pesticide use at demonstration farms, agricultural suppliers, and directly to Avansa Ag farmers.

Factor C: Extent to Which the Proposed Pesticide Use Is, Or Could Be, Part of an IPM Program

USAID promotes training in and the development and use of integrated approaches to pest management tools and tactics whenever possible. Annex 2 contains a detailed Crop-Pest-IPM-Pesticide matrix for each crop to be grown by Avansa Ag-assisted farmers, noting most major pests of each crop, a list of preventive tools and tactics, and a list of natural and synthetic chemical alternatives primarily based on recommended by leading IPM resources.

IPM philosophy includes the use of synthetic pesticides as part and parcel of an overall harmonized and coordinated approach to pest management (Annex 4).

Good crop management practices can strongly affect the success of IPM, and good agronomic or cultural practices are the most basic and often the most important prerequisites for an effective IPM program. A healthy and vigorous crop optimizes both capacity to prevent or tolerate pest damage while maintaining or increasing yield potential.

> Pesticide Safer Use training required under this PERSUAP will include IPM principles as well as crop- or pest-specific IPM practices relevant to the audience. (See Annex 2 and 4).
> Starting from the information in PERSUAP Annex 1, 2, and 4, the Avansa Ag project will develop activity-specific IPM-based management plans. Chemical controls specified in these plans will prioritize low-toxicity options.

Factor D: Proposed Method or Methods of Application, Including the Availability of Application and Safety Equipment

Pesticides can and do enter the body on the hands, skin or eyes through various ways. It can get on ones back, arms and hands from leaky backpack sprayers when spraying, through the nose and mouth as vapors while spraying and from spray drift and by mouth from ingestion on food or cigarettes.

The availability, training, and use of safety equipment in Timor-Leste is very limited. Availability of appropriate PPE is also limited and costly, but lower-cost and more available equipment can be substituted to provide some protection.

The majority of pesticide application in Timor-Leste is by hand or with backpack sprayers. Both methods of application have attendant risks.

Hand-pump backpack sprayers, used by small- and medium- scale farmers, among others, can and do eventually develop leaks at almost every parts junction (filler cap, pump handle entry, exit hose attachment, lance attachment to the hose and at the lance handle) and these leaks soak into exposed skin. Safe handling and accurate measuring of crop protection products to mix the spray solution is the first most important point where reduction of physical exposure to the skin, ingestion from the skin, or inhalation can be achieved in the short-term.

- The Avansa Ag project, during the pesticide safer use training required by this PERSUAP, will 1) promote and teach proper sprayer maintenance and repair; and 2) train participants on post-spray hygiene.
- Where pesticide use is under their direct control, Avansa Ag will assure that appropriate PPE is provided, is well maintained, and properly utilized. This includes the use of gloves for granular applications.
- Participants working with Avansa Ag will receive information on the appropriate pesticides to use through the information included in the technology packets. Avansa Ag will also work with suppliers to ensure that the appropriate PPE are available for sale at reasonable prices and that easy-to-understand information regarding the hazards of pesticide use and proper use of PPE are made available.

Factor E: Any Acute and Long-Term Toxicological Hazards, either Human or Environmental, Associated With the Proposed Use, And Measures Available To Minimize Such Hazards

Pesticides are poisons, and nearly all of them—including natural ones—present acute and/or long-term toxicological hazards, especially if they are used incorrectly. The pesticide AI matrix in Annex 1 contains information on acute and chronic human and environmental toxicological risks for each AI in products available for use in Timor-Leste.

The primary measures for minimizing acute and long-term toxicological hazards are the screening process described in Factor B to prevent the use of particularly hazardous pesticides on the Avansa Ag project, using IPM to minimize use of synthetic pesticides in general and to prioritize using low-toxicity pesticides, the safer use actions described under Factor D to prevent exposure of applicators to pesticides, and the approaches described under Factor G to ensure compatibility with environmental conditions

Table 4 lists USEPA approved pesticides that are not approved for use on Avansa Ag projects due to acute toxicity, restricted use designation, or other risk factors such as carcinogenicity, cholinesterase inhibitor, developmental or reproductive toxin, or endocrine disruptors as designated by the Pesticide Action Network.

- Since laboratory analytical capacity and health monitoring are non-existent in Timor-Leste, actions will focus on eliminating the most toxic pesticides and concentrating on IPM and training on proper pesticide use and PPE to reduce human and environmental exposure.
- The pesticide safer use training required by this PERSUAP will include basic first aid for pesticide overexposure.
- Use of IPM to minimize pesticide use and prioritize low toxicity options. Multiple pest management approaches should help reduce over-use of pesticides and reduce long-term accumulated exposure.

Factor F: Effectiveness of the Requested Pesticide for the Proposed Use

Pesticides are important pest management tools, although many pesticides gradually lose their effectiveness—especially if overused and not rotated with other classes of pesticides—due to the development of resistance by pests. Pest resistance is a heritable and significant decrease in the sensitivity of a pest population to a pesticide that is shown to reduce the field performance of those specific pesticides.

The management of pesticide resistance is an important part of sustainable pest management and this, in conjunction with alternative pest management strategies and IPM programs, can make significant contributions to reducing risks to humans and the environment. Annex 1 serves as one tool for managing resistance by providing the class of each pesticide, so that project field managers and farmers can rotate pesticides among classes.

- Training will include and emphasize pesticide rotation among the classes of pesticides to reduce the development of resistance and the above recommendations for reducing resistance.
- The pesticide safer use training required by this PERSUAP and extension activities will include the fundamentals of "safer pesticide purchase," including a recommendation to use quality products and discourage use of generic products of questionable composition.
- The pesticide safer use training required by this PERSUAP and extension activities will teach and emphasize proper sprayer calibration and spray nozzle choice.
- Monitor pesticide use for increasing use due to ineffective formulations or pest resistance.

Factor G: Compatibility of the Proposed Pesticide Use with Target and Non-Target Ecosystems

Broad-spectrum insecticides not only destroy target insect pests but also destroy the predators and parasitoids that feed naturally on them. Pollinators and insect pests' natural enemies (parasitoids and predators) are especially vulnerable to pesticides—often more so than the pests. Most pesticides are also highly toxic to birds, fish, lizards, snakes, frogs, toads and other arthropods

Table 5 compiles the known risks to groundwater and the different types of terrestrial and aquatic organisms for each pesticide active ingredient found in pesticides approved for use by the Avansa Ag project (based on Factors B and E), so that informed product choices can be made if a pesticide is to be used in or near sensitive areas or resources.

Each pesticide has physical and chemical characteristics, such as solubility in water, ability to bind to soil particles and be held there (adsorbed), and natural breakdown rate in nature. If they are strongly held by soil, they do not enter the soil water layers and the ground water table as easily.

The only *known* water pollutant on the list of pesticides approved for Avansa Ag is cyromazine. It should not be used in areas with high water tables and sandy soils.

- Before implementing an activity, identify and map all sensitive areas near the project sites.
- Use good agricultural practices and avoid using highly toxic or persistent pesticides where endangered species are known to exist.
- Do not spray or rinse equipment in or within 30 meters of ponds, drainage ditches, and surface waters.
- Minimize chemical spray drift by using low-pressure sprays and nozzles that produce large droplets, properly calibrating and maintaining spray equipment, and use of a drift-control agent, where feasible.

Factor H: Conditions under Which the Pesticide Is To Be Used, Including Climate, Geography, Hydrology, and Soils

Rainfall and steep terrain are contributing factors to the dispersal of pesticides beyond the intended crop and into soils and nearby waterways. The surface hydrology of Timor-Leste has not been extensively studied or monitored. Most rivers are relatively short, but small streams are common. Stream density varies with soil type, underlying geology and topography in the Avansa Ag districts. Many small holder farms are located near streams or in floodplains depending on the local topography, which increases the potential for pesticide contamination of waterbodies. Soil type is a consideration in developing appropriate technology packets and IPM strategies. Extensive soil information for Timor-Leste has been compiled and is available online at the Seeds for Life website and is included in the suco-level information packets for Avansa Ag planning.

- Hydrology: Do not spray pesticides with high toxicities to aquatic organisms before an impending rainstorm, as they can be washed into waterways before breaking down.
- Soils: Do not use or recommend pesticides with high leaching and groundwater pollution potential (see discussion in Factor G) near drinking water sources, on highly sandy soils or soils with water tables close (2-3 meters) to the surface.
- Soils: Transport of soil particles with pesticides adsorbed to them is a likely transportation route to waterways, employ techniques to reduce farm soil erosion whenever erosion is likely.

Factor I: Availability of Other Pesticides or Non-Chemical Control Methods

Annex 2 contains numerous non-chemical control methods for every major pest expected to be encountered on the Avansa Ag project. These IPM approaches can be expanded into crop-specific

stand- alone documents that can be reproduced as necessary, and should be considered for translation into local languages, lamination, and distribution to farm input supply companies to help advise farmers at point-of-purchase. Many non-synthetic chemical IPM tools and technologies are listed in Annexes 4 and 5. There are, however, some local homemade insecticides and insect and pathogen repellents used in Timor. These include extractions from neem leaves and vetiver roots, garlic and pepper sprays that are formulated at home and the use of vinegars.

> As appropriate, USAID projects will promote low-risk preventive and natural chemical pest controls that are found in Annexes 2, 4 and 5 of this PERSUAP, including incorporating these controls in the IPM plans developed under this PERSUAP.

Factor J: Host Country's Ability to Regulate or Control the Distribution, Storage, Use, and Disposal of the Requested Pesticide

Timor-Leste has no laws or policies currently in place to regulate pesticide importation, distribution, storage, use, or disposal. There are no restrictions other than through business licensing and limited authority by the quarantine ministry to stop problematic pesticide use, and the main ministry that oversees agriculture, the MAF, has no authority at all. The Law of Pesticides was drafted in 2011, and there is no indication that it will be passed any time soon (Annex 11).

For a country where PPE is, for all intents and purposes, not used much on small-scale farms, there are still some very toxic products being sold in quantity, all of which leads to increased risk. Several dangerous chemicals that should be banned or restricted are still encountered in Timor-Leste (Tables 3 and 4). These include multiple Class I toxic pesticides (Carbaryl, Carbofuran, Carbosulfan, Cypermethrin, Methidiathon, Methiocarb), internationally banned pesticides such as Endosulfan, and environmentally hazardous chemicals such as profenofos, which is a RUP. Small-scale farmers should be encouraged to switch to newer and less toxic chemicals. Several safer alternatives to older types of chemicals now exist.

Timor-Leste's inability to regulate pesticides and the poor understanding of proper use and PPE practices underlies the conservative approach to approving pesticides for use in the Avansa Ag project as described in Factor C and E.

Currently there is no regulation or oversight for disposal of used pesticide containers. Best practical practice is to triple-rinse the containers, puncture them to discourage re-use, and bury or burn them. Burning plastic bottles and single-use sachets can lead to the formation of toxic furans and dioxins, and is not recommended.

> IPM plans and field extension will give preference to the use of Class III and IV/U pesticide alternatives, which exist on the list of pesticides approved for use with the Avansa Ag project.
> For all project commercial farms supported by USAID, encourage and support the use of best practices with pesticide storage, use and disposal, whether or not certification is sought.

Factor K: Provision for Training of Users and Applicators

Training in Safe Pesticide Use and GAP/IPM are of paramount importance for Avansa Ag project beneficiary farmers and farm laborers using pesticides. Various NGOs have been providing such

training, along with the MAF to a lesser extent. Additional and refresher trainings are superb means for effecting beneficiary farmer behavioral change, now especially, as they expand their agricultural technologies and before risky behaviors become set.

> Avansa Ag will implement IPM and Pesticide Safer Use training for all relevant project staff and direct beneficiaries, training target individuals within six months and providing short annual refresher training thereafter.
> Demonstration farms will have handouts in Tetum on appropriate pesticide and PPE use, demonstrate best management practices, and offer courses and training on pesticide and PPE use.

Factor L: Provision Made For Monitoring the Use and Effectiveness of Each Pesticide

Record keeping should track quantities and types of pesticides used, where they were used and what they were used for with notes on efficacy. Notes on effectiveness of individual pesticides and pest numbers will help develop a more sustainable pesticide use plan for Avansa Ag beneficiary producers. Records will need to make note of any reductions in pesticide efficacy experienced, which is the first indication that resistance may be developing, and then a strategy needs to be in place to determine a shift to a different pesticide class, and rotation among classes, to overcome resistance development. Record keeping at the participating farmer level may be limited due to educational constraints and the ability to track the number of farmers reached by the Avansa Ag project through demonstration farms and lower intensity interventions.

> Develop timeline and reporting requirements and responsibilities template.
> Provide training to beneficiaries on appropriate pest management and pesticide use record-keeping.
> Monitor record keeping at demonstration farms and commercial farms to ensure compliance.
> Provide training to staff and beneficiaries on what problems need to be reported immediately to Avansa Ag and USAID staff.

Summary of the Pesticide Safer Use Action Plan (SUAP)

The Safer Use Action Plan is the definitive statement of the USAID Avansa Agrikultura project pesticide compliance requirements and is synthesized from the PER analysis. The PER analysis includes safer use/mitigation actions for each factor that form the core of SUAP actions

Synthesizing across the PER analysis, ONLY the active ingredients from pesticides listed in Annex 1 as "Yes" under the Approved for Avansa column are permitted for use/support for Avansa Ag activities. If the Approved for Avansa column states 'Depends', that means it is a restricted use pesticide (RUP) in some formulations and not others. Only formulations that are functionally equivalent in composition and application to non-restricted pesticides can be used for Avansa Ag.

The list of approved pesticides will be distributed to all suppliers working with Avansa Ag including instructions (and perhaps signage) that indicates that if farmers are working with Avansa Ag they can only purchase chemicals from the approved list if they wish to continue work with Avansa Ag.

Summary of compliance requirements:

A. Only pesticides approved by this PERSUAP may be supported with USAID funds in Avansa Ag activities.

B. In the case of value chain projects or projects otherwise supporting field crop production, pesticide support must be governed by a set of locally adapted, crop- and pest-specific IPM-based pest management plans and observe enumerated use restrictions.

C. Appropriate project staff & beneficiaries must be trained in safer pesticide use & pesticide first aid.

D. To the greatest degree practicable, projects must require use of and assure maintenance of appropriate PPE and application equipment—as well as safe pesticide purchase, handling, storage and disposal practices.

E. Projects must be systematic in their pesticide-related record keeping and monitoring.

Many Avansa Ag project beneficiaries will benefit from indirect support- visits to demonstration farms, trainings, educational materials, receiving improved varieties and sample PPE, but will not receive funds or expert assistance at their farms. Monitoring will focus on beneficiaries under direct control or influence of the Avansa Ag project: suppliers, demonstration farms, nutrition gardens, beneficiaries receiving grants or regular technical assistance visits. For project beneficiaries that do not receive direct funding or technical assistance, Avansa Ag has little control over how they use the materials provided by Avansa Ag or whether they purchase or use pesticides rejected by the project. In alignment with the Avansa Ag EMMP, 7.5% of farmers monitored for compliance with the EMMP will also be monitored for pesticide and PPE use.

Table 8 lists the potential impacts, mitigations, and monitoring schedules for Avansa Ag pesticide use.

1. Introduction

1.1. Introduction and Report Organization

USAID's Avansa Agrikultura Project (Avansa Ag) is a horticulture value chain activity aimed at addressing the key challenges of rural poverty, natural resource degradation, food insecurity, and under-nutrition. The value chain approach will be applied in achieving increased productivity along key horticulture value chains that include vegetables, fruits and legumes. Through the promotion of sustainable production practices, increased functionality of farmer groups and associations, improved market linkages, and increased availability and access to quality agricultural inputs and services, including access to finance, the project will aim to stimulate and support increased economic activity and growth in targeted rural communities and districts. Sustainability of these interventions will be supported by work to maintain sound policies and enabling environment relevant to the sector, as well as efforts to increase resilience to climate change and improve natural resource management as it relates to farm systems.

Purpose and Scope: In compliance with USAID's Pesticide Procedures (22 CFR 216.3(b)), this 2015 Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) for the USAID/Timor-Leste Avansa Agrikultura project:

- Establishes the subset of pesticides for which support is authorized on the Avansa Ag project.
- Establishes requirements attendant to support for these pesticides to assure that pesticide use/support (1) embodies the principles of safer pesticide use and, (2) per USAID policy, is within an Integrated Pest Management (IPM) framework.

These requirements come into effect for the Avansa Ag project in Timor-Leste upon approval of the PERSUAP.

Organization: The organization and format of this Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) is based on the 2013 Programmatic or Umbrella PERSUAP produced for USAID Indonesia (USAID 2013). Section 1 provides the regulatory background and framework for the development of the PERSUAP and USAID's policies on integrated pest management (IPM).

Section 2 provides background information on Timor-Leste, past and current USAID programs operating in country, other major aid programs operating in Timor-Leste, and a review of the national and international regulatory framework for pesticides.

The set of authorized pesticides and requirements for safer use are established in Section 3 of the document, the Pesticide Evaluation Report (PER), which assesses the 12 pesticide risk evaluation factors (A through L) required by 22 CFR 216.3(b).

The Safer Use Action Plan (SUAP, Section 4) provides a succinct, stand-alone statement of compliance requirements, synthesized from the 12-factor analysis. It also provides a template for assigning responsibilities and timelines for implementation of these requirements.

1.2. USAID Environmental Regulations Development

From 1974 to 1976, over 2,800 Pakistan malaria spray personnel were poisoned (5 to death) by insecticide mishaps on a USAID/WHO anti-malaria program.[1] In response to this and other incidents arising from USAID programs, a lawsuit was brought by a coalition of environmental groups for USAID's lack of environmental procedures for overseas projects. In response to the lawsuit, USAID drafted 22 Code of Federal Regulations (CFR) 216 (Reg. 216). This regulation, which was updated in 1979 to include extraterritorial affairs in response to changes in the scope of the application of the National Environmental Policy Act (NEPA), now guides most USAID activities that could have potentially negative environmental impacts.

Since that time, additional studies and statistics have demonstrated health issues with inappropriate pesticide use[2]:

- 2010 Pesticide Action Network Study[3]: interviewed 1300 peasant farmers in China, Cambodia, Sri Lanka, the Philippines, Vietnam, India, Indonesia and Malaysia
  - 2/3 of crop pesticide active ingredients are highly hazardous and the use of proper PPE are rare, even in middle-income countries
- Bangladesh: pesticide poisoning a leading cause of death in official statistics and the 2nd highest cause of death among 15-49 age group
- Cambodia: At least 88% of farmers surveyed had experienced symptoms of acute pesticide poisoning
- Indonesia: widespread use of pesticides as mosquito repellents.

1.3. Regulation 216

Pesticide Definition by USEPA: For the purposes of this PERSUAP, the word *pesticide* is used, following USEPA's guidelines,[4] for the following: fumigants, insecticides, miticides/acaricides, nematicides, molluscicides, fungicides, antimicrobials, bactericides/biocides, microbicides/antibiotics, herbicides, rodenticides, avicides, algicides, ovicides (kill eggs), disinfectants/sanitizers and anti-fouling agents (chemicals that repel or kill things like barnacles that attach to boats). Even biological agents such as biopesticides, microbial pesticides, attractants/pheromones, repellents, defoliants, dessicants and insect growth regulators are included as pesticides.

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). An initial IEE was prepared for Avansa Ag by USAID. It did not include a PERSUAP or analysis of pesticide use. Upon award of Avansa Ag, USAID requested the preparation of a PERSUAP to address potential pesticide procurement or use. Reg. 216.3(b)(1)(i) states: "When a project includes assistance for procurement or use, or both, of pesticides

[1] http://www.ncbi.nlm.nih.gov/pubmed/74508
[2] http://www.usaidgems.org/Documents/complianceTopics/ST_Pesticides_Safer_UseCompliance_Cairo_10Oct2012.pdf
[3] http://www.panap.net/sites/default/files/PANAP-Asian-Report.pdf
[4] http://www.epa.gov/pesticides/about/types.htm

registered for the same or similar uses by USEPA without restriction …" USAID interprets "pesticide procurement or use" very broadly to include[5]:

- Direct purchase of pesticides
- Payment in kind, donations, provision of free samples and other forms of subsidies
- Provision of credit to borrowers for pesticide use
- Guarantee of credit to banks or other credit providers could be procurement
- Sale
- Handling, transport, storage
- Mixing, loading, application
- Disposal
- Provision of fuel to transport pesticides
- Technical assistance in pesticide management
- Use.

Pesticides *rejected* by this PERSUAP analysis cannot be 'used' for any of the above project activities, unless an Environmental Assessment (EA) is performed. That said, Avansa Ag cannot control the procurement or use of rejected pesticides by beneficiaries with their own resources on their own farms (unless they are project demonstration farms). However, the Avansa Ag project can and should make recommendations for the purchase and use of safer alternatives.

A large part of Regulation 216 – part 216.3 – is devoted to pesticide use and safety. Part 216.3 requires that if USAID is to provide support for the use of pesticides in a project, 12 pesticide factors must be analyzed and recommendations be written to mitigate risks to human health and environmental resources. This plan must 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 is strongly encouraged.

1.4. The Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP)

In the USA, the USEPA can rely on the following safety-enhancing factors and features, not present to the same degree in most emerging market countries—including Timor-Leste:

- An educated literate population of farmers and farm laborers Quality IPM information and Pest Management Plans (PMPs)
- A well-functioning research and extension system to extend IPM information to farmers Certification systems for farmer training on restricted and other pesticides
- Quality affordable PPE to reduce pesticide exposure
- Quality pesticide labels and Material Safety Data Sheets (MSDS) to guide farmer safety
- Accurate information and training on pesticide use, transport, storage and disposal

Because of the differences in infrastructure and resource availability, USAID and US regulations require location-specific analysis of pesticide use in emerging market countries, and development of procedures to ensure safe use.

[5] ENCAP EA-ESD Course: Pesticides in USAID Projects: Environmental Requirements and Considerations http://pdf.usaid.gov/pdf_docs/pnadk577.pdf

In the late 1990s, USAID developed the Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP)—a tool to analyze the pesticide system or sector in any given country or territory. The PERSUAP tool—which was not envisioned and is not described per se in Regulation 216's language—focuses on the particular circumstances, crops, pests and IPM/pesticide choices of a project or program. This "systems approach" analyzes the pesticide sector or system from registration to import through use to disposal and develops a location- specific pesticide risk profile based on the analysis.

A PERSUAP is generally recommended by and submitted as an amendment to the project IEE or an EA (even though most PERSUAPs are very similar to an EA in terms of breadth and detail). Although not actually an explicit goal of the PERSUAP, the application of PERSUAP recommendations has additional benefits. It helps to prepare project participants to be able to more rapidly adopt Best Management Practices (BMPs) and meet the needs of Standards and Certification (S&C) Systems like GlobalGAP, Organic, Fair Trade, Rainforest Alliance, British Retail Consortium and other S&C systems, as desired, for future market access.

1.5. Integrated Pest Management—USAID Policy

In the early 1990s, USAID adopted the philosophy and practice of Integrated Pest Management (IPM) as an official policy. IPM is also strongly promoted and required as part of Regulation 216.3. Since the early 2000s, IPM, which includes judicious use of 'safer' pesticides, has been an integral part of GAPs and is increasingly considered to constitute best management practices in agriculture.

> "Integrated pest management is defined as a farmer-based and knowledge intensive management approach that encourages natural and cultural control of pest populations by anticipating pest problems and managing their numbers to reduce losses, while permitting safer pesticide uses where justified and permitted. Many indigenous, as well as newly-developed, nonchemical techniques are available for use. These include combinations of biological control, habitat manipulation, soil health management, use of resistant varieties, and modification of cultural practices (expanded upon below). IPM focuses on long-term prevention of pests and their damage, and is USAID policy. Pesticides are considered curative, and generally should be used as a last resort.[6]"

The strongest selling points for IPM beyond the health and environmental benefits are, that IPM:

- Is, in the long run, more effective than using synthetic pesticides
- Is, once-established, self-perpetuating to a degree
- Is less damaging to essential soil health and nutrient cycling leaves fewer pesticide residues that confound international trade, which generally requires less capital (but more labor) investment
- Can be used preventively to eliminate or minimize the need for "responsive" controls (e.g. applying pesticides after a pest outbreak occurs to an already-damaged area)

IPM can include possible pest management techniques and tools including:

[6] EGSSAA: INTEGRATED PEST MANAGEMENT, 2009 http://www.encapafrica.org/egssaa/ipm.pdf

- Soil and water tests, raised-bed production, tunnels, and drip-irrigation
- Pest scouting, monitoring, and identification for accurate decision-making
- Cultural methods that promote pest avoidance and a healthy plant that can better tolerate or resist pests. These methods include, but are not limited to, use of resistant varieties, early/late plantings/harvestings, crop rotation, pruning diseased parts, destruction of pest refuge plants near fields and in crop residues, and GAP practices
- Natural pest control by encouraging and protecting (or purchase and release of) parasitoids, predators, and pest diseases
- Mechanical weed or insect pest control using manual, hoe and machine practices
- Chemical practices such as use of judicious, knowledgeable, and safe application of 'natural' (derived from nature; extracted from plants, microbes, and other organisms) or synthetic pesticides

Good soil characteristics are essential to plant health. For most crops, soils need to provide adequate nutrients and moisture and be well drained. A healthy soil will have a greater capacity to moderate the uptake of fertilizers and will allow a more balanced uptake of nutrients, creating a healthy plant that is less attractive to some pests and more resistant to pest damage.

2. Background

2.1. Country Background

Figure 1: Map of the Avansa Agrikultura project area.

The following summary is from the USAID report *Accelerating Inclusive Economic Growth in Timor-Leste Assessment of Opportunities for Inclusive Economic Growth in Timor-Leste, Final Report, April 2013*:

> Despite its small size, Timor-Leste is very diverse in terms of languages, peoples, and geography. It has more than 20 languages, which include Portuguese and Tetum (the official languages), Indonesian and English (the working languages), and 15 indigenous languages. The terrain is mountainous, with highlands in the central part of the island, and a more fertile but sparsely populated southern coast. There are two seasons: the rainy season, which has very harsh, powerful downpours, and a dry season when droughts can occur.
>
> The total population of Timor-Leste is currently estimated at more than 1.2 million people (World Fact Book, 2012). Timor-Leste has a high fertility rate with six children per woman and a population growth rate of 2.9 percent per year. The under-five mortality rate is 64 per 1,000 live births (Demographic Health Survey, 2009-10). Major killers of children under five are pneumonia, diarrhoea, and malaria. There is a high prevalence of underweight children, reaching 45 percent (UN MDG Report, 2011), and 58 percent of children are stunted (DHS, 2010). Poor nutrition and food insecurity are major concerns in Timor-Leste. About 72 percent of the population is rural (World Fact Book, 2012), yet only 8.2 percent of the land is considered arable. A rural family holds on average about 1.2 ha of land and the rural population is poorer than urban populations (MAF et al., 2003). Agriculture provides at least 64 percent of the country's employment (World Fact Book, 2010), and coffee is the country's main export, with the exception of petroleum. Candlenut, spices, and coconut are also grown commercially in lesser quantities. Subsistence farmers often practice swidden cultivation and produce rice, maize, tubers, and some livestock. Close to 80 percent of the population rely on the crops they produce themselves for food and income and the poor can experience food shortages for at least two months out of the year (UNHR, 2008); www.wfp.org/countries/timor-leste/overview). Additionally, Timor- Leste depends on imports to meet its food needs, and it is estimated that 74 percent of rice is imported (Timor-Leste Survey of Living Standards, 2007).
>
> **Timor-Leste Key Statistics**
>
> | | |
> |---|---|
> | Population: | 1.2 million |
> | Fertility rate: | 6 children/female |
> | Population growth rate: | 2.9 percent |
> | Life expectancy (years): | 62.9 years |
> | Literacy rate: | 58 percent |
> | Underweight, under 5: | 45 percent |
> | Stunted, under 5: | 58 percent |
> | Urban population: | 28 percent |
> | 2013 Human Development Index: | 134 of 186 |
>
> Given that the majority of the population resides in rural areas, they are heavily dependent upon natural resources for their survival. Deforestation and soil erosion are major problems in Timor-Leste (Westerberg, 2000). Forest cover in Timor-Leste has decreased by almost 30 percent from 1972 to 1999, (Sandlund et al., 2001) and declined at a rate of 1.3 percent per year from 2000 to 2010 (CBD, 2011). It is believed that only one to six percent of the remaining cover is primary forest, and native species regeneration rates are low. Valuable timber species,

> such as sandalwood, teak, and rosewood, have been nearly logged out due to cutting during the colonial and occupation periods. During the Indonesian occupation, troops frequently burned forests to flush out guerilla fighters and many people who fled from cities cleared forested land for agriculture. Additionally, forests are under pressure due to the practice of swidden agriculture and the collection of fuelwood, as 90 to 98 percent of the country uses fuelwood for cooking (World Bank, 2007; Mercy Corps, 2011).

The following three paragraphs are from the DOCIA EMMP Report Greenhouse SHAs (2010):

> Ten endangered terrestrial mammals and three endangered reptiles are found in East Timor - nearly all mammals and one of the reptiles utilize forest habitats with two reptile species dependent on wetlands. The two known, endangered plant species are trees - sandalwood and Blume (Mangfera timorensis).
>
> Pollution from a variety of sources has potential for negative impacts particularly upon aquatic biodiversity. For example, upstream pollution of rivers from agricultural inputs and human wastes is contaminating rivers and streams and adversely affects coral reefs.
>
> It is evident from field observations that other factors have contributed to land degradation. Some of these include: grading and excavations on steep slopes for unimproved road access, uncontrolled excavation of building materials (stone and gravel) from roadside cut slopes, inadequate or poorly designed storm water collection and discharge infrastructure that channels runoff to highly erodable slopes, and land clearing/excavations to create pads for building/home site construction.

2.1.1. Agriculture

The following summary is from the USAID report *Accelerating Inclusive Economic Growth in Timor-Leste Assessment of Opportunities for Inclusive Economic Growth in Timor-Leste, Final Report, USAID, April 2013*, and the *Avansa: Integrated Food Security, Climate Change Adaptation, and Private Sector Competitiveness solicitation, August 2014*:

> Fifty percent of the land is degraded (NAP, 2008) and this degradation is due, in part, to unsustainable agricultural practices. Population movements, sometimes forced, and lack of agricultural assistance under Indonesian rule affected the sustainability of agriculture. Despite relatively low population density in Timor-Leste, the amount of suitable agricultural land available per person is insufficient. Farmers regularly cultivate areas with slopes of more than 40 degrees. Almost half of the land of Timor-Leste is this steep or more (Democratic Republic of Timor-Leste, 2003) and landslides and flash floods are common.
>
> In Timor-Leste's upland areas, the principal subsistence food crops include maize, cassava, sweet potatoes and other starchy staples (Figure 2, Table 1). The majority of, if not nearly all, farmers in Timor-Leste are smallholder farmers and plot sizes in upland areas often less than one hectare. Since 2004, there has been a significant decline in the number of households growing staple crops, i.e. corn, maize, rice and cassava, in Timor-Leste. Timor-Leste's steep topography and soil is not well suited for agriculture; however, it is the primary source of income for

the majority of Timor-Leste's population. Agricultural production is so low in many upland areas that farmers are not able to meet their own household needs for food throughout the year. Poor agricultural, water and soil conservation practices contribute to low productivity and farmers continue to rely on traditional subsistence farming methods that are reliant on saved seed and rain-fed agriculture systems. With limited inputs and poor soils, they continue environmentally harmful cultivation practices, such as slash and burn and cultivation on steep slopes. Lack of market access perpetuates low agricultural productivity as farmers have weak incentives to produce in surplus. Poor condition of infrastructure and lack of transport significantly raises the cost of doing business. As infrastructure improves and transport costs are reduced, farmers will require technical support to build skills and access resources necessary to maximize productivity of their farm systems.

Currently, farmers have limited and unreliable access to inputs, technical assistance and information from extension services. As well, farmers have little demand for inputs or finance as there are few incentives to increase production beyond subsistence levels. The farmers who do utilize inputs and technical assistance generally receive these services at little or no cost through NGO or Government of Timor-Leste (GOTL) projects. Many of these NGO or government projects provide no assistance linking farmers to markets and consequently undermine private sector-led growth in the agricultural sector. Farmers' limited understanding of, and access to, markets only further impedes their ability to profit from agriculture.

Figure 2: Map of Agro-Ecological Zones for Timor-Leste[7]

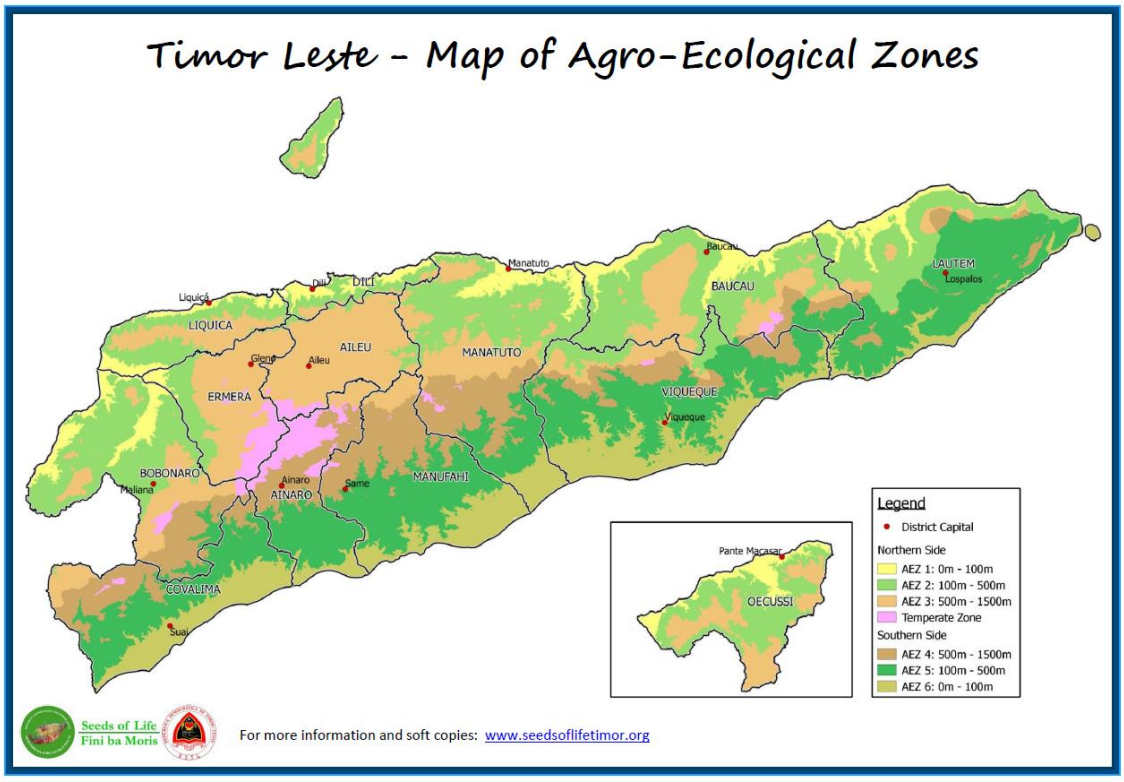


Table 1: Agro-Climatic Zones of East TimorTimor-Leste, relative percentage of land area, altitude, rainfall, and major crops[8]

Zone (percentage of land area)	Altitude (m)	Rainfall (mm year^{-1})	Length of growing season (months)	Major crops
North coast lowlands (10)	<100	<1000	4–5	Rice, maize, cassava, coconut
Northern slopes (23)	100–500	1000–1500	5–6	Maize, cassava, rice, sweet, potato, cowpea
Northern uplands (19)	500–2000	>1500	6–7	Red beans, coffee, maize, rice, cassava
Temperate uplands (2)	>2000	>2000	9	Potatoes, wheat, barley, arrowroot
Southern uplands (14)	500–2000	>2000	9	Maize, cassava, rice, sweet, potato, cowpea
Southern slopes (21)	100–500	1500–2000	8	Maize, cassava, rice, sweet, potato, cowpea
South coast lowlands (11)	<100	<1500	7–8	Rice, maize, cassava, coconut

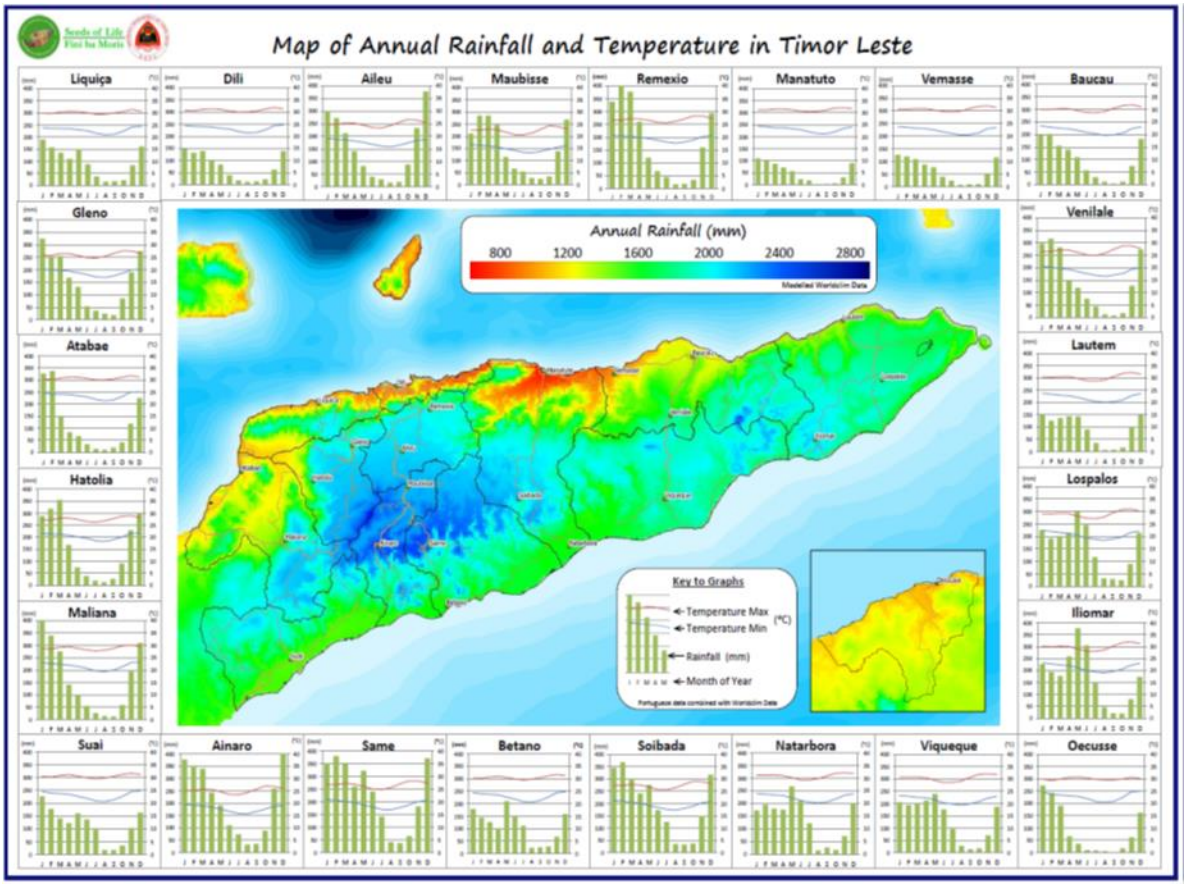
2.1.2. Timor-Leste Climate

The climate of Timor-Leste is dry tropical with distinct monsoon rainfall patterns. Rainfall patterns are distinctly different between north and south side of the island. On the north side of the island, the wet season lasts approximately from December to April or June and the south side has two rainy seasons lasting for seven to nine months with peaks in December and May. Rainfall, in general, increases with elevation, but is also subject to micro-climate variation due to the rugged topography (Figure 3). Heavy rainfall is not uncommon, with the possibility of a

[7] Seeds of Life. http://seedsoflifetimor.org/
[8] Molyneux et al 2012.

significant portion of the annual total falling in a single monsoonal event. Tropical cyclones, which can bring destructive winds and high levels of rainfall have been uncommon in Timor-Leste over the past 30 years and are more commonly associated with La Niña events and less frequent with El Niño events. Data from northern Australia indicates that El Niño events have been more common since the 1970's, which may have contributed to the lower frequency of cyclones.[9]

Figure 3: Map of Timor-Leste showing Annual Rainfall and monthly rainfall and temperatures for selected cities[10]



Rainfall is subject to El Niño Southern Oscillation (ENSO) and can vary by up to 20% during these events (Figure 4).

Humidity is generally in the 70-80% range with little annual variability. Temperature also has little annual variability with mean maximum temperatures in Dili hovering around 30-32^{o}C and mean minimum temperatures ranging from 22-25^{o}C (Figure 3).

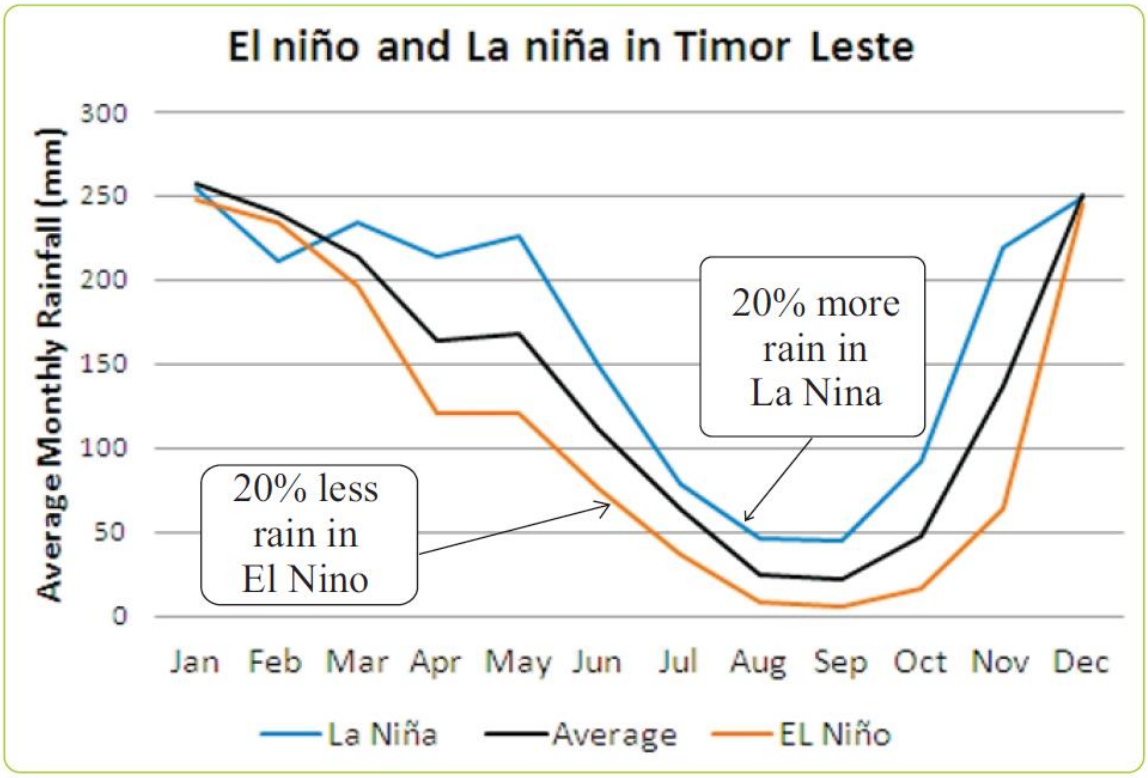
Climate variability will increase the degradation of forested areas and soil erosion, as well as the possibility of landslides and flooding. Due to climate change, the country will likely experience higher temperatures, greater variability in precipitation from more intense rains,

[9] Ministry of Economy and Development (MED). 2010. National Adaptation Programme of Action (NAPA) on Climate Change. http://unfccc.int/resource/docs/napa/tls01.pdf
[10] Seeds of Life. http://seedsoflifetimor.org/climatechange/maps-of-timor-leste/

lengthened periods of drought, variations in monsoon winds, and increased intensity of cyclones.[11]

For more details on Timor-Leste's climate, ENSO variability, climate change, and hazards, please see the Avansa Ag report: *Climate Change Adaptation and Disaster Risk Reduction for the Avansa Agrikultura Program in Timor-Leste*.

