Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP)

For mango production on small farms near Kindia and plantations near Forécariah and Kankan

In support of the Guinea Agricultural Market Linkages Activity (GAMLA) project
Implemented by Chemonics

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Acronyms

AFR	Africa Bureau of USAID
AID	US Agency for International Development (also known as USAID)
ARCA	Activité de Renforcement de la Commercialisation Agricole
BEO	Bureau Environmental Officer
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
CGIAR	Consultative Group for International Agricultural Research
CPC	Crop Protection Compendium
CRAF	Centre de Recherche Agronomique de Foulaya, Guinée
DPR	California Department of Pesticide Regulation
EA	Environmental Assessment
EC	Emulsifiable Concentrate (a pesticide formulation)
EUREPGAP	European Good Agricultural Practices (also known as EUROGAP)
EXTOXNET	Oregon State University Ecotoxicology Network Pesticides Website
ENCAP	Environmental Assessment Capacity Building Program (Africa Bureau)
EPA	U.S. Environmental Protection Agency
FAO	U.N. Food and Agriculture Organization
G	Granular (a pesticide formulation)
GAMLA	Guinea Agricultural Market Linkages Activity
GUP	General Use Pesticide
IEE	Initial Environmental Examination
IARC	International Agricultural Research Centers
ICRAF	International Center for Research in Agroforestry
IITA	International Institute for Tropical Agricultural
IPM	Integrated Pest Management
IR	Intermediate Result (part of USAID's strategic planning process)
MEO	Mission Environmental Officer
NGO	Non-Governmental Organization
NRI	Natural Resources Institute (British Assistance)
OP	Organophosphate (a class of pesticides)
PAN	Pesticide Action Network
PC Code	Pesticide Chemical Code
PER	Pesticide Evaluation Report
PERSUAP	Pesticide Evaluation Report and Safe Use Action Plan
PIC	Prior Informed Consent (a treaty, relates to pesticides)
POPs	Persistent Organic Pollutants (a treaty, relates to toxic pesticides)
Reg 216	Regulation 216 (USAID Environmental Procedures)
REO	Regional Environmental Officer
RUP	Restricted Use Pesticide
S	Solution (a pesticide formulation)
SAFGRAD	Semi-Arid Food Grains Research and Development
SO	Strategic Objective (part of USAID's strategic planning process)
SIPEF	Société Internationale pour la Plantation et le Financement

SUAP	Safe Use Action Plan
UN	United Nations
UNFAO	United Nations Food and Agriculture Organization
USAID	U.S. Agency for International Development
WARDA	West Africa Rice Development Association
WP	Wettable Powder (a pesticide formulation)

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EXECUTIVE SUMMARY

Findings and Recommendations

1. Pesticides have been used very little on mango in Guinea. There is some, but very limited, experience with the philosophy and practice of integrated pest management in Guinea. This PERSUAP has evaluated proposed and available pesticides in Guinea around Kindia, Forécariah and Kankan that can be used for control of mango pests. Primary mango varieties are Kent and Keitt.

2. This PERSUAP recognizes the following Major Diseases of mango: Anthracnose (*Colletotricum gloesporoides*); Stem-end rot—Pourriture pendonculaire (*Botryodiplodia theobrmae*) and Minor Diseases: Scab (*Elsinoe mangiferae*); Powdery mildew (*Odium spp*.); Verticillium wilt (*Verticillium albo-atrum*); and Algal Spot (*Cephaleuros virescens*). A physiological problem from low calcium called Soft nose, or in French 'le nez mou' is also a serious problem. Major Insect Pests of mango: Fruit flies—le mouche de fruits (*Troxotrypara spp.* & *Anastrepha spp.)*; Scales—la cochenille farineuse (*Ratrococus invadens*). Minor insects are Mites (*Tetraninchus spp.* & *Olygonynchus spp*.); Thrips (*Seleothrips rubrocinctus*); and Beetles (*Xylosandrus compactus* & *Diabrotica balteata*).

3. This PERSUAP approves for use on mangoes: Fungicides: Chlorothalonil/Bravo® 720 g/L and Mancozeb 800g/kg; Insecticides: Chlorpyrifos-Ethyl/Sarifos® (however, note risk to children), Cypermethrin/Win-Cyper 10% or SPIA CYPERCAL 12.5-30%, and Malathion/Win-Mal 57% or SPIA Malathion 50%; and Herbicide: Glyphosate SL 360g/L/Herbi-Total®. All are actively EPA-registered, registered by Guinea, and reasonably safe for use by farmers if safety conditions for use are followed, and training (and some oversight) is provided. Do not rinse pesticide spray or safety equipment in or near open water. Be aware that different spray nozzles may need to be used for EC and WP formulations.

4. This PERSUAP *conditionally* accepts for use on mangoes the following Insecticide: Cyfluthrine 25g/L Emulsifiable Concentrate (EC). This concentration and formulation of cyfluthrin is registered by EPA; however it is considered a Restricted Use Pesticide and a Class I (Danger) pesticide due to potential for eye damage. *Therefore, it is permitted for use by only highly trained and protected individuals, such as those providing spray services, not farmers.*

Further, cyfluthrine, as well as cypermethrin, are synthetic pyrethroid insecticides, and should not be used near open water or water sources, such as the small lake at Forécariah, and the Milo River and ponds/lakes near Kankan.

Cyfluthrine should be phased-out by the end of the project, March 2007, as other less toxic EPA-approved insecticides or lower concentrations of cylfuthrine become available and are registered by the Government of Guinea.

5.0 This PERSUAP rejects use of benomyl/benlate fungicide, as its EPA registration is cancelled.

5.1 Prochloraz/Sportak® which is used as a mango fruit pre-packing factory treatment, not directly by the project in the field, is not yet registered for use by the Government of Guinea, but registration should be sought or requested. Additional pesticides are available in Guinea that could one day be used on mango, but are not yet registered by the Government of Guinea. These include Fungicides: Sulfur/SOUFRE-SPIA® micronized sulfur at 800g/kg WP; Copper hydroxide/ Kocide® 101 (77%) WP; and Insecticide: permethrin/Percal® 100 EC by SPIA.

5.2 No pesticides other than those listed above under numbers 3 and 4 may be used by GAMLA on mangoes in Guinea, unless the PERSUAP is amended to include additional, EPA-approved (and Guinea-approved) for same or similar use, pesticides.

5.3 USAID recognizes and promotes—*as official policy*—Integrated Pest Management, or IPM. In addition to the use of pesticides, sanitation and good soil fertility must be practiced as part of an IPM program. One other non-chemical technique—the use of pesticide-laced fruit fly baits—may be tried by the GAMLA demonstration project.

5.4 This PERSUAP should be thought of as a process, not a one-off specific product.

Recommendations: The PERSUAP recommends the following actions for safer use of pesticides:

Immediately,

6. Train farmers immediately on safety issues before mango flowering in November—and before the first spraying for Anthracnose.

7. Use of safe handling and use of safety equipment and practices. Do not permit children to come near pesticides, sprayers, or pesticide spray drift. Send children away while pesticides are used. Keep pesticide drift away from houses or habitation. Use pesticides only with safety equipment. Spray only when conditions are calm (no wind, such as early morning or late afternoon) and no rain is forecast and honeybees are not foraging. Children should not enter freshly-sprayed areas. Verbally warn children about pesticide/equipment dangers.

8. As practical, through training, enhance understanding of and emphasis on the philosophy and practice of Integrated Pest Management (IPM), with pesticide use as a last resort.

9. Procurement and use of protective clothing and safety equipment by all applicators.

During Mango Flowering,

10. Try to not use *insecticides* (fungicides are OK) on flowering mangoes, or if necessary, use them early in the morning or preferably late in the afternoon when bees do not forage and wind conditions are calm.

As Time Becomes Available,

11. Encourage the continued importation of more pesticide choices to Guinea that comply with EU standards for safety and residue levels on imported products.