Figure 4: Average monthly rainfall for Timor-Leste showing average monthly precipitation and the effect of El Nino and La Nina events based on partial data from 1914-1974[12]



2.2. USAID Involvement in Horticulture Sector: Timor-Leste

The following paragraph from the USAID Avansa Agrikultura RFP provides a brief description of USAID horticultural activities in Timor-Leste:

> "USAID involvement in the horticulture sector began in 2005 with the Dezenvolve Sector Privado (DSP) activity. Building on the success of DSP, in 2010 USAID initiated a follow on activity exclusively focused on horticulture. Dezenvolve Agricultura Comunitária (DAC) is a five-year activity focused on community development through agriculture and increasing the commercial viability of horticultural production in Timor-Leste through the establishment of direct links between farmers and buyers. DAC has worked to achieve this goal through: (1)

[11] Accelerating Inclusive Economic Growth in Timor-Leste Assessment of Opportunities for Inclusive Economic Growth in Timor-Leste, Final Report, USAID, April 2013
[12] Seeds of Life. http://seedsoflifetimor.org/

> improved agricultural production technologies and (2) focused technical and management training for community members in agribusiness and production technologies; (3) improved access to market; (4) strategic partnerships with the private sector. Through AVANSA project starting in 2015, USAID will continue to build on the development gains achieved under DAC with farmers, buyers and communities. AVANSA will work to diversify models of engagement beyond contract farming and explore other opportunities to expand market linkages and support economic growth in the sector. A fundamental focus of AVANSA will be to develop long term sustainability by strengthening the private sector and local partners responsible for the delivery of services to rural farmers."[13]

A PERSUAP was not prepared for the DAC program in anticipation that a mission-wide PERSUAP would be prepared.[14] In 2014, the DAC program engaged two consultants to 1) conduct a baseline survey of farmer knowledge of pests, diseases, and pesticide use (*Results of Pesticide Use Baseline*, 2014) and; 2) to evaluate the completeness and effectiveness of the DAC program's pesticide safer use program, develop guidelines for safer use, train staff, develop a management plan, and develop templates and documentation to demonstrate compliance with USAID guidelines (*Pesticide Safety & Recordkeeping Don Humpal Deliverables Report,* July, 2014, referred to as the 'Humpal Report'). The findings from these reports are presented in the subsequent sections of this PERSUAP.

2.3. Pesticide Policy, Regulation, and Capacity

2.3.1. National Policy

In June 2015, Avansa Ag staff met with the National Director of Agriculture and Horticulture at MAF, Amaro Ximenes, to discuss pesticide policy and regulation in Timor-Leste. He stated that a draft pesticide law had been drafted in 2011, but had not been approved yet. He had not seen or reviewed it and did not believe that he could obtain a copy for us (an English translation of the law was later obtained from another office and is located in Appendix 11). Since the law has not been promulgated, there are no other laws or regulations directly governing pesticide registration, use, or import.

The draft pesticide law (Appendix PL) covers the following topics:

- Chapter 1- Definitions and exclusions
- Chapter 2- Pesticide registration and board
- Chapter 3- Pesticide control, labeling, and registration
- Chapter 4- Licensing of dealers
- Chapter 5- Prohibited pesticides
- Chapter 6- Specific rules on storage, distribution, labeling, containers, employee safety, fines
- Chapter 7- Ministry authorities and inspectors

[13] Avansa: Integrated Food Security, Climate Change Adaptation, and Private Sector Competitiveness solicitation, August 2014

[14] Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014

> Chapter 8- Cancellation and implementation

The annex of the draft law contains a list of proposed banned pesticides based on the 2000-2002 WHO list, which recommends banning all pesticides considered obsolete by WHO or fall in the Risk Classes Ia and Ib. Some class II pesticides were included if they are particularly toxic, although that is partially dependent on the formulation.

The ministry that oversees import quarantines does have some authority to stop illegal or problematic chemical use, but the MAF currently does not have any authority. MAF did maintain a short list of banned pesticides based on problems they had experienced and has recently been expanded with a list provided by FAO. Import companies can request a letter of authorization from MAF to import or use pesticides in Timor-Leste, but absent of regulation or laws, MAF has no legal authority to enforce or prevent importation or use of banned pesticides.

2.3.2. International Conventions and Policies

There are several international conventions and protocols regarding environmental issues, including pesticides. For example, Timor-Leste has signed the Kyoto Protocol regarding climate change, and has submitted a national assessment of greenhouse gas emissions. However, Timor-Leste is one of the few Asian countries that has not signed any of the international treaties or protocols on pesticide use or transport. International conventions or protocols related to pesticides include the following:

> Stockholm Convention on Persistent Organic Pollutant (POPs)
> Rotterdam Convention on Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides
> Basel Convention on the Control of Transboundry Movement of Hazardous Wastes and their Disposal
> Montreal Protocol on Substances Depleting Ozone Layer (methyl bromide)

The pesticides covered by the conventions and protocols and banned in other Asian countries are listed in Annex 6.

Timor-Leste is a member of the Asia and Pacific Plant Protection Commission, which has several committees on plant protection, plant quarantine, pest management, and pesticide management. The commission administers the intergovernmental Plant Protection Agreement and is supported by the FAO.[15] The pesticide management committee has had workshops and publications on topics including[16]:

> Advancement of pesticide regulatory management in Asia
> International code of conduct on pesticide management
> Pesticide risk assessment and phasing out of highly hazardous pesticides in Asia
> Pesticide registration toolkit development

Based on a review of online reports and documents, Timor-Leste has not been participating in the committee.

[15] http://www.apppc.org/node/1110810
[16] http://www.apppc.org/node/1110931

2.3.3. National Capacity

National capacity to develop and enforce regulations and manage pesticides is limited. As described in the Humpal Report[17]:

> "DAC's existing safer use program is still developing from an extremely low base of domestic legal, institutional, and technical capacity. There is no pesticide law in Timor-Leste. Knowledge and experience of crop protection products, whether organic, biological, or synthetic is extremely low throughout the agricultural value chains in Timor-Leste. Academic training in crop protection and Integrated Pest Management is almost entirely theoretical, very basic, and out of date. Donor and NGO activities have supported some pest management and IPM training, along with some biological control research. The organic chemistry and biochemistry capacity needed to regulate crop protection products seems to be almost completely absent. The consultant could find no evidence of a laboratory at UNTL with the equipment, reagents, and staff needed to perform analysis of botanical or synthetic active ingredients. There is no standards laboratory in TL, and the public health laboratory does not have the capacity to monitor organophosphate depression of blood cholinesterase levels or to do pesticide residue analysis.
>
> Timor-Leste is a very small country with a small revenue base. Most public service and governance systems were severely disrupted or destroyed by war, and the country is still literally in its early phases of rebuilding. Its priorities and expenditure are on basic infrastructure and services (water supply, roads, communication, power, basic health, basic education). The small size of its market and high costs of importation means that it has adopted a general policy of low barriers (few regulatory requirements, low import duties and VAT) to entry of all goods and services in order to improve people's access to them. Human resources and facilities in science and technology are at a very low level, greatly reducing the capacity of the national government to enact laws and regulations and enforce them, especially for technologically complex goods and services. There is no specific de jure government policy and regulation of crop protection products, fertilizer, or seed beyond the general commercial code. Phytosanitary protocols on living organisms are reported by DAC to impose substantial delays or destruction of rooted or bare-root plants or cutting materials.
>
> De facto government policy defaults necessarily to the importation of agricultural chemicals primarily from Indonesia, regardless of their source. The costs of a full agricultural chemical body of law and enforcement structure appear to be too high for TL. Selective borrowing of regulatory services or partnering with regional regulators and service providers will be needed for many years. The TL Standards Office estimates that 70% of all chemicals imported of all categories (cleaning and sanitation, industrial, and agricultural) come from Indonesia. These are treated in commercial law the same as any other traded product. The Standards Office first priority is to build a core of inspectors with the skills needed to handle

[17] Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014

basic mensuration – weights and measures enforcement – through collaboration via an MOU with the Indonesia Standards Bureau. The Standards Agency has no fundamental enabling legislation, only indirect legal authority to, and a laboratory structure that awaits training of staff, an operating and development budget, etc. First priority is appropriately on weights and measures.

Timorese academic and extension capacity in pest and disease diagnosis, management options, IPM is low. There is reportedly one entomologist at the UNTL, or at least a professor who is known as the primary instructor on pest/disease issues. However, DAC staff was unable to contact him via the UNTL or personal networks. US (University of Hawaii), Australian, and Indonesian universities and research centers have done some IPM projects with the TL Ministry of Agriculture and the UNTL. The University of Hawaii Program ended years ago. There are some Timorese in training throughout the region, but they will not be available to DAC before the project closes.

The TL Public Health system has no poison identification and treatment system, beyond that obtained by doctors and nurses in their training. Chemical poisoning is handled by moving the patient up the treatment facility hierarchy to the point that it can be treated or the patient is sent abroad. There is no national poison center, and the Indonesian National Poison Center and manufacturer poison hotlines have no obligation to respond to calls from TL. The chronic effects of organophosphate and carbamate pesticide exposure cannot currently be measured in country (e.g. blood cholinesterase levels in handlers and applicators of organophosphates and carbamates). This is not unusual in small developing countries without a commercial farming export sector that is required by its buyers to monitor cholinesterase enzyme levels in its employees."

2.4. Timor-Leste Pesticide Sector

Pesticide availability and application in Timor-Leste: In most emerging market countries such as Timor-Leste, pesticides have been used for several decades. Pesticide application has become an important means in dealing with pest and disease control in agriculture and other fields such as household use, quarantine, fishery, wood preservative, pre-shipment, stored products and so on. Unlike other more developed countries, however, the economic situation and instability in Timor-Leste has limited the historic availability and use of pesticides. For example, the most important commercial crop, coffee, has largely been produced organically due to economic reasons and limited availability of pesticides rather than to obtain certification. As stability and prosperity has increased, access and availability to synthetic pesticides has increased over the past 15 years.

A wide range of pesticides are now available at several agricultural suppliers in Timor-Leste, mainly in Dili. Pesticide availability in rural areas is much more limited. As background research for this report, most of the pesticide shops in Dili were visited in June 2015 including Nilton, Sarafim, Balide, Bemori, RD, and Jupiter (Annex 1). The MAF also distributes 18 pesticides (Table 2). About 120 active ingredients in pesticides were identified in Timor-Leste, with the number of pesticide brands being considerably higher as there were often several brands or formulations available for each active ingredient (Annex 1).

Table 2: Pesticides Distributed by the Ministry of Agriculture and Fisheries as of June 2015

(Criteria for approval for Avansa Ag and USEPA registered status are described in detail under Factor A and E in Section 3).

Active ingredient	Use	Chemical type	Product Name	Approved for Avansa	USEPA Registered
2,4-D	Herbicide	Phenoxy-carboxylic-acid (synthetic auxin)	DMA6 825 SL	Depends	Yes
Bacillus thuringiensis	Insecticide	Biological	Dipel DF	Yes	Yes
Beta-Cyfluthrin	Insecticide	Pyrethroid	Buldok 25 EC	Depends	Yes
BPMC	Insecticide	N-Methyl Carbamate	Emcindo 500 Ec	No	No
Brodifacoum	Rotentcide	Coumarin	Klera RMB	No	Yes
Carbaryl	Insecticide	Carbamates	Sevin 85 WP	No	Yes
Carbofuran	Insecticide, Nematicide	Carbamates	Furadan 3 GR	No	Yes
Chlorothalonil	Fungicide	Chloronitriles	Daconil 75 WP	No	Yes
Dimethoate	Insecticide, Miticide	Organophosphates	Kanon 400 EC	No	Yes
Dimethyl-amine Salt	Herbicide	Amine	DMA6	Depends	Yes
Fenobucarb (BPMC)	Insecticide	Carbamates	Dharmabas 500 EC	No	No
Fenobucarb (BPMC)	Insecticide	Carbamates	BASSA 500 EC	No	No
Glyphosate	Herbicide	Glycine	Roundup 486 SL	Yes	Yes
Mancozeb	Fungicide	Dithio-carbamates	Dithane M-45 80 WP	Yes	Yes
Mancozeb	Fungiside	Dithio-carbamates	Bazoka	Yes	Yes
Mefenoxam	Fungiside	Xylylalanine	Ridomil goldMZ	No	Yes
Unknown	Insecticide		Keong Tox	No	Unknown
Unknown	Herbicide		Polando 240/105AS	No	Unknown

Many of the pesticides available in Timor-Leste are imported from Indonesia or China, and about one-third have active ingredients that are not registered with the USEPA. It was expected that most of the active ingredients in pesticides available in Timor-Leste would also be on the list of 143 active ingredients from pesticides available in Indonesia, as listed in the Indonesian PERSUAP (Annex 10), but more than half of the active ingredients in Timor-Leste (72) were not on the Indonesian list. This is likely an indication of how large and fluid the pesticide market is. Both the list of pesticides included in this PERSUAP and those in the Indonesian PERSUAP likely under-represent the full range of pesticides available and necessarily represent a snapshot of availability at the time the PERSUAP was prepared.

Information at agricultural suppliers regarding appropriate pesticide choice, application, and safe use practices was usually very limited. PPE equipment and instruction was also very limited. When MAF officials were questioned about their pesticide use and distribution, they indicated that MAF does distribute certain pesticides (Table 2), and that they also provided training and guidelines on safe handling and application. When this information was requested at that meeting and via subsequent requests, MAF could not produce any materials.

The Humpal Report[18] summarizes the findings of the pesticide baseline review conducted in Timor-Leste in 2014:

> The *Preliminary Results of Pesticide Use Baseline* of 71 farmers (70% men; 30% women) shows variable and often low knowledge of pests, diseases and agro-chemicals. On the positive side a big majority of farmers (73%) do simple scouting and adopt a no-pest, no-spray policy. Equally positively, all (100%) of farmers surveyed who use synthetic pesticides follow the recommended intervals between pesticide application and crop harvest. However, 73% of farmers applying synthetic pesticides noted some illness (headaches, nausea, and dizziness) at some time from pesticide use, with 42% wearing no PPE and under 5% wearing fully-recommended PPE. Use of some PPE to protect the hands (27%) and the face (26%) are also low. Post-survey field visits by this consultant and senior DAC staff directly confirmed the low farmer awareness of the need to wear PPE while measuring and mixing concentrated pesticides of any type. Wearing PPE during measuring and mixing would immediately reduce exposure to the most concentrated forms of all pesticides and other farm chemicals and should substantially reduce the incidence of illness. In terms of the types of pesticides used, respondents indicated that about 55% use homemade botanical extracts, 42% use biological/microbial pesticides, and 79% use synthetic pesticides, fungicides, and herbicides. Over 12% report using only homemade botanical extracts as pesticides. The remaining farmers surveyed use a mix of botanicals, biological, and synthetic crop protection products. This is a generally positive sign for the potential to select for lower toxicity pesticides for use and to introduce and use rotation of modes of action to reduce the build-up of pest resistance.
>
> On the negative side, there is a high reliance on organophosphates and carbamates for insect pest control. This is not unexpected because of the regional and worldwide difficulties encountered in managing lepidopteran pests on brassica/cole crops. These include some of the crops most preferred by farmers (Chinese cabbage and round cabbage) and most demanded by buyers (broccoli/cauliflower).
>
> Organophosphates and carbamates have high and fast effect on lepidopteran and other insect pests when treated in a timely and accurate manner. However, these active ingredients also suppress beneficial insects and chronic human exposure can lead to depressed blood cholinesterase levels of this enzyme that is essential to nervous system function. A few of the organophosphates for sale in Timor that are registered in Indonesia for general use are Class I toxicity chemicals that should not be used by smallholders. Others are of lower human toxicity but substantial environmental toxicity that are classified as Restricted Use Pesticides (RUPs) in the USA. Under USEPA rules only certified pesticide handlers and applicators can apply RUPs in the USA. There are no certified pesticide handlers and applicators in Timor-Leste.

[18] Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014

One chemical Curacron (profenofos) is widely used and DAC should focus on reducing its use and mitigating the risks of its use. Curacron is an organo-phosphate insecticide and acaricide. It has been used widely throughout SE Asia and Australia for several years. While it is of Class II Toxicity to humans it is extremely toxic to fish and wildlife. Therefore, it has been designated by USEPA as a RUP in the United States. Over 50% of vegetable farmers who were surveyed in TL use Curacron, because of its fast-acting knock-down of major insect infestations. As with many other organophosphates, it also kills many beneficial arthropods that predate crop pests.

Field work during this assignment with DAC senior staff showed that there was low and variable safe pesticide use knowledge and skills among farmers, agricultural input dealers, and agricultural field staff. There was generally: low capacity to translate and use label instructions beyond their most basic use for dosage; no data on application equipment performance; no experience in equipment calibration; a low awareness of PPE and practical alternatives; very low familiarity with Label and Material Safety Data Sheet (MSDS) information; and little knowledge of pest resistance management.

Farmers do not fully read or understand labels or icons. Most labels are in either Bahasa Indonesia or English. The older generation of farmers understands Bahasa Indonesia, but many younger farmers do not. English language skills are very limited.

3. Pesticide Evaluation Report (PER)

Reg. 216.3(b)(1)(i) stipulates: "When a project includes assistance for procurement or use, or both, of pesticides registered for the same or similar uses by USEPA without restriction, the Initial Environmental Examination for the project shall include a separate section evaluating the economic, social and environmental risks and benefits of the planned pesticide use to determine whether the use may result in significant environmental impact. Factors to be considered in such an evaluation shall include, but not be limited to the following:" (see text box)

The 12 Pesticide Factors

Factor A. USEPA Registration Status of the Proposed Pesticides

Factor B. Basis for Selection of Pesticides

Factor C. Extent to which the proposed pesticide use is, or could be, part of an IPM program

Factor D. Proposed method or methods of application, including the availability of application and safety equipment

Factor E. Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use, and measures available to minimize such hazards

Factor F. Effectiveness of the requested pesticide for the proposed use

Factor G. Compatibility of the proposed pesticide use with target and non-target ecosystems

Factor H. Conditions under which the pesticide is to be used, including climate, geography, hydrology, and soils

Factor I. Availability of other pesticides or non-chemical control methods

Factor J. Host country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide

Factor K. Provision for training of users and applicators.

Factor L. Provision made for monitoring the use and effectiveness of each pesticide.

The PERSUAP can recommend or propose pesticides to replace those that are commonly used that are rejected, but the job of recommending pesticides for specific uses is typically done by the agricultural supplier in Timor-Leste; there often is little or no technical advice available to small landholders. MAF also supplies pesticides and provides limited extension support (Table 2). Annex 2 describes IPM plans for various crops, including *possible* pesticides choices that might be used after all other options are exhausted (most IPM information comes from the USA and other developed countries, but was adapted for Timor-Leste where possible). A PERSUAP should not replace local best available science, although that is in limited supply in Timor-Leste.

It would be ideal to find pesticides for every need that are Class IV acute toxicity (i.e. low toxicity), have no chronic human health issues, no water pollution issues, and no aquatic ecotoxicity issues. Such pesticides do not exist. Most pesticides, including "natural" pesticides, have toxicity to one or more non-target organisms. This PESUAP identifies IPM techniques for the different crop types included in the Avansa Ag project; it rejects the use of non-USEPA approved pesticides, provides lists the pesticides approved for use on Avansa Ag, recommends the least toxic alternative in the context of IPM for each proposed technology packet, and describes safe-use practices in the SUAP portion of the PERSUAP.

3.1. Factor A: USEPA Registration Status of the Proposed Pesticide

USAID activities are limited to promoting, recommending, buying, subsidizing, financing, or permitting pesticides that contain the same active ingredients (AIs) as products registered by the USEPA for the same or *similar* uses. Emphasis is placed on "similar use" because often the crops and their pest species found overseas are not present in the US, and therefore pesticides

may not be registered for the exact same use, but often are registered for similar crops, pests, methods of application, and pest situations.

The USEPA classifies pesticides according to actual toxicity of the formulated products, taking formulation types and concentrations into account, thus generally making the formulated product less toxic than the active ingredients alone would be. This method of classifying acute toxicity is accurate and representative of actual risks encountered in the field. By contrast, the WHO acute toxicity classification system is based on the active ingredient only. For a comparison of USEPA and WHO acute toxicity classification systems, see Annex 3.

In the USA, some specific commercial pesticide products are labeled as Restricted Use Pesticides (RUPs) due to inordinate risks, usually under specific circumstances of use, such as formulation or crop. However, for each AI, which may be present in a number of RUP products, there are generally additional or other products, formulations and uses—with the exact same AI— that do not possess the same risks and are thus labeled or determined to be General Use Pesticides rather than a RUP. Ergo, for each AI, there may be RUP and non-RUP products depending upon USEPA's evaluation of the risk. Only pesticide formulations or their equivalents that do not have RUP status are approved for use on the Avansa Ag project.

Annex 1 provides USEPA registration status for each AI found in pesticides that are available in Timor-Leste. Pesticides available in Indonesia are listed in Annex 10 since many pesticides imported into Timor-Leste come from Indonesia and there is little or no oversight over the importation or use of pesticides in Timor-Leste. The list of pesticides from Indonesia has not been reviewed or updated since it was developed in 2013, so pesticides approved for use under the Indonesian PESUAP are not approved for use in Timor-Leste without additional review.

The column in Annex 1 labeled "USEPA Registered" has a "yes" if the AI is registered by USEPA in pesticides for same or similar uses. If the column has a "no" it is not registered by USEPA and is it is not approved for use on the Avansa Ag project. Pesticide AIs that pass this registration factor, and all following pertinent factor analyses, are given a "Yes" in the 'Approved for Avansa' column.

Table 3 lists the AIs available in Timor-Leste that are not USEPA registered indicating that they are NOT approved for use on the Avansa Ag project.

Table 3: Pesticide AIs that are not registered by the USEPA and are not approved for use on the Avansa Ag project

Active Ingredient	Use Type	Chemical Class	Brand names	Availability
Alkylaryl polyglycol ether; BASF	Surfactant		Agristick 400 L, Agristech 200, Citowett 105 AS	Balide
Bensultap	Insecticides	Nereistoxin	Bancol50 WP	Nilton
BPMC (fenobucarb)	Insecticides	N-Methyl Carbamate	Baycarb 500 EC,Benhur 500 EC, Dham1abas 500 EC, Emcindo 500 EC, Hopcin 50 EC, Karbasin 500 EC, Pentacarb 500 EC, Sidaba 500 EC, Dharmabas 500 EC, BASSA 500 EC, Baycarb 500 EC, Pharmabas 500 EC	Serafim, Bemori, MAF List
Bupirimate	Fungicides	Pyrimidine	1\limrod 250 EC	Nilton
Cadusafos	Insecticides	organophosphorus	Rugby 10 G	Nilton

Active Ingredient	Use Type	Chemical Class	Brand names	Availability
Cartap hydrochloride	Insecticides	Nereistoxin	Karda n 50 SP, Padan 50 SP	Nilton
Coumatetralyl	Rodenticide	Coumarin	Racumin	Nilton
Cypermethrin	Insecticides	Pyrethroid	Arrive 30 EC, Arfo 30 EC, Astertrin 250 EC, Basma 200 EC, Bestox 50 EC Bravo 50 EC, Crowen 113 EC, Cyrux 50 EC, Cypermax 100 EC, Exocet 50 EC, Hoky 30 EC, Mere! 30 EC, Nurelle D 500/50 EC, Pelle 50 EC, Ripcord 5 EC, Rizotin 100 EC, Rizotin 40 WP, Sancord SO EC, Sidamethrin 50 EC, Yasithrin 30 EC, Sidametrin 50 EC,	Serafim, Bemori, Balide
Cypermethrin, Alpha	Insecticides	Pyrethroid	Amethyst 40 EC, Army Bestox 50 EC Cyborg 15 EC Fastac 15 EC Kejora 15 EC, Fastac 15 EC	Balide, Bemori
Diafenthiuron	Insecticides	Unclassified	Pegasus 500 SC	Nilton
Dimehypo, Imidacloprid	Insecticide/ Fungicide	Organophosphate	Bajaj 450 VvSC, Manuver 400 WSC Spontan 400 WSC Vista 400 WSC, Hippo 48WP	Serafim
Endosulfan	Insecticides	Cyclodiene Organochlorines	Akodan 350	Serafim
Epoxiconazole	Fungicides	triazole	Opus 75 EC	Nilton
Fenthion	Insecticides	Organophosphorus	Lebaycid 400 EC	Nilton
Fentin acetate	Insecticides	Microbial	Oebesttan 60 WP	Nilton
Fenvalerate	Insecticides	Pyrethroid	Fenkill 200 EC, Sidin 50 EC	Nilton
flufenoxuron	Insecticides	Benzoylurea	Cascade 50 EC	Nilton
Flusilazole	Fungicides	Azole	Nustar 400 EC	Nilton
Hexaconazole	Fungicides	Azole	Anvi l 50 SC, Danvil 50 SC, Heksa 50 SC	Nilton
iminoctadine tris	Fungicides	Guanidine	Belkute 40 WP	Nilton
Iprovalicarb	Fungicides	carbamate	Melody Duo 66,8 WP	Nilton
Kasugamycin hydrochloride	Bacteriside	Antiobiotic	Kasumin 5/75 WP	Nilton
Lufenuron	Insecticides	Benzoylurea	Match 50 EC	Nilton
Mevinphos	Insecticides	Organophosphate	EM4	Jupiter
MIPC (isoprocarb)	Insecticides	N-Methyl Carbamate	Ancin 50 WP, Mipcinta 50 WP, Mipcenta 50 MP	Bemori
Niclosamide	Molluscicide	Salicylanilide	Kensida 70 WP	Serafim
Oxyanion sulfate	Fungicides	Oxyanions	Kuproxat 345 F	Nilton
Paraffin HVI 650	Surfactant	Petroleum Derivative	Tenac Sticker	Nilton
Phenthoate	Insecticides	Organophosphorus	Elsan 60 EC	Nilton
Propineb	Fungicides	Dithiocarbamate Zn	Antracol 70 NP, Aurora 70 WP, Supracol 70 WP	Serafim
Phoxim	Insecticides	Organophosphorus	Catleya 500 EC, Fokker 500 EC, Destan 400 EC	Nilton

Active Ingredient	Use Type	Chemical Class	Brand names	Availability
Sodium Nitrophenoxide	Growth	Nitro Phenols	Atonik 6,5 L	Serafim, Balide, Jupiter
Triazophos	Insecticides	Organophosphorus	Raydent 200 EC	Balide
Validamycin a	Fungicides	Antibiotic	Validacin 3 AS	Nilton
Benomyl (benlate)	Fungicides	Benzimidazole	Benlok. 50 WP, Benstar 50 WP, Masalgin 50 WP	Nilton

3.1.1. Safer Use Actions/Risk Mitigation

- The monitoring plan described in the SUAP will include monitoring criteria to ensure that only PERSUAP-approved pesticides are used on the Avansa Ag project.
- Grantees financed by the Avansa Ag project should be mandated to certify in writing that only PERSUAP approved pesticides will be purchased or used with loan money.
- If the Avansa Ag project wishes to authorize the support of or use any non-USEPA registered or RUP product, including use on any demonstration farm, then an Environmental Assessment (EA) must be completed and approved by the Bureau for Asia BEO prior to use.
- The Avansa Ag PERSUAP will be reviewed annually and updated in Year 3 of the Project.

3.2. Factor B: Basis for Selection of Pesticides

This factor refers to the practical, economic, and environmental rationales for choosing a particular pesticide. USAID promotes IPM as policy, which dictates that the *least toxic* pesticide that is effective be used when feasible. Fortunately, the more toxic pesticides (Class I) are decreasing in number worldwide and the number of least toxic pesticides (Class IV) is increasing. Thus, farmers may be able to choose products of lower toxicity (Class III and IV/U pesticides), especially when appropriate personal protective equipment (PPE) is not available or used properly (See Annex 3 for details on USEPA and WHO toxicity classes).

Farmers often choose pesticides based upon price, availability, and anecdotal efficacy (their belief about how effective the pesticide is), and recommendations from neighbors or agricultural suppliers. This PERSUAP, however, uses additional criteria for selection of pesticides based upon safety and acute toxicity ratings, chronic toxicity issues, groundwater safety and relative ecotoxicological safety.

Pesticides selected for use through the development of this PERSUAP for the Avansa Ag project went through a multiple-tiered screening process. First, a list of pesticides available in Timor-Leste was compiled based on visits to local suppliers, experience on previous projects, interviews with farmers, and MAF representatives. Second, the pesticides were screened and those that were not registered with the USEPA (Factor A), had RUP designation, or had other acute toxicity or other health concerns (Factor E criteria, see below) were eliminated from the list. Third, IPM plans were developed for the different crops promoted through Avansa Ag with non-pesticide treatments, natural controls, and the least toxic pesticides prioritized. Finally, the SUAP portion of the PERSUAP was developed to promote safe use of the pesticides approved for use on the Avansa Ag project.

The FAO/WHO Joint Meeting on Pesticide Management formulated the following draft identification criteria for highly hazardous pesticides[19]:

- Pesticide formulations that meet the criteria of classes IA or IB of the **WHO Recommended Classification of Pesticides by Hazard**; or
- Pesticide active ingredients and their formulations that meet the criteria of **carcinogenicity Categories 1A and 1B of the Globally Harmonized System** on Classification and Labelling of Chemicals (GHS); or
- Pesticide active ingredients and their formulations that meet the criteria of **mutagenicity**
- **Categories 1A and 1B of the GHS**; or
- Pesticide active ingredients and their formulations that meet the criteria of **reproductive toxicity Categories 1A and 1B of the GHS**; or
- Pesticide active ingredients listed by the **Stockholm Convention** in its Annexes A and B, and those meeting all the criteria in paragraph 1 of annex D of the Convention (POPs);
- Pesticide active ingredients and formulations listed by the **Rotterdam Convention** in its Annex III (PICs); or
- Pesticides listed under the **Montreal Protocol**; or
- Pesticide active ingredients and formulations that have shown a high incidence of severe or irreversible adverse effects on human health or the environment.

The selection of pesticides approved for use on the Avansa Ag project went through a similar screening process as recommended above:

1. A list of pesticides commonly available in Timor-Leste was compiled
2. Pesticides not registered with USEPA were removed
3. Pesticides on the proposed list of prohibited pesticides in the Draft Law of Pesticides for Timor-Leste (2011) were removed
4. Pesticides formulations that meet the WHO hazard classes of Ia and Ib or USEPA toxicity class I were removed
5. Pesticides listed under the Stockholm and Rotterdam Conventions and the Montreal Protocol were removed
6. Pesticides listed as restricted use pesticides (RUP) with the USEPA were reviewed for utility in the program, only non-RUP formulations or their equivalents were allowed
7. Pesticides that had multiple additional toxicity factors such carcinogen, cholinesterase inhibitor, or developmental or reproductive toxin, or endocrine disruptors as listed on the Pesticide Action Network assessment[20] were removed
8. As part of the IPM recommendations, pesticide use was prioritized to use least-hazardous options first

[19] Progress in Pesticide Risk Assessment and Phasing-Out of Highly Hazardous Pesticides in Asia. FAO RAP Publication 2015/01. http://www.apppc.org/content/progress-pesticide-risk-assessment-and-phasing-out-highly-hazardous-pesticides-asia

[20] http://www.pesticideinfo.org/Search_Chemicals.jsp

Information on GHS carcinogenicity, mutagenicity, and reproductive toxicity was limited and was not used as selection criteria. The Pesticide Action Network assessment of carcinogens, cholinesterase inhibitor, or developmental or reproductive toxin, or endocrine disruptor risks was used instead to identify pesticides with multiple toxicity issues. Three pesticides were rejected on this basis: Carbaryl (carcinogen, cholineasterase inhibitor, reproductive toxin, also a RUP), Dimethoate (toxicity, cholinesterase inhibitor, reproductive toxin), and Thiodicarb (carcinogen, cholinesterase inhibitor, also a RUP). The proposed list of prohibited pesticides in the draft Law of Pesticides included PIC, POP, and Montreal protocol chemicals, along with WHO class Ia and Ib pesticides, so some redundancy occurred in the screening process.

Almost every pesticide known, including most "natural" pesticides, have varying levels of toxicity to one or more non-target organisms. Ecotoxicity ratings for most pesticides are listed in the table in Appendix 1 and information on natural alternative is available in Annex 5, with toxicity information. Most also have some chronic human health issues. IPM and prioritization of less-toxic alternatives along with mitigation measures allow these pesticides to be used with reduced risks to human health and the environment.

3.2.1. Safer Use Actions/Risk Mitigation

For hazardous pesticides, follow the recommendations of the recommendations in the International Code of Conduct on Pesticide Management by FAO and WHO[21]:

- 3.6 Pesticides whose handling and application require the use of personal protective equipment that is uncomfortable, expensive or not readily available should be avoided, especially in the case of small-scale users and farm workers in hot climates.
- 7.5 Prohibition of the importation, distribution, sale and purchase of highly hazardous pesticides may be considered if, based on risk assessment, risk mitigation measures or good marketing practices are insufficient to ensure that the product can be handled without unacceptable risk to humans and the environment.
- 9.4 All entities addressed by this Code should:
    - 9.4.1 support the process of information exchange and facilitate access to information on matters including pesticide hazards and risks, residues in food, drinking water and the environment, the use of pesticides in or on non-food products, IPM/IVM, pesticide efficacy, alternatives to highly hazardous pesticides and related regulatory and policy actions;
- The Avansa Ag project encourages use of pesticides with the lowest human and environmental risk profiles (based on this document, MSDSs, and pesticide labels), as practical.
- Encourage the GOTL to pass the Law of Pesticides and increase regulation of or ban Class Ia and Ib pesticides and promote less toxic alternatives.
- Provide educational materials, training, and appropriate PPE for pesticide use at demonstration farms, agricultural suppliers, and directly to Avansa Ag farmers.

[21] http://www.apppc.org/node/2187873

3.3. Factor C: Extent to Which the Proposed Pesticide Use Is, Or Could Be, Part of an IPM Program

USAID promotes training in and the development and use of integrated approaches to pest management tools and tactics whenever possible. This section emphasizes how any of the approved pesticides can be incorporated into an overall IPM strategy, as the ultimate pest control tools, following exhaustion of all preventive tools and tactics.

Some of the approved pesticides are more useful and gentler on the environment than others; Annex 1 shows relative toxicities of each pesticide AI. In general, most of the natural products and extracts are less disruptive to the ecosystem (Annex 5). However, most agricultural production does not rely solely on the use of natural pesticides and pest control methods unless it is certified as Organic.

Good crop management practices can strongly affect the success of IPM, and good agronomic or cultural practices are the most basic and often the most important prerequisites for an effective IPM program. A healthy and vigorous crop optimizes both capacity to prevent or tolerate pest damage while maintaining or increasing yield potential.

In the USA, the USDA supports several programs aimed at investigating and developing IPM tools and tactics. These include the National Institute of Food and Agriculture[22] (NIFA) and the National Sustainable Agriculture Information Service of the National Center for Appropriate Technology[23] (NCAT).

According to IPM best practices (Annex 4), pesticides use is reduced when used in combination with other IPM preventive tools, as follows:

- Soil quality and nutrition testing
- Resistant plant varieties
- Certified seed
- Seed treatment
- Soil solarization (heating under plastic with direct sun heat)
- Raised-bed production
- Use of plastic and organic mulches
- Proper seeding/thinning rate
- Soil moisture testing
- Organic fertilizers/compost
- Synthetic fertilizers
- Crop rotation
- Green manures
- Manipulate plant/harvest time
- Trap crops

[22] http://www.csrees.usda.gov/pesticides.cfm

[23] http://www.attra.ncat.org/

- Pruning
- Farmscaping
- Correct pest/disease ID
- Weekly monitoring
- Baited traps
- Sticky traps
- Pheromone traps
- Pheromone inundation
- Crop residue destruction
- Artisanal (homemade) pesticides
- Conservation practices
- Mechanical weeding
- Spot pesticide treatments
- Production of natural microbial pesticides (Annex 5).

Annex 2 contains a detailed Crop-Pest-IPM- Pesticide matrix for each crop to be grown by Avansa Ag-assisted farmers, noting most major pests of each crop, a list of preventive tools and tactics, and a list of natural and synthetic chemical alternatives primarily based on recommended by leading IPM resources.

IPM philosophy includes the use of synthetic pesticides as part and parcel of an overall harmonized and coordinated approach to pest management (Annex 4). The principles of IPM were initially developed by entomologists for farmers and users of insecticides, miticides, nematicides and molluscicides—because all of these chemicals impact animal biochemical pathways and are thus capable of harming other animals and beneficial animals if used unwisely or over-used. Thus, the most intense focus of traditional IPM is on these types of organisms and chemicals.

3.3.1. Safer Use Actions/Mitigation

- Pesticide Safer Use training required under this PERSUAP will include IPM principles as well as crop- or pest-specific IPM practices relevant to the audience. (See Annex 2 and 4).
- Starting from the information in PERSUAP Annex 1, 2, and 4, the Avansa Ag project will develop activity-specific IPM-based management plans [24]. Chemical controls specified in these plans will prioritize low-toxicity options.
- Posters and informational handouts will be developed for on-farm use in prediction and management of the major pests of each crop.
- Avansa Ag staff will train appropriate project staff, partners, and beneficiaries on IPM and least-hazardous pesticide use.

[24] http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html, see "Year-Round IPM Programs" on upper left side of website

- The Avansa Ag project will require and enforce IPM implementation in situations where the project has direct control over pesticide use, and require and enforce that field extension under direct project control be IPM-based.
- Where project control over extension or agricultural practice on the ground is less than complete, Avansa Ag will promote and support IPM to the greatest practicable extent.

3.4. Factor D: Proposed Method or Methods of Application, Including the Availability of Application and Safety Equipment

This section examines how the pesticides are to be applied. It explains specific risks with different application equipment available and application methodologies and the measures to be taken to ensure safe use for each application type. Pesticides can and do enter the body on the hands, skin or eyes through various ways. It can get on ones back, arms and hands from leaky backpack sprayers when spraying, through the nose and mouth as vapors while spraying and from spray drift and by mouth from ingestion on food or cigarettes.

The availability, training, and use of safety equipment in Timor-Leste is very limited. Availability of appropriate PPE is also limited and costly, but lower-cost and more available equipment can be substituted to provide some protection.

The survey of farmers conducted for the USAID DAC project in 2014 found that:

> 73% of farmers applying synthetic pesticides noted some illness (headaches, nausea, and dizziness) at some time from pesticide use, with 42% wearing no PPE and under 5% wearing fully-recommended PPE. Use of some PPE to protect the hands (27%) and the face (26%) are also low. Post-survey field visits by this consultant and senior DAC staff directly confirmed the low farmer awareness of the need to wear PPE while measuring and mixing concentrated pesticides of any type. Wearing PPE during measuring and mixing would immediately reduce exposure to the most concentrated forms of all pesticides and other farm chemicals and should substantially reduce the incidence of illness.[25]

Most small landowners do not receive any training on the safe application or hazards associated with pesticide use. In some cases, pesticides may be repackaged and sold in different containers without the appropriate labeling or warnings.

> Field work during this assignment with DAC senior staff showed that there was low and variable safe pesticide use knowledge and skills among farmers, agricultural input dealers, and agricultural field staff. There was generally low capacity to translate and use label instructions beyond their most basic use for dosage; no data on application equipment performance; no experience in equipment calibration; a low awareness of PPE and practical alternatives; very low familiarity with Label and Material Safety Data Sheet (MSDS) information; and little knowledge of pest resistance management. Farmers do not fully read or understand labels or icons. Most labels are in either Bahasa Indonesia or English.

[25] Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014

> The older generation of farmers understands Bahasa Indonesia, but many younger farmers do not. English language skills are very limited.[26]

The majority of pesticide application in Timor-Leste is by hand or with backpack sprayers. Both methods of application have attendant risks.

Many farmers that use pesticides formulated as granules or powders apply these by hand, without benefit of gloves. Gloves must be used for these applications.

Hand-pump backpack sprayers, used by small- and medium- scale farmers, among others, can and do eventually develop leaks at almost every parts junction (filler cap, pump handle entry, exit hose attachment, lance attachment to the hose and at the lance handle) and these leaks soak into exposed skin. Moreover, clothing serves as a wick that holds these pesticides in constant contact with the skin. Unless the clothes are washed immediately after use, other family members may also come in contact with pesticide residuals. Safe handling and accurate measuring of crop protection products to mix the spray solution is the first most important point where reduction of physical exposure to the skin, ingestion from the skin, or inhalation can be achieved in the short-term.

3.4.1. Safer Use Actions/ Mitigation

- The Avansa Ag project, during the pesticide safer use training required by this PERSUAP, will 1) promote and teach proper sprayer maintenance and repair; and 2) train participants on post-spray hygiene.
- Where pesticide use is under their direct control, Avansa Ag will assure that appropriate PPE is provided, is well maintained, and properly utilized. This includes the use of gloves for granular applications.
- Where pesticide use is not under project direct control, but the project is nonetheless supplying or directly supporting the purchase of pesticides or application equipment, Avansa Ag will assure that appropriate PPE is available at demonstration farms or from agricultural suppliers and undertake all feasible measures to promote its use.
- Avansa Ag will assure and require well-maintained sprayers and proper post-spray hygiene and facilities for pesticide use under their direct control.
- PPE is the most important practice and is more practical when low-cost PPE alternatives are known and used, even if these are not fully compliant with US OSHA and USEPA standards. PPE use recommendations are more likely to be followed when spraying is done at the coolest time of day in the early morning. Simple PPE (long-sleeved shirt, long pants, shoes or boots or plastic bags, gloves or default to plastic bags, plastic face shield made from clear water bottles, face mask or default to a clean, dense cloth mask) use would greatly reduce current exposure levels on bare hands and arms, bare feet, face, eyes, nasal passages, and lungs. If the knapsack tank is leaking fashion large trash bags to protect the back and legs during spraying.
- Emergency decontamination in the Timorese on-farm setting at the mixing stage means having water immediately at hand in large water bottles, plastic jerry cans, buckets, or basins to dilute concentrated product that is spilled. This water can also be used to wash

[26] Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014

off concentrate from PPE during mixing and to rinse pesticide containers before they are disposed.

> Calibration of measuring devices and spraying equipment is the only way to know how much of any product (organic, biological, or synthetic) is being applied. No calibration of spraying equipment appears to have been done in Timor-Leste.[27] Equipment calibration needs to become a routine exercise done once a growing season, with data recorded for use by farmers, farmer groups, farmer union, supermarket staff, IPM trainers and service providers.

> Participants working with Avansa Ag will receive information on the appropriate pesticides to use through the information included in the technology packets. Avansa Ag will also work with suppliers to ensure that the appropriate PPE are available for sale at reasonable prices and that easy-to-understand information regarding the hazards of pesticide use and proper use of PPE are made available.

> Recommendation: As appropriate, USAID projects will promote the development and use of professional spraying and record-keeping services, accessible by farmers at congregation places (farms stores, cooperatives/associations, produce consolidation/cold storage/processing sites). Spray service companies that may be specifically promoted by USAID projects will demonstrate that they maintain spray equipment and use recommended PPE.

3.5. Factor E: Any Acute and Long-Term Toxicological Hazards, either Human or Environmental, Associated With the Proposed Use, And Measures Available To Minimize Such Hazards

This section of the PERSUAP examines the acute and chronic toxicological risks associated with the proposed pesticides. Information on specific risks to environmental resources and how to mitigate or minimize such risks are detailed below under Factor G.

Pesticides are poisons, and nearly all of them—including natural ones—present acute and/or long-term toxicological hazards, especially if they are used incorrectly. The pesticide AI matrix in Annex 1 contains information on acute and chronic human and environmental toxicological risks for each AI in products available for use in Timor-Leste.

The primary measures for minimizing acute and long-term toxicological hazards are the screening process described in Factor B to prevent the use of particularly hazardous pesticides on the Avansa Ag project, using IPM to minimize use of synthetic pesticides in general and to prioritize using low-toxicity pesticides, the safer use actions described under Factor D to prevent exposure of applicators to pesticides, and the approaches described under Factor G to ensure compatibility with environmental conditions.

Table 4 lists USEPA approved pesticides that are not approved for use on Avansa Ag projects due to acute toxicity, restricted use designation, or other risk factors such as carcinogenicity, cholinesterase inhibitor, developmental or reproductive toxin, or endocrine disruptors as designated by the Pesticide Action Network.[28]

[27] Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014
[28] http://www.pesticideinfo.org/Search_Chemicals.jsp

Table 4: USEPA registered pesticides not approved for use on Avansa Ag projects due to toxicity factors.

Active Ingredient	Use Type	Chemical Class	Brand names	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicity	USEPA Acute Toxicity
Brodifacoum	Rodenticide	Coumarin	Klerat RM-B, Petrokum 0,005 RB, Klerat .005 BB	YES	YES	Ia	I
Carbaryl	Insecticides	N-Methyl Carbamate	Indovin 85 SP, Sandovin 85 WP, Sevin 85 S, Seven 85 WP	YES	YES	II	III
Carbofuran	Insecticides	N-Methyl Carbamate	Dharmafur 3 G, Furadan 3 G, Hidrafur 3 G, Petrofur 3 G, Primafur 3 G, Trufer 3 G, Furadan 3 GR	YES	MOST	Ib	I, II
Carbosulfan	Insecticides	N-Methyl Carbamate	Marshal 5 G, Marshal 25 ST, Marshal 200 EC, Marshal 200 SC, Taurus 200 EC	YES	NO	Ib	II
Chlorothalonil	Fungicides	Substituted Benzene	Daconil 500 F, Daconil 75 WP, Octanil 75 VVP, Wendry 75 WP	YES	SOME	U	I
Cypermethrin, Zeta	Insecticides	Pyrethroid	Fury 50 EC	YES	YES	Ib	I
Dimethoate	Insecticides	Organo-phosphorus	Danadim 400 EC, Dimacide 400 EC, Kanon 400 EC	YES	NO	II	II
Emamectin benzoate	Insecticides	Macrocuclic Lactone	Proclaim 5 SG, Prothol 10 EC	YES	YES		I
Fenpropathrin	Insecticides	Pyrethroid	Meothrln 50 EC	YES	YES	II	I
Fenpropathrin	Miticides/ Acaricides	pyrethroid	Meothrin 50 EC; Danitol; Valent	YES	YES	II	I
Mefenoxam	Fungicides	Xylylalanine	Ridomil Gold MZ 4/64 WG, Ridomll Gold 350 ES	YES	NO		I
Methidathion	Insecticides	Organo-phosphorus	Supracide 25 VV P	YES	YES	Ib	I
Methiocarb	Insecticides	N-Methyl Carbamate	Mesurol 50 \NP	YES	YES	1b	II
Methomyl	Insecticides	N-Methyl Carbamate	Lannate 25 WP, Lannate 40 SP, Metindo 25 WP, Myltop 25 WP	YES	YES	Ib	I
Paraquat Dichloride	Herbicides	Bipyridylium	Bravoxone 276 SL, Gramoxone 276 SL, Kingquat 280 SL, Noxone 297 AS, Noxone 297 SL	YES	YES	II	I
Profenofos	Insecticides	Organo-phosphate	Biocron, Curacron 500 EC, Calllcron 500 EC,	YES	MOST		II

Active Ingredient	Use Type	Chemical Class	Brand names	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicity	USEPA Acute Toxicity
			Detacron 500 EC, Pentacron 500 EC, Profile 430 EC, Rumba 500 EC, Tabard 500 EC				
Propynul sulfite	Miticides/ Acaricides	Organo-sulfite	Mitisun 570 EC	YES	ALL		III
Thiodicarb	Insecticides	N-Methyl Carbamate	Larvin 75 WP	YES	YES	II	II

The Stockholm Convention on Persistent Organic Pollutants (POPs) and Rotterdam Convention's Prior Informed Consent (PIC) procedure, which list banned and highly regulated toxic chemicals, respectively, were not known when Regulation 216 was written, so there is no language directly governing their use on USAID projects. Nevertheless, they present high risks to users and the environment due to persistence and toxicity and were rejected for use on the Avansa Ag project. The list of PIC and POP banned pesticides is listed in Appendix 6.

3.5.1. Safer Use Actions/ Mitigation

- Since laboratory analytical capacity and health monitoring are non-existent in Timor-Leste, actions will focus on eliminating the most toxic pesticides and concentrating on IPM and training on proper pesticide use and PPE to reduce human and environmental exposure.
- The pesticide safer use training required by this PERSUAP will include basic first aid for pesticide overexposure, availability and use of antidotes, and recommendations found on pesticide Labels and MSDSs for commonly used pesticides.
- Use of IPM to minimize pesticide use and prioritize low toxicity options. Multiple pest management approaches should help reduce over-use of pesticides and reduce long-term accumulated exposure.

3.6. Factor F: Effectiveness of the Requested Pesticide for the Proposed Use

This section of the PERSUAP requires information similar to that provided previously, but more specific to the actual conditions of application and product quality. The IPM plan includes pesticide options based on the criteria of using the least toxic option that will still meet the objectives of the plan. Seasonal considerations including temperature, crop and insect stage, soil conditions, precipitation and other site-specific conditions will be included at the implementation stage to ensure the effectiveness of both the pesticide and the overall IPM approach. This section also considers the use of low-quality generic products (such as some of those imported from China and India, from where most generic pesticides originate) as well as the development of pest resistance to proposed pesticides, both of which will decrease effectiveness (efficacy).

Pesticides are important pest management tools, although many pesticides gradually lose their effectiveness—especially if overused and not rotated with other classes of pesticides—due to the development of resistance by pests. Pest resistance is a heritable and significant decrease in the sensitivity of a pest population to a pesticide that is shown to reduce the field performance of those specific pesticides.

As described under Factors B and C, and included in the IPM descriptions in Annex 2, pesticides were selected based on availability, toxicity, and appropriateness for inclusion in the IPM plan. Selection of the appropriate pesticides was also based on available research and field experience. In some cases, the most appropriate pesticide or management approach may not be available to an Avansa Ag farmer due to limited access or cost. Alternate options, including no pesticide use are included where appropriate.

3.6.1. Pesticide Resistance

The management of pesticide resistance is an important part of sustainable pest management and this, in conjunction with alternative pest management strategies and IPM programs, can make significant contributions to reducing risks to humans and the environment. Annex 1 serves as one tool for managing resistance by providing the class of each pesticide, so that project field managers and farmers can rotate pesticides among classes.

The development of genetic resistance to pesticides in pest organisms is another adverse consequence of pesticide overuse. In the 1990's, at least 504 species of insects and mites, 150 species of pathogens, 273 weed species, 2 species of nematodes, and the Norway rat had developed resistance to at least one pesticide.[29]

Pests known to have developed significant pesticide resistance (especially to older-generation organophosphate, carbamate and synthetic pyrethroid insecticides, strobin fungicides and azine herbicides) globally:

- Psyllids
- Colorado Potato Beetle
- Corn Earworm
- Powdery mildew
- Downy mildew
- Whiteflies
- Aphids
- Spider mites
- Thrips
- Mealybugs
- Scales.

Pesticides with known global resistance by certain pests or diseases (use with care—do careful calculations of dose—and rotate with other classes or families of pesticides):

- Most of the older and more toxic pesticides no longer registered by USEPA, already rejected
- Many of the synthetic pyrethroids already rejected due to RUPs
- Permethrin
- Strobin fungicides

[29] EGSSAA: INTEGRATED PEST MANAGEMENT, 2009, http://www.encapafrica.org/egssaa/ipm.pdf

- Glyphosate herbicide
- Azine herbicides.

At some point, project field staff and farmers may begin to note that some products no longer work as well to control pests in their field, and may blame pesticide manufacturers for a weaker product. This could be due to the use of cheap generic products, improper dosing, or the development of resistance. Farmers should be trained to understand the development of resistance, and project implementers should be on the lookout for it during their field visits.

A resistance management strategy should also consider cross-resistance between pesticides with different modes/target sites of action. Pests may develop cross-resistance to pesticides based on mode/target site of action. Annex 2 shows IPM tools that are currently effective against specific pests of USAID crops. It also contains, where relevant, comments about rotating pesticides or any resistance issues of importance that are known for that pest and type of pesticide.

The Arthropod Pesticide Resistance Database[30] can be used to search for specific known resistance issues in countries with certain pest or disease resistance to specific pesticide AIs with the resources to buy and use large quantities of pesticides. Fungicide resistance and rotation recommendations are found on the Fungicide Resistance Action Committee (FRAC) website.[31]

If pesticide use is warranted and a risk of pesticide resistance development is identified, a *Resistance Risk Management* approach should be followed. The following section details points of concern for both application equipment and pesticide applications.

Ways to address and manage or mitigate pest resistance:

- **Use IPM to minimize pesticide use:** Minimizing pesticide use is fundamental to pesticide resistance management. IPM programs incorporating pest monitoring in USA states of California, New York, Maryland and Canada have demonstrated 25 to 50% reduction in pesticide use with an increase in crop quality. IPM programs will help determine the best application timing for pesticides (when they will do the most good), thus helping to reduce the number of applications.
- **The use of nonchemical strategies,** such as pest exclusion (e.g., screening, micro tunnels, greenhouses), host-free periods, crop rotation, biological control, and weed control may reduce the need to use chemicals and consequently slow the development of pesticide resistance.
- **Avoid Mixing Pesticides:** Never combine two pesticides with the same mode of action in a tank mix (e.g., two organophosphate insecticides or two azine herbicides). Such a 'super dose' often increases the chances of selection for resistant individuals. In some cases, mixing pesticides from two different classes provides superior control. However, long-term use of these two-class pesticide mixes can also give rise to pesticide resistance, if resistance mechanisms to both pesticides arise together in some individuals. Continued use of the mixture will select for these multiple-pesticide-resistant pests.
- **Avoid Persistent Chemicals:** Insects with resistant genes will be selected over susceptible ones whenever insecticide concentrations kill only the susceptible pests. An ideal pesticide quickly disappears from the environment so that persistence of a 'selecting

[30] http://www.pesticideresistance.com/
[31] http://www.frac.info

dose' does not occur. When persistent chemicals must be used, consider where they can be used in a rotation scheme to provide the control needed and with a minimum length of exposure.

- **Use Long-term Rotations:** Resistance management strategies for insects, weeds, and fungal pathogens all include rotating classes of pesticides. Pesticides with the same modes of action have been assigned the same group number by their respective pesticide resistance action committees, Insecticide Resistance Action Committee (IRAC), Fungicide Resistance Action Committee (FRAC), and Herbicide Resistance Action Committee (HRAC). These group numbers have been included in the treatment tables of this guideline to help clarify when rotating pesticides, which ones can be rotated.

However, the strategies used in rotations differ. For example, with fungicides, it is suggested that classes be rotated every application. With insecticides, a single chemical class should be used for a single generation of the target pest followed by a rotation to a new class of insecticide that will affect the next generation and any survivors from the first generation. Longer use of a single chemical class will enhance the chance of resistance since the survivors of the first generation and the next will most likely be tolerant to that class. Rotating through many chemical classes in successive generations will help maintain efficacy.

3.6.2. Safer Use Actions/ Mitigation

- Training will include and emphasize pesticide rotation among the classes of pesticides to reduce the development of resistance and the above recommendations for reducing resistance.
- The pesticide safer use training required by this PERSUAP and extension activities will include the fundamentals of "safer pesticide purchase," including a recommendation to use quality products and discourage use of generic products of questionable composition.
- The pesticide safer use training required by this PERSUAP and extension activities will teach and emphasize proper sprayer calibration and spray nozzle choice.
- Monitor pesticide use for increasing use due to ineffective formulations or pest resistance.

3.7. Factor G: Compatibility of the Proposed Pesticide Use with Target and Non-Target Ecosystems.

This section examines the potential effect of the pesticides on organisms other than the target pest. Non-target ecosystems include protected areas, species, and water resources. Non-target species of concern include fish, honeybees, birds, earthworms, aquatic organisms and beneficial insects.

> "Broad-spectrum insecticides not only destroy target insect pests but also destroy the predators and parasitoids that feed naturally on them. Pollinators and insect pests' natural enemies (parasitoids and predators) are especially vulnerable to pesticides—often more so than the pests. Most pesticides are also highly toxic to birds, fish, lizards, snakes, frogs, toads and other arthropods.
>
> By eliminating pests' natural enemies, excessive insecticide use can exacerbate pest problems and create new ones. Without natural enemies to keep them in check, pest populations can recover faster from the effects of a pesticide

application than they could have in the presence of healthy natural enemies. This effect is known as pest resurgence. Again, many species that feed on crop plants are normally not a problem because their natural enemies keep their numbers relatively low. Intensive pesticide use, however, can eliminate these natural enemies, triggering a population explosion among their prey. Species that were merely potential pests or secondary pests may rise to "key pest" status as a result."[32]

Improperly used pesticides can and do damage the following natural resource/non-target organisms:

- Honeybees—needed for pollinating two-thirds of all crops
- Fish—needed for aquifer health and human food
- Birds—needed to control insect pests
- Predators and parasitoids—needed to control insect pests earthworms needed for soil health
- Molluscs and crustaceans—needed for aquifer health and human food
- Clean water—needed for drinking, irrigating and washing
- Biodiversity and rare species—needed for ecosystem functioning.

Table 5 compiles the known risks to groundwater and the different types of terrestrial and aquatic organisms for each pesticide active ingredient found in pesticides approved for use by the Avansa Ag project (based on Factors B and E), so that informed product choices can be made if a pesticide is to be used in or near sensitive areas or resources.

Table 5: Potential environmental impacts of pesticides approved for Avansa Ag activities

Ecotoxicity: NAT = Not Acutely Toxic; PNT = Practically Not Toxic; ST = Slightly Toxic; MT = Moderately Toxic; HT= Highly Toxic; VHT = Very Highly Toxic

Active Ingredient	Use Type	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Molluscs	Crustaceans	Aquatic Insects	Plankton
Acephate	Insecticides	Potential	NAT	ST		NAT			NAT	ST	NAT
Acetamiprid	Insecticides	No data	NAT	MT	HT				NAT		
Acibenzolar-s-methyl	Fungicides		HT	PNT	PNT					PNT	
Avermectin	Insecticides	No data	ST	HT	PNT				HT	VHT	VHT
Azoxystrobin	Fungicides	Potential	ST	NAT							HT
Azoxystrobin, Difenoconazole	Fungicides	No data	MT	MT	ST		MT		MT		HT
Bacillus thuringiensis	Insecticides	No data		PNT	NAT	NAT		ST	ST		
Beauveria bassiana	Insecticide	No data	NAT	NAT	NAT		NAT		NAT		

[32] EGSSAA: INTEGRATED PEST MANAGEMENT, 2009, http://www.encapafrica.org/egssaa/ipm.pdf

Active Ingredient	Use Type	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Molluscs	Crustaceans	Aquatic Insects	Plankton
Beta Cyfluthrin	Insecticides	No data	VHT	HT	PNT			ST		VHT	VHT
Bifenthrin	Insecticides		VHT	HT							VHT
Boric Acid	Insecticide	No data	NAT	NAT							NAT
Buprofezin	Insecticides			NAT		NAT					
Carbendazim	Fungicides	No data	MT	NAT	ST	ST			ST		HT
Chlorfenapyr	Insecticides			HT							VHT
Chlorpyrifos	Insecticides	No data	HT	HT	HT	MT	PNT	MT	VHT	HT	MT
Copper Hydroxide	Fungicides	No Data	MT					HT	NAT		
Cyhalothrin, lambda	Insecticides	No data	VHT	HT	PNT		VHT	VHT	VHT	VHT	
Cymoxanil	Fungicides	No data	MT	MT	ST		MT		MT	MT	ST
Cypermethrin, Beta	Insecticides		VHT							VHT	
Cyromazine	Insecticides	Yes		ST							
Dazomet	Fungicides	Potential	ST	ST		ST			HT		HT
Deltamethrin	Insecticides	No data	HT	MT		VHT		NAT		VHT	VHT
Diazinon	Insecticides	Potential	MT	HT		MT		ST	ST	HT	MT
Diflubenzuron	Insecticides		NAT	ST		NAT		NAT	MT	VHT	MT
Dimethomorph	Fungicides		MT	ST							ST
Dimethyl-amine Salt	Herbicides		NAT						NAT		ST
Ethephon	Growth		NAT	ST					NAT	NAT	NAT
Fenamidone	Fungicides	No data	MT	MT	MT		MT		MT		
Fenarimol	Fungicides		MT	ST							
Fenbuconazole	Fungicides		MT	NAT							HT
Fipronil	Insecticides	Potential	HT						VHT	VHT	VHT
Forchlorfenuron	Plant Growth Regulator	Potential									
Fosetyl-AL	Fungicides	Potential	NAT	ST					NAT		MT
Gamma Cyhalothrin	Insecticides		HT								
Gibberellic Acid	Growth										
Glyphosate	Herbicides	Potential	ST	ST	NAT		PNT		MT		ST
Glyphosate-monoammonium Salt	Herbicides	Potential	ST			ST			MT		ST
Imidacloprid	Insecticides	Potential	NAT		MT					VHT	
Iprodione	Fungicides			NAT	ST						
Malathion/ mercaptothion	Insecticides	Potential	MT	HT	MT	HT	ST	VHT	MT	VHT	HT
Mancozeb	Fungicides	No data	MT	MT	ST	HT					NAT

Active Ingredient	Use Type	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Molluscs	Crustaceans	Aquatic Insects	Plankton
Maneb	Fungicides	No data	MT	MT	ST	HT					NAT
MCPA	Herbicides	No data	ST	PNT	NAT	ST		ST	NAT	NAT	ST
Metalaxyl	Fungicides	Potential	ST	PNT	PNT						ST
Metaldehyde	Molluscicide	Potential	NAT								
Metiram	Fungicides	NAT	ST	PNT	PNT	ST		ST	ST	PNT	
Metsulfuron-methyl	Herbicides	Potential	NAT	MT	NAT		MT		NAT		
Neem	Insecticide	MT	NAT	MT			MT	NAT		MT	
Oxyfluorfen	Herbicides	No data	HT	PNT	PNT			HT		HT	HT
Oxytetracycline	Bacteriside	No data	NAT	ST				ST	ST		NAT
Paclobutrazol	Growth		ST			ST		ST	ST		ST
Permethrin	Insecticides	No data	VHT	VHT	PNT	ST	ST	ST	VHT	MT	MT
Phosphorous Acid	Fungicides	No data	ST								
Propamocarb hydrochloride	Fungicides	No data	PNT	PNT	ST	PNT		PNT	PNT	PNT	PNT
Propiconazole	Fungicides	Potential	MT					MT	ST	MT	MT
Pyridaben	Insecticide		VHT	HT						VHT	VHT
Sodium 5 Nitroguaiacolate	Growth										
Spinosad A/D	Insecticides	No data	MT	HT	PNT		ST			HT	MT
Streptomycin Sulfate	Bacteriside	Potential	ST	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
Tebuconazole	Fungicides	No data	MT	NAT	ST	NAT	NAT	NAT	ST	NA	NAT
Thiamethoxam	Insecticides	No data	PNT	HT	PNT		PNT	PNT	PNT	PNT	
Thiophanate-methyl	Fungicides	No data	PNT		PNT	PNT	PNT	PNT	PNT	PNT	PNT
Thiram	Fungicides	No data	MT	NAT	HT	MT	MT	MT	MT	MT	NA
Triadimefon	Fungicides	Potential	MT	MT	PNT		MT		NAT		
Triasulfuron	Herbicides										
Trichoderma harzianum and Trichoderma plysporum	Fungicides	No data	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
Ziram	Fungicides	No data	HT	NAT	PNT	VHT	HT		NAT	HT	HT

3.7.1. Neonicotinoid Pesticides, Risks to Pollinators and Colony Collapse Disorder

A group of new (since the late 1990s) neonicotinoid pesticides has, for the past 5 years, been implicated as one—among several—factors in the unusual die-off of honeybee colonies in the USA and throughout Europe. Other factors include parasitic honeybee mites, viruses transmitted by these mites, climate change, loss of habitat, other pesticides and changes in nutrition. This

honeybee die-off phenomenon is named Colony Collapse Disorder (CCD). Countries in Southeast Asia register neonicotinoids including acetamiprid, imidacloprid, clothianidin, thiacloprid and thiamethoxam. Of these, clothianidin has been most strongly implicated as a potential key factor in CCD.

On April 30, 2013, the EU (European Union) imposed a two-year ban on the use of clothianidin, imidacloprid and thiamethoxam on flowering crops pollinated by honeybees, to take effect in December 1, 2013, unless compelling scientific evidence to the contrary becomes available.[33]

Then, on May 2, 2013, the USEPA and USDA published a study[34] of their own on CCD. One of the principal authors, Dr. May Berenbaum, herself a professional beekeeper and renowned entomologist, disagrees with this approach. In an interview with the New York Times,[35] Dr. Berenbaum notes that it is not a simple matter of just removing pesticides. There are too many factors involved. The authors prefered to "let science drive the outcome of decision making" instead of jumping to conclusions based upon the results of a few studies.

In Australia and Canada, where neonicotinoid pesticides are also extensively used, CCD is not a serious issue. This implies that other factors, or combinations of factors, are at work. USAID regulations follow USEPA regulations and advice. Three neonicotinoids are approved for use on the Avansa Ag project, depending on the formulation: acetamiprid, imidacloprid and thiamethoxam. Some formulations of imidacloprid and thiamethoxam are classified as restricted use and may not be available in Timor-Leste in an approved formulation.

3.7.2. Persistent Pesticides

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

Many pesticide breakdown products are themselves toxic and each may also have a significant half-life. Since pesticides break down with exposure to soil microbes and natural chemicals, sunlight and water, there are half-lives for exposure to each of these factors. Fortunately, most of the very persistent pesticides AIs, like chlorinated hydrocarbons, are no longer available or used in modern agriculture.

Pesticides with a long residual period (that are labeled persistent and may last for years) include atrazine herbicide and organochlorine pesticides. Many if not most of the newer carbamate, organophosphate, neonicotinoid, synthetic pyrethroid, natural botanical and microbial extracts, mineral and vegetable oils, soap fatty acids, growth regulator insecticides and most fungicides recommended in Annex 2 break down much more quickly in the environment, generally within weeks.

[33] http://www.bbc.co.uk/news/world-europe-22335520
[34] http://www.usda.gov/documents/ReportHoneyBeeHealth.pdf
[35] http://www.nytimes.com/2013/05/03/science/earth/government-study-cites-mix-of-factors-in-death-of-honeybees.html?nl=todaysheadlines&emc=edit_th_20130503&_r=0

3.7.3. Pesticides can adsorb to soil or leach and contaminate groundwater

Each pesticide has physical and chemical characteristics, such as solubility in water, ability to bind to soil particles and be held there (adsorbed), and natural breakdown rate in nature. If they are strongly held by soil, they do not enter the soil water layers and the ground water table as easily.[36]

In general, pesticides with the following characteristics have the potential to contaminate groundwater:

- Water solubility greater than 3 mg/liter
- Soil adsorption coefficient of less than 1,900
- Aerobic soil half-life greater than 690 days
- An anaerobic soil half-life greater than 9 days
- Hydrolysis half-life greater than 14 days

The potential for pesticides to enter groundwater depends, as indicated above, on the electrical charge contained on a pesticide molecule and its ability and propensity to adhere to soil particles, but this also depends on the nature and charge of the soil particles dominant in the agriculture production area. Sand, clay and organic matter, and different combinations of all of these have different charges and adhesion potential for organic and inorganic molecules. Sandy soil often has less charge capacity than clay or organic matter and will thus not interact significantly with and hold charged pesticide molecules. So in areas with sandy soil the leaching potential for pesticides is increased, as is the velocity with which water and the pesticide migrate.

A pesticide's ability to enter groundwater also depends on how quickly and by what means it is broken down and the distance (and thus time) it has to travel to the groundwater. If the groundwater table is high, the risk that the pesticide will reach it before being broken down is increased. Thus, a sandy soil with a high water table is the most risky situation for groundwater contamination by pesticides. Groundwater contamination potential for each pesticide active ingredient is listed in Table 5.

The only *known* water pollutant on the list of pesticides approved for Avansa Ag is cyromazine. It should not be used in areas with high water tables and sandy soils.

3.7.4. Safer Use Actions/Mitigation

Where a project has direct control over pesticide use, assure the following. Where a project is supporting or recommending pesticide use, but has less than complete control take all practicable measures to assure the following:

- Before the implementing an activity, identify and map all sensitive areas near the project sites.
- Maintain a 2.5 to 5 km buffer no-spray zone around national parks or other protected areas where agricultural activities are prohibited. Investigate and strongly recommend the use of botanical and biological controls, as practical, or produce Organic crops near these valuable natural resources.

[36] http://sitem.herts.ac.uk/aeru/projects/footprint/index.htm

- Use good agricultural practices and avoid using highly toxic or persistent pesticides where endangered species are known to exist.
- Do not apply granular pesticides in fields frequented by migratory waterfowl. Completely cover granules with soil, especially spilled granules at the ends of rows.
- Do not spray or rinse equipment in or within 30 meters of ponds, drainage ditches, and surface waters.
- Minimize chemical spray drift by using low-pressure sprays and nozzles that produce large droplets, properly calibrating and maintaining spray equipment, and use of a drift-control agent, where feasible.
- Do not spray pesticides with high toxicities to aquatic organisms before an impending rainstorm, as they can be washed into waterways before breaking down.
- Ensure that pesticides labeled for certain types of use environments, or areas, are in fact used according to label recommendations.
- Since transport of soil particles with pesticides adsorbed to them is a likely transportation route to waterways, employ techniques to reduce farm soil erosion whenever erosion is likely (such as terracing, employing ground covers between rows, planting rows perpendicular to the slope, buffers between crop areas and waterbodies, using drip irrigation, and so on).
- If beekeeping activities occur near the activity area, warn beekeepers of upcoming spray events so that they may move or protect their hives.
- Spray at night (best) very early morning or late afternoon when winds are below 13 kph, there is no rain and bees do not forage.
- Read and follow pesticide label instructions including environmental warnings.
- Choose a pesticide least toxic to fish and wildlife (Table 5).
- Properly dispose of empty pesticide containers (and provide training on what this means locally).
- Do not use or recommend pesticides with high leaching and groundwater pollution potential (cyromazine in particular) near drinking water sources, on highly sandy soils or soils with water tables close (2-3 meters) to the surface.

3.8. Factor H: Conditions under Which the Pesticide Is To Be Used, Including Climate, Geography, Hydrology, and Soils

In general, in addition to covering biodiversity and protected areas under Factor G above, this requirement attempts to protect natural resources from the dangers of pesticide misuse and contamination, especially of groundwater resources.

3.8.1. Climate and Geography

Timor-Leste's climate and geography are described in the background section to this report (Section 2.1), with maps on rainfall, temperatures and country relief. Refer to them for background information on this factor. Timor-Leste has a dry tropical climate with distinct monsoon rainfall patterns, which is very different from conditions in the U.S. and Europe where much of the information on IPM and pesticides originates. Information needs to be carefully adapted to the local conditions, including warmer temperatures and torrential rainfall.

Information adapted to conditions in Timor-Leste is becoming more available through local NGO efforts such as Seeds for Life[37] and cooperative efforts such as the Asia and Pacific Plant Protection Commission.[38]

Rainfall and steep terrain are contributing factors to the dispersal of pesticides beyond the intended crop and into soils and nearby waterways. Specific information on rainfall, temperatures, slope, and land use are available for the Avansa Ag districts at the suco level in the Climate Change Adaptation and Disaster Risk Reduction for USAID's Avansa Agrikultura Project in Timor-Leste report and supporting maps. Additional discussion of potential groundwater and soil contamination from pesticides occurs under Factor G.

3.8.2. Hydrology

The surface hydrology of Timor-Leste has not been extensively studied or monitored. Most rivers are relatively short, but small streams are common. Stream density varies with soil type, underlying geology and topography in the Avansa Ag districts. Many small holder farms are located near streams or in floodplains depending on the local topography, which increases the potential for pesticide contamination of waterbodies.

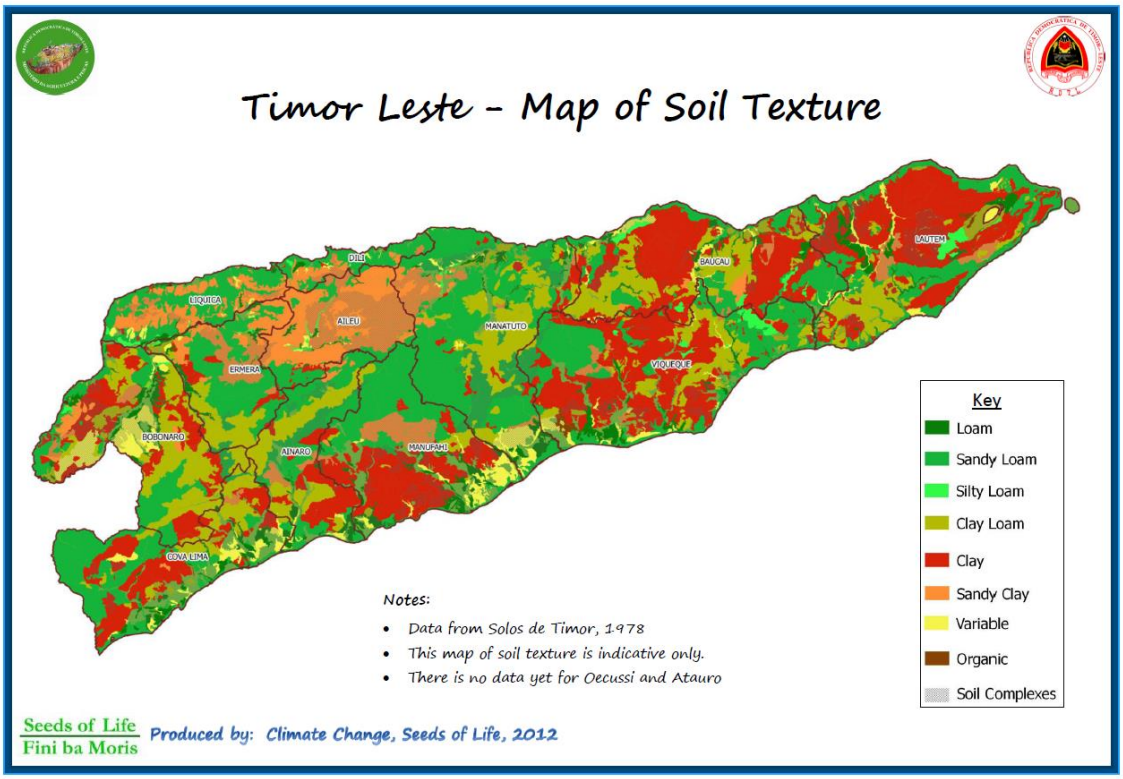
A comprehensive groundwater study was completed in 2012, which produced a detailed groundwater resources map for the entire country.[39]

3.8.3. Soils

Soil type is a consideration in developing appropriate technology packets and IPM strategies. Extensive soil information for Timor-Leste has been compiled and is available online at the Seeds for Life website and is included in the suco-level information packets for Avansa Ag planning.[40] Figure 5 is an example soil texture map for Timor-Leste.

[37] http://seedsoflifetimor.org/
[38] http://www.apppc.org/node/1110805
[39] http://www.besiktimor.org/
[40] http://seedsoflifetimor.org/

Figure 5: Soil texture map of Timor-Leste[41]



3.8.4. Safer Use Actions/Mitigation

Where a project has direct control over pesticide use, assure the following. Where a project is supporting or recommending pesticide use but has less than complete control, take all practicable measures to assure the following:

- Hydrology: Do not spray or rinse pesticide equipment in or within 30 meters of ponds, irrigation and drainage ditches, and other surface waters.
- Hydrology: Do not spray pesticides with high toxicities to aquatic organisms before an impending rainstorm, as they can be washed into waterways before breaking down.
- Soils: Do not use or recommend pesticides with high leaching and groundwater pollution potential (see discussion in Factor G) near drinking water sources, on highly sandy soils or soils with water tables close (2-3 meters) to the surface.
- Soils: Transport of soil particles with pesticides adsorbed to them is a likely transportation route to waterways, employ techniques to reduce farm soil erosion whenever erosion is likely. Such techniques include vegetated buffer strips, green manure, mulching, terracing, employing wind breaks, employing ground covers between rows, planting rows perpendicular to the slope, using drip irrigation, and so on.

[41] Source: Seeds of Life. http://seedsoflifetimor.org/

3.9. Factor I: Availability of Other Pesticides or Non-Chemical Control Methods

This section identifies less toxic synthetic, as well as non-synthetic or 'natural' (extracts of naturally-occurring plants, spices, oils, fatty acids, induced resistance elicitors, minerals, microbes or microbial extracts) pesticide options for control of pests, and their relative advantages and disadvantages. Many of these 'natural' pesticides can be toxic to humans, and several are even classified as RUPs due to environmental risks; thus safe pesticide use practices extend to these natural as well as synthetic (produced in laboratories or factories) pesticides.

Annexes 2 and 5 contain numerous non-chemical control methods for every major pest expected to be encountered on the Avansa Ag project. These IPM approaches can be expanded into crop-specific stand- alone documents that can be reproduced as necessary, and should be considered for translation into local languages, lamination, and distribution to farm input supply companies to help advise farmers at point-of-purchase.

3.9.1. Natural pest controls availability

Many non-synthetic chemical IPM tools and technologies are listed in Annexes 4 and 5. The list of natural pesticides likely entering Timor-Leste from Indonesia and other countries is not very extensive compared with other emerging market countries.

There are, however, some local homemade insecticides and insect and pathogen repellents used in Timor. These include extractions from neem leaves and vetiver roots, garlic and pepper sprays that are formulated at home and the use of vinegars. It is anticipated that the local production of wood vinegar will be introduced from Indonesia since this is an up and coming home industry produced natural insecticide and plant growth stimulator.

Fermented animal urine and shrimp paste are often sprayed on solacinium crops to inhibit growth and development of bad bacteria and fungi in plant leaves and stems.

Some herb crops from the basil, mint, and mustard families are used as natural fumigants and pre-plant deterrents to nematodes. Incorporation of the green manure from these crops seems to drive nematodes deeper into the sub-soils and out of range of annual plant root growth.

In general, most synthetic nematicides and soil pesticides/fumigants are very highly toxic. However, there are some companies producing next-generation natural chemicals in the USA: Bio Huma Netics[42] for natural nematicides and Agra Quest[43] for bioactive essential oils.

For commercial operations, especially greenhouses, biological controls and beneficial organisms are available commercially from two large international companies, Koppert of Holland and Biobest of Belgium.[44] Koppert provides many biological controls against spider mites, beetles, leaf miners, mealy bugs, thrips, aphids, whiteflies, and moth and butterfly larvae. Koppert also provides the Koppert Side Effects List, a list of the side effects of pesticides on biological organisms.[45]

[42] http://www.bhn.name
[43] http://www.agraquest.com
[44] http://www.biobest.be
[45] http://www.koppert.com

Biobest of Belgium provides many of the same or similar biological controls as Koppert and includes a control against leafhoppers. These are especially useful for greenhouse and seedling production systems. Both companies also sell live bumblebees for greenhouse pollination assistance.

Importation of these natural predators has never been attempted and may be very difficult to process through Timor-Leste animal quarantine.

3.9.2. Safer use Measures/Mitigation

> As appropriate, USAID projects will promote low-risk preventive and natural chemical pest controls that are found in Annexes 2, 4 and 5 of this PERSUAP, including incorporating these controls in the IPM plans developed under this PERSUAP.

3.10. Factor J: Host Country's Ability to Regulate or Control the Distribution, Storage, Use, and Disposal of the Requested Pesticide

This section examines Timor-Leste's existing infrastructure and human resources for managing the use of the proposed pesticides. If the host country's ability to regulate pesticides is inadequate then the use of pesticides could result in greater risk to human health and the environment. Timor-Leste's lack of regulatory oversight and capacity is discussed in-depth in Section 2.3. In summary, Timor-Leste has no laws or policies currently in place to regulate pesticide importation, distribution, storage, use, or disposal. There are no restrictions other than through business licensing and limited authority by the quarantine ministry to stop problematic pesticide use, and the main ministry that oversees agriculture, the MAF, has no authority at all. The Law of Pesticides was drafted in 2011, and there is no indication that it will be passed any time soon (Annex 11).

For a country where PPE is, for all intents and purposes, not used much on small-scale farms, there are still some very toxic products being sold in quantity, all of which leads to increased risk. Several dangerous chemicals that should be banned or restricted are still encountered in Timor-Leste (Tables 3 and 4). These include multiple Class I toxic pesticides (Carbaryl, Carbofuran, Carbosulfan, Cypermethrin, Methidiathon, Methiocarb), internationally banned pesticides such as Endosulfan, and environmentally hazardous chemicals such as profenofos, which is a RUP. Small-scale farmers should be encouraged to switch to newer and less toxic chemicals. Several safer alternatives to older types of chemicals now exist.

Timor-Leste's inability to regulate pesticides and the poor understanding of proper use and PPE practices underlies the conservative approach to approving pesticides for use in the Avansa Ag project as described in Factor C and E.

3.10.1. Disposal of pesticide containers

Currently there is no regulation or oversight for disposal of used pesticide containers. Best practical practice is to triple-rinse the containers, puncture them to discourage re-use, and bury or burn them. Burning plastic bottles and single-use sachets can lead to the formation of toxic furans and dioxins, and is not recommended.

GlobalGAP[46] and other certification systems require that empty pesticide containers are triple rinsed over a pesticide mixing pit and then properly stored in plastic drums in the field or storage shed, to await disposal. Website The USEPA provides pesticide and container best practices disposal options.[47]

3.10.2. Safer Use/Mitigation Actions

- Absolutely no POPs or PIC chemicals will be used or supported on USAID projects.
- Where alternatives (Classes III and IV/U) exist, do not recommend or use USEPA and WHO Acute Toxicity Class II pesticide products on USAID projects, unless the USAID project can verify that producers and laborers (pesticide applicators) properly and consistently utilize PPE as recommended by the pesticide label and MSDS.
- IPM plans and field extension will give preference to the use of Class III and IV/U pesticide alternatives, which exist on the list of pesticides approved for use with the Avansa Ag project.
- For all project commercial farms supported by USAID, encourage and support the use of best practices with pesticide storage, use and disposal, whether or not certification is sought.
- Explore options for a pesticide container recycling program through agricultural suppliers and explore options for incinerating used pesticide containers (possibly at medical waste incinerators, if available).

3.11. Factor K: Provision for Training of Users and Applicators

USAID recognizes that, in addition to the use of PPE, safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly acute in emerging market countries, where the level of education of pesticide users is typically lower than in developed countries. In Timor-Leste, a significant portion of the population is illiterate, and many cannot read labels in Indonesian or English.

Upstream efforts are needed with supermarket suppliers of pesticides and agricultural suppliers to ensure that there is consistent and reinforced messaging on labels, MSDS, PPE, characteristics of application equipment, education on organic, biological, and synthetic pesticides and growth regulators, attractants and traps, IPM programs, and pest resistance management. Pest resistance management is a new topic in TL at both the agricultural staff and farmer levels.

3.11.1. Farmers need intensive and repeated training

Training in Safe Pesticide Use and GAP/IPM are of paramount importance for Avansa Ag project beneficiary farmers and farm laborers using pesticides. Various NGOs have been providing such training, along with the MAF to a lesser extent. Additional and refresher trainings are superb means for effecting beneficiary farmer behavioral change, now especially, as they expand their agricultural technologies and before risky behaviors become set.