12. Write IPM plans with simple recommendations for each of the two orchard sizes of mangoes to be protected.

13. Try fruit fly traps for population reduction without all of the pesticide residues.

14. Produce safe use training materials.

15. Avoid damage to environment through training to avoid non-target ecosystems.

16. Develop or adapt posters—with pictograms as well as text—combined with training on use of safety equipment and safe methods.

17. Rotate pesticides to reduce the build-up of pest resistance to them.

18. Monitor resistance by noting reduction in efficacy of each pesticide product.

19. Follow the information contained on the pesticide labels and also the information in Table 4 carefully to avoid killing non-target and beneficial organisms.

20. Simple monitoring plans will be drawn up by site managers.

Continuously,

21. Continuously search for alternate pesticides (to those recommended for use by this PERSUAP) to have a larger set to choose from and as additional choices become available over time, and are EPA-approved.

22. As needed or on an annual basis, update changes (additions or subtractions) to the list of pesticides and communicate these changes to USAID for amendment of the PERSUAP.

23. CRAF produce quick reference guides or fact sheets for each pesticide and each use or pest to keep on hand at the project office and field sites.

24. Continue to utilize pesticides with low ground water contamination potential.

25. Maintain good plant nutrition and health by fertilizing and pruning.

GUINEA Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP) in support of IEE for the GAMLA (ARCA-Guinea) project

PROGRAM/ACTIVITY DATA:
Project Numbers: PCE-I-00-99-00003-00, Task Order #29 with Chemonics.
Country/Region: Guinea
Programs/Activity Title: Guinea Agricultural Market Linkages Activity (GAMLA), known in French as Activité de Renforcement de la Commercialisation Agricole (ARCA)
Crop: Mango Trees, primarily 2 varieties, Kent and Keitt
Pesticide User Level: On-Farm Demonstration Plots

1.0 Serving USAID/Guinea Strategic Objective #1 and Intermediate Result #2

The GAMLA project works in service of one of USAID's Strategic Objectives and an Intermediate Result. The Natural Resource Management Strategic Objective is #1: Increased use of sustainable resource management practices; and the Intermediate Result is IR-2 Farm productivity increased. Sub-Intermediate Results are as follows: IR-2.1: Producers' knowledge about environmentally sound, productivity-enhancing practices increased; IR-2.2: Improved production management skills acquired & used by producers; IR-2.3: Marketing skills acquired & used by producers; and IR-2.4: Agricultural marketing systems strengthened.

1.1 BACKGROUND AND PROJECT DESCRIPTIONS

GAMLA
The primary objective of GAMLA is to increase market-driven production, processing, and sales of selected agricultural and forest products. Secondary objectives include identifying longer-term opportunities for agribusiness development in Guinea, determining key policy constraints and solutions to agribusiness development, and finding water technologies that could have a significant impact on rural income generation.

GAMLA will contribute to a key strategic objective of USAID/Guinea: Increased Use of Sustainable Natural Resource Management Practices. By creating additional economic opportunities in rural-based value chains, Guinean farmers will be motivated to manage their productive resource base in a more sustainable manner by, for example, decreasing use of unsustainable slash and burn farming techniques on the country's steep hillsides.

Guinea's potential as a regional and international exporter of horticultural crops and forest products has long been recognized. The country has modern port facilities in Conakry, several weekly flights to major European markets, and near ideal growing conditions for a host of tropical products that regional and European markets demand.

Guinea's potential, however, has mostly remained untapped, due, in large measure, to the absence of effective linkages along the farm to market commodity chain.

GAMLA will seek to reinforce those linkages through a mixture of technical assistance and training at key points in the farm to market continuum. GAMLA, in coordination with USAID, will identify and prioritize promising product areas and market opportunities through the implementation of feasibility studies, analysis, and product development plans. Commodities pre-identified for project focus include shea export to the U.S. cosmetic market, mangoes (both fresh and processed) to Europe, potatoes for sale in Senegal, and chili peppers. The project will work closely with other USAID-funded activities to develop synergies and use limited resources most effectively.

In early September 2005, GAMLA will submit four pre-feasibility studies to USAID to confirm (or affirm) whether the products mentioned above should the focus of the project. Detailed value chain analyses of promising commodity sub-sectors will be done after the pre-feasibility studies have been completed. In December, GAMLA will submit four product development plans that will describe specific actions that the project will undertake to improve linkages between the farm and the market. During the remaining 17 months of the project, activities will focus on providing technical assistance and training.

The intended direct beneficiaries of this activity are entrepreneurs and enterprises engaged in handling, processing, or trading agricultural commodities and services. These include producer associations, and individual farmers that produce specifically for markets, handlers, traders, processors, exporters and input/service providers.

Several types of technical assistance and training will be made available. These include: identifying sources of external investment and trading partners; developing business plans; securing agribusiness financing opportunities with local banks; organizing trial shipments to potential importers; and introducing improved processes and technologies such as low cost irrigation schemes or commodity storage facilities to increase productivity and/or improve product quality.

1.2 Purpose and scope of this IEE and PERSUAP

In General

All USAID activities are subject to evaluation via—at minimum—an Initial Environmental Examination (IEE). And because of risk concerns presented by pesticides, the USAID environmental regulations require that at least the 12 factors outlined in the Pesticide Procedures described in 22 CFR 216.3 (b)(1)(i) (a through l) be addressed in the IEE for any program that includes assistance for the procurement or use of pesticides. The Africa Bureau asks that these factors be examined in a particular type of document, termed a "Pesticide Evaluation Report and Safer Use Action Plan" (PERSUAP), which is submitted as an attachment to a short summary IEE (the IEE itself can be very brief, with the analytical work contained in the attached PERSUAP).

The PERSUAP focuses on the particular circumstances of the program in question, the risk management choices available, and how a risk management plan would be implemented in the field. Further details about what to include in a PERSUAP are given below.

Why is a local-level assessment such as a PERSUAP needed for USAID pesticide programs? To help in understanding the utility, consider the U.S. system for promoting pesticide safety. When the USEPA registers pesticides for use in the United States, it specifies the manner in which the product can be "safely" used (i.e., with an acceptably small risk), including safety equipment needed when applying the pesticide, how to apply it, the allowed uses, etc. But the context in which EPA makes these registration decisions is important to note. An extensive system of capabilities and resources exist in the USA that help give EPA confidence these specifications will be followed and the product will be used appropriately. These include a 97% literacy rate—meaning most of the population can read labels; close control by EPA over the content of the pesticide label; training requirements and programs for those pesticide products that require applicator certification—like for many toxicity class I or II pesticides; worker protection requirements; occupational safety regulations; and relatively effective federal, state and local enforcement mechanisms.

In allowing the use of certain pesticides in its African programs, USAID cannot rely on the same societal capabilities and resources that the USEPA does to assure appropriate use of the product. The preparation of a PERSUAP gives a program manager the opportunity to consider practical actions by which to *reduce the risks* of using pesticide products in a program in an African country, taking into consideration the context in which the products will be used, the particular elements of the program, and the different capacities of the partners involved.

Who prepares a PERSUAP?

USAID program managers are generally responsible for assuring that environmental review requirements for their programs are met, including PERSUAPs. As for all environmental reviews, guidance and assistance for PERSUAPs is available from the appropriate Mission Environmental Officer (MEO), Regional Environmental Officer (REO), the Africa Bureau Environmental Officer (BEO), or the BEO/DCHA if Title II (PL 480) funds are involved. Considerable reference materials, as well as examples of other PERSUAPs, are available through these contacts, or directly from the Africa Bureau's ENCAP program website, www.encapafrica.org. PERSUAPs are currently prepared for Africa Bureau by three independent consultants with considerable experience doing these. In the future, African technical folks will need to be trained to do these as well.

Components of an activity-level PERSUAP

A PERSUAP basically consists of two parts, a "PER" and a "SUAP." The Pesticide Evaluation Report (PER) section addresses the 12 informational elements required in the

Agency's Pesticide Procedures contained in the Code of Federal Regulations, Regulation 216. The Safer Use Action Plan (SUAP) puts the conclusions reached in the PER into a plan of action, including assignment of responsibility to appropriate parties connected with the pesticide program.