[46] http://www.globalgap.org/uk_en/
[47] http://www2.epa.gov/sites/production/files/2015-03/documents/chap-13-jul-2013.pdf

The following is a summary of pesticide safer use training topics to be addressed in conjunction with the training program developed for the USAID DAC project described in Annex 7:

- **IPM**: best practices approach to pest/disease control, using a diligent sequence of control methods (crop rotation, living fences, natural repellant plants, beneficial insects, scouting and manual control) prior to safe and limited use of lowest toxicity effective organic and/or synthetic pest/disease control chemicals. Simple crop/pest cycle handouts in Tetum for farmers should be introduced in these trainings and used in field extension.
- **Chemical knowledge:** Training to include Safer Use principles on selection of effective products that are the lowest toxicity, registration, correct use, application procedures and label specifications. This training includes an in-depth review of label information (resources in Tetum and/or with photos will be provided wherever possible), as well as a discussion of dosage rates, application rates, equipment calibration and maintenance, application intervals, re-entry and pre-harvest intervals and demonstrations of proper equipment use.
- **Storage:** Proper storage of chemicals in relation to other structures on the property. The need for a separate, clearly marked facility will be emphasized for exclusive storage of farm chemicals. Pesticides should be kept away from food for human or animal consumption, children and sources of drinking water. Pesticides should always be stored in their original containers.
- **Transport:** Safe transport of pesticides will be discussed (i.e. not using public transportation if possible, keeping chemicals in a closed environment, how to avoid punctures and torn bags, etc). Worker protection: Types of personal protective equipment (PPE), when they should be worn and why, and how they should be cared for. The basic PPE recommended for all pesticide applications includes long-sleeved shirts, long pants, shoes and socks. Depending on the toxicity and label directions, chemical-resistant gloves, aprons, and masks may be required and are available at local agricultural supply stores. Participants will be encouraged to wash PPE separate from everyday clothing and to keep their PPE in good condition.
- **Safety practices:** Proper mixing techniques, the importance of using clean water for mixing, and the importance of not contaminating water sources. The types of containers used in chemical preparation, their proper use, cleaning and storage will be addressed. Applicators are taught not to eat, drink or smoke while applying pesticides.
- **First aid and medical facilities**: First aid materials must be made available (soap, clean water and a towel) in case of spills. Participants will be taught to identify the primary symptoms of chemical exposure and what do to in an emergency.
- **Waste Management:** How to clean up and safely dispose of any chemical not used. For liquids, empty containers should be rinsed 3 times, and rinsate emptied into the spray tank as part of the application mixture. When the product is used completely, chemical containers should be triple rinsed and punctured before being buried. Containers should never be reused.
- **Protection of drinking water:** Training will emphasize the importance of protecting potable water sources and avoiding contamination of ground and surface waters. Participants will be trained to identify their drinking water source and to keep all pesticides away from that source. Characteristics of the water source and mitigation measures to avoid contamination will be addressed.

- **Environmental safety:** The importance of protecting natural resources and the proper use of pesticides to avoid environmental contamination and impacts on non-target organisms will be addressed.
- **Women and Children:** At demonstration farms and where feasible, additional training should be targeted towards women and children who may come enter production fields or who may be exposed indirectly to spray drift or residues on the pesticide users clothing at home. Basic training materials in the form of pesticide safety field guides in Tetum with illustrations will be developed.

3.11.2. Safer Use/Mitigation Actions

- Avansa Ag will implement IPM and Pesticide Safer Use training for all relevant project staff and direct beneficiaries, training target individuals within six months and providing short annual refresher training thereafter.
- Demonstration farms will have handouts in Tetum on appropriate pesticide and PPE use, demonstrate best management practices, and offer courses and training on pesticide and PPE use.
- Avansa Ag should provide to agricultural suppliers, commercial farms, and to the extent feasible, individual farmers, training programs on monitoring and data record keeping techniques for pest control and pesticide needs and/or effectiveness.
- Explore options for a certified pesticide applicator program where individuals will receive in-depth training leading to a certification that allows them provide pesticide application services to farming communities and appropriately handle more hazardous pesticides.

3.12. Factor L: Provision Made For Monitoring the Use and Effectiveness of Each Pesticide

Evaluating the risks, impacts and benefits of pesticide use should be an ongoing, dynamic process. Pest resistance is one of the risks for which this element is intended, as well as human health and safety and environmental effects.

Record keeping should track quantities and types of pesticides used, where they were used and what they were used for with notes on efficacy. Notes on effectiveness of individual pesticides and pest numbers will help develop a more sustainable pesticide use plan for Avansa Ag beneficiary producers. Records will need to make note of any reductions in pesticide efficacy experienced, which is the first indication that resistance may be developing, and then a strategy needs to be in place to determine a shift to a different pesticide class, and rotation among classes, to overcome resistance development. Record keeping at the participating farmer level may be limited due to educational constraints and the ability to track the number of farmers reached by the Avansa Ag project through demonstration farms and lower intensity interventions.

3.12.1. Avansa Ag beneficiaries and record keeping

Developing a systemized approach to record keeping will allow seasonal and annual comparison of pesticide effectiveness, pest numbers, crop production, maintenance of safety equipment, and so on. Example record keeping forms are located in Annex 8. They will be adapted for use on Avansa Ag activities prior to implementation. The following aspects should be included in the

record keeping system for Avansa Ag activities where there is direct control such as commercial farms and demonstration farms:

- Pesticide documentation: This list allows suppliers and farmers to ensure that the pesticides they are using are approved. It should also provide notes on special safety requirements.
- IPM measures tried/used (see Annex 2): Avansa Ag farmers should try to incorporate a minimum of at least ten new IPM measures per annum and document their success or failure.
- PPE: Lists of the types of equipment made available to applicators, number of pieces, prices and contact details of suppliers, dates when equipment needs to be washed, maintained or replaced. PPE should be numbered or personally assigned to applicators to ensure that it is not taken into the home where (as a contaminated material) it could pose a risk to family members.
- Monitoring/recording pests: Agronomists should incorporate into their records regular field pest monitoring and identification. This could be done by the agronomists themselves, or if properly trained, by farmers.
- Environmental conditions: Field conditions should be incorporated into the record keeping system (for example; precipitation, soil analyses and moisture, soil pH, temperatures and so on).
- The records and information should be transmitted at least annually to Avansa Ag to be included in the monitoring program and annual reports.

Monitoring by Avansa Ag field staff and beneficiary farmers should report:

- Pesticide resistance development among pests has likely occurred and could eventually occur more, and will be noted by farmers complaining that the spray no longer works as it once did.
- Human poisonings and any incidences of chronic health issues.
- Farm animal and livestock deaths from pesticides.
- Any incidences of water pollution.
- Fish, bird, wildlife or honeybee kills.

Any of the above items should be reported immediately to Avansa Ag and USAID. Other information should be transmitted at least annually to USAID and USAID should report on this progress in pesticide environmental and human health safety in annual reports.

Safer Use/Mitigation Actions:

- Develop timeline and reporting requirements and responsibilities template.
- Provide training to beneficiaries on appropriate pest management and pesticide use record-keeping.
- Monitor record keeping at demonstration farms and commercial farms to ensure compliance.
- Provide training to staff and beneficiaries on what problems need to be reported immediately to Avansa Ag and USAID staff. Develop incident reporting template.

4. Pesticide Safer Use Action Plan (SUAP)

4.1. Introduction

This Safer Use Action Plan is the definitive statement of the USAID Avansa Agrikultura project pesticide compliance requirements and is synthesized from the PER analysis. The PER analysis includes safer use/mitigation actions for each factor that form the core of SUAP actions that are described in detail in Section 4.5:

- Section 4.2 lists the pesticides that are approved for use and procurement on the project.
- Section 4.3 establishes USAID field monitoring requirements for compliance with safer use conditions.
- Section 4.4 summarizes the safer use conditions attendant to use/support of these pesticides.
- Section 4.5 details the conditions in the environmental mitigation and monitoring tracking form for assigning responsibilities and timelines for implementation of these requirements and for tracking compliance.

With respect to pesticides, the Safer Use Action Plan satisfies the requirement for an environmental mitigation and monitoring plan (EMMP). The project EMMP should simply incorporate the SUAP by reference.

4.2. Approved and Rejected Pesticides for the Avansa Ag Project

Synthesizing across the PER analysis, ONLY the active ingredients from pesticides listed in Table 6 are permitted for use/support for Avansa Ag activities. If the **Approved for Avansa** column states 'Depends', that means it is a restricted use pesticide (RUP) in some formulations and not others. Only formulations that are functionally equivalent in composition and application to non-restricted pesticides can be used for Avansa Ag. Information on RUP status can be obtained from the Pesticide Action Network website by looking up the active ingredient and the current registration status.[48]

The list of approved pesticides will be distributed to all suppliers working with Avansa Ag including instructions (and perhaps signage) that indicates that if farmers are working with Avansa Ag, that they can only purchase chemicals from the approved list if they wish to continue working with the program.

AIs available in Timor-Leste but REJECTED for use on the Avansa Ag project are listed in Table 7.

Table 6: Active Ingredients Approved for use on the Avansa Ag project

Active Ingredient	Use Type	Chemical Class	Common Brand names	Availability	Approved for Avansa
Acephate	Insecticides	Organo-phosphorus	Oafat 75 SP, Lancer 75 SP, Orthene 75 SP	Nilton	Yes
Acetamiprid	Insecticides	Neonicotinold	Amsipilan 20 SP, Mospilan 30 EC	Nilton	Yes

[48] http://www.pesticideinfo.org/Search_Chemicals.jsp

Acibenzolar-s-methyl	Fungicides	Benzothiadiazole	Bion-M 1/48 WP	Nilton	Yes
Avermectin	Insecticides	Microbial	Agrimec 18 EC, Aspire, Bamex 18 EC, Calebtio EC, Demolish 18 EC, Klliri 20 .EC, Promectin 18 EC, Wito 4 EC	Nilton	Depends
Azoxystrobin	Fungicides	Strobin	Amistar top 325 SC , Amotan 250	Nilton	Yes
Azoxystrobin, Difenoconazole	Fungicides	Azole	Amistartop 325 SC, Score 250 EC	Nilton	Yes
Bacillus thuringiensis	Insecticides		Agrisal WP, Bactospeine WP, Dipel WP, &nbsN: Florbac FC Thuricide HP, Turex WP, Dipel DF	Balide, MAF List	Yes
Beauveria bassiana	Insecticide	Biopesticide	By Vil, Natural BUR	Balide	Yes
Beta Cyfluthrin	Insecticides	Synthetic Pyrethroid	Buldok 25 EC, Raydock 28 EC, SUMO 50 EC	Serafim, Balide, MAF List	Depends
Bifenthrin	Insecticides	Pyrethroid	Talstar 25 EC; Sumialpha 25 EC	Nilton	Depends
Boric Acid	Insecticide	Inorganic			Yes
Buprofezin	Insecticides	Unclassified	Applaud 100 EC, Applaud 10 \NP	Nilton	Yes
Carbendazim	Fungicides	benzimidazole	Delsene MX 80 WP	Nilton	Yes
Chlorfenapyr	Insecticides	Pyrazole	Rampage 100 EC, Rampage 100 SC	Nilton	Yes
Chlorpyrifos	Insecticides	Organo-phosphorus	Basban 200 EC, Clobber 200 EC, Dursban 20 EC, Kresban 200 EC ,Nurelle 0 500/50 EC Posban 200 EC, Dursban 200 EC	Serafim, Balide, Bemori, Jupitar	Depends-Durbisan OK
Copper Hydroxide	Fungicides	Inorganic Copper	Cobox, Kocide 77	Nilton	Yes
Cyhalothrin, lambda	Insecticides	Pyrethroid	Alika 247 ZC, Granat 25 EC, Hamador 25 EC, Matador 25 CS, Rolidor 25 EC, Trigon, BioMac 10 WP, Matador 25 CS, ICON 10 WP	Serafim, Balide, Bemori	Depends
Cymoxanil	Fungicides	Unclassified	Curzate 8/64 WP, Curci 10 \NP, Victory Mlx 8/64 WP	Nilton	Depends
Cypermethrin, Beta	Insecticides	Pyrethroid	Beta 15 EC, Chix 25 EC	Bemori	Depends
Cyromazine	Insecticides	Triazine	Cyrroiex 75 SP, Trigard 75 WP, Guntur 75 VVP	Nilton	Yes
Dazomet	Fungicides	Unclassified	Basamid G	Nilton	Depends
Deltamethrin	Insecticides	Pyrethroid	Decis 25 EC, Marcis 25 EC, Naichi 25 EC, Oscar 25 EC	Serafin, Balide, Jupiter	Depends
Diazinon	Insecticides	Organo-phosphorus	Diazinon 60 EC, Sidazinon 600 EC, Diazinon 600 EC	Serafim, Balide, Bemori	Depends
Diflubenzuron	Insecticides	Benzoylurea	Solano 25 WP	Nilton	Depends
Dimethomorph	Fungicides	Morpholine	Acrobat 50 WP	Nilton	Yes
Dimethyl-amine Salt	Herbicides	Amine	DMA6 825 SL, Indamin 720 HC, Tasmin 865 SC	Bemori, MAF List	Depends
Ethephon	Growth	Organo-phosphorus	Ethrel10 LS, Ethrel 2,5 LS, Prothepon 480 SL	Balide	Yes

Fenamidone	Fungicides	Imidazole	Pitora 10/50 WG	Nilton	Yes
Fenarimol	Fungicides	Pyrimidine	Rubigan 120 EC	Nilton	Yes
Fenbuconazole	Fungicides	Azole	Indar 240 F	Nilton	Yes
Fipronil	Insecticides	Pyrazole	Regent 0.3 G, Regent 50 SC, Regent 50 SL	Balide	Depends
Forchlorfenuron	Plant Growth Regulator	Urea	Gibberellic acid- Not RUP		Yes
Fosetyl-AL	Fungicides	Unclassified	Aliette		Yes
Gamma Cyhalothrin	Insecticides	Pyrethroid	Proaxis 15 CS	Nilton	Depends
Gibberellic Acid	Growth	Botanical	Bigest 40 EC, Gibgro, Progibb 20 SL	Nilton	Yes
Glyphosate	Herbicides	Phosphono-glycine	Amiphosate 480 SL, Basmilang 480 AS, Bionasa 480 AS, Bio Up 490 SL, Indofos 480 AS, Konup 480 SL, Proris 240 AS, Penta up-z Rambo 480 AS, Crash 480 AS, Roll-up 480 SL, Roundup 486 AS, Sandoup 480 SL, Sidafos 480 AS, Roundup 486 SL, Ridox 48 SL	Serafim, Balide, Bemori, Jupitar, MAF List	Yes
Glyphosate-monoammonium Salt	Herbicides	Phosphono-glycine	Bionasa 75 WSG	Nilton	Yes
Imidacloprid	Insecticides	Neonicotinoid	Avidor 25 VVP, Abuki 50 SL Amirld, Caleb tsan 28 EC, Confider 5 WP, Confider 200 SL, Delouse 200 SL, Imidasal 10 WP, Imidor 50 SL, Neptune 25 WP, Winder 100 EC, Wingran 0,5 G	Nilton	Depends
Iprodione	Fungicides	Dicarboximides	Roval 50 WP	Serafim	Yes
Malathion/mercaptothion	Insecticides	Organ-ophosphate	Fyfanon 440 EC	Nilton	Yes
Mancozeb	Fungicides	Dithiocarbamate	Actozeb 80 WP, Amacozeb 80 WP, Antila 80 WP, Bazoka 80 WP, Raksasa 80 WP, Sidazsb 80 WP, Tanzsb 80 WP, Victory 80 WP, Victory mix 8/64 WP Vondozeb 80 WP, Dithane M-45 WP	Bemori, MAF List	Yes
Maneb	Fungicides	Dithiocarbamate	Detanneb 80 WP, Phycozan 70 \NP Pilaram 80 WP • Promaneb 80 WP	Nilton	Yes
MCPA	Herbicides	Chlorophenoxy acid	Agroxone 4, Rambasan 400 AC	Nilton	Yes
Metalaxyl	Fungicides	Benzanoid	Rampart 25 WP, Sarornyl 35 SD, Starmyl 25 WP	Nilton	Depends
Metaldehyde	Molluscicide	Aldehyde	Siputox 5 G	Nilton	Yes
Metiram	Fungicides	Dithiocarbamate	Polycom 80 WP	Nilton	Yes
Metsulfuron-methyl	Herbicides	Sulfonylurea	Ally20WDG, Allyplus 77 VVP, rvictafuron 20 VVDG	Nilton	Yes
Neem	Insecticide	Biopesticide	Pestona 500 EC	Balide	Yes
Oxyfluorfen	Herbicides	Diphenyl ether	Goal2 EC, Gol-ok 2 EC	Nilton	Yes
Oxytetracycline	Bacteriside	Antibiotic	Bactocyn 150 AL	Nilton	Yes

Paclobutrazol	Growth	Azole	Cultar 250 SC, Goldstar 250 EC	Nilton	Depends
Permethrin	Insecticides	Pyrethroid	Meriam 50 EC, Methrisida 100 EC, Pounce 20 EC, Pentatrin 20 EC, Prego 20 EC	Bemori	Yes
Phosphorous Acid	Fungicides	Inorganic	Folirfos 400 AS	Nilton	Yes
Propamocarb hydrochloride	Fungicides	Carbamate	Previcur - N, Previcur Flex	Nilton	Yes
Propiconazole	Fungicides	Azole	Golex 250 EC	Nilton	Yes
Pyridaben	Insecticide	METI	Samite 135 EC	Balide	Yes
Sodium 5 Nitroguaiacolate	Growth		Oekamon 22.43 L	Nilton	Yes
Spinosad A/D	Insecticides	Microbial	Tracer 120 SC	Nilton	Yes
Streptomycin Sulfate	Bacteriside	Antibiotic	Plantomycin 7 SP	Nilton	Yes
Tebuconazole	Fungicides	Azole	Folicur 250 EC, Folicur 25 WP	Nilton	Yes
Thiamethoxam	Insecticides	Neonicotinoid	Actara 25 WG	Nilton	Depends
Thiophanate-methyl	Fungicides	Benzimidazole precursor	Topsin M 70 WP , Judo 70 WP, Topsin 500 EC,	Jupiter	Yes
Thiram	Fungicides	Dithiocarbamate	Tiflo 80 WP	Nilton	Yes
Triadimefon	Fungicides	Azole	Bayleton 250 EC, Clinten 250 EC	Nilton	Yes
Triasulfuron	Herbicides	Sulfonylurea	Logran 20 WG	Nilton	Yes
Trichoderma harzianum and Trichoderma plysporum	Fungicides	Microbial	Anfush, Natural Glo	Balide	Yes
Ziram	Fungicides	Dithiocarbamate	Tiflo 80 VVP	Nilton	Yes

Table 7: Active Ingredients Rejected for use on the Avansa Ag project

Active Ingredient	Use Type	Chemical Class	Common Brand names	Availability	Approved for Avansa
Alkylaryl polyglycol ether; BASF	Surfactant		Agristick 400 L, Agristech 200, Citowett 105 AS	Balide	No
Bensultap	Insecticides	Nereistoxin	Bancol50 WP	Nilton	No
BPMC (fenobucarb)	Insecticides	N-Methyl Carbamate	Baycarb 500 EC,Benhur 500 EC, Dham1abas 500 EC, Emcindo 500 EC, Hopcin 50 EC, Karbasin 500 EC, Pentacarb 500 EC, Sidaba 500 EC, Dharmabas 500 EC, BASSA 500 EC, Baycarb 500 EC, Pharmabas 500 EC	Serafim, Bemori, MAF List	No
Brodifacoum	Rodenticides	Coumarin	Klerat RM-B, Petrokum 0,005 RB, Klerat .005 BB	Serafim, MAF	No
Bupirimate	Fungicides	Pyrimidine	1\limrod 250 EC	Nilton	No
Cadusafos	Insecticides	Organo-phosphorus	Rugby 10 G	Nilton	No
Carbaryl	Insecticides	N-Methyl Carbamate	Indovin 85 SP, Sandovin 85 WP,	Serafim, Bemori, MAF	No

Active Ingredient	Use Type	Chemical Class	Common Brand names	Availability	Approved for Avansa
			Sevin 85 S, Seven 85 WP	List	
Carbofuran	Insecticides	N-Methyl Carbamate	Dharmafur 3 G, Furadan 3 G, Hidrafur 3 G, Petrofur 3 G, Primafur 3 G, Trufer 3 G, Furadan 3 GR	Serafim, Balide, Bemori, Jupiter, MAF List	No
Carbosulfan	Insecticides	N-Methyl Carbamate	Marshal 5 G, Marshal 25 ST, Marshal 200 EC, Marshal 200 SC, Taurus 200 EC	Nilton	No
Cartap hydrochloride	Insecticides	Nereistoxin	Karda n 50 SP, Padan 50 SP	Nilton	No
Chlorothalonil	Fungicides	Substituted Benzene	Daconil 500 F, Daconil 75 WP, Octanil 75 VVP, Wendry 75 WP	Serafim, Bemori, MAF List	No
Coumatetralyl	Rodenticide	Coumarin	Racumin	Nilton	No
Cypermethrin	Insecticides	Pyrethroid	Arrive 30 EC, Arfo 30 EC, Astertrin 250 EC, Basma 200 EC, Bestox 50 EC Bravo 50 EC, Crowen 113 EC, Cyrux 50 EC, Cypermax 100 EC, Exocet 50 EC, Hoky 30 EC, Mere! 30 EC, Nurelle D 500/50 EC, Pelle 50 EC, Ripcord 5 EC, Rizotin 100 EC, Rizotin 40 WP, Sancord SO EC, Sidamethrin 50 EC, Yasithrin 30 EC, Sidametrin 50 EC,	Serafim, Bemori, Balide	No
Cypermethrin, Alpha	Insecticides	Pyrethroid	Amethyst 40 EC, &nosp ; Army, Bestox 50 EC, Cyborg 15 EC, Fastac 15 EC, Kejora 15 EC, Fastac 15 EC	Balide, Bemori	No
Cypermethrin, Zeta	Insecticides	Pyrethroid	Fury 50 EC	Nilton	No
Diafenthiuron	Insecticides	unclassified	Pegasus 500 SC	Nilton	No
Dimehypo, Imidacloprid	Insecticide/Fungicide	Organo-phosphate	Bajaj 450 VvSC, Manuver 400 WSC, Spontan 400 WSC, Vista 400 WSC, Hippo 48WP	Serafim	No
Dimethoate	Insecticides	Organo-phosphorus	Danadim 400 EC, Dimacide 400 EC, Kanon 400 EC	Serafim, Bemori, MAF List	No
Emamectin benzoate	Insecticides	Macrocuclic Lactone	Proclaim 5 SG, Prothol 10 EC	Nilton	No
Endosulfan	Insecticides	Cyclodiene Organochlorines	Akodan 350	Serafim	No
Epoxiconazole	Fungicides	triazole	Opus 75 EC	Nilton	No
Fenpropathrin	Insecticides	Pyrethroid	Meothrln 50 EC	Nilton	No
Fenpropathrin	Miticides/Acaricides	pyrethroid	Meothrin 50 EC; Danitol; Valent	Nilton	No
Fenthion	Insecticides	Organophosphorus	Lebaycid 400 EC	Nilton	No
Fentin acetate	Insecticides	Microbial	Oebesttan 60 WP	Nilton	No
Fenvalerate	Insecticides	Pyrethroid	Fenkill 200 EC, Sidin 50 EC	Nilton	No
flufenoxuron	Insecticides	Benzoylurea	Cascade 50 EC	Nilton	No

Active Ingredient	Use Type	Chemical Class	Common Brand names	Availability	Approved for Avansa
Flusilazole	Fungicides	azole	Nustar 400 EC	Nilton	No
Hexaconazole	Fungicides	Azole	Anvi l 50 SC, Danvil 50 SC, Heksa 50 SC	Nilton	No
iminoctadine tris	Fungicides	Guanidine	Belkute 40 WP	Nilton	No
Iprovalicarb	Fungicides	carbamate	Melody Duo 66,8 WP	Nilton	No
Kasugamycin hydrochloride	Bacteriside	Antiobiotic	Kasumin 5/75 WP	Nilton	No
Lufenuron	Insecticides	Benzoylurea	Match 50 EC	Nilton	No
Mefenoxam	Fungicides	Xylylalanine	Ridomil Gold MZ 4/64 WG, Ridomll Gold 350 ES	MAF List	No
Methidathion	Insecticides	Organo-phosphorus	Supracide 25 VV P	Nilton	No
Methiocarb	Insecticides	N-Methyl Carbamate	Mesurol 50 \NP	Nilton	No
Methomyl	Insecticides	N-Methyl Carbamate	Lannate 25 WP, Lannate 40 SP, Metindo 25 WP, Myltop 25 WP	Nilton	No
Mevinphos	Insecticides	Organo-phosphate	EM4	Jupiter	No
MIPC (isoprocarb)	Insecticides	N-Methyl Carbamate	Ancin 50 WP, Mipcinta 50 WP, Mipcenta 50 MP	Bemori	No
Niclosamide	Molluscicide	Salicylanilide	Kensida 70 WP	Serafim	No
Oxyanion sulfate	Fungicides	Oxyanions	Kuproxat 345 F	Nilton	No
Paraffin HVI 650	Surfactant	Petroleum Derivative	Tenac Sticker	Nilton	No
Paraquat Dichloride	Herbicides	Bipyridylium	Bravoxone 276 SL, Gramoxone 276 SL, Kingquat 280 SL, Noxone 297 AS, Noxone 297 SL	Serafim, Balide	No
Phenthoate	Insecticides	Organo-phosphorus	Elsan 60 EC	Nilton	No
Profenofos	Insecticides	Organo-phosphate	Biocron, Curacron 500 EC, Calllcron 500 EC, Detacron 500 EC, Pentacron 500 EC, Profile 430 EC, Rumba 500 EC, Tabard 500 EC	Serafin, Balide, Jupiter	No
Propineb	Fungicides	Dithiocarbamate Zn	Antracol 70 NP, Aurora 70 WP Supracol 70 WP	Serafim	No
Propynul sulfite	Miticides/Acaricides	Organosulfite	Mitisun 570 EC	Nilton	No
Phoxim	Insecticides	Organo-phosphorus	Catleya 500 EC, Fokker 500 EC, Destan 400 EC	Nilton	No
Sodium Nitrophenoxide	Growth	Nitro Phenols	Atonik 6,5 L,	Serafim, Balide, Jupiter	No
Thiodicarb	Insecticides	N-Methyl Carbamate	Larvin 75 WP	Nilton	No
Triazophos	Insecticides	Organo-phosphorus	Raydent 200 EC	Balide	No
Validamycin a	Fungicides	Antibiotic	Validacin 3 AS	Nilton	No
Benomyl (benlate)	Fungicides	Benzimidazole	Benlok. 50 WP, Benstar 50 WP, Masalgin 50 WP	Nilton	No

4.3. USAID field monitoring requirement

For value chain projects or projects otherwise supporting field crop production, the COR, MEO and/or REA must make inspection visits at least two times annually to several randomly selected farms receiving project assistance to check for compliance with the safer use measures summarized in Section 4.4 and detailed in the mandatory compliance tracking and reporting template in Section 4.5.

4.4. Summary of Compliance Requirements (Safer Use Measures)

The allowed AIs in Table 6 can ONLY be used in compliance with the safer use measures and restrictions specified in the PER. These are summarized as follows:

A. Only pesticides approved by this PERSUAP may be supported with USAID funds in Avansa Ag activities. These pesticides are enumerated in section 4.2 above.

   Pesticide 'support' means use of USAID funds to: purchase pesticides; directly fund the application of pesticides; recommend pesticides for use; or purposely facilitate or enable the application or purchase of pesticides via provision of application equipment, credit support, or other means.

   Implementation:

   > See tables in Section 4.2
   > Produce and distribute list of "Approved for Avansa Ag" pesticides to agricultural supply shops, demonstration farms, and other beneficiaries

B. In the case of value chain projects or projects otherwise supporting field crop production, pesticide support must be governed by a set of locally adapted, crop- and pest-specific IPM-based pest management plans and observe enumerated use restrictions.

   Implementation:

   > Annex 2 sets out in table format crop-by-crop, pest-by-pest chemical and non- chemical management methods recommended by this PERSUAP. This is intended to serve as the basis for a crop-specific pest management plan.
   > Materials will be developed in Tetum for specific activities and demonstration farms
   > Annex 1 provides toxicology information for each approved active ingredient, including human acute toxicities and chronic health issues, water pollution potential, as well as potential ecotoxicities to important non-target organisms like fish, honeybee pollinators, birds and several aquatic organisms.

C. Appropriate project staff & beneficiaries must be trained in safer pesticide use & pesticide first aid.

   Implementation:

   > Factor K describes elements that should be included in safer use pesticide and IPM training
   > Annex 7 provides a description of a two-day pesticide training course developed for the DAC project and available in Tetum. It will be used as a basis for developing training courses and materials.

D. To the greatest degree practicable, projects must require use of and assure maintenance of appropriate PPE and application equipment—as well as safe pesticide purchase, handling, storage and disposal practices.

Implementation:

> See example training curriculum in Annex 7
> Avansa Ag will work with agricultural suppliers to ensure that appropriate PPE is available, and to the extent feasible, affordable
> Avansa Ag will distribute information on appropriate pesticide and PPE use and maintenance to agricultural suppliers and through demonstration farm programs
> Follow Safer Use/Mitigation Actions described under Factor D regarding equipment use and maintenance

E. Projects must be systematic in their pesticide-related record keeping and monitoring.

Implementation:

> Annex 8 provides example record-keeping templates/aids
> Avansa Ag specific record keeping templates will be developed as appropriate for the end-user

4.5. Safer Use Monitoring and Mitigation Plan

Table 8 describes mitigations, monitoring indicators, monitoring schedules, and responsible personnel for the safer use action plan. It is the EMMP for pesticide use on the Avansa Ag project.

Many Avansa Ag project beneficiaries will benefit from indirect support- visits to demonstration farms, trainings, educational materials, receiving improved varieties and sample PPE, but will not receive funds or expert assistance at their farms. Monitoring will focus on beneficiaries under direct control or influence of the Avansa Ag project: suppliers, demonstration farms, nutrition gardens, beneficiaries receiving grants or regular technical assistance visits. For project beneficiaries that do not receive direct funding or technical assistance, Avansa Ag has little control over how they use the materials provided by Avansa Ag or whether they purchase or use pesticides rejected by the project. In alignment with the Avansa Ag EMMP, 7.5% of farmers monitored for compliance with the EMMP will also be monitored for pesticide and PPE use.

Additional field monitoring (See Annex 9 for examples from other projects) and record keeping templates specific to end-users and activities will be developed (see Annex 8 for examples) prior to implementation of pesticide-using activities.

Table 8: Potential impacts, mitigation, and monitoring for pesticide use

Mitigation	Monitoring Indicator/Criteria	Monitoring Schedule	Responsible Parties
Potentital Impact: Human health risks			
Use only approved pesticides	› Pesticide must be on approved list	› At time of procurement › Every six months	› Cesaltino Lopes › District specialists › DCOP- Jeff Gucker
Grantees mandated to certify in writing that only PERSUAP approved pesticides will be purchased or used	› Review of contract › Field inspection of pesticide use	› At time of contract › Every six months	› Grants manager- Natalino › Cesaltino Lopes

Mitigation	Monitoring Indicator/Criteria	Monitoring Schedule	Responsible Parties
Encourage use of pesticides with the lowest human and environmental risk profiles (based on this document, MSDSs, and pesticide labels), as practical.	› Appropriate training materials on IPM & Pesticide safety › IPM plan developed for activity	› At time of implementation	› Cesaltino Lopes › District specialists › DCOP
Provide educational materials, training, and appropriate PPE for pesticide use at demonstration farms, agricultural suppliers, and directly to Avansa Ag farmers Training and educational materials to include: › IPM › Appropriate pesticide selection, application, transport and storage › PPE › Provide basic first aid training for pesticide overexposure, availability and use of antidotes, and recommendations found on pesticide Labels and MSDSs for commonly used pesticides › Promote and teach proper sprayer maintenance and repair including calibration and nozzle choice › Post-spray hygiene › Proper disposal of used pesticide containers › What problems need to be reported immediately to Avansa Ag and USAID staff › Focus safety for women and children- avoiding handling pesticides, entering fields after application	› Training materials developed › Training materials delivered › % of beneficiaries trained	› At implementation › Every six months	› Cesaltino Lopes › District specialists › DCOP- Jeff Gucker ›
Where pesticide use is under their direct control, Avansa Ag shall assure that appropriate PPE is provided, is well maintained, and properly utilized.	› Appropriate PPE is available on-site › PPE is checked and maintained on a regular basis (checklist) › PPE is being used properly	› Training and PPE provided at activity startus › Every six months	› Cesaltino Lopes › District specialists
Assure and require well-maintained sprayers and proper post-spray hygiene and facilities for pesticide use for Avansa Ag projects	› Sprayers are functioning properly › Post-spray facilities are present and functioning	› At project startup › Every six months	› Cesaltino Lopes › District specialists
Emergency decontamination available at farms (bucket of water)	› Decontamination options are present	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Recommend using quality products and discourage use of generic products of questionable composition	› Inspect pesticide suppliers and users for generic or poorly packed pesticides	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Ensure proper disposal of used pesticide containers for Avansa Ag controlled projects	› System of collection and disposal developed › No improperly disposed containers at sites	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Potentital Impact: Pest resistance			
Training on IPM principles as well as crop- or pest-specific IPM practices relevant to the audience, promote and support IPM to the greatest practicable extent Training will include and emphasize pesticide rotation	› IPM training and materials developed › Training and materials delivered › Number of beneficiaries	› At activity startup › Every six months	› Cesaltino Lopes › District specialists › DCOP Jeff Gucker

Mitigation	Monitoring Indicator/Criteria	Monitoring Schedule	Responsible Parties
among the classes of pesticides and using high quality pesticides Training on monitoring and data record keeping techniques for pest control and pesticide needs and/or effectiveness.	trained		
Posters and informational handouts will be developed for on-farm use in prediction and management of the major pests of each crop	› Materials developed	› At project implementation	› Cesaltino Lopes › District specialists
Require and enforce IPM implementation in situations where the project has direct control over pesticide use, and require and enforce that field extension under direct project control be IPM-based.	› .IPM plans developed › IPM methods implemented	› At activity startup › Every six months	› Cesaltino Lopes › District specialists › DCOP Jeff Gucker
Monitor pesticide use for increasing use due to ineffective formulations or pest resistance.	› Change in pesticide use/effectiveness › Change in pest infestation rates	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Potentital Impact: Contamination of nearby water bodies, potable water sources, or groundwater			
Choose low toxicity pesticides when possible	› No spraying near water bodies › No spraying in heat of afternoon › Minimal drift observed during spraying › Sprayers have been trained in safe spray technique	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
For chemicals with high aquatic toxicity: do not spray on farms with nearby streams or other natural water bodies. Develop alternative pest-management approaches.	› Develop list of chemicals with high aquatic toxicity › Check proposed pesticides at activity initiation ›	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Use spraying BMPs: › Spray in the early morning or late afternoon when winds are low › Apply largest droplets which provide sufficient coverage and control › Use high flow rate nozzles to apply the highest practical spray volume › Use the lower spray pressures recommended for the nozzle › Do not spray before a rainstorm	› BMPs are being followed	› Every six months	› Cesaltino Lopes › District specialists
Do not use cyromazine in areas with high water tables and/or sandy soils	› Activity initiation includes review of soils and hydrology › Training materials include information about cyromazine › Not being applied in floodplains or vulnerable areas	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Do not spray or rinse within 30m of waterbodies or	› Note location of waterbodies at project	› At activity	› Cesaltino Lopes

Mitigation	Monitoring Indicator/Criteria	Monitoring Schedule	Responsible Parties
water sources	initiation › Monitor spraying	startup › Every six months	› District specialists
Use farm BMPs to reduce erosion	› BMPs being implemented › Erosion and siltation is controlled during rainy season	› At activity startup › Every six months › At least once during rainy season, preferably during rain event	› Cesaltino Lopes › District specialists
Potentital Impact: Sensitive areas			
Before the implementing an activity, identify and map all sensitive areas near the project sites.	› Maps are reviewed and information is incorporated at activity development phase › Pesticides use near sensitive areas	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Maintain a 2.5 to 5 km buffer no-spray zone around national parks or other protected areas where agricultural activities are prohibited.	› Maps are reviewed and information is incorporated at activity development phase › Pesticides use within 2.5km of protected areas	› At activity startup › Every six months	› Cesaltino Lopes › District specialists
Use good agricultural practices and avoid using highly toxic or persistent pesticides where endangered species are known to exist.	› Maps are reviewed and information is incorporated at activity development phase › Pesticides type and use near sensitive areas	› At activity startup › Every six months	› Cesaltino Lopes › District specialists

5. PERSUAP References

Ministry of Economy and Development (MED). 2010. National Adaptation Programme of Action (NAPA) on Climate Change. http://unfccc.int/resource/docs/napa/tls01.pdf

Molyneux, N., G Rangel da Cruz, R. Williams, R. Anderson, and N. Turner. 2012. Climate Change and Population Growth in Timor-Leste: Implications for Food Security. Ambio 2012, 41:823-840.

USAID. 2010. DOCIA EMMP Report Greenhouse SHAs.

USAID. 2013. Accelerating Inclusive Economic Growth in Timor-Leste, Assessment of Opportunities for Inclusive Economic Growth in Timor-Leste, Final Report, April 2013

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USAID. 2014. Avansa: Integrated Food Security, Climate Change Adaptation, and Private Sector Competitiveness solicitation, August 2014

USAID. 2014. Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014

Website references used to develop the PERSUAP:

International Treaties and Conventions:

POPs website: http://www.pops.int

PIC Website: http://www.pic.int

Basel Convention: http://www.basel.int/

Montreal Protocol: http://www.unep.org/OZONE/pdfs/Montreal-Protocol2000.pdf

Pesticide poisonings:

http://www.panna.org/resources/panups/panup_20080403

http://magazine.panna.org/spring2006/inDepthGlobalPoisoning.html

IPM and PMP websites:

http://www.encapafrica.org/egssaa/ipm.pdf

http://www.ipm.ucdavis.edu/

http://edis.ifas.ufl.edu/pg058

http://www.ipmcenters.org/pmsp/index.cfm

http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/154769/Cotton-pest-management-guide-1.pdf

Pesticide Research Websites:

http://www.pesticideinfo.org/Search_Chemicals.jsp (One of the primary sources on toxicity, registration status, and RUP)

http://extoxnet.orst.edu/pips/ghindex.html (Extoxnet Oregon State database with ecotox)

http://www.agf.gov.bc.ca/pesticides/f_2.htm (all types of application equipment)

http://www.greenbook.net/Search/AdvancedSearch (pesticide Material Safety Data Sheets)

http://www.epa.gov/pesticides/reregistration/status.htm (USEPA Registration Eligibility Decisions)

Ecotoxicity:

http://www.ohioline.osu.edu/hyg-fact/2000/2161.html (pesticide toxicity to honeybees)

http://wihort.uwex.edu/turf/Earthworms.htm (pesticide toxicity to earthworms)

Safety:

http://www.epa.gov/oppbppd1/biopesticides/ingredients/index.htm (USEPA regulated biopesticides)

http://www.ipm.ucdavis.edu/index.html (IPM, PMPs and pesticide recommendations)

http://edis.ifas.ufl.edu/pdffiles/PI/PI07300.pdf (Restricted Use Pesticides)

http://www.epa.gov/pesticides/health/ (USEPA Health & Safety)

http://www.epa.gov/opppmsd1/PPISdata/index.html (USEPA pesticide product information)

Personal Protection Equipment (PPE):

http://www.epa.gov/oppfead1/safety/workers/equip.htm (all types of PPE)

http://www.cdc.gov/nasd/docs/d001701-d001800/d001797/d001797.html (respiratory PPE)

Annex 1: Pesticides in Timor-Leste

The table in this annex compiles all of the AIs in pesticides (natural and synthetic) available in Timor-Leste based on a survey conducted in June 2015. Project decision-makers—especially those who interface at the field level with beneficiary farmers—are encouraged to look at the label of potential pesticide choices to determine the AIs contained in them and then use this Annex as a quick reference guide to attributes and issues with each chemical.

The pesticide attributes include pesticide class (to manage resistance by rotating chemicals from different classes), USEPA registration and Restricted Use Pesticide (RUP) status (to comply with Regulation 216) and acute toxicity (judged by this document to be safe, or not, for smallholder farmers). Class I chemicals are not considered safe for smallholder farmers to use. This annex also presents chronic health issues, water pollution potential, and potential toxicities to important non-target organisms like fish, honeybee pollinators, birds and several aquatic organisms.

Further, this table contains basic pieces of human safety and environmental data needed for the various analyses required throughout the PER; therefore it is referred to throughout this document. It provides data used to produce the project-critical information for planning activities and safety protocols. Thus, this PERSUAP provides useful tools for evaluating and choosing among IPM options, including natural and synthetic pesticides, while adhering to 22 CFR 216.

Key to matrix:

Approved for Avansa = No:	Do not promote products containing these AIs on Avansa Ag projects
Approved for Avansa = Yes:	Can be promoted on Avansa Ag projects
Approved for Avansa = Depends:	Some products accepted; some products rejected depending on RUP status
RUP:	Few = one or two products; Some = a third of products; Most/All = most or all products
WHO Acute Toxicity Classes:	O = Obsolete; Ia = Extremely Hazardous; Ib = Highly Hazardous; II = Moderately Hazardous; III = Slightly Hazardous; U = Unlikely to present acute hazard in normal use
USEPA Acute Toxicity Classes:	I = Extremely Toxic; II = Highly Toxic; III = Moderately Toxic; IV = Slightly Toxic
Chronic Human Toxicity:	KC = Known Carcinogen; PC = Possible Carcinogen; LC = Likely Carcinogen; ED = Potential Endocrine Disruptor; RD = Potential Reproductive & Development Toxin; P = Risk of Parkinson's
Ecotoxicity:	NAT = Not Acutely Toxic; PNT = Practically Not Toxic; ST = Slightly Toxic; MT = Moderately Toxic; HT = Highly Toxic; VHT = Very Highly Toxic

References for Annex 1 are located in Section 5, References.