This IEE and PERSUAP in Particular

This IEE and PERSUAP addresses only the proposed use of pesticides in on-farm production of mangoes in Guinea.

1.3 Country Background

Guinea is a tropical Western Africa country, with 245,857 sq km (slightly larger than Oregon) bordering the North Atlantic Ocean for 320 Kilometers, between Guinea-Bissau and Sierra Leone and also sharing borders with Cote d'Ivoire, Liberia, Mali, and Senegal. It is generally hot and humid with a monsoonal-type rainy season (June to November) with southwesterly winds, and a dry season (December to May) with northeasterly harmattan winds. Guinea is generally flat coastal plain, with hilly to mountainous interior, and has three distinct zones: lower Guinea, along the coast, upper Guinea near Mali, and the hilly highlands region in-between. It goes from 0 meters at the coast to 1,752 meters above sea, at Mount Nimba.

The country is divided into 33 prefectures and 1 special zone (Conakry), as follows: Beyla, Boffa, Boke, Coyah, Dabola, Dalaba, Dinguiraye, Dubreka, Faranah, Forécariah, Fria, Gaoual, Gueckedou, Kankan, Kerouane, Kindia, Kissidougou, Koubia, Koundara, Kouroussa, Labe, Lelouma, Lola, Macenta, Mali, Mamou, Mandiana, Nzerekore, Pita, Siguiri, Telimele, Tougue, and Yomou. The country has 30,500 kilometers of highways, 5,033 of which are paved. Guinea has a population of 9.5 million, a median age of 18 years, and a growth rate of 2.37%.

Natural resources include bauxite, iron ore, diamonds, gold, uranium, hydropower, fish, and salt. Export commodities include bauxite, alumina, gold, diamonds, coffee, fish, and agricultural products. Agriculture contributes 25% to GDP. 80% of the 3 million labor force is employed in agriculture. Agricultural products until now have been rice, coffee, pineapples, palm kernels, cassava, bananas, sweet potatoes; cattle, sheep, goats; and timber. Major industries include bauxite, gold, diamonds; alumina refining; light manufacturing and agricultural processing. 3.63% of the country is arable, with 2.58% under permanent crops, with 950 square kilometers of irrigated land.

1.4 Crop protection research and development

Mangoes, citrus fruits, avocados, bananas, and oranges are the most significant cultural fruits in Guinea.

Mangoes are widely available throughout Guinea, but are especially prevalent in the Haute Guinea and Maritime regions where the tradition of family plantations has been in place for centuries. Over the years, family plantations have become more organized and commercial, largely because of the introduction of improved seed varieties. Aside from producing fruit, mango trees have an important social role in Guinea because of the shade they provide.

The colored Florida mango was introduced by research to the francophone countries of the sub region, first at the l'Institut Fruits et Agrumes Coloniaux (IFAC)—the actual center of agronomical research in Foulaya (CRAF)—and then at other research centers in neighboring countries. Most of the Floridian grafted mango varieties (Kent, Keitt, Irwin, Smith, Palmer, Eldon, MiamiLate) were introduced at the research station in Foulaya. Amelie was not introduced in Foulaya, but is present in Haute Guinea today.

The fruit-bearing culture, unlike other types, does not benefit from any particular care, especially with regards to phytosanitary protection, which constitutes a major disadvantage to its development.

The principal sanitary threats to mangoes are of fungal, physiological or entomological origin. Anthracnosis and peduncular rot (stem end rot) are two common fungal diseases, and both are caused by pathogens of varying virulences. The most dangerous pathogens are *Lasiodiplodia theobromae* and *Dothiorella dominicana*. These fungal diseases are more prevalent in Maritime Guinea than in Haute Guinea (J.Y.Rey).

Physiological diseases affect the pulp of the fruit in many ways. The pulp may become less firm and more gelatinous or, in some cases, it may develop small black hollowed-out marks (caves). Most often the effect is precocious germination, which presents itself in many forms. At Smith's plantation, the roots that grow from the seed resemble those of a young plant. At Kent's plantation, and sometimes at Keitt's, the roots are fine, numerous and dense. Before the roots start to grow, an intense gelatinous seed develops under the beak. Termed the "soft nose" by exporters, this gelatinous area tends to rot during transport. This phenomenon appears especially in humid zones on clay terrain rich in hydrogen.

Entomological problems are very serious for mangoes, and are usually provoked by two types of insects: 1) the fruit fly, and 2) the mango mealy bug.

Fruit flies pose the greatest entomological threat to mangoes trees. They are dangerous not only because of the damage they cause to fruit, but also because they are insects of quarantine. Mangos seem to be the principal host of Tephritides (fruit flies) of the Ceratitis genre. The attacks generally begin in early May with the emergence of the cosvra species.

Not only do these flies result in production losses, but they also damage fruit, thereby reducing the quality of the fruit and its commercial export value.

Specific methods for treating fruit flies have not yet been proposed and tested. Sorting out healthy fruits is the only preventative technique used during mango harvests. Entomological research is therefore essential to finding effective, easy to employ, and cost-efficient methods for harvesting healthy mangos.

The first studies carried out by The Agronomical Center of Foulaya in Kindia, Guinea, highlighted the presence of flies on mangoes in 1994. Studies on the dynamics of these flies were carried out from 1994-1997 in and around Foulaya. Five species of flies of the Ceratitis (Tephritidae) genera were identified at the time of these studies:

- *Ceratitis punctata, Wied*
- *Ceratitis cosyra, Walker*
- *Ceratitis rosa, Karsch*
- *Ceratitis capitata, wied*
- *Ceratitis anonae, Graham*

These studies showed that these populations of flies are more prevalent among all mango varieties at the end of May and the beginning of June (80 captures weekly on average for 3 food traps)

Over the three years of the study, the diseases were more widespread among later varieties than the Irwin variety. Although there have not been repeated follow-ups on the pheromone trap samples, flies found them more attractive than the food traps in 1994.

Preliminary observations carried out in and around Foulaya revealed the presence of fruit flies in the mango groves from April to July. The flies used guavas and papayas as their plant hosts, and did not appear to favor one over (Hill, 1975 ; Kranz 1981).

1.5 Study Methodology

Crop pests, lack of sanitation and poor soil fertility have important negative impacts on the production of agricultural commodities, including mango. To date a small number of pesticides have been used to combat pest problems in Guinea, mostly due to lack of resources and capital. Herbicides far out-sell insecticides and fungicides. The USAID Environmental Procedures for pesticide use (as provided by USAID Environmental Procedures: Text of Title 22, Code of Federal Regulations Part 216, Reg. 216), advise that all projects involving assistance for the procurement or use, or both, of pesticides shall be subject to the procedures prescribed in §216.3(b)(1)(i) through (v).

A team of two specialists has been selected to develop a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) for mango demonstration plots in Guinea. Team members for this consultancy included Dr. Alan Schroeder (International Consultant) and Mr. Ousmane Koleah SOUMAH (Guinée Consultant). See detailed terms of reference in Attachment 1.

The work reported here was conducted between the last week of October and the first week of November, 2005. Data were obtained through discussions with project staff, consultants, pesticide sales representatives, SIPEF staff, a fruit exporter, and farmers.

By USAID's definition, 'use' is broad to include direct or actual use or procurement, including the handling, transport, storage, mixing, loading, application and disposal of pesticides. Recommending pesticides in training programs or in published bulletins is considered also to need a PERSUAP. Indirect uses also fall under its purview such as providing fuel for transporting pesticides and technical assistance to pesticide management operations.

"Use" is said to occur if training curriculum include information on safer pesticide use even if it does not involve actual application of pesticide. It also applies if pesticide procurement is facilitated by credit or loans. USAID also strongly encourages including instruction in IPM and alternatives to pesticides in any training on pesticide use as defined above. Under this approach, pesticides are considered a tool of 'last resort' and pesticide choice should as far as feasible be the 'least toxic' choices. Support to pesticide research and pesticide regulatory activities is not considered use.