Table A1-1: Pesticides Available in Timor-Leste

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
Kasugamycin hydrochloride	Bacteriside	Antiobiotic	No	Kasumin 5/75 WP	Nilton	NO														
Oxytetracycline	Bacteriside	Antibiotic	Yes	Bactocyn 150 AL	Nilton	YES	NO				No data	NAT	ST				ST	ST		NAT
Streptomycin Sulfate	Bacteriside	Antibiotic	Yes	Plantomycin 7 SP	Nilton	YES	NO		IV	CR	Potential	ST	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
Acibenzolar-s-methyl	Fungicides	Benzothiadiazole	Yes	Bion-M 1/48 WP	Nilton	YES	NO			PC		HT	PNT	PNT					PNT	
Azoxystrobin	Fungicides	Strobin	Yes	Amistar top 325 SC , Amotan 250	Nilton	YES	NO	U			Potential	ST	NAT							HT
Azoxystrobin, Difenoconazole	Fungicides	Azole	Yes	Amistartop 325 SC, Score 250 EC	Nilton	YES	NO	III	III	PC	No data	MT	MT	ST		MT		MT		HT
Benomyl (benlate)	Fungicides	Benzimidazole	No	Benlok. 50 WP, Benstar 50 WP, Masalgin 50 WP	Nilton	NO														
Bupirimate	Fungicides	Pyrimidine	No	1\limrod 250 EC	Nilton	NO														
Carbendazim	Fungicides	Benzimidazole	Yes	Delsene MX 80 WP	Nilton	YES	NO	U	III	PC/ED	No data	MT	NAT	ST	ST			ST		HT
Chlorothalonil	Fungicides	Substituted Benzene	No	Daconil 500 F, Daconil 75 WP, Octanil 75 VVP, Wendry 75 WP	Serafim, Bemori, MAF List	YES	SOME	U	I	LC	Potential	VHT	MT		HT		ST	VHT	MT	VHT
Copper Hydroxide	Fungicides	Inorganic Copper	Yes	Cobox, Kocide 77	Nilton	YES	NO	III	III		No Data	MT					HT	NAT		
Cymoxanil	Fungicides	Unclassified	Depends	Curzate 8/64 WP, Curci 10 \NP, Victory Mlx 8/64 WP,	Nilton	YES	SOME	III	III	none	No data	MT	MT	ST		MT		MT	MT	ST
Dazomet	Fungicides	Unclassified	Depends	Basamid G	Nilton	YES	SOME	III	II	D	Potential	ST	ST		ST			HT		HT
Dimethomorph	Fungicides	Morpholine	Yes	Acrobat 50 WP	Nilton	YES	NO	U	IV			MT	ST							ST
Epoxiconazole	Fungicides	triazole	No	Opus 75 EC	Nilton	NO														
Fenamidone	Fungicides	Imidazole	Yes	Pitora 10/50 WG	Nilton	YES	NO	None	II, III	None	No data	MT	MT	MT		MT		MT		

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
Fenarimol	Fungicides	Pyrimidine	Yes	Rubigan 120 EC	Nilton	YES	NO	U	IV			MT	ST							
Fenbuconazole	Fungicides	Azole	Yes	Indar 240 F	Nilton	YES	NO	U	III	PC		MT	NAT							HT
Flusilazole	Fungicides	Azole	No	Nustar 400 EC	Nilton	NO														
Fosetyl-AL	Fungicides	Unclassified	Yes	Aliette		YES	NO	NA	III		Potential	NAT	ST					NAT		MT
Hexaconazole	Fungicides	Azole	No	Anvi l 50 SC, Danvil 50 SC,, Heksa 50 SC	Nilton	NO														
iminoctadine tris	Fungicides	Guanidine	No	Belkute 40 WP	Nilton	NO														
Iprodione	Fungicides	Dicarboximides	Yes	Roval 50 WP	Serafim	YES	SOME	III	III	None			NAT	ST						
Iprovalicarb	Fungicides	carbamate	No	Melody Duo 66,8 WP	Nilton	NO														
Mancozeb	Fungicides	Dithiocarbamate	Yes	Actozeb 80 WP, Amacozeb 80 WP,, Antila 80 WP, , Bazoka 80 WP, Raksasa 80 WP, , Sidazsb 80 WP, , Tanzsb 80 WP,, Victory 80 WP, Victory mix 8/64 WP Vondozeb 80 WP, Dithane M-45 WP	Bemori, MAF List	YES	NO	U	III	PC, ED, RD	No data	MT	MT	ST	HT					NAT
Maneb	Fungicides	Dithiocarbamate	Yes	Detanneb 80 WP, Phycozan 70 \NP Pilaram 80 WP • Promaneb 80 WP	Nilton	YES	NO	U	III	PC, ED, RD	No data	MT	MT	ST	HT					NAT
Mefenoxam	Fungicides	Xylylalanine	No	Ridomil Gold MZ 4/64 WG, RidomII Gold 350 ES	MAF List	YES	NO		I		Potential	ST	ST							ST
Metalaxyl	Fungicides	Benzanoid	Depends	Rampart 25 WP, Sarornyl 35 SD, Starmyl 25 WP	Nilton	YES	SOME	III	II, III	NL	Potential	ST	PNT	PNT						ST
Metiram	Fungicides	Dithiocarbamate	Yes	Polycom 80 WP	Nilton	YES	NO	U	III	KC	NAT	ST	PNT	PNT	ST		ST	ST	PNT	
Oxyanion	Fungicides	Oxyanions	No	Kuproxat 345 F	Nilton	NO														

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
sulfate																				
Phosphorous Acid	Fungicides	Inorganic	Yes	Folirfos 400 AS	Nilton	YES	NO	U	III	none	No data	ST								
Propamocarb hydrochloride	Fungicides	Carbamate	Yes	Previcur - N, Previcur Flex	Nilton	YES	NO	U	III	D	No data	PNT	PNT	ST	PNT		PNT	PNT	PNT	PNT
Propiconazole	Fungicides	Azole	Yes	Golex 250 EC	Nilton	YES	NO	II	II, III	PC, RD	Potential	MT					MT	ST	MT	MT
Propineb	Fungicides	Dithiocarbamate Zn	No	Antracol 70 NP, Aurora 70 WP, Supracol 70 WP	Serafim	NO														
Tebuconazole	Fungicides	Azole	Yes	Folicur 250 EC, Folicur 25 WP	Nilton	YES	NO	III	III		No data	MT	NAT	ST	NAT	NAT	NAT	ST	NA	NAT
Thiophanate-methyl	Fungicides	Benzimidazole precursor	Yes	Topsin M 70 WP , Judo 70 WP, Topsin 500 EC,	Jupiter	YES	NO	U	III	PC	No data	PNT	No data	PNT	PNT	PNT	PNT	PNT	PNT	PNT
Thiram	Fungicides	Dithiocarbamate	Yes	Tiflo 80 WP	Nilton	YES	NO	III	III	PA	No data	MT	NAT	HT	MT	MT	MT	MT	MT	NA
Triadimefon	Fungicides	Azole	Yes	Bayleton 250 EC, Clinten 250 EC	Nilton	yes	NO	III	II, III	RD	Potential	MT	MT	PNT		MT		NAT		
Trichoderma harzianum and Trichoderma plysporum	Fungicides	Microbial	Yes	Anfush, Natural Glo	Balide	YES	NO	U	IV		No data	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
Validamycin a	Fungicides	Antibiotic	No	Validacin 3 AS	Nilton	NO														
Ziram	Fungicides	Dithiocarbamate	Yes	Tiflo 80 VVP	Nilton	YES	NO	III	III	ED, RD, PC	No data	HT	NAT	PNT	VHT	HT		NAT	HT	HT
Ethephon	Growth	Organophosphorus	Yes	Ethrel10 LS, Ethrel 2,5 LS,, Prothepon 480 SL	Balide	YES	NO	U	IV			NAT	ST					NAT	NAT	NAT
Gibberellic Acid	Growth	Botanical	Yes	Bigest 40 EC, Gibgro, Progibb 20 SL	Nilton	YES	NO	U	IV											
Paclobutrazol	Growth	Azole	Depends	Cultar 250 SC, Goldstar 250 EC	Nilton	YES	SOME	III	III			ST			ST		ST	ST		ST
Sodium 5 Nitroguaiacolat	Growth		Yes	Oekamon 22.43 L	Nilton	YES	NO													

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
e																				
Sodium Nitrophenoxide	Growth	Nitro Phenols	No	Atonik 6,5 L,	Serafim, Balide, Jupiter	NO														
Dimethyl-amine Salt	Herbicides	Amine	Depends	DMA6 825 SL, Indamin 720 HC, Tasmin 865 SC	Bemori, MAF List	YES	SOME		III			NAT						NAT		ST
Glyphosate	Herbicides	Phosphono-glycine	Yes	Amiphosate 480 SL, Basmilang 480 AS,, Bionasa 480 AS, Bio Up 490 SL, Indofos 480 AS,, Konup 480 SL, , Proris 240 AS, Penta up-z Rambo 480 AS,, Crash 480 AS,, Roll-up 480 SL,, Roundup 486 AS,, Sandoup 480 SL, Sidafos 480 AS, Roundup 486 SL, Ridox 48 SL	Serafim, Balide, Bemori, Jupitar, MAF List	YES	NO	U	II, III	None	Potential	ST	ST	NAT		PNT		MT		ST
Glyphosate-monoammonium Salt	Herbicides	Phosphono-glycine	Yes	Bionasa 75 WSG	Nilton	YES	NO		III		Potential	ST			ST			MT		ST
MCPA	Herbicides	Chlorophen oxy acid	Yes	Agroxone 4, Rambasan 400 AC	Nilton	YES	NO	II	II, IIII	PC	No data	ST	PNT	NAT	ST		ST	NAT	NAT	ST
Metsulfuron-methyl	Herbicides	Sulfonylure a	Yes	Ally20WDG, Allyplus 77 VVP, rvictafuron 20 VVDG	Nilton	YES	NO	U	III	None	Potential	NAT	MT	NAT		MT		NAT		
Oxyfluorfen	Herbicides	Diphenyl ether	Yes	Goal2 EC, Gol-ok 2 EC	Nilton	YES	NO	U	II, III	PC	No data	HT	PNT	PNT			HT		HT	HT
Paraquat Dichloride	Herbicides	Bipyridylium	No	Bravoxone 276 SL, Gramoxone 276 SL, Kingquat 280 SL,, Noxone 297 AS, Noxone 297 SL,	Serafim, Balide	YES	YES	II	I	ED	Potential	ST	ST		ST	NAT	NAT		NAT	ST
Triasulfuron	Herbicides	Sulfonylure	Yes	Logran 20 WG	Nilton	YES	NO	U	II											

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
		a																		
Beauveria bassiana	Insecticide	Biopesticide	Yes	By Vil, Natural BUR	Balide	YES	NO	None	III	None	No data	NAT	NAT	NAT		NAT		NAT		
Boric Acid	Insecticide	Inorganic	Yes			Yes	NO	None	III		No data	NAT	NAT							NAT
Neem	Insecticide	Biopesticide	Yes	Pestona 500 EC	Balide	YES	NO		III	None	MT	NAT	MT			MT	NAT		MT	
Pyridaben	Insecticide	METI	Yes	Samite 135 EC	Balide	YES	NO	III	III	None		VHT	HT						VHT	VHT
Dimehypo, Imidacloprid	Insecticide/ Fungicide	Organo-phosphate	No	Bajaj 450 VvSC, Manuver 400 WSC, Spontan 400 WSC, Vista 400 WSC, Hippo 48WP	Serafim	NO														
Acephate	Insecticides	Organo-phosphorus	Yes	Oafat 75 SP, Lancer 75 SP, Orthene 75 SP	Nilton	YES	NO	III	III	PC, ED	Potential	NAT	ST		NAT			NAT	ST	NAT
Acetamiprid	Insecticides	Neonicotinoid	Yes	Amsipilan 20 SP, Mospilan 30 EC	Nilton	YES	NO	None	III	None	No data	NAT	MT	HT				NAT		
Avermectin	Insecticides	Microbial	Depends	Agrimec 18 EC, Aspire, Bamex 18 EC, Calebtio EC, Demolish 18 EC, Klliri 20 .EC, Promectin 18 EC, Wito 4 EC	Nilton	YES	SOME	None	II, III	RD	No data	ST	HT	PNT				HT	VHT	VHT
Bacillus thuringiensis	Insecticides		Yes	Agrisal WP, Bactospeine WP, Dipel WP,, &nbsN: Florbac FC Thuricide HP,, Turex WP, Dipel DF,	Balide, MAF List	Yes	NO	None	III	None	No data		PNT	NAT	NAT		ST	ST		
Bensultap	Insecticides	Nereistoxin	No	Bancol50 WP	Nilton	NO														
Beta Cyfluthrin	Insecticides	Synthetic Pyrethroid	Depends	Buldok 25 EC, Raydock 28 EC, SUMO 50 EC	Serafim, Balide, MAF List	YES	SOME	II	II, III	ED	No data	VHT	HT	PNT			ST		VHT	VHT
Bifenthrin	Insecticides	Pyrethroid	Depends	Talstar 25 EC; Sumialpha 25 EC	Nilton	YES	SOME	II	II	PC, ED		VHT	HT							VHT
BPMC (fenobucarb)	Insecticides	N-Methyl Carbamate	No	Baycarb 500 EC,Benhur 500 EC,,	Serafim, Bemori,	NO														

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
				Dham1abas 500 EC,, Emcindo 500 EC,, Hopcin 50 EC, Karbasin 500 EC, Pentacarb 500 EC,, Sidaba 500 EC, Dharmabas 500 EC, BASSA 500 EC, Baycarb 500 EC, Pharmabas 500 EC,	MAF List																
Buprofezin	Insecticides	Unclassified	Yes	Applaud 100 EC, Applaud 10 \NP	Nilton	YES	NO	U	IV				NAT		NAT					
Cadusafos	Insecticides	organo-phosphorus	No	Rugby 10 G	Nilton	NO														
Carbaryl	Insecticides	N-Methyl Carbamate	No	Indovin 85 SP, Sandovin 85 WP, Sevin 85 S, Seven 85 WP	Serafim, Bemori, MAF List	Yes	YES	II	III	ED	Potential	MT	HT		MT		ST	MT	HT	MT
Carbofuran	Insecticides	N-Methyl Carbamate	No	Dharmafur 3 G, Furadan 3 G, Hidrafur 3 G, Petrofur 3 G, Primafur 3 G, Trufer 3 G, Furadan 3 GR	Serafim, Balide, Bemori, Jupiter, MAF List	YES	MOST	Ib	I, II	ED	potential	MT	HT	HT	ST	MT	MT	HT	HT	VHT
Carbosulfan	Insecticides	N-Methyl Carbamate	No	Marshal 5 G, Marshal 25 ST, Marshal 200 EC,, Marshal 200 SC, Taurus 200 EC	Nilton	YES	NO	Ib	II	ED	Potential	MT	HT		ST		MT	HT	HT	MT
Cartap hydrochloride	Insecticides	Nereistoxin	No	Karda n 50 SP, Padan 50 SP	Nilton	NO														
Chlorfenapyr	Insecticides	Pyrazole	Yes	Rampage 100 EC, Rampage 100 SC	Nilton	YES	NO	II	II	PC			HT							VHT
Chlorpyrifos	Insecticides	Organo-phosphorus	Depends-Durbisan not RUP	Basban 200 EC, Clobber 200 EC,, Dursban 20 EC,, Kresban 200 EC ,Nurelle 0 500/50 EC Posban 200 EC,	Serafim, Balide, Bemori, Jupitar	YES	SOME	II	II, III	ED	No data	HT	HT	HT	MT	PNT	MT	VHT	HT	MT

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
				Dursban 200 EC																
Cyhalothrin, lambda	Insecticides	Pyrethroid	Depends	Alika 247 ZC, Granat 25 EC, Hamador 25 EC, Matador 25 CS, Rolidor 25 EC, Trigon, BioMac 10 WP, Matador 25 CS, ICON 10 WP	Serafim, Balide, Bemori	YES	SOME	II	II, III	ED	No data	VHT	HT	PNT		VHT	VHT	VHT	VHT	
Cypermethrin	Insecticides	Pyrethroid	No	Arrive 30 EC, Arfo 30 EC,, Astertrin 250 EC, Basma 200 EC, Bestox 50 EC, Bravo 50 EC,, Crowen 113 EC,, Cyrux 50 EC,, Cypermax 100 EC,, Exocet 50 EC,, Hoky 30 EC,, Mere! 30 EC,, Nurelle D 500/50 EC, Pelle 50 EC,, Ripcord 5 EC,, Rizotin 100 EC,, Rizotin 40 WP, Sancord SO EC, Sidamethrin 50 EC,, Yasithrin 30 EC, Sidametrin 50 EC	Serafim, Bemori, Balide	NO														
Cypermethrin, Alpha	Insecticides	Pyrethroid	No	Amethyst 40 EC, &nosp ; Army, Bestox 50 EC, Cyborg 15 EC, Fastac 15 EC, Kejora 15 EC, Fastac 15 EC	Balide, Bemori	NO														
Cypermethrin, Beta	Insecticides	Pyrethroid	Depends	Beta 15 EC, Chix 25 EC	Bemori	YES	SOME	II	II	PC, ED		VHT							VHT	
Cypermethrin, Zeta	Insecticides	Pyrethroid	No	Fury 50 EC	Nilton	YES	YES	Ib	I	PC, ED		HT					MT	VHT	VHT	VHT
Cyromazine	Insecticides	Triazine	Yes	Cyrroiex 75 SP, Trigard 75 WP, Guntur 75 VVP	Nilton	YES	NO	U			YES		ST							
Deltamethrin	Insecticides	Pyrethroid	Depends	Decis 25 EC, Marcis	Serafin,	YES	SOME	II	II, III	None	No data	HT	MT		VHT		NAT		VHT	VHT

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
				25 EC, Naichi 25 EC, Oscar 25 EC	Balide, Jupiter															
Diafenthiuron	Insecticides	Unclassified	No	Pegasus 500 SC	Nilton	NO														
Diazinon	Insecticides	Organo-phosphorus	Depends	Diazinon 60 EC, Sidazinon 600 EC, Diazinon 600 EC	Serafim, Balide, Bemori	YES	FEW	II	II	ED	Potential	MT	HT		MT		ST	ST	HT	MT
Diflubenzuron	Insecticides	Benzoylure a	Depends	Solano 25 WP	Nilton	YES	YES	U	III	ED		NAT	ST		NAT		NAT	MT	VHT	MT
Dimethoate	Insecticides	Organopho sphorus	No	Danadim 400 EC, Dimacide 400 EC, Kanon 400 EC	Serafim, Bemori, MAF List	YES	NO	II	II	PC	Potential	ST	VHT	VHT	HT	MT	VHT	HT	VHT	MT
Emamectin benzoate	Insecticides	Macrocuclic Lactone	No	Proclaim 5 SG, Prothol 10 EC	Nilton	YES	YES		I		Potential	HT	HT	HT	HT	HT	HT	HT	HT	HT
Endosulfan	Insecticides	Cyclodiene Organochlo rines	No	Akodan 350	Serafim	NO														
Fenpropathrin	Insecticides	Pyrethroid	No	Meothrln 50 EC	Nilton	YES	YES	II	I			VHT			VHT			VHT	MT	VHT
Fenthion	Insecticides	Organo-phosphorus	No	Lebaycid 400 EC	Nilton	NO														
Fentin acetate	Insecticides	Microbial	No	Oebesttan 60 WP	Nilton	NO														
Fenvalerate	Insecticides	Pyrethroid	No	Fenkill 200 EC, Sidin 50 EC	Nilton	NO														
Fipronil	Insecticides	Pyrazole	Depends	Regent 0.3 G, Regent 50 SC, Regent 50 SL	Balide	YES	SOME	II	II	PC, ED	Potential	HT						VHT	VHT	VHT
flufenoxuron	Insecticides	Benzoylure a	No	Cascade 50 EC	Nilton	NO														
Gamma Cyhalothrin	Insecticides	Pyrethroid	Depends	Proaxis 15 CS	Nilton	YES	YES	II	II			HT								
Imidacloprid	Insecticides	Neonicotino id	Depends	Avidor 25 VVP, Abuki 50 SL Amirld,, Caleb tsan 28 EC,, Confider 5 WP,, Confider 200 SL,, Delouse 200 SL,, Imidasal 10 WP,,	Nilton	YES	SOME	II	II, III	None	Potential	NAT		MT					VHT	

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
				Imidor 50 SL,, Neptune 25 WP,, Winder 100 EC,, Wingran 0,5 G																
Lufenuron	Insecticides	Benzoylurea	No	Match 50 EC	Nilton	NO														
Malathion/mercaptothion	Insecticides	Organo-phosphate	Yes	Fyfanon 440 EC	Nilton	YES	NO	III	II	PC, ED	Potential	MT	HT	MT	HT	ST	VHT	MT	VHT	HT
Methidathion	Insecticides	Organo-phosphorus	No	Supracide 25 VV P	Nilton	YES	YES	Ib	I	PC	Potential	MT	VHT				ST	HT	VHT	ST
Methiocarb	Insecticides	N-Methyl Carbamate	No	Mesurol 50 \NP	Nilton	YES	YES	1b	II		Potential	HT	HT		MT		MT	MT		HT
Methomyl	Insecticides	N-Methyl Carbamate	No	Lannate 25 WP, Lannate 40 SP, Metindo 25 WP, Myltop 25 WP	Nilton	YES	YES	Ib	I	ED	Potential	MT	HT		ST		ST	HT	HT	HT
Mevinphos	Insecticides	Organo-phosphate	No	EM4	Jupiter	NO														
MIPC (isoprocarb)	Insecticides	N-Methyl Carbamate	No	Ancin 50 WP, Mipcinta 50 WP, Mipcenta 50 MP	Bemori	NO														
Permethrin	Insecticides	Pyrethroid	Yes	Meriam 50 EC, Methrisida 100 EC, Pounce 20 EC, Pentatrin 20 EC, Prego 20 EC,	Bemori	YES	NO	II	III	PC, ED	No data	VHT	VHT	PNT	ST	ST	ST	VHT	MT	MT
Phenthoate	Insecticides	Organophosphorus	No	Elsan 60 EC	Nilton	NO														
Phoxim	Insecticides	Organo-phosphorus	No	Catleya 500 EC, Fokker 500 EC, Destan 400 EC	Nilton	NO														
Profenofos	Insecticides	Organo-phosphate	No	Biocron, Curacron 500 EC, Calllcron 500 EC, Detacron 500 EC, Pentacron 500 EC, Profile 430 EC, Rumba 500 EC, Tabard 500	Serafin, Balide, Jupiter	YES	MOST		II		Potential	HT					VHT	VHT	VHT	MT

Active Ingredient	Use Type	Chemical Class	Approved for Avansa	Brand names	Availability	USEPA Registered	Restricted Use Pesticide Status	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Fish	Bees	Birds	Amphibians	Worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
				EC																
Spinosad A/D	Insecticides	Microbial	Yes	Tracer 120 SC	Nilton	YES	FEW	U	III	NL	No data	MT	HT	PNT		ST			HT	MT
Thiamethoxam	Insecticides	Neonicotinoid	Depends	Actara 25 WG	Nilton	YES	SOME		III	PC	No data	PNT	HT	PNT		PNT	PNT	PNT	PNT	
Thiodicarb	Insecticides	N-Methyl Carbamate	No	Larvin 75 WP	Nilton	YES	YES	II	II	PC		MT	ST		VHT		MT	VHT		VHT
Triazophos	Insecticides	Organophosphorus	No	Raydent 200 EC	Balide	NO														
Fenpropathrin	Miticides/Acaricides	pyrethroid	No	Meothrin 50 EC; Danitol; Valent	Nilton	YES	YES	II	I			VHT			VHT			VHT	MT	VHT
Propynul sulfite	Miticides/Acaricides	Organosulfite	No	Mitisun 570 EC	Nilton	YES	ALL		III	LC	Potential	HT		HT	HT	HT	HT	HT	HT	HY
Metaldehyde	Molluscicide	Aldehyde	Yes	Siputox 5 G	Nilton	YES	NO	II	II	PC	Potential	NAT								
Niclosamide	Molluscicide	Salicylanilide	No	Kensida 70 WP	Serafim	NO														
Forchlorfenuron	Plant Growth Regulator	Urea	Yes	Gibberellic acid- Not RUP		YES	FEW		III		Potential									
Coumatetralyl	Rodenticide	Coumarin	No	Racumin	Nilton	NO														
Brodifacoum	Rodenticide	Coumarin	No	Klerat RM-B, Petrokum 0,005 RB, Klerat .005 BB	Serafim, MAF	YES	YES	Ia	I	None		MT								
Alkylaryl polyglycol ether; BASF	Surfactant		No	Agristick 400 L, Agristech 200, Citowett 105 AS	Balide	NO														
Paraffin HVI 650	Surfactant	Petroleum Derivative	No	Tenac Sticker	Nilton	NO														

Annex 2: Matrix of Avansa Ag Crops with Pests, Recommended Pest Prevention Tactics & Curative Tools and Tactics

Table A2-1: General preventive and curative GAP and IPM options

Preventive	Preventive	Curative
Soil nutrient, texture and pH testing	Farmer ability to correctly identify pest predators, parasitoids and diseases	Mechanical insect control by hand picking
Pest resistant/tolerant seed/plant variety	Weekly field scouting to assess pest levels/damage	Farmers make & apply local artisanal plant extracts (neem, pyrethroid, garlic, chili, other)
Early/late plantings or harvestings to avoid pests	Use of trap crops to trap and destroy pests	Weed control by machine cultivation, hoe or hand
Seed treatment with pesticides	Removal/pruning of diseased or heavily infested plants/tree branches	Purchase and release of predators or parasitoids to control major pests
Soil moisture testing	Planting parasite-attracting plants on field margins	Use of pheromone traps to reduce overall pest levels
Raised-bed production or mounding	Put baits and use other practices to encourage predator/parasite build- up	Use of pheromone inundation to confuse pest mating
Irrigation and drip irrigation	Use of pheromone traps to monitor pest levels	Spot treatment of pest hotspots with insecticides, miticides or fungicides
Use of natural fertilizers (manure, compost)	Inter-planting crops with aromatic herbs (celery, cilantro, parsley, dill or local plants) that repel pests	Area spraying (complete field coverage) using synthetic and natural insecticides, miticides or nematocides
Use of purchased mineral fertilizers	Mulching with organic materials or plastic to control weeds	Use of synthetic and natural fungicides or bactericides
Combinations of organic and mineral fertilizers	Plant living barriers or bamboo/tree barriers on windward edge of field	Use of herbicides for weed control
Crop rotation	Exclude insect pests by using vegetable tunnels and micro- tunnels	Farm use of a locked storage building for pesticides
Use of green manure crops	Use of biodiversity or energy conservation practices	Farmer use of pesticide in-ground compost trap for depositing and capturing spilled or leftover pesticides
Farmer ability to correctly identify pests and their damage	Crop stalks, residue and dropped fruit destruction/composting season end	Farmer use of receptacle for empty pesticide bottle disposal

Table A2-2: Specific preventive and curative GAP and IPM options

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Fruits			
Papaya	Papaya mealybug, Paracoccus marginatus	› Field borders should be kept clean of weeds and debris that may support mealybugs between plantings. › Sanitation: Eliminate crop residues, weeds and grass roots. › Remove and destroy ant nests. › Use biostimulants to strengthen the plants against wilt mealybug.	› Use natural biocontrols such three exotic papaya mealy bug parasitoids such as Acerophagus papayae, Pseudleptomastix mexicana and Anagyrus loecki.
Papaya	Anthracnose	› Sanitation.	› Fungicides are generally not

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
			used.
Papaya	Dieback Erwinia papayae	› Sanitation: Eliminate crop residues, weeds and grass roots. › Eradication.	› Fungicides are generally not used.
Papaya	Weeds	› Hoe or hand weeding. › Plastic mulch.	› Herbicides are not recommended.
Carambola	Alternaria, Anthracnose, fruit fly attacks	› Sanitation: Eliminate crop residues, weeds and grass roots. › Maintain vigor › Spray at flowering with Azoxystrubin › Bagging of f fruit if fruit flies become a problem	› No cures
Coconut	Pseudotheraptus wayi, Oryctes rhinoceros	› Vigor and fertility maintained › Encourage weaver ant population by intercropping fruit trees and shrubs	› Inject systemic insecticide at the end of each rainy season and in peak of dry season if elevated populations are found
Cacao	Cacao pod borer, Conopomorpha cramerella	› Water and fertilize seedlings to maintain vigor to resist mosquito bug. › Control weeds in and around plantation. Enclosing cacao pods with a plastic sleeve. Frequent and complete pod-harvesting. Canopy thinning › Black ants, Dolichoderus bituberculatus	› Insecticides are not recommended.
Cacao	Tea mirid Helopeltis spp	› Water and fertilize seedlings to maintain vigor to resist mosquito bug. › Control weeds in and around plantation.	› Make and use natural artisanal neem oil, neem seed extract or soapy water. › Use synthetic insecticides containing deltamethrin or spinosad.
Cacao	Black pod disease, Phytophthora palmivora	› Maintain adequate shade using fruit and banana plants and allow cacao to be well aerated with some sun. › Sanitation: Remove and destroy diseased pods. Control weeds. › Immediately after cacao harvest initiate pruning by carefully removing diseased branches and burning them.	› Fungicides are not recommended.
Cacao	Vascular streak dieback, Oncobasidium theobromae	› Maintain adequate shade using fruit and banana plants and allow cacao to be well aerated with some sun. › Sanitation: Remove and destroy diseased twigs. Control weeds. › Eradication of infected plants. Planting tolerant clones.	› Fungicides are not recommended.
Clove	Vascular streak dieback, Oncobasidium theobromae	› Maintain adequate shade using fruit and banana plants and allow cacao to be well aerated with some sun. › Sanitation: Remove and destroy diseased twigs. Control weeds.	› Fungicides are not recommended.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		› Eradication of infected plants. Planting tolerant clones.	
Avocado	Root rots	› Use disease-free stock › Use resistant cultivars › Monitor for disease presence › Use good sanitation practices › Maintain good drainage › Avoid excess irrigation › Keep equipment clean › Add gypsum to soil	› Phosphonate fungicides
Avocado	Cankers	› Monitor for disease presence › Use resistant cultivars › Use good sanitation practices › Wound prevention › Keep lower trunks dry › Disinfect pruning tools	› Fungicides of limited value, but can be tried
Avocado	Thrips	› Monitor for threshold populations › Natural enemies › Control fertilization to avoid lush vegetative growth	› General use, reduced risk insecticides in rotation › Spinosad for organic production
Avocado	Caterpillars	› Monitor for threshold population › Natural enemies › Physical removal	› General use, reduced risk insecticides ›
Avocado	Mites	› Monitor threshold populations › Confirm mite species › Encourage natural enemies and predators	› General use, reduced risk insecticides in rotation › Miticides
Banana	Banana rust thrips	› Monitor for threshold populations › Cover bunches with polyethylene bag	› General use, reduced risk insecticides in rotation ›
Banana	Banana borer	› Monitor for threshold populations › Cut and remove harvested stumps › Minimize plant debris	› General use, reduced risk insecticides in rotation ›
Banana	Pseudostem weevil	› Monitor for threshold populations › Pheromone traps › Remove crop debris	› General use, reduced risk insecticides in rotation
Banana	Viruses	› Control aphid vector › Rogueing › Use disease-free planting stock › Control surrounding weed hosts	› None
Banana	Sigatoka leaf spot	› Avoid crowding of plants › Removal of crop debris › Maintain good drainage › Maintain good air circulation	› Fungicides in rotation
Banana	Black leaf streak	› Use large pseudostems › Avoid crowding of plants › Maintain good air circulation › Pruning of excess leaves › Removal of plant debris	› Fungicides in rotation

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Banana	Fusarium wilt	› Crop rotation › Maintain good drainage › Avoid root damage › Use clean planting stock › Clean implements › Organic amendments such as neem cake	› Biocontrol agents such *Trichoderma, Bacillus subtilis, Pseudomonas fluorescens*
Blackberry	Blights	› Use resistant cultivars › Sanitation	› None
Blueberry (rabbiteye)	Bud mites	› Monitor for threshold populations	› Oil sprays
Blueberry (rabbiteye)	Cutworms	› Monitor for threshold populations	› General use, reduced risk insecticides in rotation › *Bacillus thuringiensis*
Blueberry (rabbiteye)	Spanworms	› Monitor for threshold populations	› General use, reduced risk insecticides in rotation › *Bacillus thuringiensis*
Blueberry (rabbiteye)	Fruit worms	› Monitor for threshold populations	› General use, reduced risk insecticides in rotation ›
Blueberry (rabbiteye)	Flower thrips	› Monitor for threshold populations	› General use, reduced risk insecticides in rotation
Blueberry (rabbiteye)	Stem canker/stem blight	› Use resistant cultivars › Sanitation › Selective pruning	› None
Blueberry (rabbiteye)	Blueberry stunt phytoplasma	› Use resistant cultivars › Sanitation › Rogueing › Control vector	› None
Blueberry (rabbiteye)	Blights	› Use resistant cultivars › Sanitation	› Fungicides in rotation
Blueberry (rabbiteye)	Leaf spots	› Use resistant cultvars › Sanitation › Maintain good air circulation	› Fungicides in rotation
Blueberry (rabbiteye)	Mummy berry	› Monitor for disease presence	› Fungicides in rotation
Carambola	Scale	› Monitor for threshold populations › Encourage natural enemies	› General use, reduced risk insecticides in rotation (more effective at nymph stage) › Oils
Carambola	Weevil	› Monitor for threshold populations	› *Biologicals such as Bacillus thuringiensis, Chromobacterium subtsugae,* and *Paecilomyces fumosoroseus* › General use, reduced risk insecticides in rotation
Carambola	Thrips	› Monitor for threshold populations	› *Biologicals such as Bacillus thuringiensis, Chromobacterium subtsugae,* and *Paecilomyces fumosoroseus*

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
			› General use, reduced risk insecticides in rotation
Carambola	Anthracnose	› Maintain good air circulation	› Fungicides in rotation
Carambola	Pythium decline	› Maintain good drainage	› None
Citrus (Tangerine, Pummelo)	rind borer	› Collection and destruction of rotten and dropped fruits.	
Citrus (Tangerine, Pummelo)	aphids	› Destroy ant colonies › Use yellow sticky trap › Conserve and enhance population of Predators: like Lacewings birds, earwigs, some ground beetles and rove beetles, spiders	
Citrus (Tangerine, Pummelo)	citrus leaf miner	› Collection and destruction of moths during night time using battery or flame torch › Prune affected shoots › Grow attractant plants to attract the defenders	› Foliar spray with imidacloprid 17.8% SL › Permethrin
Citrus (Tangerine, Pummelo)	mealybug	› Collect and destroy the damaged leaves, twigs and stems › Use sticky barrier › Use pheromone trap › Pruning of affected parts and burning	
Citrus (Tangerine, Pummelo)	fruit sucking moth	› Collection and destruction of moths during night time using battery or flame torch › Prune affected shoots › Grow attractant plants to attract the defenders	
Citrus (Tangerine, Pummelo)	citrus butterfly	› Collection and destruction of moths during night time using battery or flame torch › Prune affected shoots › Grow attractant plants to attract the defenders › Hand pick the larvae and destroy. Biological control: › Conserve the parasitoids such as Trichogramma evanescens	
Citrus (Tangerine, Pummelo)	black fly	› Collect and destroy the damaged plant parts, nymphs, pupa and adults. › Use light trap (wavelength of 550 nm) › Yellow sticky traps or cards reduce the density of black flies › Pupal parasitoids › Predators: Coccinellids, Spiders	
Citrus (Tangerine, Pummelo)	mites	› Water stress often aggravates mite problem. Make sure that trees are well irrigated, particularly during the	

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		stress in late summer. › The most important natural enemies of citrus mite are a predacious mite Euseius hibisci and the predators	
Citrus (Tangerine, Pummelo)	nematodes	› Deep summer ploughing of fields to control nematodes and soil borne diseases	
Citrus (Tangerine, Pummelo)	anthracnose/fruit rot	› Collection and destruction of rotten and dropped fruits.	› Captan/Zineb
Citrus (Tangerine, Pummelo)	scab	› Collect and destroy the infested leaves, twigs and fruits.	› Spray with 0.3 % COC or 1.0% Bordeaux mixture or 0.2% chlorothalonil at 15 day interval
Citrus (Tangerine, Pummelo	citrus canker	› Select seedlings free from canker for planting in main field › Prune out and burn all canker infected twigs › Maintain proper aeration by training and pruning for reducing the leaf wetness period	› Spray with Captan 75% WP › Streptomycin Sulphate 9% + Tetracycline Hydrocloride 1%) SP › Spray Streptocycline 50 to 100 ppm solution repeatedly at an interval of 15 to 20 days after the appearance of new growth.
Citrus (Tangerine, Pummelo	citrus Tristeza Virus (CTV)	› Use of resistant / tolerant varieties/stocks › Use certified budwood free of CTV › Remove all diseased trees as and when the disease is noticed. › Disease spread can be controlled by removing diseased bark and a buffer strip of healthy, light brown to greenish bark around the margins of the infection.	› For acid lime, use seedling immunised with mild strain of Citrus Tristeza Virus (Cross protection). › Periodic sprays of insecticides like Monochrotophos 0.05 % controls the population of citrus aphids that reduces secondary spread of the disease in the orchard › Copper oxy chloride 50% WP
Citrus (Tangerine, Pummelo	gummosis	› Disease spread can be controlled by removing diseased bark and a buffer strip of healthy, light brown to greenish bark around the margins of the infection. › Preventive measures like selection of proper site with adequate drainage. › Use of resistant rootstocks and avoiding contact of water with the tree trunk by adopting ring method of irrigation are effective.	› Aureofungin 46.15% w/v
Citrus (Tangerine, Pummelo	greening	› Selection of proper site with adequate drainage and high budding › Provision of an inner ring about 45 cm around the tree trunk to prevent moist soil. › Avoid irrigation water from coming in direct contact with the tree trunk. › Avoid injuries to crown roots or base of stem during cultural operations. › Use resistant sour orange rootstocks for propagating economic varieties › Use certified pathogen free bud	› Control psyllids with insecticides like dimethoate or imidacloprid › Applying Bordeaux paste or $ZnSO_4$, $CuSO_4$, lime (5:1:4) to a height of about 60 cm above the ground level at least once a year.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		wood for propagation	
Cocoa			
Coconut			
Coffee			
Custard Apple	Chalcid fly	› Monitor for threshold population	› General use, reduced risk insecticides in rotation
Custard apple	Mealy bugs	› Monitor for threshold population › Destroy infected leaves and branches › Natural enemies	› Insecticidal soaps › General use, reduced risk insecticides in rotation
Custard apple	Scale	› Monitor for threshold populations › Natural enemies	› Oils
Custard apple	Fruit flies	› Collect and destroy infected fruit › Summer ploughing › Use natural enemies	› General use, reduced risk insecticides in rotation
Custard apple	Fruit bats	› Cover fruit with bags	› None
Custard apple	Fruit rot		
Custard apple	Anthracnose	› Remove infected fruit, twigs, and leaves › Use resistant varieties › Maintain good air circulation	› Fungicides in rotation
Durian	Anthracnose, Fruit borers,	› Top the tree to maintain 4 to 5 meter height for working › Spray Azoxystrubin at time of bloom › Maintain good air circulation › Bag all fruit	› Fungicides in rotation
Fig	Carpenterworm	› Monitor for threshold populations › Control riparian hosts › Prune infested wood › Maintain vigorous tree growth	› Entomophagous nematode preparations
Fig	Beetles	› Monitor for threshold populations › Early harvest › Orchard sanitation › Use resistant varieties	› Chlorpyrifos (dormant) › Malathion (growing)
Fig	Scale	› Monitor for threshold population › Natural enemies	› Dormant oil
Fig	Alternaria rot (fruit)	› Early harvest › Reduce dust › Control mites › Clean picking boxes and containers	› None
Fig	Botrytis limb blight	› Prune infected shoots	› None
Fig	Sour rot (fruit)	› Control vectors (beetles and fruit flies)	› None
Grape	Leafhoppers	› Monitor for threshold populations › Encourage natural enemies › Remove basal leaves › Remove weed hosts	› Oils › Insecticidal soaps › Kaolin clay › General use, reduced risk

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
			insecticides
Grape	Thrips	› Monitor for threshold populations › Encourage predators › Control surrounding hosts	› Spinosad › General use, reduced risk insecticides
Grape	Spider mites	› Monitor for threshold populations › Reduce dust › Encourage natural enemies	› Neem Oil › Insecticidal soaps › General use, reduced risk insecticides
Grape	Vine mealybugs	› Sanitize equipment › Use natural enemies	› Oils › General use, reduced risk insecticides
Grape	Botrytis bunch rot	› Use resistant cultivars › Canopy management › Control N and water levels	› Stylet oil › Serenade › Fungicides
Grape	Pierce's Disease	› Control glassywinged sharpshooter in vineyard and surrounding vegetation (imidochloprid)	› None
Grape	Powdery mildew	› Use risk index › Basal leaf removal	› Sulfur › Fungicides in rotation
Guava	Fruit fly	› Monitor for threshold population › Remove infested fruits › Traps	› General use, reduced risk insecticides
Guava	Caterpillar	› Monitor for threshold population › Physical removal	› General use, reduced risk insecticides
Guava	Wilt	› Sanitation › Resistant rootstocks	› *Aspergillus niger*
Guava	Anthracnose	› Monitor for disease presence	› Bordeaux mixture
Guava	Canker	› Avoid fruit injury	› Bordeaux mixture › Lime sulfur
Jack Fruit	Borers	› Monitor for threshold populations › Selective pruning › Encourage natural enemies	› General use, reduced risk insecticides
Jack Fruit	Spittle bugs	› Monitor for threshold populations	› General use, reduced risk insecticides
Jack Fruit	Mealy bugs	› Monitor for threshold populations › Deep ploughing › Selective pruning › Encourage natural enemies	› General use, reduced risk insecticides
Jack Fruit	Rots	› Monitor for disease presence › Maintain good air movement	› Bordeaux mixture
Jack Fruit	Dieback	› Monitor for disease presence	› Carbendezin › Thiophenate methyl
Jack Fruit	Leafspot	› Monitor for disease presence › Maintain good air movement	› Bordeaux mixture
Mango	Mites	› Monitor for threshold populations	› Oils › Miticides in rotation
Mango	Thrips	› Monitor for threshold populations	› General use, reduced risk insecticides in rotation

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Mango	Scale	› Monitor for threshold populations › Prune to open canopy	› General use, reduced risk insecticides in rotation › Oils
Mango	Ambrosia beetles	› Parasitic wasps	› Bacillus thuringeniensis › Pyrethrins
Mango	Anthracnose	› Remove infected debris	› Copper-containing fungicides › Sulfur › Ferbam
Mango	Powdery mildew	› Maintain open canopy › Remove infected debris	› Sulfur
Mango	Scab	› Monitor for disease presence	› Copper-containing fungicides
Passion fruit	Fruit flies	› Monitor for threshold populations	› Malathion
Passion fruit	Mealy bugs	› Monitor for threshold populations	› General use, reduced risk insecticides
Passion fruit	Aphids	› Monitor for threshold populations	› General use, reduced risk insecticides
Passion fruit	Brown spot	› Sanitation	› Fungicides
Passion fruit	Septoria spot	› Sanitation	› Copper-containing fungicides
Passion fruit	Root rot	› Maintain good drainage › Sanitation	› Copper containing fungicides
Persimmon	Gill's mealybugs, Ferrisia gilli	› growing a healthy crop, › using disease-resistant plants,	› Caulking cracks to keep insects or rodents from entering a building.
Persimmon	persimmon borer	› Control for insects that may carry the fungus. › Watch your tree for signs of an insect infestation	› Spray the tree with insecticide if necessary.
Persimmon	Rootknot nematode, Meloidogyne spp	› Burned	› painting any open cuts or wounds on the surface
Persimmon	Leaf spot, or anthracnose	› rake up dropped leaves › avoid wetting the leaves of the tree during irrigation	› Sprays containing baking soda or sulfur.
Persimmon	Agrobacterium tumefaciens	› Destroyed young trees	› Cover open cuts or wounds on the surface
Persimmon	Vascular wilt	› Planting wilt-resistant varieties of persimmon trees in soil that is free of the pathogen.	› Spray the tree with insecticide if necessary.
Pineapple	Pineapple mealybug	› Avoid using 5-6 years old suckers for planting › Mealybug spread can be minimized by destroying ant colonies. › The mealybug infested fields must be prepared by removing all the plant residues and incinerating them. › Remove weeds present in the field as they support a hike in mealybug population by giving them alternate food resources. › Remove alternate hosts such as Hibiscus, custard apple, guava in	No cure once infected

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		and around crop field. › Use sterilized equipment when taking up planting and intercultural operations in an uninfested field.	
Pineapple	Pineapple scales	› Application of Beauveria bassiana/Verticillium lecanii @ 5 ml/g)/ l of water is effective during high humid months › Release eggs or first instar larvae of Chrysoperla spp › Follow biological practices	
Pineapple	Thrips	› Mulching reduces thrips infestation considerably › Intercrop with plants that have a natural repellence to thrips such as citronella, garlic and pyrethrum. › Establish windbreaks as they reduce thrips population › A spray made of garlic and pepper will control thrips › Fresh roots of Derris eliptica solution mixed with soap and water at a ratio of 1:4:225 soap:solution: water.	
Pineapple	Pineapple fruit borer	› Conserve natural enemies through ecological engineering › Augmentative release of natural enemies	
Pineapple	Pineapple fruit fly	› Plucking off of infested fruits and fermented fruits and destroying them or expose them to sun to kill developing larvae. › Bagging or netting of fruits.	
Pineapple	Pineapple red mite	› The best management action is to plant only mite-free seed-plant material. › Population densities of mites can be reduced by lower or minimal fertilizer applications	
Pineapple	Root nematodes	› Maintain weed free and host free fallow period of at least for 6 month for significant decline in nematode population › Thorough land preparation will reduce nematode population	
Pineapple	Phytophthora heart (top) rot:	› Avoid excessively deep planting › Prevent soil entering the heart during planting › Maintain proper drainage for minimizing the risk of Phytophthora infection. › Planting on raised beds of at least 20 cm height › Constructing drains to intercept run-	

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		off before it reaches plantation › Constructing drains within field so that water can be removed quickly without causing erosion › Installing underground drains. › Liming materials which increase pH should be used cautiously as P. cinnamomi become active at pH above 4 in the soil › In high nutrient soils, P. nicotianae, becomes active so apply fertilizers optimally.	
Pineapple	Phytophthora root rot	› Same as in top rot	
Pineapple	Base (butt) rot	› Do not leave a portion of fruit attached to the crown when picking › Improve soil drainage	
Pineapple	Fruitlet core rot (green eye	› Follow common cultural practices	
Pineapple	Fusariosis	› Follow common cultural practices	
Pineapple	Green fruit rot	› Follow common cultural practices	
Pineapple	Interfruitlet corking	› Follow common cultural practices	
Pineapple	Leathery pocket	› Follow common cultural practices	
Pineapple	Water blister	› Collect and destroy the plant debris and diseased plants. › Handle fruit carefully to avoid bruising and scuffing (rapid fungal invasion occurs even minute, weeping fractures) › Reject sun burnt and damaged fruit because these have minor skin cracks that are readily infected › Remove pineapple refuse and rejected fruit from in and around packing shed › Maintain proper drainage	
Pineapple	Fruit rot by yeast (candida species)	› Collect and destroy the plant debris and diseased plants. › Protect the young developing fruit with paper bags in frost prone area › Discard the fruit showing even minor interfruitlet cracking › Any fruit showing fractures between fruitlets should be picked at the earliest stages of fruit maturity to minimize losses	
Pineapple	Marbling	› Follow common cultural practices	
Pineapple	Pink disease	› Follow common cultural practices	
Pineapple	Mealybug wilt disease	› Use planting materials from wilt free areas or from fields with a low level of wilt disease › If <3% plants show wilt symptoms then remove the infected plants by	

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		hand and destroy them › If >10% plants show wilt symptoms do not use the field as a source of planting material › Eradicate badly affected areas immediately after harvest › Keep main fields and field boundaries free of weeds and trash which may act reservoirs for ants and mealybugs	
Pineapple	Yellow spot	› void destroying old weeAdy patches near young crown planting or fields with developing fruit (to prevent spread of thrips to fruits)	
Pineapple	Rodents	› Use traps to reduce rodent population by using locally available attractive baits	
Pomegranate	Anar Butterfly	› Resistant varieties	› Spray the tree with insecticide if necessary.
Pomegranate	Stem boring beetles	› Monitoring threshold population	› Neem seed spraying, pruning, kerosene into holes.
Pomegranate	Mealy bugs	› turn the soil › prune the branch	› Release the cryptolaemus
Pomegranate	Thrips		› Neem seed, acrobe, B. thuringiensis
Pomegranate	Aphid	› Burning of crop residue › Monitor for threshold populations	› General use, reduced risk insecticides in rotation
Pomegranate	Fruit borer	› Bagging or covering of fruit	› Apply pesticide
Pomegranate	Powdery mildew	› Deep ploughing	› General use, reduced risk insecticides in rotation
Quince	Quince rust and Gymnosporangium	› Do not plant near juniper or Pomaceous plants › If There are any Junipers or Pomaceous fruit trees in the area, cut all cankerous areas out of the pomaceous trees and cut all growths off the trunks of the junipers	› Chlorothalonil is effective against this rust.
Rambutan	Botryodiplodia theobromae	› The graft union should be coated with a 50/50 slurry of burnt lime and copper oxychloride at regular intervals for the first 2 years after grafting.	› The control is same as the prevention
Rambutan	Rhyparida (black beetles)	› Collect and burn old plant material	› Control with trichlorphon
Rambutan	Caterpillars	› Collect and burn old plant material	› Control with Pyritheroids
Raspberry	Spider mites	› Increase water during times of heavy evapotranspiration › Encourage vigorous plant growth › Monitor for threshold of 15 mites per leaf	› Use of horticulture soap and early use of neem oil before full bloom › Water blast › Use miticide if there are no beneficial insects present
Raspberry	Japanese Beetle	› Monitor for threshold populations	› General use, reduced risk insecticides in rotation

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Raspberry	Rose Chafer	› Select clean site free of Sod › Use bio-spores › Pasteurize manures › Till in a trap crop at the end of each season › If Grubs are present at planting time, use pre-plant insecticide incorporated into the soil (last resort)	› Hand pick beetles (adults) › Hand dig and destroy Chafer › Apply approved soil drench insecticide through drip lines
Raspberry	Spotted Wing Drosaphila	› Monitor for threshold populations › Use traps › Harvest frequently	› None
Raspberry	Blueberry stunt phytoplasma	› Use resistant cultivars › Sanitation › Rogueing › Control vector	› None
Raspberry	Blights	› Use resistant cultivars › Sanitation	› Fungicides in rotation
Salak	Lice Wool, Bud Weevil, Stem Weevil	› Practice good orchard sanitation	› Use of approved pesticides
Sapote	Fruit fly (Dacus sp).	› Sanitation for farming area › Cover fruit at first stage › Traps	› Use pesticide such Agrothion 50 EC
Sapote	Root Weevil (Diaprepes abbreviatus)	› Using resistant variety › Monitor for threshold populations › Encourage natural enemies › Remove weeds and plant debris in production area	› Use insecticide
Sapote	Fungus, Corticium salmonocolor	› Rake up leave and painting wounds area, remove the branches are affected	› Use fungicide to control spreading of diseases
Sapote	Capnodium sp	› Cuting and burn effected fruit	› Use of fungicide
Sapote	Marasmius scandens Mass	› Avoid cool, wet growing conditions, remove branch are affected	› Use of fungicide such Benlate
Singapure Cherry	Black knot	› Prune and destroy galls, cutting several inches below the gall whenever they are found but especially during dormancy. › Remove unwanted Prunus species from the area. If the trunk or a large branch is affected, cut out the gall and also remove about 1 inch of wood around the gall.	› Apply a fungicide just as green tissue is seen in the spring and again just before and just after flowering.
Singapure Cherry	Brown rot	› Monitor for threshold populations, › Physical removal	› Apply a fungicide when blossoms first open and again at 70 to 90 percent bloom.
Singapure Cherry	Coccomyces leaf spot	› Monitor for threshold populations › Physical removal	› Apply a fungicide as leaves emerge in the spring.
Singapure Cherry	Leucostoma canker	› Prune cankered limbs and promote tree vigor.	› Apply a fungicide as leaves emerge in the spring.
Singapure Cherry	Necrotic ring spot	› Destroy infected trees. Plums and other stone fruits are also	› Apply a fungicide as leaves emerge in the spring.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		susceptible.	
Soursop, Cheremoya	Mealybug	› Apply soapy surfactants if population approaches threshold › Apply oils that shine leaves	› These insect pests can be controlled by spraying with approved insecticide
Soursop, Cheremoya	Carpenter Moth Larvae	› Damage may be reduced by collecting and burning of infested twigs.	
Soursop, Cheremoya	Scale Insects	› Avoid general use of broad spectrum insecticides › Apply soapy surfactants if population approaches threshold › Encourage plant health with proper irrigation and plant nutrition	› These insect pests can be controlled by spraying with approved insecticide
Soursop, Cheremoya	Oriental fruit fly	› Bagging the fruits may help reduce fruit fly damage.	› Sweet cinnamon based powders may be used to attract fruit flies mixed with insecticide
Soursop, Cheremoya	Nest Building Ants	› Use of boron baits › Before populations build up use lime wash around the base of the trunk and the trunks of adjacent trees	› Ants may be controlled with insecticide
Soursop, Cheremoya	Root Rots	› diseases trees should be cut down and burned	
Soursop, Cheremoya	Pink Disease	› The disease may be controlled by collecting and burning infected twigs, branches, and leaves	› spraying the tree with copper fungicide
Soursop, Cheremoya	Anthracnose	› Practice good orchard hygene	› Spray with good approved fungicide at time at first bloom
Star Apple *(Chrysophyllum cainito)*	oriental fruit fly - Dacus dorsalis	› Monitor for threshold population › Traps › Use natural enemies › Wrapping young fruit › Removing and destroying the infested fruits	› General use, reduced risk insecticides in rotation
Star Apple	twig borers	› Remove and burn infested twigs	› General use, reduced risk insecticides in rotation
Star Apple	carpenter moth	› Monitor for threshold population › Natural enemies › Physical removal	› General use, reduced risk insecticides in rotation
Star Apple	mealy bugs	› Monitor for threshold population › Destroy infected leaves and branches › Natural enemies	› General use, reduced risk insecticides in rotation
Star Apple	scale insects	› Monitor for threshold populations › Encourage natural enemies	› General use, reduced risk insecticides in rotation
Star Apple	Lasiodiplodia theobromae-fungus	› Removing and destroying the infested fruits › Sanitation	› General use, reduced risk insecticides in rotation (copper fungicides
Star Apple	Fusarium solani	› Soil sterilization › Destroy infected branches	› General use, reduced risk insecticides in rotation
Strawberry	Two Spotted Spider Mites	› Increase water during times of heavy	› Use of horticulture soap and

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		evapotranspiration › Encourage vigorous plant growth › Monitor for threshold of 15 mites per leaf	early use of neem oil before full bloom › Water blast › Use miticide if there are no beneficial insects present
Strawberry	White Grub	› Select clean site free of Sod › Use bio-spores › Pasteurize manures › Till in a trap crop at the end of each season › If Grubs are present at planting time, use pre-plant insecticide incorporated into the soil (last resort)	› Hand pick beetles › Hand dig and destroy grubs › Apply approved soil drench insecticide through drip lines
Strawberry	Black Rot and Leaf Spot	› Rotate Crop › Provide good drainage › Avoid plant stress › Use clean plant material › Use tunnel or covering in rainy season › Limit nitrogen › Use mulch › Remove infected leaves › Frequent picking	› No Fungicide to Effectively Control
Strawberry	Grey Mold	› Rotate Crop › Provide good drainage › Plant on high rounded beds › Use tunnel or covering in rainy season › Mulch furrows with straw in rainy season › Use mulch › Remove infected fruit	› Two well-timed applications of approved fungicides, once at beginning of bloom second at full bloom
Strawberry	Anthracnose and Leather Rot	› Do not allow fruit to come in contact with soil	› No effective fungicide control
Tamarillo	Aphids	› A strong spray of water from a hose will knock many of the aphids off the plant, and they won't be able to return. › If insecticides are needed, insecticidal soaps and oils are the best choices for most situations. › Oils may include petroleum-based horticultural oils or plant-derived oils such as neem or canola oil. › Also, don't use soaps or oils on water-stressed plants or when the temperature exceeds 90°F. These materials may be phytotoxic to some plants. › Insecticides such as oils and soaps	› Many other insecticides are available to control aphids in the home garden and landscape, including foliar-applied formulations of malathion, permethrin, and acephate (nonfood crops only). While these materials may kill higher numbers of aphids than soaps and oils, their use should be limited, because they also kill the natural enemies that provide long-term control of aphids and other pests, and they are associated with bee kills and environmental problems. Repeated applications of these materials may also result in resistance to the material
Tamarillo	Whitefly	› Yellow sticky traps are helpful for	› Judicious use of approved

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		monitoring and suppressing adult populations. › If found, use the Bug Blaster to hose off plants with a strong stream of water and reduce pest numbers. › Natural predators of this pest include ladybugs and lacewing larvae, which feed on their eggs and thewhitefly parasite which destroys nymphs and pupae. For best results, make releases when pest levels are low to medium. › If populations are high, use a least-toxic, short-lived organic pesticide to establish control, then release predatory insects to maintain control. › Insecticidal soap, neem oil and botanical insecticides can be used to "knock down" heavily infested areas.	insecticides
Tamarillo	Mosaics	› Whiteflies and Aphids are the vectors, control these insects in order to control mosaic viruses	
Vanilla	Black rot, Phytophthora	› Plant vanilla using recommended spacing; › control weeds around plants; › remove infected parts of plants and destroy by burning; › application of appropriate fungicide can help to protect the plants from disease	› Curative same as control
Vanilla	Root and stem rot, Fusarium batatatis	› Plant vanilla in well-draining soils › avoid overcrowding the plants; › prune out infected plant parts; › plant vanilla varieties that are tolerant of resistant to the disease	› No Cure
Vanilla	Anthracnose Colletotrichum spp.	› Provide plants with adequate fertilization; › application of an appropriate fungicicde, e.g. › Bordeaux mixture, can help to protect the plant from the disease	› If cleared, asoxystrubin application preferably at time of blooming can give be curative
Vanilla	Rust Uromyces joffrini	› Remove some leaves from the plants to allow better penetration of sunlight	› disease can be controlled through the application of appropriate fungicides
Vegetables			
Bitter Gourd	Downy and Powdery mildew, aphids, Spider mites, leaf minor	› Spray with skim milk for mildews › Rotate the crop › Agrimec can be used in early stages for control of leaf minors	› Alternate sprays with organic materials including pepper, turmeric, garlic
Spounge Gourd	Downy and Powdery mildew, aphids, Spider mites, leaf minor	› Spray with skim milk for mildews › Rotate the crop › Agrimec can be used in early stages	› Alternate sprays with organic materials including pepper, turmeric, garlic

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		for control of leaf minors	
Wing Bean	Should be disease and pest free	Rotated in mixed cultivation	
Sweet Potato	Black Rot, Bacterial Wilt, Alternaria Blight	› Start with tissue cultured slips at Gen 0 and propagate in pasturized media for gen 2 and 3	› Cure postharvest as prescribed
Long Bean	Pea Mosaic, Bean Beetle, Flea beetles	› Select mosaic resistant varieties › Time planting to harvest through the beetle season › Net the crop with #25 net to keep out adult beetles, spray the net with pyritherine to deter juvinials	› Alternate sprays with organic materials including pepper, turmeric, garlic › Agrimec may be used at time of blooming
Black and White Pepper	Foot Rot, Anhracnose, Charcole roth, stripped mealy bug, pepper lace beetle	› Plant on high well drained beds › Consider climate smart high tunnel in rainy season › Pick off lace beetles by hand at early infestation stage, power rinse for mealy bugs at early stage	› Alternate sprays with organic materials including pepper, turmeric, garlic › Use systemic fungicides in rainy season ›
Asparagus	Asparagus miner	› Encourage natural enemies › Burning of crop residue › Monitor for threshold populations	› Parasitic wasps › General use, reduced risk insecticides in rotation
Asparagus	Aphids	› Burning of crop residue › Monitor for threshold populations	› General use, reduced risk insecticides in rotation
Asparagus	Beetles	› Monitor for threshold populations › Encourage natural enemies › Remove weeds and plant debris in production area	› General use, reduced risk insecticides in rotation › Parasitic wasps and beetles
Asparagus	Caterpillars	› Monitor for threshold populations › Physical removal	› General use, reduced risk insecticides in rotation
Asparagus	Slugs	› Physical removal › Trapping	› Baits
Asparagus	Weeds	› Select fields with low perennial weed populations › Rotate production fields › Preirrigate weeds and cultivate to reduced seedbank › Cultivation/hand weeding › Clean cultivation equipment	› Reduced risk herbicides
Asparagus	Purple spot, Rust	› Burning of crop residue › Sanitation › Avoid cool, wet growing conditions	› Chemical treatments generally not needed or recommended
Beans, Bush and Pole	Beetles	› Monitor for threshold populations › Physical removal	› Parasitic wasps › General use, reduced risk insecticides in rotation
Beans, Bush and Pole	Aphids	› Monitor for threshold populations	› General use, reduced risk insecticides in rotation
Beans, Bush and Pole	Borers, Earworm (pods)	› Physical removal	› Wasps, lacewing › *Bacillus thuringensis* › General use, reduced risk insecticides in rotation

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Beans, Bush and Pole	Thrips	› Monitor for threshold populations › Crop screens	› Insecticidal oils and soaps › General use, reduced risk insecticides in rotation
Beans, Bush and Pole	Anthracnose	› Sanitation › Avoid cool, wet growing periods › Resistant varieties	› Azoxystrobin › Potassium bicarbonate › Pyraclostrobin
Beans, Bush and Pole	Bacterial Blight	› Crop rotation › Sanitation › Use clean seed	› Copper fungicides
Beets	Leaf miner	› Monitor for threshold populations › Crop rotation › Eliminate weed host › Crop screens	› General use, reduced risk insecticides in rotation
Beets	Cercospora leaf spot	› Crop rotation › Avoid late N applications › Incorporate crop residue into soil › Select fields with good air movement	› Copper fungicides
Beets	Various rots	› Crop rotation › Subsoiling › Incorporate crop residue into soil › Minimize soil throwing onto crown during cultivation	› None available
Capsicum, chilis and sweet	Anthracnose, Colletrotichum sp.	› Use certified disease-free seed and transplants of resistant varieties23. › Seed can be disinfested with a 30-minute soak at 52°C. › Sanitize seedling flats if reusing them. › Rotate out of infested fields to other crops for 3 years. Avoid potato, soybean, tomato, eggplant, and cucurbits as rotation crops24. › If using overhead sprinkler irrigation, apply in early morning so plants can dry before night-fall. › Use mulch to reduce water splash onto leaves and fruit, and weed regularly without damaging fruit. › Harvest fruit as soon as it is ripe. › Sanitation: Remove and dispose of diseased plants throughout season and after harvest.	› At flowering, can use synthetic fungicides containing mancozeb or metiram.
Capsicum, chilis and sweet	Leaf curl virus	› Practice crop rotation › Destroy infected plants especially before flowering and fruit set. › Remove solanaceous weeds › Control root-knot nematodes › Remove possible source of primary inoculums (infected seeds, weeds, tobacco products) Screening of seed beds › Plastic mulch	› Spray natural solutions of insecticidal soap, horticultural oil, neem oil or Beauveria bassiana if the infestation is heavy. › Treat soil with synthetic systemic insecticides containing imidacloprid or thiamethoxam. › Spray with synthetic insecticides containing acetamiprid.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Capsicum, chilis and sweet	Bacterial wilt	› Use of certified disease-free propagation material › Do weed control. › Use resistant or tolerant varieties. › Plant in well-drained soils, avoid over-irrigation. › Use deep well water for irrigation. › Remove and destroy diseased plants.	› Spray with copper-containing compounds.
Capsicum, chilis and sweet	Helicoverpa armigera	› Avoid planting crops successively that are hosts to tomato fruitworm like corn, cotton, sorghum, tobacco and soybean. › Two weeks before planting, remove weeds and grasses to destroy earworm larvae and adults harboring in those weeds and grasses. › Practice crop rotation. › Plow, disc and harrow fields at least 2 times before sowing seeds. This exposes pupae of tomato fruitworm (tomato fruitworm pupates in the soil) to chickens, birds, ants and other predators. › Make and use pheromone or light traps. › Begin sampling soon after fruit development. Eggs hatch in 5 to 7 days following egg-laying. › Larval hand picking › Parasitoid Trichogramma sp. › Botanical insecticides	› Insecticidal control of tomato fruitworm is difficult and depends on proper timing and thorough coverage. Once larvae enter the tomato, control with insecticides is difficult. › Botanical and homemade water extracts include neem and ginger. › Trichogramma wasps from the biolaboratory provide some control of tomato fruitworm eggs. › Direct insecticidal control towards young larvae that are feeding on the fruit, before entering it. › Natural sprays of Bacillus thuringiensis (BT) and the Entrust formulation of spinosad.
Capsicum, chilis and sweet	Fruitflies	› Sanitation: clean up crop residues. › Use traps baited with attractant (methyl eugenol)	› Natural sprays of Bacillus thuringiensis (BT) and the Entrust formulation of spinosad.
Capsicum, chilis and sweet	Mites Polyphagotarsonemus latus	› Spider mites have many natural enemies that often limit populations; predacious mites and some insect feeds on spider mites, eg (Phytoseiulus persimilis and Amblyseius andersoni); the major predator mites commercially available for purchase and release are the western predatory mite and Phytoseiulus. › Do weed control in and around field. › Adequate irrigation is important because water- stressed plants are most likely to be damaged.	› Broad-spectrum insecticide treatments for other pests frequently cause mite outbreaks, so avoid these when possible. › Natural insecticidal soaps or agricultural oils and neem extracts can be used for management (apply especially on the undersides of leaves). › Use of synthetic insecticides containing malathion or abamectin.
Capsicum, chilis and sweet	Thrips parvispinus	› Use resistant varieties. › Practice crop rotation out of solanaceous and other host crops. › Use blue sticky traps for monitoring. › Use plastic mulch.	› Use insecticides containing thiamenthoxam, acetamiprid, imidacloprid, spinosad abamectin.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Capsicum, chilis and sweet	Weeds	› Hoe or hand weeding. › Plastic mulch.	› Herbicides not recommended
Carrot	Aphids	› Monitor for threshold populations › Promote natural enemies	› Various botanicals and oils › General use, reduced risk insecticides in rotation
Carrot	Leafhoppers	› Monitor for threshold populations › Promote natural enemies › Remove crop debris	› Various botanical and oils › General use, reduced risk insecticides in rotation
Carrot	Various blights	› Monitor disease threshold › Crop rotation › Hot water treated seed › Disk fields to destroy carrot top residue › Field sanitation › Resistant cultivars	› Various biologicals › Soil fumigants › Copper-containing compounds
Carrot	Root knot nematode	› Crop rotation › Monitor soil for presence › Cover crops such as winter rye and oat	› Soil fumigants
Carrot	Weeds	› Hoe or hand weeding › Control surrounding vegetation to limit seedbank › Crop rotation	› Metam sodium
Chard	Various beetles	› Monitor for threshold populations › Crop rotation › Control surrounding vegetation › Disk field following harvest	› Methomyl › Diazinon › Pyrethroids › Baits
Chard	Leaf miners	› Disk field immediately following harvest	› Parasitic wasps › Diazinon › Pyrethroids › Insecticidal soaps
Chard	Loopers	› Monitor threshold populations › Control surrounding weeds › Disk field immediately following harvest	› Bacillus thuringensis › Spinosad › Tebefunozide › Pyrethroids
Chard	Cercospora leaf spot	› Crop rotation › Avoid late N applications › Incorporate crop residue into soil › Select fields with good air movement	› Copper-containing fungicides
Cole crops, broccoli, cabbage, cauliflower, Chinese cabbage, kale	Diamondback moth, Plutella xylostella,	› Parasitoid, Diadegma semiclausum › For monitoring, use light traps over soap dish to control adult stages and monitoring insect population's dynamics. › Sticky bright yellow or blue traps will help to trap and control adult stages. › Crop rotation with non-susceptible hosts. › Use of trap crops such as inter-planted or edge-planted mustards	› Use of natural biological control with Trichogramma species, Metharizium anisopliae, Beauveria bassiana, Bacillus thuringiensis and neem applications. › Use the Insect Growth Regulator (IGR). › Rotate synthetic insecticides containing abamectin, imidacloprid, emamectin benzoate.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		(but monitor and destroy plants before adults are produced). › Mating disruption with sex pheromones has been shown to be effective in reducing diamondback moth populations in Florida. › Sprinkle irrigation may reduce the number of caterpillars in the field; if it is applied at dusk, it may limit the activity of adults.	
Cole crops, broccoli, cabbage, cauliflower, kale	Cluster caterpillar, Crocidolomia pavonana	› Natural enemies like ground beetles, spiders, damsel bugs, minute pirate bugs, assassin bugs, bigeyed bugs, and lacewing larvae naturally control armyworms. › Parasitic wasp species Trichogramma, Copidosoma, Apanteles, Diadegma, and Hyposoter sting and parasitize eggs and larvae (some of these organisms are available for purchase commercially). › Use of nocturnal overhead sprinkler irrigation to dislodge and repel pests. › Use of pheromone misters and emitters to disrupt mating. › Use of floating row screen or mesh covers to exclude egg-laying moths.	› Use of natural biological control with Trichogramma species, Metharizium anisopliae, Beauveria bassiana, Bacillus thuringiensis and neem applications. › Use the Insect Growth Regulator (IGR). › Rotate synthetic insecticides containing abamectin, imidacloprid, emamectin benzoate.
Cole crops, broccoli, cabbage, cauliflower, kale	Cutworm, Agrotis sp.	› Natural enemies like ground beetles, spiders, damsel bugs, minute pirate bugs, assassin bugs, bigeyed bugs, and lacewing larvae naturally control armyworms. Parasitic wasp species Trichogramma, Copidosoma, Apanteles, Diadegma, and Hyposoter sting and parasitize eggs and larvae (some of these organisms are available for purchase commercially). › Use of nocturnal overhead sprinkler irrigation to dislodge and repel pests. › Use of pheromone misters and emitters to disrupt mating. › Use of floating row screen or mesh covers to exclude egg-laying moths. › Re-planting.	› Use of natural biological control with Trichogramma species, Metharizium anisopliae, Beauveria bassiana, Bacillus thuringiensis and neem applications. › Use the Insect Growth Regulator (IGR). › Rotate synthetic insecticides containing abamectin, imidacloprid, emamectin benzoate.
Cole crops, broccoli, cabbage, cauliflower, kale	Club root, Plasmodiophora brassicae	› Use lime to increase the pH if soil pH is lower than 7.2. › Use resistant varieties if available. › Use crop rotation to non-cole crops for several years. › Control brassicaceous weeds near field. › Manage drainage so soil does not water-log. › Use fresh soil for seed bed.	› Use Trichoderma sp.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		› Elevated seed bed.	
Cole crops, broccoli, cabbage, cauliflower, kale	Weeds	› Hoe or hand weeding › Plastic mulch	› Herbicides are not recommended
Coriander	Aphids	› Monitor threshold populations › Encourage natural enemies › Resistant varieties	› General use, reduced risk insecticides › Insecticidal soaps
Coriander	Chalcid fly	› Monitor threshold populations › Encourage natural enemies	› General use, reduced risk insecticides
Coriander	Cutworm	› Monitor threshold populations › Physical removal › Sanitation	› General use, reduced risk insecticides
Coriander	Powdery mildew	› Select fields with good air circulation › Resistant varieties	› Wettable sulfur
Coriander	Wilt	› Soil solarization › Crop rotation › Resistant varieties › Control soil moisture › Trichoderma	› Neem cake application › Copper-containing compounds
Coriander	Blight	› Soil solarisation › Crop rotation	› Copper-containing compounds
Corn, sweet	Corn earworm	› Monitor for threshold populations › Adjust plantingdates	› General use, reduced risk insecticides
	Armyworms	› Monitor for threshold populations › Adjust planting dates › Encourage natural enemies › Control surrounding grass	› General use, reduced risk insecticides
	Various blights	› Resistant varieties	› Mancozeb › Propiconazole › Azoxystrobin
	Rust	› Resistant varieties	› Copper-containing fungicides
Cowpea	Legume pod borer, Maruca vitrata	› Parasatoids › Encourage natural enemies › Monitor surrounding vegetation	› Biopesticides › General use, reduced risk insecticides
Cowpea	Thrips	› Natural enemies › Resistant varieties › Parasatoids	› Botanical extracts › Entomopathogens › General use, reduced risk insecticides
Cowpea	Aphids	› Monitor threshold populations › Predators › High plant density › Early planting	› General use, reduced risk insecticides
Cowpea	Anthracnose	› Resistant varieties › Use clean seed › Clear crop debris	› Mancozeb › Benomyl
Cowpea	Various stem rots	› Remove crop debris › Use clean seed	› Captofol

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Cowpea	Fusarium	› Use resistant varieties	› None
Cowpea	Cercospora leaf spot	› Use clean seed › Use resistant varieties	› Benomyl
Cowpeas	Viruses	› Control vectors	› None
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Beetles	› Monitor threshold populations › Natural enemies (marginally effective) › Physical removal › Trap crops › Tolerant varieties	› General use, reduced risk insecticides › Feed attractants, baits
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Aphids	› Monitor threshold populations › Natural enemies	› General use, reduced risk insecticides › Insecticidal soaps
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Downy mildew, Powdery mildew	› Use resistant varieties › Select fields with good air circulation › Trellising	› Rotate fungicides
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Leaf spots	› Crop rotation › Select fields with good air circulation	› Bravo › Mancozeb
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Anthracnose	› Crop rotation › Select fields with good air circulation	› Bravo › Mancozeb
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Root knot nematode	› Crop rotation › Soil test	› Soil fumigants
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Phytophthera blight	› Soil management, good drainage › Clean equipment › Crop rotation › Good air circulation	› Actinovate › Biofungicides
Cucurbits, cucumber, melons, pumpkin, squash, watermelon, zucchini	Bacterial wilt	› Soil management › Raised beds › Clean seed › Resistant varieties › Crop rotation › Good air circulation › Control beetle vectors › Incorporate crop residues	› Actinovate › Copper
English Peas/Snow Peas	Aphids	› Monitor for threshold populations › Natural enemies	› General use, reduced risk insecticides
English Peas/Snow	Seedcorn maggot	› Monitor for threshold populations	› Botanical extracts

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Peas		› Predators › Parasitoids › Incorporate crop residues	› General use, reduced risk insecticides
English Peas/Snow Peas	Root rot	› Crop rotation › Avoid fields with history of root rot › Maintain good aeration and drainage	› Actinovate › Double Nickel biofungicide
English Peas/Snow Peas	Wilt	› Use resistant varieties › Good air circulation	› Actinovate › Double Nickel biofungicide
English Peas/Snow Peas	Leaf spot	› Good air circulation › Clean seed › Disk crop debris following harvest	› Neem oil › Copper-containing fungicides
English Peas/Snow Peas	Root knot nematodes	› Crop rotation › Cover crops › Soil monitoring	› Soil fumigants
Lettuce	Aphids	› Monitor for threshold populations › Natural enemies › Disk crop residue › Use of row covers	› General use, reduced risk insectides › Insecticidal soaps
Lettuce	Leafhoppers	› Monitor for threshold populations › Control surrounding host vegetation › Use of row covers › Disk crop residue	› Actinovate › Mycotrol › Pyrethrins › Garlic oil › Cedar oil
Lettuce	Anthracnose	› Crop rotation › Disease-free seed › Plant rows in direction of prevailing winds › Remove alternate host weeds › Avoid sprinkler irrigation › Deep plough after harvest	› Actinovate › Neem oil
Lettuce	Botrytis gray mold	› Crop rotation › Maintain good drainage › Select fields with good air circulation › Plant rows in direction of prevailing winds › Sanitation › Removed affected leaves quickly › Deep plough after harvest › Avoid overhead irrigation	› Actinovate and other biofungicides › Neem oil
Lettuce	Rots	› Crop rotation › Raised beds › Maintain good drainage › Upright varieties less susceptible › Plant parallel to prevailing winds › Use wide row spacings › Avoid overhead irrigation › Deep plow plant debris	› Actinovate › Double nickel biofungicide › Copper-containing fungicides
Lettuce	Downy mildew	› Good air circulation › Select fields with good air circulation	› Actinovate › Double nickel biofungicide

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		› Avoid overhead irrigation › Control alternate hosts › Use resistant varieties	› Neem oil
Lettuce	Viruses	› Control vectors › Use resistant varieties › Eliminate weed hosts	› Insecticides to control vectors
Lettuce	Root knot nematodes	› Soil monitoring › Crop rotation › Cover crops › Maintain clean equipment	› AzaGard › NemaQ
Lettuce	Weeds	› Organic mulch › Plastic mulch › Cultivation › Cover crops › Hand weeding, hoeing	› Minimal use of reduced risk herbicides
Mustard	Caterpillars	› Monitor for threshold populations › Physical removal	› General use, reduced risk insecticides
Mustard	Aphids	› Monitor for threshold populations › Entomopathogens	› General use, reduced risk insecticides › Insecticidal soaps › Neem oil
Mustard	Downy and powdery mildew	› Crop rotation › Select fields with good air circulation › Field sanitation	› Fungicides
Mustard	Rust	› Crop rotation › Select fields with good air circulation › Field sanitation	› Copper-containing fungicides
Mustard	Alternaria blight	› Crop rotation › Use clean seed › Select fields with good air circulation › Field sanitation	› Mancozeb
Okra	Leafhoppers	› Monitor for threshold populations › Encourage predators › Use resistant varieties	› General use, reduced risk insecticides › Neem oil › Entomopathogens
Okra	Aphids	› Montor for threshold populations › Natural enemies	› Neem oil › General use, reduced risk insecticides in rotation
Okra	Borers	› Monitor for threshold populations › Use trap crops › Removed borer affected shoots › Parasitoids	› General use, reduced risk insecticides in rotation
Okra	Spider mites	› Monitor for threshold populations › Encourage predators › Overhead irrigation discourages mites	› Neem oil › *Bacillus thuringienses* › General use, reduced risk insecticides in rotation
Okra	Cercospora	› Select fields with good air circulation › Remove infected leaves	› Copper-containing fungicides

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
Okra	Powdery mildew	› Select fields with good air circulation › Field sanitation	› Foliar fungicides
Okra	Rhizoctonia	› Maintain good drainage › Avoid cool soils	› Fungicidal drenches in rotation
Okra	Pythium	› Maintain good drainage › Avoid cool soils › Avoid dense seedling populations	› Fungicidal drenches in rotation
Okra	Mosaic virus	› Use resistant varieties › Control vectors › Rogue infected plants	› None
Okra	Root knot nematodes	› Monitor soil populations › Crop rotation › Cover crops	› Fumigants › Nematicides
Onion	Beet armyworm, *Spodoptera exigua*	› Natural enemies like ground beetles, spiders, damsel bugs, minute pirate bugs, assassin bugs, bigeyed bugs, and lacewing larvae naturally control armyworms. Parasitic wasp species Trichogramma, Copidosoma, Apanteles, Diadegma, and Hyposoter sting and parasitize eggs and larvae (some of these organisms are available for purchase commercially). › Use of nocturnal overhead sprinkler irrigation to dislodge and repel pests. › Use of pheromone misters and emitters to disrupt mating. › Use of floating row screen or mesh covers to exclude egg-laying moths. › Larval hand picking. › Light trapping.	› Use of virus SeNPV. › Use of natural biological control with Trichogramma species, Metharizium anisopliae, Beauveria bassiana, Bacillus thuringiensis and neem applications. › Use the Insect Growth Regulator (IGR). › Rotate synthetic insecticides containing abamectin, imidacloprid, emamectin benzoate.
Onion	Leafminers, *Liriomyza* spp	› Weed and crop residues removal after harvest. › Crop rotation with corn, onions or other species not related with snow peas. › Use of plastic mulch with a reflectent color, silver grey will be one of the more effectives. › Use of yellow or blue sticky traps. › Parasitoids/predators › Botanical insecticides	› Use of synthetic insecticides containing abamectine or cyromazine.
Onion	Purple blotch Alternaria porri	› Use certified disease-free seedlings. › Sanitation, clean up crop residues, burn. › Plastic mulch covering to avoid plant contact with soil and minimize weeds that enhance microclimate conditions favorable to disease dispersion. › Heat treatment of bulbs at 35 to 40 °C for 4 to 8h reduces the disease	› Use of natural fungicides containing Trichoderma, Pseudomonas fluorenscens, or Bacillus subtilus.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		significantly. › Eliminate crop residues, plant during dry season, and avoid irrigation during heat of the day. › Use crop rotation. › Use certified seed and good drainage.	
Onion	Downy mildew Peronospora destructor	› Plastic mulch covering to avoid plant contact with soil and minimize weeds that enhance microclimate conditions favorable to disease dispersion. › Heat treatment of bulbs at 35 to 40 °C for 4 to 8h reduces the disease significantly. › Eliminate crop residues, plant during dry season, and avoid irrigation during heat of the day	› Neem oil › Actinovate › Double nickel biofungicide
Onion	Weeds	› Hoe or hand weeding › Plastic mulch	› Herbicides are not recommended
Spinach	Damping off	› Deep ploughing of plant debris › Crop rotation › Maintain good drainage › Raised beds	› Double Nickel biofungicide › Actinovate
Spinach	Downy mildew	› Select fields with good air flow › Use resistant varieties › Deep ploughing of infected debris	› Double Nickel biofungicide › Actinovate › Copper-containing fungicides
Spinach	White rust	› Crop rotation › Use resistant varieties › Deep ploughing of infected debris	› Neem oil › Conpper-containing fungicides
Spinach	Cucumber mosaic virus	› Control aphid vector › Use resistant varieties › Use clean seed › Control weed hosts	› None
Spinach	Anthracnose	› Select field with good air circulation › Use resistant varieties › Crop rotation	› Actinovate › Copper-containing fungicides › Neem oil
Spinach	Aphids	› Monitor for threshold populations › Vaccum › Leaf blower › Floating row covers › Encourage natural enemies › Control surrounding vegetation	› Neem oil › Insecticidal soaps › General use, reduced risk insecticides in rotation
Spinach	Leaf miner	› Monitor for threshold populations › Control weed hosts › Crop rotation › Encourage natural enemies › Row covers	› Neem oil › Insecticidal soaps › General use, reduced risk insecticides in rotation
Spinach	Looper	› Monitor for threshold populations › Pheromone traps	› Bacillus thuringienses › Mycotrol

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		› Encourage natural enemies › Floating row covers › Control weed hosts	› Pyrethrins
Spinach	Flea beetle	› Monitor for threshold populations › Crop rotation › Control weed hosts › Encourage natural enemies › Floating row covers	› Mycotrol › Pyrethrins
Tomato	Late blight, *Phytophthora infestans* Early blight, *Alternaria solani*	› Use tolerant varieties. › Drain the growing area adequately before planting. › Follow proper planting date; do not plant late. › Farmers use sticks and lines to raise tomato plants and fruit into the air to aerate the plant and raise the leaves and fruit away from the soil. › Pruning lower leaves › Bamboo stacking › Plastic mulch › Trichoderma › Bacillus subtilis › Psedomonas flourescens	› Use synthetic fungicides containing azoxystrobin, copper sulfate, mancozeb, chlorothalonil, dimethomorph, pyraclostrobin.
Tomato	Tomato leaf curl virus transmitted by whiteflies	› Practice crop rotation › Destroy infected plants especially before flowering and fruit set. › Re solanaceous weeds › Control root-knot nematodes › Remove possible source of primary inoculums (infected seeds, weeds, tobacco products) Screening of seed beds › Plastic mulch › Trichoderma › Bacillus subtilis › Pseudomonas flourescens.	› Spray natural solutions of insecticidal soap, horticultural oil, neem oil or *Beauveria bassiana* if the infestation is heavy. › Treat soil with synthetic systemic insecticides containing imidacloprid or thiamethoxam. › Spray with synthetic insecticides containing acetamiprid.
Tomato	Fruitworm, *H. armigera*	› Avoid planting crops successively that are hosts to tomato fruitworm like corn, cotton, sorghum, tobacco and soybean. › Two weeks before planting, remove weeds and grasses to destroy earworm larvae and adults harboring in those weeds and grasses. › Practice crop rotation. › Plow, disc and harrow fields at least 2 times before sowing seeds. This exposes pupae of tomato fruitworm (tomato fruitworm pupates in the soil) to chickens, birds, ants and other predators. › Make and use pheromone or light traps.	› Insecticidal control of tomato fruitworm is difficult and depends on proper timing and thorough coverage. Once larvae enter the tomato, control with insecticides is difficult. › Botanical and homemade water extracts include neem and ginger. › Trichogramma wasps from the biolaboratory provide some control of tomato fruitworm eggs. › Direct insecticidal control towards young larvae that are feeding on the fruit, before entering it.