1.6 USAID Development Partners and Programs Under Consideration

Development partners include the Société Internationale pour la Plantation et le Financement (SIPEF), Centre de Recherche Agronomique de Guinée (CRAF), United States Agency for International Development (USAID)/Guinea, sales of agricultural inputs by SAREF International and Société des Produits Industriels et Agricoles (SPIA), and farmers/orchards chosen to be part of the mango demonstration plots.

1.7 Crop and Pests

Crop Mango (*Mangifera indica*)
Varieties: Kent
Keats (Keitt)

Pests
Major Diseases:
Anthracnose (*Colletotricum gloesporoides*)
Stem-end rot—Pourriture pendonculaire (*Botryodiplodia theobrmae*)

Minor Diseases:
Scab (*Elsinoe mangiferae*)
Powdery mildew (*Odium spp*.)
Verticillium wilt (*Verticillium albo-atrum*)
Algal Spot (*Cephaleuros virescens*)

Other: Soft nose—le nez mou—a physiological problem from low calcium

Major Insects:

Fruit flies—le mouche de fruits (*Troxotrypara spp. & Anastrepha spp.)*
Scales—la cochenille farineuse (*Ratrococus invadens*)

Minor Insects :

Mites (*Tetraninchus spp.* & *Olygonynchus spp*.)
Thrips (*Seleothrips rubrocinctus*)
Beetles (*Xylosandrus compactus* & *Diabrotica balteata*)

1.8 Mango pest control in general and in the USA State of Florida

In general, the Crop Protection Compendium indicates that for many countries, pest management on mangoes is a real challenge. However, several country-specific sites, namely those for Australia, India and South Africa, have suggestions for pest management that are relevant and are referenced and used in this document.

Since the regulations that must be followed by foreign partners in implementing USAID projects must mirror those found in the USA (by the EPA), the mango situation in the USA is documented here to show not just what is recommended, but also EPA-approved for use in the USA.

The University of Florida has a websites, http://edis.ifas.ufl.edu/IG073 and http://edis.ifas.ufl.edu/PI052, which contain articles titled: "Insect Management in Mango" by Jorge Pena and Freddie Johnson, article first written 1993, revised in 1998, and reviewed in 2003; and "Florida Crop/Pest Management Profile: Mango" by Mark A. Mossler & O. Norman Nesheim, published in 2002.

The following are their recommendations of products used in the USA (note that pests in the USA will not always be the same as pests in West Africa, thus recommendations may differ or vary).

Fungicides

Copper (Kocide®/Basicop®). Copper has been used as a fungicide for a long time and can be applied in several forms (copper hydroxide, copper sulfate, etc.). Copper can be used to manage anthracnose, scab, and algal spot. The cost of control per hectare is relatively cheap at $5/kilogram and $32/hectare. For copper hydroxide, the Pre-Harvest Interval and Re-Entry Interval are 24 hours each.

Sulfur (Thiolux®). Sulfur has been used as a fungicide for a long time and can be applied in two forms of either copper sulfate or elemental sulfur. Sulfur can be used to manage powdery mildew and anthracnose (and mites occasionally). Sulfur is also relatively cheap at $1.80/kilogram and $52 per hectare. For sulfur, the Pre-Harvest Interval and Re-Entry Interval are 24 hours each.

Ferbam (Ferbam Granuflo®). Ferbam is an iron-containing dithiocarbamate fungicide used to manage anthracnose in mango in Florida under a special local needs registration. The cost is relatively cheap at median price of ferbam is $19 per kilogram of active ingredient and the approximate cost per application is $40 per hectare. The PHI and REI for ferbam are 24 hours. The restriction is that no more than 60.8 pounds of active ingredient may be applied per season.

Florida-used crop oils (Sunspray®, JMS Stylet Oil®). Crop oils smother immobile insects like scales, mites, and aphids. The oils are usually mixed at 1.5 to 3 percent solutions which are applied thoroughly onto each tree.

Insecticides

Florida control of scales: Immediately after harvest, apply: Methidathion (also known as Supracide)—an organophosphate insecticide that controls sucking insects—at 2 EC (Emulsifiable Concentrate) 1 liter/hectare; and/or an insecticidal soap product like M-Pede. *Do not apply Supracide between bloom and harvest.*

Florida control of mites, thrips, aphids, weevils: apply Pyrellin (pyrethrins + rotenone) at 1 liter per hectare to leaves. Mites can also be controlled with sulfur like Microthiol at 80% Wettable Powder at 15-25 kilos/hectare.

Florida control of mealybug on fruit: no labeled control available.

Florida control of fruit fly and other insects: Malathion, an organophosphate which is relatively cheap, is a broad-spectrum insecticide that has been used to control fruit fly in the USA (and has been used extensively in West Africa to control desert locust outbreaks).

Florida control of thrips and whiteflies: Imidacloprid (Provado®), a neonicotinoid insecticide. *The material is not to be applied during bloom or when bees are present.*

Alternative Control in Florida

Several very new "reduced impact" chemicals are being tested and registered for use in mango, such as Armicarb® (monopotassium carbonic acid) for disease management.

The University of Florida also has a site dedicated to diagnosing mango problems, at: http://it.ifas.ufl.edu/software/tropicalfruits_cd.html.

----------End of mango pest control in Florida section----------

1.91 Pesticides proposed, available and accepted for use in ARCA-Guinea

Fungicides

* Chlorothalonil/Bravo® 720 g/L (a protectant/preventive fungicide to apply before onset of anthracnose)
* Mancozeb 800g/kg (fungicide for anthracnose & stem-end rot, apply flower to harvest) (not too expensive)

Insecticides

* Chlorpyrifos-Ethyl/Sarifos® (insecticide for fruit flies) distributed by SAREF
* Cypermethrin/Win-Cyper 10% or SPIA CYPERCAL 12.5-30%
* Malathion/SPIA 50% or Win-Cyper 10%

Herbicide

* Glophosate SL (Soluble Concentrate) 360g/L/Herbi-Total® distributed by SAREF, and produced by Japanese Helicom Corporation.

1.92 Pesticides *rejected for use* in ARCA-Guinea

Benomyl—USA Registration Cancelled. Not registered for use in the USA by EPA.

1.93 Pesticides conditionally accepted for use in ARCA-Guinea

* Cyfluthrine 25g/L Emulsifiable Concentrate (EC). This insecticide—called Sarfluthrin in Guinea—and distributed by SAREF, is accepted for use only by highly trained and protected individuals, *not farmers*. The handling and mixing of the concentrated form available (25g/L) is too toxic. Normally, it too would be rejected for use because it is Class I toxicity due to concentration, but it is kept as an option due to the paucity of pesticide choices available in Guinea, and the possibility that it could be applied by a highly trained spray service member, with all safety equipment, especially for mixing or diluting the concentrate, on contract for the farmers. Another option would be to sell diluted product to farmers, if SAREF or the project can do this.

1.94 Other pesticides (in addition to those proposed by the project) that are available—and if the Government of Guinea registers them (they are not yet registered)—*may be used in the future*.