Crop	Major Pests and Diseases	Preventative IPM tactics	Curative IPM Tools: Pesticides
		› Begin sampling soon after fruit development. Eggs hatch in 5 to 7 days following egg-laying.	› Natural sprays of *Bacillus thuringiensis* (BT) and the Entrust formulation of spinosad.
Tomato	Weeds	› Hoe or hand weeding › Plastic mulch	› Herbicides are not recommended.

Annex 3: Acute 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 and WHO Toxicity 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. WHO classification shows relative toxicities of all pesticide active (or technical) ingredients, whereas USEPA 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.

Table A3-1: 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*

Table A3-2: WHO classification (based only on active or 'technical' ingredient)

Class	Descriptive term	Oral LD_{50} for the rat	Dermal LD_{50} for the rat

		(mg/kg body wt.)		(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. Elements of an Integrated Pest Management (IPM) Program

Integrated Pest Management[49]

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

Step 1: Learn and value farmers' indigenous 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 these farmer's GAP 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. Standards and Certification (S&C) farmers will have records of historical pesticide use and trends, as well as information on current use of artisanal or local IPM tactics.

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 are often 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. Continue dialog with project field staff, ministry extension staff and 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 parasitoids, and to act upon their observations.

Step 5: Do effective activities and training to promote IPM. Next, identify strategies and mechanisms for fostering the transfer of the needed IPM technology under various project and institutional arrangements, mechanisms, and funding levels. Define what is available for immediate transfer and what may require more adaptation and validation research. Set up an initial planning workshop (with a COP-supported and signed Action Plan) 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. At first, frequent (usually weekly) sessions are conducted for 10–20 farmers during the cropping season in farmers' fields by trained instructors or extension agents.

[49] http://www.fao.org/docrep/006/ad487e/ad487e00.htm; http://www.fao.org/docrep/006/ad487e/ad487e02.htm; http://en.wikipedia.org/wiki/Farmer_Field_School; http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html

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 is difficult except when there is a clear financial incentive (e.g., credit, advance knowledge of nearby infestations for early action leading to yield improvement).

Educational material: In many countries, basic written and photographic guides to pest identification and crop-specific management techniques are unavailable or out of date. Videos featuring graphic pictures of the effects of acute and chronic pesticide exposure, and interviews with poisoning victims can be particularly effective.

Youth education: Promoting and improving the quality of programs on IPM and the risks of synthetic pesticides has been effective at technical schools for rural youth. In addition to becoming future farmers, these students can bring informed views back to their communities.

Food market incentives (especially important in the last decade): Promoting Organic, GlobalGAP, BRC, Fair Trade or other certification for access to the lucrative and rapidly growing S&C systems-driven international and regional food markets can be, and is, a strong incentive to adopt IPM.

Step 6: Partner successfully with other IPM implementers. The following design steps are considered essential. *Articulate the partnership's vision of IPM*

Organizations may forge partnerships based on a common commitment to "IPM" – only to discover too late that 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 program integration into larger project*. The IPM program is likely to be part of a larger "sustainable agriculture" project. The IPM program must fit into a partner's overall goals. The extent of this integration should be clearly expressed in the proposed 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 the fields regularly. 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 for extension workers. Implementation of IPM depends heavily on education, training, and demonstration to help farmers and extension 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 extension workers and educational programs for government officials and the public are also 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 Good Agriculture Practices (that include safe pesticide storage, use and disposal), maintain farm or project files of: farmer and farm employee training records certification; farm soil, water, biodiversity, cropping and pesticide use maps; pesticide purchase and stock records; price increases or decreases, 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 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, including restricted access, for use of common but hazardous fumigants like aluminium phosphide.

Annex 5. Natural Alternatives to Synthetic Pesticides

Table A5-1: Botanical Active Ingredients in Pesticides, Repellents, and Baits Regulated by USEPA

Name	Other Names	Use	Toxicity	USEPA Tracking Number
Allium sativum	Garlic	Repels insects	Low	128827
Allyl isothiocyanate	Oil of Mustard	Kills & repels insects	Questionable	004901
Anise Oil	Repels vertebrates	Low	004301	
4-allyl anisole	Estragole	Kills beetles	Low	062150
Azadirachtin	*Azadirachta indica* Neem tree extract	Kills & repels insects	Low, IV	121701
Bergamot		Repels vertebrates		129029
Canola Oil	*Brassica Napus B. Campestris*	Kills many insects	Low	011332
Capsaicin	*Capsicum frutescans*	Repels vertebrates	Low, III	070701
Castor Oil		Repels vertebrates	Low	031608
Cedarwood Oil		Repels moth larvae	Low	040505
Cinnamaldehyde	*Ceylon and Chinese* cinnamon oils	Kills insects, fungi & repels vertebrates*	Low	040506
Citronella Oil		Repels insects & vertebrates	Low	021901
Cloves, Crushed			Low	128895
Dihydroazadirachtin	Neem tree extract *Azadirachta indica*	Kills & repels insects	III-IV	121702
Eucalyptus Oil		Repels insects, mites fleas & mosquitoes	Low	040503
Eugenol	Oil of cloves	Kills insects**	Low	102701
Geraniol	Oil of rose isomeric w/ linalool	Repels vertebrates**	Low	597501
Geranium Oil			Low	597500
Indole	from all plants	Trap bait: corn rootworm beetles	Low	25000-
Jasmine Oil			Low	040501
Jojoba Oil		Kills & repels whitefly kills powdery mildew	Low	067200
Lavandin Oil		Repels clothes moth	Low	040500
Lemongrass		Repels vertebrates	Low	040502
Linalool	Oil of Ceylon isomeric w/geraniol	Repels insects, ticks, mites & spiders	Low	128838
Maple lactone		Roach trap bait	Low	004049
Methyl salicylate	Oil of wintergreen	Repels moths, beetle & vertebrates	May be Toxic in large quantity	76601-
Mint	Herb	Kills aphids	Low	128892
Mint Oil		Kills aphids	Low	128800
Mustard Oil		Repels insects, spiders & vertebrates	Low	004901

Name	Other Names	Use	Toxicity	USEPA Tracking Number
Neem Oil		Kills whitefly, aphids	Low	025006
1-Octen-3-ol	From clover, alfalfa	Trap bait: mosquitoes	Low	69037-
Orange		Repels vertebrates	Low	040517
p-Methane-3,8 diol	*Eucalyptus sp.*	Repels biting flies, mosquitoes	Low	
2-Phenylethyl-propionate	From peanuts	Kills insects, ticks, mites & spiders	Low	102601
Pyrethrum	*Chrysanthemum sp.*	Stored products use	III	
Red pepper	Chilli	Repels insects	Low	070703
Rosemary	Herb		Low	128893
Rotenone	*Derris sp., Tephrosia*	Controls ticks	III	
Ryania	*Ryania speciosa*	Kills thrips, codling moth, corn borers		
Sabadilla	*Schoenocaulon sp.*		III	
Sesame Oil	*Sesamum indicum*	Pyrethroid synergist	Low	
Soybean Oil	Soja	Kills insects, mites	Low	031605
Thyme	Herb	Controls aphids	Low	128894
1,2,4 Trimethoxy-benzene	From squash	Trap bait: corn rootworm, cucumber beetles	Low	40515-
Verbenone	From pine trees	Repels bark beetles	Low	128986

** attracts corn rootworm beetles, ** attracts Japanese beetles. Not all plant extracts are listed.*

More detailed information available for most oils: http://www.epa.gov/pesticides/reregistration/status.htm.

Natural Source: Only one or a few sources are listed. Most of these chemicals are found in many different plants.

Since the time in the late 1990s when USEPA did register biological ingredients listed above, it has since developed a list of botanical extracts (mostly essential oils) under *Minimum Risk Pesticides Exempted under FIFRA Section 25(b).*[50] Some of the very same ingredients are in both lists. However, most US states and USAID consider botanical extracts and essential oils used to kill, destroy, mitigate, or repel pests to be analyzed and treated as pesticides.

Table A5-2: Natural Pesticides That Have Been Commercialized

Insecticides	
azadirachtin—component in neem oil	botanical extract
Bacillus thuringiensis-BT	microbial
Beauveria basiana	microbial
cartap hydrochloride	marine worm (*Lumbriconereis heterodopa*) extract
chili pepper extract	botanical (spice)
emamectin benzoate	botanical extract

[50] http://www.epa.gov/oppbppd1/biopesticides/regtools/25b_list.htm

garlic extract/allicin	botanical extract (spice)
harpin protein	plant induced resistance elicitor
kaolin clay	inorganic mineral
d-limonene	citrus extract (spice)
Metarhizium anisopliae	microbial
narrow range dormant oil	paraffin oil
neem oil	botanical extract
nuclear polyhedrosis virus (NPV)	microbial
Paecilomyces lilacinus	microbial
Paecilomyces fumosoroseus	microbial
pyrethrin	botanical extract
pyriproxyfen	IGR (Juvenile Hormone mimic)
ryania	botanical extract
soap (insecticidal)	fatty acids
spinosad	microbial extract
buprofezin	IGR (Chitin Synthesis inhibitor)
Fungicides	
Bacillus subtilis	microbial
Bordeaux mix	inorganic (Bordeaux ingredients USEPA registered)
copper	inorganic
copper hydroxide	inorganic
copper oxychloride	inorganic
copper sulfate	inorganic
harpin protein	plant induced resistance elicitor
sulfur	inorganic
Trichoderma species	microbial
Nematocides	
Myrothecium verrucaria	microbial
tomatillo oil + thyme oil extracts (Promax[51])	botanical + spice extracts—soil biopesticide
Molluscicide	
iron phosphate	inorganic

[51] http://www.bhn.name/humagro/biopesticides.html

Annex 6. Summary of pesticides listed in the Stockholm and Rotterdam Conventions and the Montreal Protocol that have been banned in Asian countries[52]

		Bangladesh	Cambodia	China	DPR Korea	India	Japan	Lao PDR	Malaysia	Mongolia	Myanmar	Nepal	Pakistan	Sri Lanka	Thailand	Viet Nam	Total
PIC	2, 4, 5-T and its salts and esters		■		■		■	■	■	■	■			■	■	■	10
PIC	Alachlor	■							■	■	■			■		■	6
PIC	Aldicarb	■	■			■			■	■							5
POP, PIC	Aldrin	■	■	■		■	■	■	■	■	■	■		■	■	■	13
PIC	Binapacryl	■	■		■			■	■	■	■		■		■		9
PIC	Captafol	■	■		■		■	■	■	■		na	■			■	10
POP, PIC	Chlordane	■	■			■	■	■	■	■	■	■		■	■	■	12
POP	Chlordecone		■				■			■					■		4
PIC	Chlordimeform	■	■	■	■			■	■	■	■		■		■		10
PIC	Chlorobenzilate	■	■		■	■		■	■	■	■		■		na		9
POP, PIC	DDT	■	■	■			■	■	■	■	■	■	■	■	■	■	13
POP, PIC	Dieldrin	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
PIC	Dinoseb and its salts and esters		■					■	■	■	■				■		6
PIC	Dinitro-ortho-cresol (DNOC) and its salts		■		■				■	■					na		4
PIC	EDB		■	■		■		■	■	■	■				■		8
POP, PIC	Endosulfan	■	■			■	■	■	■	■	■	■	■	■	■	■	13
POP	Endrin	■	■	■		■	■	■		■	■	■	■	■	■	■	13
PIC	Ethylene dichloride	■	■						■	■			■		■		6
PIC	Ethylene oxide		■					■	■	■	■			■	■		7
PIC	Fluoroacetamide	■	■	■	■			■		■	■				na		7
POP, PIC	HCH/BHC (mixed isomers)	■	■	■		■	■		■	■		■		■	■	■	11
POP	α-HCH	■	■	■			■		■	■			■		■		8
POP	β-HCH	■	■	■			■		■	■			■		■		8
POP, PIC	Heptachior	■	■			■	■	■	■	■	■	■	■	■	■	■	13
POP, PIC	Hexachlorobenzene HCB	■	■				■			■			■		■	■	7
POP, PIC	Lindane (gamma-HCH)	■	■	■		■	■	■	■	■	■	■		■	■	■	13
PIC	Mercury compound (Hg)		■		■		■	■	■	■	■	■	■		na	■	11
PIC	Mercuric Fungicides	■	■		■		■		■	■		■		■	na		8
Montreal	Methyl Bromide				■			■			■	■					5
POP	Mirex	■	■	■			■			■		■			■		7
PIC	Monocrotophos	■	■	■			■	■		■	■	■	■		■	■	11
PIC	Parathion	■	■	■			■			■		■	■	■	■	■	10
POP	Pentachlorobenzene (PeCB)		■			■	■			■				■	na		5
PIC	Pentachlorophenol/PCP and its salts and esters		■	■		■	■		■	■				■	■	■	9
POP, PIC	Toxophene	■	■	■		■	■	■		■	■	■	■		na	■	11
	Total	25	33	16	11	14	23	21	25	35	22	16	17	17	24	18	

■ = banned na = no answer

[52] Progress in Pesticide Risk Assessment and Phasing-Out of Highly Hazardous Pesticides in Asia, Annex 3. FAO RAP Publication 2015/01. http://www.apppc.org/content/progress-pesticide-risk-assessment-and-phasing-out-highly-hazardous-pesticides-asia

Annex 7. Training Topics and Safe Pesticide Use Web Resources

GAP/IPM:

- Pest identification: How to recognize common important pests and diseases
- Monitoring: The importance of frequent crop monitoring for pests, diseases and weeds
- GAP and IPM concepts, tactics and tools found in Annex 4 that can reduce pesticide use and associated risks on specific pests of target crops

The following is an example curriculum on *Pesticides Application and Safety* that was developed for the DAC project as described in the Humpal Report, which can be used as a starting point for developing Avansa Ag training modules.[53]

Recommended module order for follow-up 2-day training as follows:

Day One (1)

Module 8 - Calibration. However, the trainer should follow my method and start with direct physical calibration first thing and as early as possible in the morning (trying to reinforce a point about early morning-cool weather spraying so that it is more likely that farmers will wear PPE). Classroom training on calibration is pretty useless so just use this model to train trainers. In any one zone of training with field staff or farmers, the trainer should be able to take two sprayers from our set and combine them with 2-4 sprayers from farmer groups or farmers. Normally a three-person team does the spraying of clean water only (sprayer, record keeper, timer) for each piece of equipment. If DAC buys another 500 ml to 1000 ml graduated cylinder, then the trainer can run two measuring points after the first joint exercise is done, as long as he has directly verified that everyone knows the steps and how to read the measuring devices.

Module 1 - Five Golden Rules. I have extensively modified this one and provided an overview introduction to the current way that all pesticides are now regulated and managed (human toxicity, environmental toxicity, and resistance management).

Module 3 - Personnel Protective Equipment PPE. This one gives the instructor time to get quickly back into hands on activities to show how even simple materials can replace some of the PPE. Protection during mixing must be higher than protection during application. Divide into teams of 4-5 and have them do the water bottle mask, the plastic bag gloves and foot covering, and the trash bag aprons and back protectors. The trick here is to start setting the standards of use and to start upgrading the PPE for powdered and biological WP formulations for which the Indonesian labels are insufficient. Washing gloves or plastic bags every time that one finishes mixing, spraying, or moving between farms, is one of those standards that DAC staff need to constantly reinforce with the input dealers, supermarket agriculture staff, and themselves.

Module 2 - Purchase, Transport and Storage of Crop Protection Products. Label reading as a mandatory step. Lowest toxicity, effective treatment decision criterion. Transport in locked wooden box and certainly not mixed with food or drink. Individual

[53] Pesticide Safety & Recordkeeping Don Humpal Deliverables Report, July 29, 2014

household current storage (plastic bags stored in house in kitchen) practice is not good. The greenhouse general

stores, while having a warning sign, are not well organized and have no emergency safeguards or accidental spill set-up. Better organization and separation of pesticides from fertilizers and other materials, separation of liquid pesticides from powdered pesticides, storage of PPE and first aid kit outside of any chemical store is needed.

Module 4 - Mixing and Preparing Crop Protection Products. Over and over the PPE stuff must be transferred to trainees with the understanding that pouring and mixing is the most dangerous hazard point to everybody. An exercise wearing the plastic-bottle mask and gloves and trying to measure is important for each little group. An exercise using the syringes to try to get water out of narrow necked water bottles (like many pesticide containers in TL) and figuring out how to get around this problem (smaller syringes or use of syringes with needles, dedicated measuring cups/devices). Labels and MSDS.

Reading and understanding the labels is the next major step after calibration and PPE that makes the big difference in safer use. [This may need to move to Day 2 if training proceeds as slowly as our Day 1 did) Homework assignment. Give participants a homework assignment to scale up calibration to calculate the amount of spray that would be applied to 1 hectare, the total amount of product applied on 1 hectare for selected products, and total cost to a full hectare basis (labels usually provide instructions on a per ha basis for application rates that are explicit or implicit. (associated with the total water volume applied and need to be calculated).

Day Two (2)

Calibration Exercise first thing. More calibration with good record keeping to generate the comparative database on sprayer performance and to observe leak problems with older equipment and good PPE when leaks occur. Demonstration of how to dispose of pesticide bottle rinsate and how to dispose of sprayer rinsate with associated discussion of minimizing personal and environmental risks.

Module 9. Efficient knapsack Sprayer Use. Helps to reinforce the calibration exercise. New Module. Resistance Management Powerpoint. Introduces a new concept to most, incorporates some IPM elements, discusses MOA rotation, and now ends with a biological control example.

Module 11. Recordkeeping A placement that should be used to reinforce the need to know what you have done over time so that you can identify either human toxicity, pesticide efficacy and resistance, or the source of other problems so that you can solve them. Pull in some of the greenhouse records to look at MOA rotations. Kmanek rotation of fungicides for late blight management could be used as an example.

Module 5. Disposal of empty Crop Protection Product(CPP)containers.

Module 10. Good Spraying Practices (except for the spray droplet paper items which will be difficult to supply). This one could be much of the core of the training with farmers. I did most of it verbally interspersed with other modules, but this is a good synthesizing module to guide DAC staff training of farmers.

Group Exercise. Comparison of the sprayer calibration results. Set these out one next to the other and see how they would perform using the label of a sample product to see if they do the job (under-dose, dose within range, over-dose). Calculate and stress the costs of over-dosing and the loss of cash expended if you under dose and fail to control the pest, disease, or weed.

Supplemental Modules

Module 6. Nozzle Selection (beyond the initial introductory slides this module is too advanced given both knowledge needed and the equipment available in TL at this time)

Module 7. Portable Application Equipment (good initial slides but the topic gets complicated quickly and later slides should only be used with staff who have seen and had some experience with all three types of spraying equipment available in TL: hand-pumped, pressurized, and mechanically-powered sprayers)

USAID Environmental Management Module for senior staff. This module lays out the CFR216 and PERSUAP general principles and can be used to inform activity work planning.

Web Safe Pesticide Use Training Resources

General Mitigation of Potential Pesticide Dangers General Measures to Ensure Safe Use:
http://pdf.usaid.gov/pdf_docs/PNADK154.pdf, Chapter 13

USEPA Recommended Worker Protection Standards:
http://www.epa.gov/oppfead1/safety/workers/equip.htm (all types of PPE)

http://www.cdc.gov/nasd/docs/d001701-d001800/d001797/d001797.html (respiratory PPE)

Routes of Pesticide Exposure and Mitigation of Risks:

http://pdf.usaid.gov/pdf_docs/PNADK154.pdf, Chapter 13

Basic First Aid for Pesticide Overexposure:

http://pdf.usaid.gov/pdf_docs/PNADK154.pdf, Chapter 13

International PIC & POPs Lists:

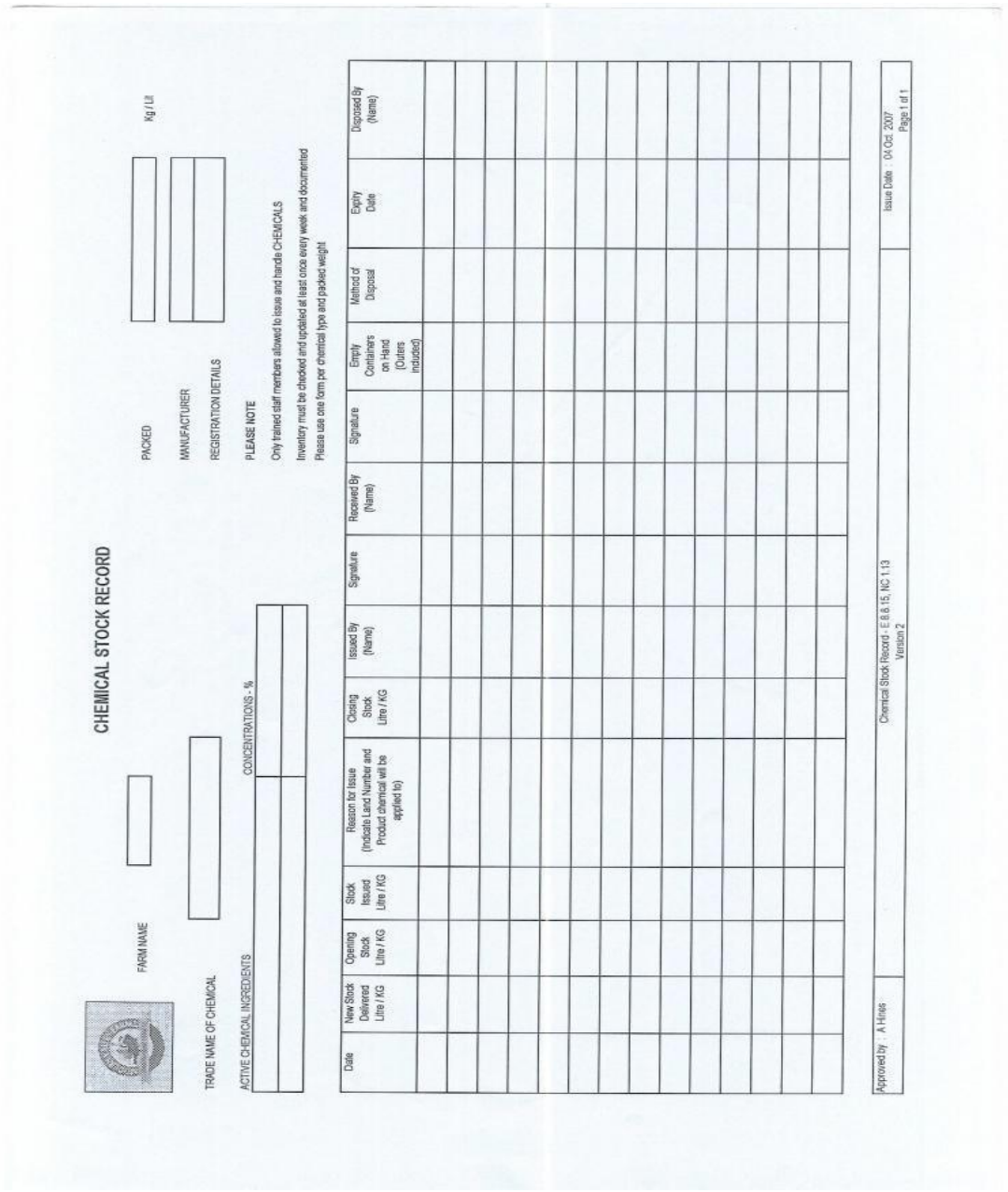
PIC Pesticides and Industrial Chemicals (http://www.pic.int)

POPs Pesticides and Chemicals (http://www.pops.int)

Pesticide Disposal Options:

http://www.epa.gov/oppfead1/labeling/lrm/chap-13.htm

Annex 8: Example Farm and Project Record Keeping Associated with Pesticide Use



CHEMICAL STOCK RECORD

FARM NAME

PACKED

Kg / Lit

MANUFACTURER

REGISTRATION DETAILS

TRADE NAME OF CHEMICAL

ACTIVE CHEMICAL INGREDIENTS

CONCENTRATIONS - %

PLEASE NOTE

Only trained staff members allowed to issue and handle CHEMICALS

Inventory must be checked and updated at least once every week and documented

Please use one form per chemical type and packed weight

Date	New Stock Delivered Litre / KG	Opening Stock Litre / KG	Stock Issued Litre / KG	Reason for Issue (Indicate Land Number and Product chemical will be applied to)	Closing Stock Litre / KG	Issued By (Name)	Signature	Received By (Name)	Signature	Empty Containers on Hand (Outers included)	Method of Disposal	Expiry Date	Disposed By (Name)

Approved by : A Hinks

Chemical Stock Record - E 8.8.15, NC 1.13
Version 2

Issue Date : 04 Oct. 2007
Page 1 of 1

CHEMICAL APPLICATION INSTRUCTIONS - JOVAC

DATE | PRODUCT

LAND NUMBER | BLOCK NUMBER

CHEMI CHEMICAL PRODUCT(S) TO BE APPLIED	ACTUAL DOSAGE PER LAND	Water Vol.	Har. Int. day	Target	INSTRUCTIONS FOR APPLICATION

APPLICATION MACHINERY TO BE USED | Foliar Application | INSTRUCTION GIVEN BY (NAME) | SIGNATURE

WHO EXECUTED THE INSTRUCTION

NAME | SIGNATURE | Time of Spray Start | Finish

SUITABLE AND CLEAN PROTECTIVE CLOTHING

Gloves | Boots | Raincoa | Overall | Nose/ Mouth | Respirator | Eye Pro.

SPECIAL INSTRUCTIONS WHEN HANDLING CHEMICALS

Handling Dry Concentate | Handling Liquid Conc. | Water After Use | Keep Locked No Children | Chemical Are Dangero.

PROTECTIVE CLOTHING ISSUED TO

Name		Name		Name	
Signature		Signature		Signature	
Name		Name		Name	
Signature		Signature		Signature	

WAS THERE EXCESS SPRAY MIX? YES | NO

APPROXIMATE QUANTITY ____ Liters

WHAT HAVE YOU DONE WITH THE EXCESS SPRAY MIX? | EXECUTED BY (NAME)

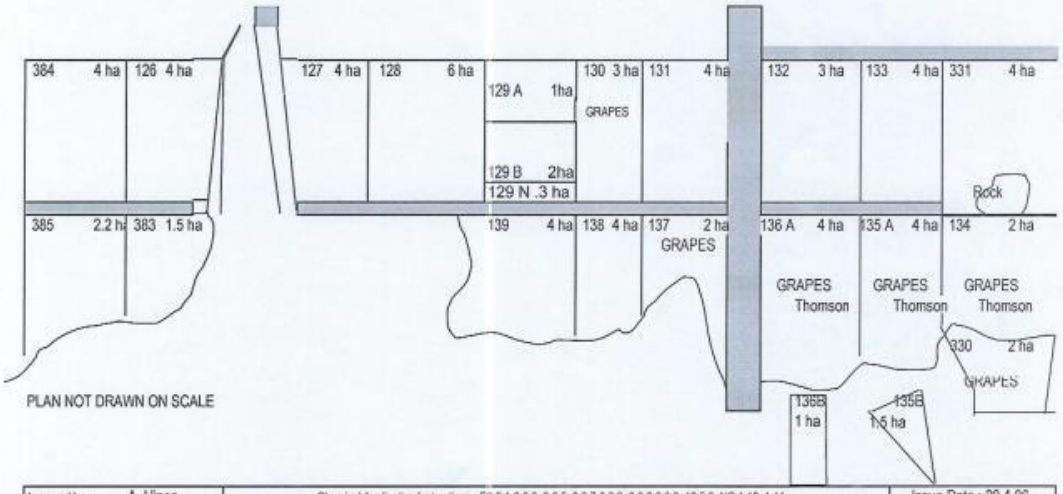
Spray Washing YES / NO

Lit of water

Location: Washing Disposal Area

Weather Conditions

Rain	Dry	Clody	Tempture	Sunny	Wind YES / NO



PLAN NOT DRAWN ON SCALE

Approved by : A .Hines Pepared by : E .Nair	Chemical Application Instructions - E8.3.1-8.3.3, 8.3.5, 8.3.7-8.3.9, 8.6.2-8.6.3, 12.5.3, NC 1.10, 1.11 Version 9	Issue Date : 20.4.06 Page 1 of 1

CONTROL FORM FOR THE USE OF PERTICIDES

Save the Children

GENERAL DATA			
FARMERS NAME			
Community:	**Municipality:**	**Province:**	**Altitude:**
USE OF PESTICIDES - 1st TREATMENT			
CROP:		**SURFACE:**	
Pest to be treated	Name of material	Date and time of application	Quantity used
Environmental conditions:			
Justification for use			
Other recommended control measures			
Result of application			
NAME AND SIGNATURE OF IG AND NRM SUPERVISOR:			
USE OF PESTICIDES - 2nd TREATMENT			
CROP:		**SURFACE:**	
Pest to be treated	Name of material	Date and time of application	Quantity used
Environmental conditions:			
Justification for use			
Other recommended control measures			
Result of application			
NAME AND SIGNATURE OF IG AND NRM SUPERVISOR:			

Annex 9. Example Field Monitoring Forms for Pesticide Use and Safety

Name of USAID Staff Responsible for Monitoring Demonstration Farms:	
Name of Demonstration Farmer:	
Crop:	
Date:	

What are the major pests encountered by the farmer?

Which of the *attached* Preventive and Curative GAP and IPM tools and tactics are used by farmer?

Are pesticides used by demo farmer?	Yes: ____	No: ____
How are pesticides applied?	Backpack sprayer: ____	Other: ____
What are the names of the pesticides used?	Yes: ____	No: ____
Which PPE does farmer have and use?	Gloves: ____	Overalls: ____
	Boots: ____	Respirator: ____
	Goggles: ____	
Has the farmer had IPM and Safe Pesticide Use training?	Yes: ____	No: ____
Are there any empty pesticide containers scattered in the field?	Yes: ____	No: ____
Are there signs that the backpack sprayer has leaks?	Yes: ____	No: ____
Does the farmer understand the pesticide label information?	Yes: ____	No: ____
Is the pesticide stored safely out of the house or away from kids?	Yes: ____	No: ____
Does the farmer use gloves for mixing the pesticide with water?	Yes: ____	No: ____
What times of the day are the pesticides applied?	Yes: ____	No: ____
Are pesticides applied during rain or windy conditions?	Yes: ____	No: ____
Are women or children permitted to apply pesticides?	Yes: ____	No: ____

	_____	_____
Are empty pesticide containers are used to store water?	Yes: _____	No: _____
Does the farmer rinse equipment away from streams and open water?	Yes: _____	No: _____
Does the farmer wash clothes after applying pesticides?	Yes: _____	No: _____
How does the farmer dispose of empty pesticide containers?	Puncture/bury: _____	Burn: _____
Is there any evidence that pesticides are becoming less effective?	Yes: _____	No: _____

Pesticide Use Checklist for PVOs, NGOs, and others

The following checklist is intended to assist in identifying potential environmental problems with pesticide use. It will also help in guiding project management to ensure that pesticides are not used inappropriately. Since pesticide use is mainly an issue with agricultural projects involving trees or food production, livestock projects, and health projects (control of mosquitoes, schistosomiasis pathogens, tsetse fly, etc.), particular care should be taken with those sectors. The same caution should be used anytime pesticides are employed as part of project activities in any sector.

1. Check off all ways in which pesticides will be used.

	By Project Staff	By Recipient	Others (Specify)
Demonstration	_____	_____	_____
Research	_____	_____	_____
Training	_____	_____	_____
Vector Control	_____	_____	_____
Others (list)	_____	_____	_____

2. Check the technical expertise of the people to be handling pesticides:

	By Project Staff	By Recipient	Others (Specify)
Well-trained	_____	_____	_____
Moderately trained	_____	_____	_____
Not trained	_____	_____	_____
Others (explain)	_____	_____	_____

3. Pesticides are needed to manage pests on (check one or more):

_____ Crops

_____ Livestock

_____ Others; please specify: _____

4. Can your staff identify the main pest organisms?

_____Yes _____No

5. Do you know which pesticides are needed?

_____Yes _____No

6. List pesticides needed, indicating each commodity (crop type, livestock type, tree, etc.) and specify pests (name of specific insects, diseases, weeds, storage pests, etc.) needing control, using the format shown below.

Commodity Pest Pesticide Common Name Trade Name

7. Pesticide Storage Facilities

a) Do you have a storage facility on the project site designated solely for pesticides?

_____Yes, describe:

_____No

b) Is the storage shed well lit, ventilated, and safe from flooding?

_____Yes _____No

c) Are pesticides kept away from food, feed, or water?

_____Yes _____No

d) Are storage facilities secure and kept locked when not in use?

_____Yes _____No

e) Are all pesticides kept in their original, labeled containers?

_____Yes _____No

f) Are warning signs posted outside the storage sheds?

_____Yes _____No

g) Are pesticides stored away from flammable/combustible materials?

_____Yes _____No

h) Is there a well-established procedure to clean up spills?

_____Yes, namely:

_____No

8. Safe Use of Pesticides

a) Do you have a place to mix the pesticides safely?

_____Yes, describe:

_____No

b) Do you have protective clothing (e.g. rubber boots, coveralls, gloves, masks, eye protection)?

_____Yes, describe:

_____No

c) Do you have measuring and mixing equipment?

_____Yes, describe:

_____No

d) Do you have a supervisor in the project designated to oversee all pesticide operations?

_____Yes, who?:_____;

Level of training? _____

_____No

e) Is your staff familiar with appropriate pesticide disposal procedures?

_____Yes _____No

f) Describe how you plan to dispose of pesticide containers:

metal? _____

glass? _____

plastic? _____

paper? _____

cardboard? _____

g) Is your staff familiar with first-aid procedures for pesticide poisoning?

_____Yes _____No

h) Are emergency procedures in place in case of accidental poisonings?

_____Yes: Briefly describe_____

_____ _____

_____No

i) Are there procedures for observing restricted entry intervals after applications?

_____Yes _____No

9. Application Equipment

a) Describe equipment you will be using to apply the pesticide.

b) Is there a trained person on the project whose job will be to maintain application equipment, including nozzles and sieves?

_____Yes _____No

c) Are spare parts available in local stores?

_____Yes _____No

Pesticide Use Checklist for

10. General Pest Management Concerns

a) Have you identified pesticide-related risks in your project area and analyzed whether pesticide use is justified, affordable, and can be adequately managed and supervised?

_____Yes _____No

_____N/A

b) Will your staff be training other people in pest management and pesticide use?

_____Yes, whom?

_____No

c) Are funds available for necessary materials, training methods, and follow-up included in your project paper?

_____Yes, estimated costs? _____ _____

_____No

11. IPM approach

a) Is the project promoting the adoption of preventive, non-chemical management measures?

_____Yes _____No

If yes, indicate which (crop rotation, biocontrol, use of resistant cultivars, crop diversification, tillage, sanitation, manual weed destruction,etc):_____
_

_____

b) Are pesticides being applied only as last-resort measures and based on action threshold criteria? Are there pest monitoring procedures being used to determine the need for pesticide treatments?

_____Yes _____No

c) Can farmers and project extensionists readily distinguish pest from non-pest organisms?

Can they recognize common beneficial species (pollinators, predators, and parasitoids)?

_____Yes _____No

12. Environmental Impact

a) Are there wildlife sanctuaries, preserves, or any other protected habitats in or near the project implementation area that might be affected by pesticide use?

_____Yes, namely:

_____No

b) Are there water bodies (lakes, lagoons, reservoirs, rivers, streams, estuaries, etc.) near the project areas that might be subject to pesticide contamination through drift, runoff, or spills?

_____Yes. Describe:

_____No

c) Are wildlife and domestic animals protected from poisoned baits?

_____Yes. How?

_____No

13. Pesticide monitoring

Is there a system in place for tracking pesticide use activities, including frequency of applications, techniques, chemicals used, doses, target pests, effectiveness, criteria for applying, and safe use practices?

_____Yes

_____No

14. Literature Needs

Have you included literature needs in your activity?

_____Yes

_____No

15. Check off areas where additional assistance may be needed:

	Consultancy	Training
Pest identification	_____	_____
Pesticide selection	_____	_____
Handling pesticides	_____	_____
(transport, mixing, loading, application, equipment clean up, disposal)		
Application equipment	_____	_____
IPM	_____	_____
Pesticide storage	_____	_____
Protective clothing	_____	_____
Measuring & mixing equipment	_____	_____
Training (designate activity)	_____	_____
Literature	_____	_____
Training materials	_____	_____
Other (specify)	_____	_____

Double check above

Annex 10. PERSUAP Analyses of Active Ingredients in Pesticides Registered in Indonesia

This annex compiles all of the AIs in pesticides (natural and synthetic) registered for use in Indonesia, and proposed for imminent registration as of 2013.

If an AI or pesticide is not in Annex 1 of this PERSUAP, it may have been missed in the initial survey of pesticides available in Timor-Leste. This annex presents information on additional pesticides available in Indonesia that may be imported or available in Timor-Leste as well. However, the process for approving pesticides for use on USAID projects in Indonesia is different from that in Timor-Leste, so pesticides approved for use in Indonesia are NOT approved for use on Avansa Ag projects unless additional review is conducted. This table is provided for informational purposes only- but may indicate the toxicity and hazards associated with pesticides encountered in the field or at agricultural supply shops. The Avansa Ag PERSUAP will be reviewed on an annual basis, and additional pesticides may be added or removed from the approved list at that time.