Fungicides

* Sulfur
* Copper hydroxide

Insecticides

* Permethrin

Table1: Summary of all pesticides available for use by the GAMLA project

Pesticide Types	**No.**
Fumigants	0
Fungicide seed treatments	0
Insecticide stored seed treatments	0
Nematicides	0
Herbicides	1
Bactericides	0
Fungicides	2*
Insecticides	3**
Acaricides	0

* One fungicide, benomyl, was eliminated due to cancelled EPA status
** One insecticide, cyfluthrin, accepted only with specific conditions for use

Table 2: Toxicity for each pesticide, based upon EPA's classification scheme

USEPA Toxicity Class			
Class I highly toxic	**Class II moderately toxic**	**Class III slightly toxic**	**Class IV relatively non-toxic**
cyfluthrine 25g/L[1]	Chlorothalonil[2]	chlorpyrifos-ethyl[3] cypermethrin[3] malathion[3] glyphosate	mancozeb prochloraz[4]

1 class I due to potential to cause eye damage; accepted only conditionally—not for farmer use; only well-trained & protected applicators may use this concentrated product.
2 for fungicides, if a choice is available and the cost to treat is relatively comparable, try to use less toxic (class IV) chemicals first or preferentially, then class III chemicals, in that order, in place of class II chemicals. That is, use mancozeb preferentially instead of chlorothalonyl, if practical.
3 range II-III depending on concentration or formulation.
4 prochloraz, not used by GAMLA, but used as a mango sorting factory pre-packing fruit fungicide treatment, would likely not be used in the orchard.

Toxicity of pesticides

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).

Basically, there are two systems of pesticide toxicity classification. These are the WHO and the USEPA systems of classification. The WHO classification is based on the active ingredient whereas USEPA's classification refers to formulated pesticide products. Table 3 shows classification of pesticides according to the two systems.

Table 3: Toxicity classification of pesticides

a) WHO classification

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

b) USEPA classification

Class	Descriptive term	Mammalian LD_{50}		Mammalian Inhalation LC_{50}	Irritation		Aquatic invert/fish (LC_{50} or EC_{50})[1]	Honey bee acute oral (LD_{50})
		Oral	Dermal		Eye[2]	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	

[1] Expressed in ppm or mg/l of water

[2] 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

	Relatively non-toxic						101-1000	
	Practically non-toxic						1001-10,000	> 11 µg/bee
	Non-toxic						> 10,000	

According to common usage in the US, there are two broad categories of pesticides, restricted-use (RUPs) and general use (GUPs). Field application and use of RUPs can only be carried out by licensed operators. Use of GUPs does not require licensing. These are pesticides mostly in Class III or Class IV. The criteria for restricted-use classification are usually based on human hazard; additional considerations include effects on aquatic organisms, effects of residues on birds, hazard to other non-target organisms, and accident history.

1.95 History of IPM programs in Guinea

A West Africa regional cocoa network has performed IPM research and held a workshop in 2002 in Guinea. The following IPM initiatives have been organized by the International Agricultural Research Centers (IARCs): Assistance for the reinforcement of national capacities to prospect for biological controls of desert locusts; Management of green mites on cassava; and Development of a national cadre for biodiversity.

One technique used by farmers in Forécariah was to use leftover cinders from cooking fires as insect repellents. They can be used as a defense of stored stocks of cowpea, and to protect okra leaves. This may not be practical for mango protection. Palm oil and leaves also provide some insecticidal properties for cowpea.

1.96 Priority Geographic Areas of Intervention

Kindia (coast-to-highlands): small family orchards of less than 7 hectares
Kankan (upper Guinea): larger plantations
Forécariah (coastal Guinea): larger plantation (10 ha)

2.0 The Pesticide Evaluation Report (PER)

2.1 Pesticide Import and Consumption

Pesticides are imported into Guinea primarily by 2 larger companies: SPIA and SAREF, and to an extent by Tidiane Agriculture. Other importers/distributors who worked to distribute past Japanese KRII donations include: Comptoir Agricole, Etablissements Encig SARL, Etablissements Papa Sylla & Fils, COGEP International, Societe SAMAK, Multinvest Africa, and others. No pesticides are known to be manufactured or sub-packaged in Guinea. SPIA pesticides are manufactured in either Senegal or France by Calliope. SAREF pesticides are mostly Bayer generics made in Japan by Hellicom.

According to Earth Trends, an average of 274 kg/ha of pesticides have been used on crops in Guinea in from 1994-6 for agricultural production, very low by comparison with other countries: http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_324.pdf. Data for mangoes is unavailable.

2.2 Current pesticide use in Guinea's agriculture sector in general and mango sector in specific

Agriculture sector

Herbicides are used most, with use on rice, maize, sugarcane, banana, pineapple, coffee, groundnut, and cocoa.

Insecticides are used for market gardening of vegetables, citrus, tree crops, coffee, cotton, banana, stored pests, oil palm, tobacco and ectoparasites of livestock.

Fungicides are used for seed treatments, market gardening, tree crops, citrus, oil palm, rice, cashew, pineapple, coffee, banana, and cocoa.

Rodenticides are both sold by the major pesticide sellers, and were found for sale in small rodent-edible bags with labels in the open market in Conakry. Molluscicides, plant growth regulators, and phosgene gas pellets for stored grain pests round out the available products and uses in Guinea.

Mango sector

Currently little or no pesticides are used in the mango sector due to lack of advice and resources, according to consultants and farmer interviews. In one instance near Kindia, a farmer noted that he had to use an insecticide against red ants on mango trees so that local mango pickers could climb the trees without being stung by the ants. Farmers in Forécariah had used 3 pesticides on melons grown next to their mango orchard.

2.3 Provisions made for monitoring the use and effectiveness of the pesticide

Monitoring the use and effectiveness of pesticides used on mango farmer demonstration plots will be accomplished in Guinea by Centre de Recherche Agronomique de Guinée (CRAF) on contract with ARCA-Guinea.

2.4 Guinea's ability to regulate or control the distribution, storage, use, and disposal of the pesticide

Consultants visited 4 pesticide storage/sales facilities: two in Kindia and two in Conakry. All were well organized and relatively clean, with one exception in Conakry where some small bags of insecticides were clearly torn and leaking powdered pesticide onto the shelves (and the odor of pesticides was evident). The results of the visits were welcome, as most African country pesticide sales places are not so clean and organized.

Commercialized and available products in Guinea are *not always registered* because some products were introduced by neighboring countries in the absence of formal regulations and registration. The Government of Guinea is currently in the process of formally registering pesticide products for use in Guinea.

The registration of all pesticides in Guinea is handled by the phytosanitary legislative service of the Division of Vegetable Protection (Direction Nationale de l'Agriculture). Written documents that describe the restricted and/or limited use of pesticides are available.

The registration process of phyto & pharmacutical products in Guinea is as follows:

Import and distribution demand (approved importer)

National Pesticide Committee (inter-ministerial committee [agriculture, commerce, environment, finances, public health….] + national chamber of agriculture)

- Verification of specifications (ticketing, presentation, packaging)

Phytosanitary legislation service of the Division of Vegetable Protection

- Experimentation to check the efficiency of the product
- Certification of the effectiveness of the product
- Registration of the product (after approval of the national pesticide committee)
- Official approval
- Proposition to cancel approval

Division of Vegetable Protection (National Directorate of Agriculture)

National Directorate of Agriculture

Ministry of Agriculture, Ministry of Livestock, Water and Forestry (stop official approval)

The ability for Guinea to regulate use is limited, as it is in most African countries, by lack of resources.

2.5 Provisions made for training of users and applicators, and outline a training plan for participants and extension officers

Training of users and applicators, along with training plans will be accomplished in Guinea by Centre de Recherche Agronomique de Guinée (CRAF) on contract with ARCA-Guinea.

2.6 Pesticide types and major users

Pesticide types include both organic, as well as inorganic anti-fungal compounds like copper and sulfur, mostly organophosphate and synthetic pyrethroid insecticides, and various types of fungicides and herbicides. Major uses are of herbicides and are on sugar cane, cotton, rice, and maize.

2.7 Toxicity of pesticides

All toxicity classes, I-IV, are sold in Guinea. For this PERSUAP, emphasis is placed on general use and class III and IV pesticides. Classes I and II and Restricted Use Products are avoided unless there is a compelling reason—along with proper mitigative measures—to use them.

2.8 Pesticides recommended by extension

Pesticides recommended by extension are those that were proposed for use by the GAMLA project. The extension service in Guinea has had few resources to properly cover the country and experiment on different pesticides for mangoes in the past.

2.9 Pesticides used in stored grains

Pesticides used in stored grains in Guinea include phosgene gas pellets (phostoxin), permethrin, propoxur, malathion powder, and pirimiphos-methyl. Phostoxin is highly effective, but is also highly toxic, especially for farmers without training to use—it should only be used by highly trained individuals such as those working for a pesticide application company, and with use of an organic chemical respirator with carbon-filter cartridge.

2.10 Pesticide Registration and Regulation

The law instituting the pesticide legislation was promulgated in August 1992. The application of this law began in March 1994. Since 2000, the Government of Guinea has been registering imported pesticides and pesticides sold by approved distributors.

A national pesticide committee (CNP) was eventually created to advise the Ministry of Agriculture, Livestock, Water and Forestry on certain aspects of pesticide use. For example, the CNP advises ministries on whether they should experiment, temporarily authorize the sale, approve, refuse and/or withdraw phytopharmaceutical products from the market when necessary.

Periodically, the CNP monitors the stocks of approved importers/distributors to assure that they meet specific regulatory provisions (authorization of recording, labeling, packing, storage, the effects on the environment, etc).

It is often difficult to apply import regulations to the distribution and use of phytopharmaceutical products, especially since many products were illegally introduced by neighboring countries. The phytosanitary legislation service at the National Directorate of Agriculture is working to find ways to apply these regulations more effectively by January 2006. A copy of the current legislation is found in Attachment 6. A copy of all products registered for import and use in Guinea is found in Attachment 7.

2.11 The FAO's Prior Informed Consent (PIC) procedures

Guinea was one of the first countries to ratify, accept and approve the Rotterdam PIC Convention on pesticides. The FAO's Prior Informed Consent procedures are applied by FAO in all countries where they work. A copy of those procedures is found at the following website: http://www.fao.org/docrep/x5588E/x5588e0l.htm. A list of pesticides that are prohibited under these agreements is attached as Attachment 8.

2.12 Pesticide handling and safety procedures

Pesticide sales companies in Guinea understand well the proper handling and safety procedures for pesticides. Many of the farmers interviewed were not aware of all potential dangers and ways to avoid risk, and are thus in need of training or sensitization. Farmers in Forécariah were aware of many pesticide concerns and safety equipment and measures due to the past presence of a melon-producing company that provided safety equipment and information on pesticide and empty container handling and dangers.

The Government of Guinea, through the extension service, could provide more training on safe pesticide handling and use.

2.13 Obsolete pesticides

The United Nations FAO has been responsible for collecting information on obsolete stocks of pesticides throughout Africa. As of 1999, there existed four tons of nine different types of obsolete pesticides in Guinea, at 12 identified sites. There are no national or UN programs currently funded to clean up these obsolete stocks in Guinea. The GAMLA project should only use newly-purchased stocks of pesticides from reputable dealers. UN obsolete stock site: http://pops.gpa.unep.org/donor/FAO.htm.

2.14 Summary Table of Important Regulation 216 Elements

The following Table (Table 4) condenses much of the important information required by the 12 elements for each pesticide approved by this PERSUAP for use in Guinea on mangoes, and should be referred to for summaries of IPM tactics, toxicity, and safety concerns, among other information.

Table 4. Synoptic summary of the *Proposed (NOT ALL APPROVED—see below) and Additional Pesticides Registered and Available in Guinea to be Promoted for use in the GAMLA project*, by categories, including registration in the US and Guinea, target pests, summaries of IPM measures, toxicological and environmental hazards, and special concerns.

Generic name of Pesticide (or accepted common name)/EPA and Iraq ACB Status	**IPM program recommendations from various sources**	**Toxicological and Environmental Hazards**	**Primary concerns**
1. Insecticides (including Miticides)			
Chorpyrifos-Ethyl. An organophosphate insecticide & nematacide. Registered by USEPA. Toxicity Classes III and II, CAUTION and WARNING. Registered in Guinea. Classified as a General Use Pesticide (GUP). In the USA, residential and household uses of chlorpyrifos were cancelled by EPA on June 8, 2000 due to risks to children. **Sold in Guinea as by SAREF as Sarifos (a Bayer generic made in Japan by Helicom Corporation), and by SPIA as Spiphor 480 EC.** Broad spectrum insecticide used on	Constant monitoring by trained scouts to detect the presence of insect pests. Minimum effective dosages used. Insecticides rotated on a regular basis to prevent resistance.	Cholinesterase inhibitor. Strong risk to children. Organophosphate that attacks central nervous system, cardiovascular system, and respiratory system. Muscle twitch, weakness, tremor, headache, nausea, vomiting, diarrhea, dizziness, tightness of chest, pin-point (very small) eye pupils, blurred vision, convulsions, seizure. Suspected endocrine disruptor. Not likely carcinogen. Kills amphibians, worms, crustaceans, fish, mollusks, nematodes, flatworms, aquatic insects, phytoplankton and zooplankton. Toxic to birds and bees. Harms aquatic plants.	Potential impacts to humans (especially children), fish, aquatic invertebrates, earthworms, bees, non-target insects, livestock, and other domestic and wild mammals. **Special concern**: impacts to humans, birds, bees, and all aquatic organisms. **Be very careful around water, and with all applications near homes and children.**

fruit to control white flies, thrips, aphids, leafhoppers, and flies. Treat before fruiting, during pre-flower and flowering at 500 ml/100 L water. Pre-harvest interval is 14 days on fruit.			
Cyfluthrine 25g/L EC. A synthetic pyrethroid insecticide conditionally approved for only well-trained & protected applicators. A synthetic pyrethroid insecticide & nematacide. Registered by USEPA. Toxicity Classes I, DANGER, due to potential for irreversible eye damage. Registered in Guinea. **Classified in the USA as a Restricted Use Pesticide (RUP) due to toxicity to aquatic organisms and fish.** Controls a wide variety of pests including bugs, flies, fruit flies on all tree fruits; cutworms on all grasses, and leaf hoppers. For fruits and fruit pests, use at 1-	Threshold densities of pests should be used to determine whether to apply and the dosage. Rotate insecticides to avoid buildup of resistance.	Strong eye and skin irritant. May cause tremors, convulsions, excessive salivation, and numb feeling. High doses can kill humans. Kills fish, bees, aquatic invertebrates, crustaceans, mollusks and zooplankton. Harms earthworms and phytoplankton. Relatively non-toxic to birds, livestock, and wild mammals.	Potential impacts to bees, humans, fish, aquatic invertebrates, earthworms, and soil dwelling beneficial arthropods. **Special concern:** Potential eye damage, use goggles. Very harmful to aquatic organisms; use care near open water.

4ml/20L, or follow label instructions for use rate per hectare. Maximum 4 applications per year. Pre-harvest interval is 0 days.			
Cypermethrin. A synthetic pyrethroid. Registered by EPA. Toxicity Classes III and II, CAUTION and WARNING depending upon formulation. Registered in Guinea as Win-Cyper 10%. Some higher percentage formulations are RUP due to toxicity to fish. Available as Win-Cyper 10% from Stimulus Management (an Indian Company). Also available in the region by SPIA as CYPERCAL 12.5-30%, *however, it was not found available in Guinea.* For control of many different types of pests including those found on mango.	Constant monitoring by trained scouts to detect insect pests. Minimum effective dosage of pesticide is used. Rotated on a regular basis to prevent resistance.	Moderately safe. Affects the central nervous system. Symptoms of cypermethrin poisoning in humans include numbness, burning, loss of bladder control, vomiting, incoordination, seizures, coma and death. Possible human carcinogen and reproductive effects. Cypermethrin should not be applied near water, because it is very toxic to fish and other aquatic organisms like mollusks, zooplankton, crustaceans, and earthworms. Cypermethrin is highly toxic to bees. It is practically non-toxic to birds,	Potential impacts on aquatic organisms. **Special concerns:** Kills bees, fish and aquatic organisms. Do not use near water, or clean pesticide equipment in open water. Use care with lake near Forecariah and Milo River near Kankan.