Key to matrix:

Red shading:	Not allowed on USAID projects in INDONESIA
Green shading:	Can be promoted on USAID-supported farms in INDONESIA
Yellow shading:	Some products accepted; some products rejected for projects in INDONESIA
RUP:	Few = one or two products; Some = a third of products; Most/All = most or all products
WHO Acute Toxicity Classes:	O = Obsolete; Ia = Extremely Hazardous; Ib = Highly Hazardous; II = Moderately Hazardous; III = Slightly Hazardous; U = Unlikely to present acute hazard in normal use
USEPA Acute Toxicity Classes:	I = Extremely Toxic; II = Highly Toxic; III = Moderately Toxic; IV = Slightly Toxic
Chronic Human Toxicity:	KC = Known Carcinogen; PC = Possible Carcinogen; LC = Likely Carcinogen; ED = Potential Endocrine Disruptor; RD = Potential Reproductive & Development Toxin; P = Risk of Parkinson's
Ecotoxicity:	NAT = Not Acutely Toxic; PNT = Practically Not Toxic; ST = Slightly Toxic; MT = Moderately Toxic; HT = Highly Toxic; VHT = Very Highly Toxic

Table A10-1: Indonesia Pesticide Active Ingredients in Registered Products — DO NOT USE For Avansa Agricultura in Timor-Leste

Active Ingredients	Class	USEPA Registered	Restricted Use Pesticide	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity								
								fish	bees	birds	amphibians	worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
Miticides/Acaricides																
abamectin/avermectin	microbial	yes	**some**	none	II, III	RD	no data	ST	HT	PNT				HT	VHT	VHT
amitraz	formamdine	yes	no	III	II	PC, RD	no data	MT	PNT	ST	ST			NAT		ST
tetradifon	bridged diphenyl	**no**	no	U	III	none	no data	MT	MT	NAT	MT	NAT	ST	ST		MT
Insecticides																
abamectin	microbial	yes	**some**	None	II, III	RD	no data	ST	HT	PNT				HT	VHT	VHT
acetamiprid	neonicotinoid	yes	no	none	III	none	no data	NAT	MT	HT				NAT		
acrinathrin	pyrethroid	**no**	no	U	IV	ED	no data	MT	ST	MT		MT		MT		
alphacypermethrin	pyrethroid	**no**	no	none	II, III	PC	no data	HT	HT	PNT			MT	VHT	VHT	VHT
aluminum phosphide	inorganic	yes	**all**	none	**I**	none	no data	HT	HT	HT				MT		
bendiocarb/benthiocarb	carbamate	**no**	**some**	II	II, III	RD	no data	MT	HT	HT				MT	HT	VHT
carbofuran	carbamate	yes	**most**	**Ib**	**I**, II	ED	potential	MT	HT	HT	ST	MT	MT	HT	HT	VHT
cartap hydrochloride	nereistoxin	**no**	no	II	II	none	no data	MT	MT							
chlorfenvinphos	organophosphate	**no**	no	**Ib**	**I**, II	ED	no data	HT	HT	HT	MT	MT		HT		
chlorpyrifos (ethyl)	organophospate	yes	**some**	II	II, III	ED	no data	HT	HT	HT	MT	PNT	MT	VHT	HT	MT
cyfluthrin	synthetic pyrethroid	yes	**some**	II	II, III	ED	no data	VHT	HT	PNT			ST		VHT	VHT
cypermethrin	pyrethroid	yes	**some**	none	II, III	PC	no data	HT	HT	PNT			MT	VHT	VHT	VHT
deltamethrin	pyrethroid	yes	**cotton**	II	II, III	none	no data	HT	MT		VHT		NAT		VHT	VHT
dichlorvos/DDVP	organophospate	yes	no	**Ib**	**I,** II, III	PC, ED	no data	MT	HT	HT				HT		
dimethoate	organophospate	yes	no	II	II	PC	potential	ST	VHT	VHT	HT	MT	VHT	HT	VHT	MT
endosulfan	organochlorine (POPs)	yes	**most**	II	**I**, II	ED	no data	VHT	MT	MT	MT	MT	MT	HT	HT	MT
ethofenprox	pyrethroid	yes	no	U	III	PC, RD	no data	HT	HT	MT		MT		HT		
fenamiphos	organophosphate	**no**	**some**	**Ib**	**I**	none	potential	HT	HT	HT		MT		VHT		MT
fenitrothion	organophosphate	yes	no	II	II, III	ED	no data	MT	HT	MT	MT	MT	MT	VHT	HT	MT
imidacloprid	neonicotinoid	yes	no	II	II, III	none	potential	NAT		MT					VHT	
lambda cyhalothrin	pyrethroid	yes	**some**	II	II, III	ED	no data	VHT	HT	PNT		VHT	VHT	VHT		
methamidophos	organophospate	**no**	no	**Ib**	**I**	none	potential	ST			ST			VHT		MT
methomyl	carbamate	yes	**few**	**Ib**	**I**, II, III	ED	potential	MT	HT	HT	ST	HT	ST	HT	VHT	HT
monocrotophos	organophosphate	**no**	no	**Ib**	**I**	none	no data	ST	HT	HT		MT	MT	MT		HT
permethrin	pyrethroid	yes	no	II	III	PC, ED	no data	VHT	VHT	PNT	ST	ST	ST	VHT	MT	MT
pirimiphos-methyl	organophospate	yes	no	III	III	none	no data	MT	HT	MT						
profenofos	organophosphate	yes	**all**	II	III	none	potential	HT						VHT	VHT	VHT
propoxur	carbamate	yes	no	II	II, III	PC	no data	MT	HT	VHT	ST	NAT	ST	HT	ST	MT
terbufos	organophosphate	yes	**most**	**Ia**	**I**	none	no data	VHT	MT	MT		HT		VHT		VHT
triflumuron	insect growth regulator	**no**	no	U	none	none	no data	VHT	ST	MT				MT	MT	MT
Bacillus thuringiensis-BT	microbial	Yes	No	None	III	None	no data		PNT	NAT	NAT		ST	ST		
Beauveria bassiana	microbial	Yes	No	None	III	none	no data	NAT	NAT	NAT		NAT		NAT		
cyromazine	triazine	Yes	No	U	III	ED	**known**	MT	ST	MT		MT		MT	NAT	

Active Ingredients	Class	USEPA Registered	Restricted Use Pesticide	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity								
								fish	bees	birds	amphibians	worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
fipronil	pyrazole	Yes	Few	III	II, III	PC, ED	potential	HT	HT	HT					HT	HT
lufenuron	benzoyl urea	Yes	No	NL	III	NL	no data	MT	ST	MT		MT		HT	ST	
malathion/mercaptothion	organophosphate	Yes	No	III	II	PC, ED	potential	MT	HT	MT	HT	ST	VHT	MT	VHT	HT
pyrethrins (Marigold extract)	botanical	Yes	No	II	III	PC	no data	HT	HT	ST		MT		HT		
spinosad	microbial	Yes	No	U	III	NL	no data	MT	HT	PNT		ST			HT	MT
thiamethoxam	neonicotinoid	Yes	few	NL	III	PC	no data	PNT	HT	PNT		PNT	PNT	PNT	PNT	
Fungicides																
benomyl (benlate)	benzimidazole	**no**	no	U	III	PC, ED, RD	no data	HT	PNT	MT	ST	HT		NAT		ST
boscalid (nicobifen)	carboximide (anilide)	yes	no	none	II, III	PC	no data	MT	MT	MT		MT		MT		
carbendazim	benzimidazole	yes	no	U	III	PC, ED	no data	MT	NAT	ST	ST			ST		HT
chlorothalonil	chloronitrile	yes	no	none	**I**, II	PC	potential	VHT			HT		ST	VHT	MT	MT
copper ammonium complex	inorganic	yes	no	none	III	none	no data	HT				MT				
copper (cuprous) oxide	inorganic	yes	no	none	I, III	none	no data	NAT								
copper oxychloride	inorganic	yes	no	none	II, III	none	no data	MT	MT	MT		MT				
copper sulfate	inorganic	yes	no	II	**I**, III	none	no data	MT	HT	PNT	HT	HT	VHT	ST		ST
difenoconazole	azole	yes	no	III	III	PC	no data	MT	MT	ST		MT		MT		HT
fenamidone	unclassified	yes	no	none	II, III	none	no data	MT	MT	MT		MT		MT		
folpet	thiophthalimide	yes	no	U	II, III	PC	no data	HT	PNT	ST	HT	MT	ST	HT		MT
fosetyl aluminum	unclassified	yes	no	none	III	none	potential	NAT	ST	ST		MT		NAT		MT
iprovalicarb	unclassified	**no**	no	U	none	**LC**	no data	MT	ST	MT		MT				
kresoxim-methyl	strobin	yes	no	U	III	PC	potential	ST	ST	ST		MT		MT		VHT
mancozeb/maneb-zinc	dithiocarbamate	yes	no	U	III	RD	no data	MT	MT	ST	HT					NAT
phosphorous acid	inorganic	yes	no	U	III	none	no data	ST								
propamocarb HCl	carbamate	yes	no	none	III	none	no data	MT	MT	MT		MT		MT		
propiconazole	azole	yes	no	II	II, III	PC, RD	potential	MT					MT	ST	MT	MT
propineb	dithiocarbamate Zn	**no**	no	U		RD	no data	MT	PNT	PNT			MT	MT	MT	MT
sodium metabisulfite	inorganic	yes	no	none	III	none	no data	ST								
tebuconazole	azole	yes	no	III	II, III	PC	potential	MT	MT	MT		MT		MT	MT	HT
thiram	dithiocarbamate	yes	no	III	III	ED, RD, PC, ED	no data	HT	NAT	PNT	VHT	HT		NAT	HT	HT
triadimefon	triazole	yes	no	III	II, III	RD	potential	MT	MT	PNT		MT		NAT		
alkyldimethylbenzyl ammonium chlorid	quaternary ammonium	**no**	no	none	**I**	none	no data	HT				MT	MT	HT	MT	HT
copper hydroxide	inorganic	yes	no	II	II, III	none	no data	HT	MT	MT		MT	HT	NAT	HT	HT
cymoxanil	unclassified	yes	no	III	III	none	no data	MT	MT	ST		MT		MT	MT	ST
dichlorophen	chlorinated phenol	**no**	no	III	III	PC, RD	no data	HT		NAT			MT	MT		
epoxiconazole	triazole	**no**	no	none	none	PC	no data	MT	MT	MT		MT				
famoxadone	oxazole	yes	no	U	III	none	no data	HT	MT	ST				HT		
flusilazole	azole	**no**	no	III	III	none	no data	MT	MT	MT		MT		MT		
flutriafol	triazole	**no**	no	III	NL	ED	potential	MT	MT	LT		MT		MT		
metalaxyl	benzanoid	yes	no	III	II, III	NL	potential	ST	PNT	PNT						ST

Active Ingredients	Class	USEPA Registered	Restricted Use Pesticide	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity								
								fish	bees	birds	amphibians	worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
penconazole	azole	**no**	no	U	NL	ED	no data	MT	MT	MT		MT		MT		
pyraclostrobin	strobin	yes	no	none	II, III	none	no data	ST	MT	MT		MT		HT		
triadimenol	triazole	yes	no	III	II, III	PC, ED	no data	MT	ST	MT		MT				
Trichoderma species	microbial	yes	no	none	III	none	No data									
Herbicides																
2 4 DB acid	chlorophenoxy acid	yes	no	III	III	RD	No data	ST							ST	
2 4 D isooctyl ester	chlorophenoxy ester	yes	No	None	III	PC	potential	ST								MT
acetochlor	chloroacetanilide	yes	Most	III	II, III	PC, ED	Potential	MT	MT	ST		MT				MT
ametryne	triazine	yes	No	III	III	ED	Potential	ST	MT	NAT	MT		MT			ST
atrazine	triazine	yes	Most	U	III	PC, ED	Known	ST	NAT	PNT	ST	ST	ST	ST	ST	ST
chlorimuron (ethyl)	sulfonyl urea	no	No	U	III	None	No data	NAT	ST	NAT		MT		NAT		MT
clethodim	cyclohexenone	yes	No	None	II, III	None	Potential	MT	MT	MT		MT		MT		
fluazifop-p-butyl	propionic acid	yes	No	III	II, III	None	No data	MT	ST	PNT					ST	
fomesafen	diphehyl ether	yes	No	III	I, II, III	PC	No data	NAT	MT	NAT		MT		NAT		ST
glyphosate	phosphonoglycine	yes	No	U	II, III	None	Potential	ST	ST	NAT		PNT		MT		ST
hydramethylnon	unclassified	yes	No	III	III	PC, RD	No data	HT	MT	MT				MT		
imazethapyr	amidazolinone	yes	No	U	II, III	None	Potential	NAT	HT	NAT		NAT		NAT		
mepiquat chloride	quaternary ammonium	yes	No	III	II, III	None	Potential	ST	MT	MT		MT		HT		VHT
metolachlor/S-metolochlor	chloroacetamide	yes	no	III	III	PC, ED	known	MT	ST	MT		MT		MT		
metribuzin	triazinone	yes	No	II	II, III	ED	Potential	MT	NAT	MT		MT		ST		ST
metsulfuron-methyl	sulfonyl urea	yes	No	U	III	None	Potential	NAT	MT	NAT		MT		NAT		
nicosulfuron	sulfonylurea	yes	No	U	II, III	None	Potential	MT	MT	MT		MT		MT		
paraquat	bipyridylium	yes	most	II	I	P	potential	ST	NAT	MT	ST		ST	ST	NAT	ST
pendimethalin	dinitroanaline	Yes	No	III	III	PC, ED	No data	MT	NAT	ST				MT	MT	
propaquizafop	a propionic acid	No	No	U	None	None	No data	MT	MT	MT		MT		MT		
pyrothiobac-sodium	pyrimidinyloxybenz	Yes	No	U	II	PC	potential	NAT	MT	NAT				NAT		
sulcotrione	unclassified	No	No	None	None	none	No data									
terbuthylazine	triazine	yes	no	U	III	none	No data	MT	MT	MT		MT		MT		HT
bentazon	benzothiazinone	Yes	No	III	III	None	No data	NAT	MT	MT		MT	ST	MT		
bromoxynil	hydroxybenzonitrile	Yes	Nop	II	II	PC, RD	No data	ST	MT	MT		MT	MT			VHT
clomazone	isoxazolidinone	Yes	No	II	II, III	NL	Potential	MT	MT	NAT		MT		MT		HT
cyanazine	triazine	No	No	II	II, III	PC, ED, RD	Known	ST	MT	MT		MT	ST	MT		HT
DCPA/dacthal	alkyl phthalate	yes	no	U	III	PC	known	ST				NAT				ST
diuron	urea	yes	No	U	III	LC, ED, RD	Known	ST			ST		ST	ST	MT	ST
fluometuron	urea	yes	No	U	III	PC	potential	ST					ST			MT
halosulfuron (methyl)	pyrazole	yes	No	U	III	None	Potential	ST	MT	ST		ST		ST		NAT
linuron	urea	yes	No	U	III	PC, ED, RD	Potential	MT	NAT	MT		MT	ST	MT	ST	MT
MCPA	chlorophenoxy acid	yes	no	II	II, III	PC	No data	ST	PNT	NAT	ST		ST	NAT	NAT	ST

Active Ingredients	Class	USEPA Registered	Restricted Use Pesticide	WHO Acute Toxicty Class	USEPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity								
								fish	bees	birds	amphibians	worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
mesotrione	unclassified	yes	No	None	II, III	None	No data	NAT	MT	MT		MT		NAT		
metam sodium	dithiocarbamate	yes	Half	II	I	PC, RD		MT	MT	MT		VHT		VHT		HT
nicosulfuron (methyl)	sulfonylurea	yes	no	U	II, III	None	Potential	MT	MT	MT		MT		MT		
oxyfluorfen	diphehyl ether	yes	no	U	II, III	PC	No data	HT	PNT	PNT			HT		HT	HT
prometryn	triazine	yes	no	U	III	ED, RD	Potential	MT	NAT	PNT	ST	NAT		NAT	ST	ST
propachlor	chloroacetanilide	yes	no	III	I, II	LC, RD	No data	HT	ST	HT	MT	MT		MT		
propanil	analide	yes	no	III	II, III	PC	Potential	MT	NAT	MT	ST		NAT	ST	ST	ST
quizalofop-p-tefuryl	aryloxyphenoxypropionate	yes	no	II	III	None	No data	MT	MT	NAT		MT		MT		
thiobencarb(e)/benthiocarb	thiocarbamate	yes	no	II	III	none	Potential	MT	ST	NAT	MT		MT	MT	MT	HT
trifluralin	dinitroanaline	yes	no	U	II, III	PC, ED	No data	HT	PNT	PNT	MT	HT	ST	ST	ST	MT
Rodenticides																
bromadiolone	Coumarin	Yes	No	Ia	III	None	No data	MT		MT				MT		
coumatetralyl	Coumarin	No		Ib	I	None	No data	MT		MT						
difethialone	Coumarin	Yes	No	Ia	II, III	None	No data	VHT		HT	MT			HT		
zinc phosphide	inorganic	yes	some	Ib	I, II, III	RD	No data	HT	VHT	HT				MT		
Nematicides																
fenamiphos	organophosphate	No	Some	Ib	I	None	Potential	HT	HT	HT		MT		VHT		MT
oxamyl	carbamate	Yes	Most	Ib	I	None	No data	ST	HT	VHT		HT		ST		MT
terbufos	organophosphate	Yes	Most	Ia	I	None	No data	VHT	MT	MT		HT		VHT		VHT
Paecilomyces lilacinus Strain 251	microbial egg parasite	yes	no	none	III	None	No data									
alkyldimethylbenzyl ammonium chloride	quaternary ammonium	no	no	none	I	none	no data	HT				MT	MT	HT	MT	HT
bromine	inorganic	yes	no	NL	II	NL	no data	HT								MT
bromine chloride	inorganic	yes	no	NL	I	NL	no data	HT					HT	MT		HT
chlorine dioxide	inorganic	yes	no	NL	III	NL	no data	NAT			VHT		NAT	NAT		
copper	inorganic	yes	no	NL	I, II, III	NL	no data	MT				HT	HT	MT	MT	HT
copper ammonium complex	inorganic	yes	no	none	III	none	no data	HT				MT				
didecyldimethyl ammonium chloride	quaternary ammonium	yes	no	NL	I	NL	no data	HT				MT	MT	HT	MT	HT
formaldehyde	organic	yes	no	NL	I	KC	no data	NAT		NAT	ST		NAT	NAT		ST
hydrogen peroxide	inorganic	yes	no	NL	I, III	NL	no data	MT						HT		
iodine	inorganic	yes	no	NL	I, III	NL	no data	MT			ST					HT
phenol	benzene	yes	no	NL	II, III	NL	no data	ST				NAT	NAT	ST	NAT	ST
quaternary ammonium	inorganic	no	no	NL	NL	NL	no data			ST						
sodium hypochlorite (Clorox)	inorganic	yes	no	NL	I, II, III	NL	no data	HT				MT	MT	MT	HT	MT
sulfuric acid	acid	yes	few	NL	I	NL	no data	ST						ST		

Annex 11: Draft Timor-Leste Law of Pesticides as of 2011

This is the original unedited document obtained from the GOTL in June 2015.

Decree-Law No ..... / 2011

of ..... of .....

LAW OF PESTICIDE S

To prevent intensive pesticide use in monitoring the development of agriculture in Timor-Leste, and the handsome or potential danger for human health and the environment of unlimited use of the pesticides, the Government establishes the present law to regulate the import, manufacture , sale and distribution of pesticides in East Timor.

In accordance with Articles 115.3 and 116 (d) of the Constitution the Government states that to have legal force.

Chapter I

Interpretation

Article 1. °

Settings

In this Act unless the context otherwise egija (insist):

"Component and active" means the biologically active part of this pesticide in the FORMULA;

"Helper" It means any substance or thing used as a support for the application or the effectiveness of a pesticide and includes folds, publisher, emulsifying agents and synergists;

"Approved" in relation to containers, packages or labels means approved by the Committee on Pesticide Registration;

"No pesticide" means a particular pesticide by the Commission to be a prohibited pesticide;

"Botanical pesticide" includes but is not limited to *derris* dust, pyrethrum, *neme,* azadiraca, garlic and species of bacillus *thuringiensis.*

"Commission" means Pesticide Registration Board under this Act;

"Container" means something in which or by which pesticides may be boxed, covered, closed, contained or packed;

"Customs Services" means Services of Timor-Leste Customs;

"Formula" means the combination of ingredients designed to restore the useful and effective pesticide for the purpose reivindicad;

"Import" means bringing or sending bring to Timor-Leste and includes transit;

"Inspector" means an inspector d and pesticide appointed under this Act;

"Label" means matter written, printed or graphic, or displayed in the container immediately pesticide and on the outside of the cover of the container or package flap pesticide;

"Garment manufacturer" means the person or company that manufactures the pesticide;

"Maximum residue limit" means the maximum concentration of a residue in food ingredient, product Agriculture or the feeding of animals from time to time is recognized as acceptable in Food Codex or as may be prescribed by the Minister.

"Minister" means the Minister of Agriculture, Forestry and Fisheries;

"Ministry" means the Ministry of Agriculture, Fisheries and sta Flore;

"Official Gazette of the Republic" sign ifica the Official Gazette of the Democratic Republic of Timor-Leste:

"Pest" means any form of plant or animal life which is harmful to plants, animals or humans The term encompasses vectors of human or animal disease and unwanted species of plants or animals.;

"Prescribed" means prescribed by this Act or by order or direction of the Minister;

"Re -entrad the period" means the span the after using a pesticide in a special place in which it is dangerous to enter a person in that place without clothing or protective equipment;

"Registration" means the Pesticide Registry established under this Act;

"Registrar" means the Official Pesticide Registration appointed under this Act;

"Restricted Use Pesticide" means the registration granted to a pesticide by the Commission with the condition d and r used only by the holder li CENCA restricted use;

"Sell" means offering or exposing for sale or have in possession p r aa sale, and "sale" te m the same meaning;

"Business or product name" means the brand name applied to each type of pesticide by the garment manufacturer, distributor, importer or seller;

"Retention period" sign ifica the minimum period that must pass between r:

a. the last use of the pesticide in relation to a pasture or collection of animal; and

b. harvesting and cutting or grazing animals, crops or pasture, or collection of animal food products;

in order to ensure non pesticide residues exceeding the maximum residue limit.

Article 2. °

Meaning of "pesticide"

1. "Pesticide" means any formula used to destroy, control or prevention of any pest that causes injury or that interferes with the production, processing, armazenag in transportation or food market, agricultural, forest or Products forest, cooked foods or animal, or it may be administered to animals for the control of insects, arachnids or other pests on or in their bodies.

2. The term includes fó rmulas applied before or after harvest to protect the deterioration of the product during transport and armagenazem action.

Article 3. °

Exclusion of Certain Pesticides

The term "pesticide" non includes a pesticide that is:

a. insect repellent for use in humans;

b. formul ada as an aerosol for domestic or so for pest control (not that the formula includes a banned pesticide);

c. used domestically to control ectoparasites or endoparasites more in ruminants, horses, pigs or poultry;

d. used in water supply systems or in swimming pools;

e. used as a soil pain conditions;

f. used as an inoculum soil which is executed in bacteria or enzymes;

g. used as a helper or plant growth regulator, drying or agent for fruit s fine or prevention tion d premature fallen fruit;

h. pestecida one that indulges the pattern of Organic Certification aceitad the East Timor or is a botanical pesticide;

i. used for disinfection purposes, bleaching or sterilizing substances including water;

j. a natural predator, including insects, weevil s and macroscopic parasites used to destroy or control pest and s n but will include Bacteria is laughing, protozoa, fungi, viruses and mycoplasmas;

k. an oral electrolyte;

l. **antelminta** one or oral **fluquecida;**

m. an anti-diarr oral eia not containing antibi O ticos; or

n. otherwise prescribed by order of the Minister.

CHAPTER II

Registrar of Pesticides, Pesticide Registration and Pesticide Registration Board

Article 4. °

The Registrar of Pesticides

1. The Registrar of Pesticides is responsible for record keeping in relation to pesticides in Timor-Lest and, and for issuing licenses and authorizations s.

2. The Registrar should be the Director of Food Production in the National Agriculture and Animal Husbandry of the Ministry of Agriculture Directorate, Forestry and Fisheries s or other person appointed by the Minister.

Article 5. °

Recorder Skills

1. The Registrar must:

a. keep a Register of Pesticides, one Prohibited Pesticides relationship and publish certain materials in the Official Gazette of the Republic as it requires gone by this Law;

b. pesticide issue licenses under d this Act for the import, manufacture, sale or distribution of any pesticide;

c. issue permits for restricted use and experience l under this Act, with the view of the Commission;

d. maintain relations licenses and permits issued under d this Law;

e. managing the Commission and the ordering process to the Commission;

f. If rvices provide the Customs details of what is registered and prohibited pesticides; and

g. retain the business relationships or product names and quantities of pesticides imported into East Timor.

2. The Registrar may delegate to employees that he po to appoint within the Ministry of Agriculture, Forestry and Fisheries some of the skills he attributed the í.

Article 6. °

Pesticides Register

1. The Registrar must be delivered to the Pesticide Registration the following details of each registered pesticide:

a. Your business name or product;

b. Its chemical name and the concentration of the activ component s is not s-activ;

c. Your type of formula;

d. His own life;

e. The packet size;

f. Plants / products to be treated and target organisms and the purpose of the use of pesticides.

g. Applications and doses or concentrations for use;

h. The name and place of business of his garment manufacturer;

i. The name and place of business of the importer;

j. The name and register the business place; and

k. The date of registration.

2. Each pesticide that entered in the Register should be given a number which is known as the registration number.

3. An original copy label of each pesticide registered by the Registrar must keep the same, as evidence of the registered product.

Article 7. °

Pesticide Registration Board

The Pesticide Registration Board is responsible for Pesticide Registration in East Timor.

Article 8. °

Composition of the Commission

1. The Commission shall consist of:

a. the Registrar, who is the Chairman;

b. the Director of Research and Extension Center n the Ministry which is the Secretary;

c. the Director of the Division of Quarantine Services No prosecutor or person named in that Division;

d. the Health Inspector of the Health Services Inspectorate of the Ministry of Health or official that service; and

e. no more than three people who are experienced in the use of pesticides or pest control and related scientific disciplines, which will be appointed by the Minister.

2. Members of the Commission are appointed by the Minister shall serve for a period of three years but can be renamed by the Minister under this Section.

3. Members of the Commission are appointed by the Minister may resign at any time through a written communication addressed to the Minister.

4. The Minister may dismiss an appointed member of the Commission for failure or neglect of duty as a member of the Commission and the va ga must be completed within 3 months.

Article 9. °

Commission powers

The Commission shall:

a. evaluate, estimate and determine each application for registration of a pesticide and inform the Registrar d their findings;

b. determine the cancellation, suspension or revocation of a registration made under this Act;

c. determining a pesticide to be a banned pesticide in terms of presence you Law and inform the Registrar of this determination;

d. determine the terms of use of any pesticide, including pesticides whose use should be regulated by the restricted authorization and inform the Registrar of the conditions;

e. issue guidelines for armagenazem, distribution, use and sale of pesticides in Timor-Leste;

f. consider and warn the proposals for regulations under this Act, and warn the Minister on matters related to pesticides;

g. promote efficient, safe use, armagenazem and sale of pesticides; and

h. perform other functions assigned to it under this Act;

Article 10. °

Functions of the Commission

1. Under other provisions of this Act, the Commission shall regulate its procedure since it thinks appropriate.

2. A quorum shall consist of the President, Secretary and two other members.

CHAPTER III

Pesticide control - Register

Article 11. °

All pesticides must be Registered by the Pesticide Registration Board

1. No one should use or have n their possession, import, manufacture, sell or distribute a pesticide in East Timor unless:

a. the pesticide is registered by the Pesticide Registration Board under this Act; and

b. the pesticide is contained in a container or package and if approved label is visibly set in such a container or package.

2. This provision will be subject're under a restricted or experimental use authorization which may be issued by the Registrar under d this Law.

Article 12. °

Requests to the Commission for the Registration and Packet approval, containers and labels

1. A person may apply to the Commission for registration of a pesticide and approval of labels and containers, or d and pesticide packages.

2. Each application for registration and approval by the Commission should be made in a form prescribed by the Registrar.

Article 13. °

Permission or request Refusal to Register

In order to allow the application for registration, the Commission:

a. It should be convencid that the proposed use of the pesticidal:

   i. It should not be an undue risk to the safety d people exposed to it during their will gest or people who use something containing their waste;

   ii. It should not be likely to have harmful effects to human beings;

   iii. It should not be likely to have unintended effect that is harmful to animals, plants or things and the environment;

   iv. should not be unduly hampered trade or commerce between East Timor and other parts; and

   v. It should be effective for its purpose; and

b. must approve:

   i. The pesticide labels; and its

   ii. packages and containers.

Article 14. °

Labels

The Commission should not approve a label under this Act unless the label copy to be submitted with the application containing:

a. the following individuals:

   i business name or product of the pesticide.;

   ii the weight or volume of the liquid pesticide.;

iii. s name d to the common Chemistry and percentages of the component or active equivalent as appropriate acids; and

b. adequate instructions concerning the following as are apropriad s:

i.as circumstances in which the product must be used;

ii.como is that the product should be used;

iii. time the product should be used;

iv the frequency of use of the product.;

v. available when the product is no longer required;

vi. array of product containers;

vii. safe gest will the product and first aid in the event of an accident caused by gest will the product.;

viii. retention period after use of the product;

ix. re-entry period after use of the product; and

x. qualquer other matters prescribed under this.

Article 15. °

The Comi SSAO may impose conditions for the Register

1. In considerção the discretion under Article 13, the Commission:

a. p ode to impose conditions for the import, manufacture, sale, distribution, use or disposal of a particular pesticide; and

b. at any time, amend the existing conditions or impose additional for registration.

2. The conditions that the Commission may impose m includes a pesticide to be used by the holder of the authorization for restricted use and in accordance with the terms thereof.

Article 16. °

Reasons for Refusal of Registration and Approval

1. If the Commission refuses to register the pesticide, you should state the reasons for refusal if it is requested by the applicant to do so.

Article 17. °

Withdrawal of registration

1. Each record made under this Act shall remain in force until such time as it is canceled by the Commission.

2. Where a garment manufacturer or pesticide dispenser change the formula of a pesticide, the Commission shall cancel such registration.

3. Where the registration of a pesticide has been canceled, the Registrar shall direct the disposal of existing stocks of the pesticide.

Article 18. °

Publication in the Official Gazette of the Republic

1. The Registrar shall cause to be published in the Official Gazette of the Republic as soon as is practicable after the registration:

a. the business name or product;

b. the identity of the active components; and

c. the name and business of the local garment manufacturer and importer of any pesticide registered under this law;

2. Where the registration of a pesticide has been concelado, the Registrar shall publish notice of cancellation in the Official Gazette of the Republic.

Article 19. °

Transition

1. Some pesticid that must be sold or distributed in Timor-Leste, on the date on which this Act comes into force shall be exempt from the requirements relating to registration, p or a period of one year from the date on which this law comes into force.

2. Any pesticide should be used in Timor-Leste within one year after the date on which this Act comes into force should be exempt from requirements relating to registration for a period of two years from the date on which the This Law enters into force.

3. These transitional provisions do not apply to banned pesticides.

CHAPTER IV

Pesticide control - Permits and authorizations s

Article 20. °

Dealers in pesticides should m have license or authorization will the Registrar

1. No one should import, manufacture, sell or distribute pesticides in East Timor unless it is headline r a pesticide license or permit issued by the Registrar under this Act.

2. Any person who imports, manufactures, sells or distributes any pesticide:

a. except under the authority of a license or authorization shall be granted under this Act; and

b. according to the terms and conditions of the license or permit;

commits a crime.

Article 21. °

Pesticide License

1. The Registrar may issue pesticide licenses to import, manufacture, sell or distribute pesticides registered in East Timor.

2. Each pesticide permit issued under this Act remains in force for a period of two years or such other period that may be prescribed.

3. Pesticide without a license should not be transferable.

4. The headline r pesticide license should save the relations related to the importation, sale and distribution of pesticides that may be prescribed or as the Registrar may from one moment to the next request.

5. A pesticide license can be renewed a moment's notice by the Registrar for a period of two years.

Article 22. °

Order Pesticide licenses

1. Each application for pesticide license must be made in the prescribed form to the Registrar and must be accompanied by a stipend, prescribed by the Registrar, not exceeding $ 50.

2. Separate applications should be made in respect of any premises in or from which it is proposed to import, manufacture, sell or distribute pesticides.

Article 23. °

Authorization shall Restricted Use

1. The Registrar may, with the view of the Commission will issue the authorization for restricted use for a certain period and subject to specified conditions.

2. No one should buy, obtain, use or possess any pesticide restricted unless it is headline r authorization shall d and restricted issued by the Registrar, under the law.

Article 24. °

Experimental Use permit

1. The Registrar may, with the view of the Commission will issue an authorization for experimental use.

2. An authorization shall experimental use should allow the importation of pesticides not registered for scientific research purposes or to facilitate an essay or experience to be realized.

3. An experimental use permit shall be granted for a stipulated period and shall specify the pesticide and the conditions concerning the quantity, armagenazem, supply, use and disposal of pesticides.

Article 25. °

Authorization shall Requests

Each application for authorization will be for restricted or experimental use should be made to the Registrar in the prescribed form and must be accompanied by a stipend prescribed by the Registrar not exceeding $ 50.

CAP TITLE V

Pesticide control - Prohibited Pesticides

Article 26. °

1. No one should use, have in its possession, import, manufacture, sell or distribute any pesticide except the with the written permission of the Minister, uand the act in accordance with the Commission's view.

2. The pesticides listed in List 1 of this Act are prohibited.

3. The Commission may, by its own motion or at the request therefor by a person, determine that a pesticide to be one prohibited pesticide.

4. Decide whether the pesticide is a pesticide prohibited the Commission shall take into account as follows:

a. s and powder pesticide ssa have an effect which is harmful to human being;

b. s and pesticide may have someone m unintended effect that is detrimental to any animal, plant or to the environment;

c. if any special knowledge, skill or training is required in the management of pesticides; and

d. if any special equipment is required to use the product safely;

5. The Commission d eve inform the Registrar of its determination that a pesticide is a prohibited pesticide.

6. The recorder should keep a list of all determinations and publish the names of pesticides as it were prohibited in the Official Gazette of the Republic as practical as possible.

CHAPTER VI

Pesticide control - Penalties and Crimes Mixed

Article 27. °

Adulter of pesticides, broken down or deteriorated

No one should matter r, manufacture, sell, distribute or store any pesticide that is:

a. tampered with or has been decomposed or deteriorated as well as being ineffective or dangerous; or

b. packaged in containers which have been deteriorated or damaged as well as being dangerous in storage or in use.

Article 28. °

The Pesticides should not be stored, transported, or Sold Distr ib u e s, near Alimentícias substances, etc.

No one should store, transport r, sell or distribute any pesticide close to food substances, vestment or accessories as it would result in contamination of food substances, vestment or accessories.

Article 29. °

The labels should not be Changed without approval

Where a label has been approved, there is no change in the case of some forecasts ta matter in Article 14 that dev and Previ be done without the approval of the Commission.

Article 30. °

Packages or containers must not be changed without approval

Where the package or container of a pesticid to have been approved m s, there is no re in pacotamento or changes in containers should be done without prior approval of the Commission.

Article 31. °

Announcement of Pesticides

1. Any material written, printed or graphic related to and accompanying ing a pesticide stored, transported, sold or distributed in East Timor should include the particular sea and substance of the instructions referred to in Article 14.

2. It is a crime to the announcement of a pesticide in a manner that is false, misleading or misplaced, and not justified by the registration conditions.

3. A complaint by a pesticide have included in an advertisement or project must comply with the label of exposure referred to in Article 14, not unlike the sub-Article 2 requirements of this article.

Article 32. °

Pesticide containers

1. All containers containing pesticides should be clar and durably marked with the will're prescribed.

2. Some containers previously used for the purpose of arren damental of pesticides should not be imported into East Timor.

Article 33. °

S pesticide disposal or destruction

No one should have a pesticide or pesticide container except what is in accordance with the instructions of the approved label or otherwise as may be determined by the Commission.

Article 34. °

Pesticide Residues

1. No one should reap any plant or harvest or kill any animal that has more than the maximum residue limits;

2. No one should matter r, manufacture, sell or distributed some food to go or product that contains more than the maximum residue limits.

Article 35. °

Duties of employers

Each employer must:

a. ensure that all employees who use pesticides must comply with the requirements of this Act or any conditions imposed on a registration or permission;

b. enable managing pesticide employed with any vestment protec tion required and vestment as may be prescribed; and

c. ensure that an employee who is asked to manage pesticides must be properly instructed to comply with the safety rule.

Article 36. °

Crime and Punishment

1. Anyone who:

a. i n frinja any provision of this Act; or

b. fail to fulfill any order or plan made or given or imposed by the Registrar or an inspector in accordance with the powers conferred by this Act or any regulation or Ministerial Order made in accordance with this Law;

commits an offense under this Act.

2. Any person who commits an offense under this Act is subject to conviction under criminal law:

a. to a fine not exceeding $ 500 or to imprisonment for a term not supe r ior to 6 months;

b. the cancellation of the license or authorization will of the person;

c. to be disqualified from holding a license or authorization shall be for a period not supeior three years; and

d. an order of the Court that any pesticide used, owned or con trolled No charge d that crime be confiscated le d to the Commission to be willing as the Commission thinks appropriate r.

CHAPTER VII

Execution

Article 37. °

Inspector Pesticide

The Minister may appoint from the Ministry of Agriculture staff, Forestry and Fisheries persons to be re known as Inspector, a measure that may be necessary in connection with this Act.

Article 38. °

Inspector powers

An inspector may, in order to ensure compliance with this Act:

a. ped go someone pair to produce for inspection a license or authorization shall be issued under this Act;

b. at any reasonable time, enter and inspect r r any facility where pesticides are stored or exposed for sale or distribution;

c. register any transport and examines some r defeat book, manifest, storage plan charges or other documents necessary ary s;

d. examine or search for cargo, mail bags, luggage, transport, containers or any place where pesticides may be stored;

e. inspect, examine and take samples of any pesticide, substance or label; and

f. holds -

i. any pesticide Quality and has reasonable grounds to believe has been used or is owned or controlled in contravention of this Act;

ii. something to do, list or other documents required to be manti by this law where there is reasonable basis to believe that a crime has been committed; and

iii. anything that there is reasonable basis to believe that could be used in some procecdimentos under this Act.

Article 39. °

Seizure of Property Seizure and Costs

1. If an inspector seize something under Article 38 (f) the inspector shall take reasonable measures to return it if the reason for his arrest does not exist.

2. All costs and expenses of any analysis, examination, seizure, detention, destruction or disposal of any article or other business with it under this Act must be supported by the importer, owner or person in possession of such an article as is appropriate.

Article 40. °

Prevention of crime or Obstructing inspector

Every person who directly or indirectly obstructs or prevents an inspector or any person who helps an Inspector in the performance of his duty under this Act, commits an offense.

CHAPTER VIII

Final Provisions

Article 41. °

Cancellation

All previous legislation re speitante the regulation d pesticides, including chelae referred to in Article 3, are canceled.

Article 42. °

Regulation

The Minister d Agriculture and Fisheries is responsible for the regulation of this Decree-Law.

Article 43. °

Enter into force

This Decree shall enter into force 30 days following the date of its publication in the Official Gazette.

Seen and approved by the Cabinet in 2010 of _____ __

The Prime Minister,

_____

Kay Rala Xanana Gusmão

The Minister of Agriculture and Fisheries,

_____

Mariano Sabino Assanami

Promulgated on ___ / ___ / 2011

To be published

The President of the Republic,

_____

José Ramos-Horta

GROUP 1

THE PROPOSAL List of Prohibited Pesticides

Active ingredient	Chemical family	Home use	WHO class	LD50 (Mg / kg)	Stockholm Convention on Persistent Organic Polluter (POPs) (2001)	Convention Rotterdam on Prior Informed Consent (PIC)
1,2-dibrometano (EDB)			Table 7			PIC
2,4,5-T		Obsolete	Table 6			PIC
3-Chloro-1,2-Propanediol (alpha *cyanohydrin)*		R	Ib	112		
Acrolein		H	Ib	29		
Alacchlor		I	III	930		
Aldicarb	C	IS	Ia	0.93		
Aldrin	OC	Obsolete	Table 6 7		POP	PIC
Àcool allyl		H	Ib	64		
Azinphos- ethyl	OP	I	Ib	12		
Azinphos-methyl	OP	I	Ib	16		
Blasticidin-S		F	Ib	16		
Brodifacoum	CO	R	Ia	0. 3		
Bromadiolone	CO	R	Ia	1:12		
Bromethatin	CO	R	Ia	2		
Butocarboxim		R	Ib	158		
Butoxycarboxim	C	I	Ib	D288		
Cadusafos	OP	N, R	Ib	37		
Calcium arsenate	AS	I	Ib	20		
Calcium cyanide		FM	Ia	39		
Camphechlor (aka toxaphene)			Table 7		POP	PIC
Captafol		F	Ia	5000		PIC
Carbofuran	C	I	Ib	8		
Chlor d ane	OC	I	II	4 6 0	POP	PIC
Ch lordimeform		Obseleto	Table 6			PIC
Chlorfenvinphos	OP	I	Ib	31		
Chlormephos	OP	I	Ia	7		
Chlorobenzilate		Obsolete	Table 6			PIC
Chlorethoxyfos	OP	I	Ia	1.8		
Chlorophacinone		R	Ia	3.1		
Coumaphos	OP	BC, MT	Ib	7.1		
Coumatetralyl	CO	R	Ib	16		

Active ingredient	Chemical family	Home use	WHO class	LD50 (Mg / kg)	Stockholm Convention on Persistent Organic Polluter (POPs) (2001)	Convention Rotterdam on Prior Informed Consent (PIC)
D 2.4 ethyl, butyl and isobutyl esters	PAA	H	II	113		
Demeton-S-methyl	OP	I	Ib	40		
Dichlorvos	OP	I	Ib	56		
Dicrotophos	OP	I	Ib	22		
Dieldrin	OC	I	Table 6		POP	PIC
Difenacoum	CO	R	Ia	1.8		
Difethialone		R	Ia	12:56		
Dinoterb	NP	R	Ib	25		
Dinoseb		Obsolete	Table 6			PIC
Diphacinone		R	Ia	2.3		
Disulfoton	OP	I	Ia	2.6		
DNOC	NP	S, H	Ib	25		
Edifenphos	OP	F	Ib	150		
Endosulfan	OC	I	II	80		
Endrin	OC	Obsolete	Table 6			
EPN	OP	I	Ia	14		
Ethiophencarb	C	I	Ib	200		
Ethoprophos	OP	IS	Ia	D26		
Famphur	OP	I	Ib	48		
Fenamiphos	OP	N	Ib	15		
Focoumafen	CO	R	Ia	00:25		
Flucythrinate	PY	I	Ib	c67		
Fluoroacetamide		R	Ib	13		
Fonophos	OP	IS	Ia	c8		
Formetanate	C	BC, MT	Ib	21		
Furathiocarb	C	IS	Ib	42		
Gamma HCH (Lindane)	OC	I	II	100		
HCH	OC	I	II	100		
Heptachlor	OC	I	II	100		
Heptenophos	OP	I	Ib	96		
Hexachlorobenzene	OC	F-ST	Ia	D10000	POP	PIC
Isazofos	OP	IS	Ib	60		
Isofenphos	OP	I	Ib	28		
Isoxathion	OP	I	Ib	112		

Active ingredient	Chemical family	Home use	WHO class	LD50 (Mg / kg)	Stockholm Convention on Persistent Organic Polluter (POPs) (2001)	Convention Rotterdam on Prior Informed Consent (PIC)
Lead arsenate	AS	L	Ib	c10		
Lindane (see gamma HCH)	OC	I	II	100		PIC
Mecabam	OP	I	Ib	36		
Mercuric Clórido (and other mercury components)	HG	FS	Ia	1		PIC
Mercuric oxide	HG	Obsolete	Ib	18		
Methamidophos	OP	I	Ib	30		
Methidathion	OP	I	Ib	25		
Methiocarb	C	I	Ib	20		
Methomyl	C	I	Ib	17		
Mevinphos	OP	I	I a	D4		
Monocrotophos	OP	I	Ib	14		PIC
Nicotine		I	Ib	D50		
Omethoate	OP	I	Ib	50		
Oxamyl	C	I	Ib	6		
Oxydemeton-methyl	OP	I	Ib	65		
Paraquat	BP	H	I I	150		
Parathion	OP	I	Ia	13		PIC
Parathion-methyl	OP	I	I a	14		PIC
Paris green	AS	L	Ib	22		
Pentachlorphenol		I, F, H	Ib	D80		PIC
Phen ylmercu ryacetate	HG	F-ST	I a	24		
Phorate	OP	I	I a	2		
Phosphamidon	OP	I	I a	7		PIC
Pindone		R	Ib	50		
Pirimiphos-ethyl	OP	I	Ib	140		
Propaphos	OP	I	Ib	70		
Propetamphos	OP	I	Ib	106		
Sodium arsenite	AS	R	Ib	10		
Sodium cyanide		R	Ib	6		
Sodium fluoroacetate		R	Ia	0.2		
Strychnine		R	Ib	16		
Sulfotep	OP	I	Ia	5		
Tebupirimfos	OP	I	Ia	1.3		
Tefluthrin	PY	IS	Ib	c22		

Active ingredient	Chemical family	Home use	WHO class	LD50 (Mg / kg)	Stockholm Convention on Persistent Organic Polluter (POPs) (2001)	Convention Rotterdam on Prior Informed Consent (PIC)
Terbufos	OP	I	Ia	c2		
Thalium Sulfate		R	Ib	11		
Thiofanox	C	IS	Ib	8		
Thiometon	OP	I	Ib	120		
Triazophos	OP	I	Ib	82		
Triphenyl tin	OT					
Vamidothion	OP	I	Ib	103		
Warfarin	CO	R	Ib	10		
Zeta-cypermethrin	PY	I	Ib	86		
Zinc phosphide		R	Ib	45		

Notes to the list of banned pesticides:

1. The information in this list is derived from the *WHO Recommended Pesticide Risk Rating and Classification Standards, 2000-2002.* The principle has been to ban all pesticides considered obsolete by WHO or includes u within d the Risk Classes Ia and Ib. Some additional pesticides in Class II of risk are included if they are known to have especially severe effects toxic the people. The current toxic degree is certainly dependent on the current type of f O FORMULA and concentration of the ingredients of the product. The estimates above refer to just technical ingredients active degree and not to existing commercial products.

2. The LD50 is a statistical estimate of the number of milligrams of toxic per kilogram of body weight which is the precision kill 50% of a large population of test animals (usually rats). Note that a low LD50 indicates a more toxic composition. Who does not provide the value of LD 50 to obsolete chemicals.

3. The LD50 is derived from penetrating oral toxic pure active ingredient. WHO risk classes est set will according oral LD 50 not to the x LD50 dermal and Bai, ie dermal toxic is greater than the oral route. In this case the value is preceded by the letter "D".

4. "C" refers to a value within a usual that a wide range of values.

5. **WHO Risk classes** :

Ia: Extremely Risky

Ib: Highly Risky

II: Moderately Arriscad the

III: Slightly Risky

6. **Abbreviations for Main uses *(not exhaustive)***

AC	*Acaricide*
F	*Fungicide*
FM	*Fumigant*
F-ST	*Fungicide* for seed treatment
I	Insecticide
IS	the soil insecticide applied to
L	Larvicide
M	*Miticide*
N	*Nematocide*
PAA	acid *Phenoxyacetic*
R	*Rodenticide*