Insecticidal Soap. Registered-USEPA Toxicity Class II WARNING; **Not yet registered or available in Guinea.** No residual affect. For use on mangoes, maize and dry beans, runner beans, French beans, okra, hot peppers, passion fruit, and cocoa. Controls soft-bodied & low mobility pests like thrips, scales, aphids, mites, leafhoppers, and mealybugs.	Trained crews scout to identify and count pests. Populations are monitored several times a week, and spray decisions are made when pests exceed set levels. Rotation of pesticides in other families to reduce chance of resistance.	Practically non-toxic orally. Slightly toxic via inhalation and dermally. No body organs affected from chronic use. No reproductive effects; non-mutagenic; non-teratogenic; non-carcinogenic; and not a known endocrine disruptor. Non-toxic to birds, fish, earthworms, bees, beneficial arthropods, domestic/wild animals, and aquatic plants. Slightly toxic to aquatic invertebrates.	No potential impacts if used as directed.
Malathion. An organophosphate insecticide. Registered-USEPA Toxicity Classes II WARNING & III CAUTION; **Registered in Guinea as 57% formulation.** Available through Stimulus Management as Win-Mal 57%. SPIA/Senegal markets Malathion 500 EC (50%) in West Africa for use at 4-5 L/Ha, *however, it was not found available in Guinea.* For use on tree crops, market	Constant monitoring by trained scouts to detect insect pests. Minimum effective dosage of pesticide is used. Rotated on a regular basis to prevent resistance.	Slightly toxic dermally, relatively non-toxic via inhalation. May affect the central nervous system, immune system, adrenal glands, kidneys, liver, and blood. Unlikely to cause reproductive effects in humans at normal use levels. Probably non-teratogenic; possibly mutagenic, currently unknown. Inconclusive data on carcinogenicity, most likely non-carcinogenic. Slightly to moderately toxic to birds. Slightly toxic to fish, depending on species. Highly toxic to aquatic invertebrates, tadpoles, earthworms, and honeybees. Not toxic except at high dosages to domestic/wild mammals. Harmful to many beneficial arthropods.	Potential impacts to humans, birds, aquatic invertebrates, tadpoles, earthworms, honeybees, and beneficial arthropods. **Special concern: Pesticide handlers, aquatic invertebrates, tadpoles, earthworms, honeybees, beneficial arthropods**.

gardening, & rice.			
2. Herbicides			
Glyphosate. An herbicide. Registered by USEPA. Toxicity Class III, CAUTION. Registered in Guinea. Classified as a General Use Pesticide (GUP). **Sold in Guinea as "Herbi-Total" 360g/L by SAREF.** General use on all broad-leaf plants for weed control. Use at 4 L/ha in 400 L water. No waiting period is needed on mango since this is applied to the soil and broken down rapidly.	IPM: After first use of glyphosate, cut newer-emerged weeds & grasses by hand with machete, and maintain. Maintain soil and mango tree fertility.	Slight acute human toxicity. Moderate acute aquatic toxicity. Moderately toxic to crustaceans; slightly toxic to fish and zooplankton. Ground water contamination uncertain.	Potential impacts: Use caution around open water and drinking water sources. **Special concern:** Lasts up to 3 years in soil. Do not use near drinking water or open water sources or where there is shallow water table. Overuse may result in weed resistance to glyphosate. Systemic in plant & plant parts.
3. Fungicides			
Chlorothalonil. A fungicide. Registered by USEPA. Toxicity Class II WARNING. Registered in Guinea. Classified as a General Use Pesticide (GUP).	If practical, monitor for presence of disease, and spray only if disease is	Burning sensation in eyes. Skin irritation. Eyes will have redness, blurred vision and pain. If ingested, abdominal pain and burning sensation. A probable carcinogen.	Potential impacts to aquatic systems, like the lake found in Forécariah. **Special concern:** Kills fish

Product Name: Bravo 500, also sold in Guinea as Spithalonil 75 WP by SPIA. Wide spectrum fungicide. Application period: Before the appearance of the disease, then with regular intervals following the conditions of the environment 2 – 3 kg/ha. Waiting period of application is 4 weeks before harvest.	present or likely to be present. Use orchard sanitation.	Potential for ground water contamination. Very highly toxic to fish, amphibians, and crustaceans.	and other aquatic organisms. Likely causes cancer. **Use extra care in mixing and application as this is a class II compound.**
Mancozeb. A fungicide. Registered by USEPA. Toxicity Class IV CAUTION. Registered in Guinea. Products may contain manganese. Classified as a General Use Pesticide (GUP). **Product name: Ivory 80 WP (800g/kg) sold by SPIA** Used in Australia and South Africa for anthracnose control. Dose 1440 to 1840 g/ha for control of Anthracnose. Apply at 2 – 3	Crop monitoring for fungal diseases and may be able to develop action thresholds for spraying. Non-chemical control measures are used such as good sanitation, and hand removal of diseased leaves and plant parts. Fungicide is rotated to prevent	May cause irritation of nose, throat, eyes, and skin. Ingestion causes nausea, diarrhea, vomiting. Can affect thyroid gland. USEPA listing as probable human carcinogen. On list of pesticides that are potentially hormone disruptors. Unlikely to produce reproductive effects; non-teratogenic; inconclusive mutagenicity but data suggest non-mutagenic or weakly mutagenic. Kills amphibians, fish and zooplankton. Moderately to highly toxic to aquatic invertebrates. Not toxic to bees or beneficial arthropods. Moderately toxic to aquatic plants. Domestic/wild mammals not to be grazed in treated areas. Relatively non-toxic to birds.	Potential impacts to humans, fish, aquatic invertebrates, and grazing animals. **Special concern**: toxicity to fish and aquatic invertebrates, and grazing animals; and potential carcinogenic action in humans.

applications per season, in general. Waiting period before harvest is 14 days.	resistance.		
Benomyl/Benlate. NOT APPROVED. Cancelled by USEPA. Use other fungicide choices.	Field counting or other detection methods; correct target pest ID, population monitoring; treating only at threshold level. Use other fungicide choices.	Most common occupational hazards: skin allergies and dermatitis. Teratogenic effects, reproductive effects: not likely. Mutagenicity: no conclusion Possible carcinogen. Highly toxic to earthworms and fish. Moderately toxic to birds. Slightly to moderately toxic to aquatic invertebrates. Relatively non-toxic to bees, aquatic plants, beneficial arthropods, livestock, and domestic animals.	Potential impacts to humans, earthworms, fish, aquatic invertebrates, aquatic plants, birds. Special concerns: fish and earthworms.

Discussion of SAREF Cyfluthrine 25g/L EC

A database search of Cyfluthrine 25g/L, which is essentially Baythroid 25%, shows that this synthetic pyrethroid is registered by USEPA and by the government of Guinea, but this particular formulation (EC—emulsifiable concentrate) of Baythroid is toxicity class I DANGER according to the PAN websites: (http://www.pesticideinfo.org/List_Products.jsp?Rec_Id=PC33504&Chem_Name=Cyfluthrin&PC_Code=128831), and should never be used by untrained individuals like farmers nor the general public, and they should never be stored where children can access them. Cyfluthrine is also listed as a "Restricted Use Pesticide—or RUP" by the EPA, and thus can only be purchased by and used in the USA by very well-trained and certified individuals. The general public cannot legally purchase or use these RUPs.

Problem: Too concentrated to handle and mix

The problem with cyfluthrine 25g/L EC is it is too concentrated to be handled and mixed safely, except by the best trained persons. Once they are mixed with water, they should be sufficiently diluted so that it is not super-risky for applicators and farmers and their kids and families living close to the mango trees.

However, Baythroid Technical ingredient is class II and not restricted use—but still considered by USAID to be too toxic for use by the untrained. Further, there are some Bayer "Tempo" insecticides that are listed as WP—or wettable powder—and are listed as class III toxicity CAUTION—less toxic than class II and acceptable by USAID. Nonetheless, it is doubtful that these other formulations could be imported in time for the current mango flowering season, which will commence in November 2005, nor that the importer would import relatively small quantities required specifically for this project. It may be less expensive for the importer to ship concentrated product, like the 25g/L, than one diluted with water and less concentrated, but heavier for increased shipping costs.

Option 1 for use: Spray service option for cyfluthrine

Another option that could be considered for GAMLA is to have spraying services for cyfluthrine 25g/L specifically contracted by specialists to the farmers as part of a package that is eventually paid for from the fruit sales. That way a highly trained and protected (with safety equipment) individual providing the service package—including purchasing *and applying* the cyfluthrine 25g/L or cupric hydroxide—could ensure a good and necessary measure of safety. Here, the spray person should avoid permitting pesticide drift to hit houses near mango trees in Kindia by spraying early in the morning when it is calm, cool, and bees are not yet foraging.

Option 2 for use: Sell diluted product to farmers

Another option would be for the farmers to buy a more dilute solution of cyfluthrine that is ready to apply by motorized backpack sprayer, with goggles, safety equipment, *original product label information,* and that has been mixed by a highly-trained and

protected individual. It is very important that, in addition to the judicious use of safety equipment and safe application methods, a copy of the label is provided with the diluted product and with verbal instructions to the farmer on precautions to take.

2.15 Pesticide choices according to the 12 Regulation 216 Pesticide Procedures

As required by USAID's Pesticide Procedures (22 CFR 216.3(b) (1) (i)), this PERSUAP and associated IEE will consider the environmental and human health consequences of pesticide use and procurement, and technical assistance and training in pesticides, according to the "12 factors to consider" that is paragraphs a to l of the Pesticide Procedures.

Pesticide procedures element a: USEPA registration status of the proposed GAMLA pesticides. Pesticides are registered in the U.S. as formulated products and also by the technical active ingredients. "Registration status" possibilities of the active ingredients and the formulated products include "never registered", "active registration", and "cancelled registration". Pesticides should also be registered for use by the government in the target country.

USAID is effectively limited to using pesticide active ingredients registered in the U.S. by the U.S. Environmental Protection Agency for the same *or similar* uses. Emphasis is placed on *similar use* because many of the pests—and some crops—found overseas are not present in the USA, and therefore pesticides may not be registered for the exact same use, but often are registered for similar pests, crop and pest situations.

As seen in Table 4, all pesticides approved for use, either conditionally, or relatively unconditionally, are approved by EPA for same or similar use in the USA.

Guinea has a developing pesticide registration process in place and is beginning to accept more and more pesticides as this sector expands.

For many if not most technical folks, there is much confusion about EPA registration numbers. Therefore, a short EPA registration number tutorial is included here, below.

Numbers often confused with EPA registration numbers

The most common EPA "numbers" *–but not pesticide registration numbers*, are the EPA PC Codes, or the Pesticide Chemical (PC) codes to categorize or keep track of *active ingredients* only, not the formulated products. PC codes are not pesticide registration numbers. Registration numbers are given to individual specialized pesticide products formulated from active ingredients by the pesticide manufacturers. Registration numbers are also given to the technical active ingredients. So, for one active ingredient pesticide chemical (PC) code, there can be hundreds of registered products, each with their own unique registration number.

And, to make things more complicated, a particular pesticide product may have a registration number from *having been registered* in the past, but then the EPA may cancel the use of that specific product, or the company may not re-register it, but the registration number remains. So, even a registration number is not sufficient. One has to search beyond the registration number to see if it is still active (still registered for use in the USA) or cancelled (not able to be sold or used in the USA).

The best way to see this "cancelled versus active" registration data is to type in the name of the active ingredient into the site http://www.pesticideinfo.org/Search_Chemicals.jsp. One will receive a list containing that active ingredient and closely-related active ingredients. From that list, click on the active ingredient again to arrive at a webpage that shows "identification, toxicity, use, water pollution potential, ecological toxicity and regulatory information" for the chemical active ingredient that you are researching. Then, go down the page until you see the following (this is from the PAN database webpage for metalaxyl):

Products Containing This Chemical
Current and historic U.S. registered products

View US Products **o** All Products (64 Total) o Currently Registered Products (32 Total)

One can see that there are only 32 currently or actively registered metalaxyl products out of a total of 64 metalaxyl products (note that all 64 will have EPA registration numbers, but only 32 are active, which means that only those 32 can legally be purchased and used; the other 32 have been cancelled for use in the USA). One can either view all 64, or just the 32 that are actively registered by EPA for use in the USA.

Other numbers confused with EPA registration numbers

Other numbers that are found associated with pesticides and that are often confused with registration numbers are the Chemical Abstract Service (CAS) Registry Number and the California DPR Chemical Code (DPR).

The Chemical Abstract Service (CAS) Registry Number is a unique identifier assigned to each chemical and to some mixtures of chemicals by the Chemical Abstracts Service, a division of the American Chemical Society. This number is used worldwide. The CAS registry number includes up to 9 digits which are separated into 3 groups by hyphens (xxxxxx-xx-x). The first part of the number, starting from the left, has up to 6 digits; the second part has 2 digits. The final part consists of a single check digit or checksum that makes it easy to determine whether a CAS number is valid or not.

Due to the high amount of agriculture and stringent environmental controls, the USA state of California tightly controls pesticides used, and has its own code for tracking pesticides. The California Department of Pesticide Regulation (DPR) assigns a unique chemical code number to serve as an identifier for a particular pesticide active ingredient or mixture of active ingredients. These numbers are also often mistaken for EPA registration numbers, but they are not.

Few Pesticide Choices Available in Guinea

There are very few choices of fungicides and insecticides available through the two above importing companies, and there is very little illicit importation of poor-quality products along the borders. There are commercial pesticides existing for sale that have not yet been registered by the government.

Below is a pesticide that has been proposed for use by the GAMLA project, but has been disallowed from (not permitted for) use in Guinea, primarily because it has no active USAEPA registration status, nor a Guinea registration, due to high toxicity to humans or the environment.

Pesticides Disallowed—Not Permitted—for use on GAMLA

Fungicides	**EPA Registrations**	**Guinea Registration**
Benomyl (benlate)	No	No

For GAMLA, folks applying pesticides will require immediate training in pesticide safe use and IPM principles.

EPA Registration Status Issues and Discussion

This PERSUAP recommends for use on GAMLA project 2 fungicides, 3 insecticides, and one herbicide. For use of these products, the following recommendations are given:

* *Immediate training in safe use of pesticides.*

GAMLA project pesticide applicators—especially farmers—require training in safe pesticide handling, calibration, use and disposal.

* *Continuously search for alternate pesticides (to those recommended for use by this PERSUAP) as additional choices increase over time, and are EPA-approved.*

* *As needed or on an annual basis, update changes (additions or subtractions) to the list of pesticides and communicate these changes to USAID for amendment of the PERSUAP.*

* *Use of safe handling and use practices*

Safe handling and use practices are outlined in another part of this PERSUAP.

* *CRAF produce quick reference guides or fact sheets for each pesticide and each use or pest to keep on hand at the project office and field sites.*

A quick reference guide will be useful for pesticide decision-makers to refer to for each approved pesticide, as they make pesticide choice decisions.

----------End of Element a----------

Pesticide procedures element b: Basis for Selection of GAMLA Pesticides. This refers to the economic and environmental rationale for choosing a particular pesticide. In general, the least toxic pesticide that is effective is selected. Basis for selection factors are given below.

The primary factors for basis of selection or pesticide choice in this PERSUAP for Guinea are: registration, availability, efficacy, cost, environment and safety. The use of General Use Pesticides, or GUPs, adds a measure of safety. Table 4 shows that all but one pesticide are GUPs, and the one Restricted Use Pesticide (RUP) is only approved conditionally. The tables also show relative safety and environmental concerns data for improved selection of pesticides depending upon conditions of use.

Basis for Selection of Pesticides: Issues and Discussion on safety and cost

Relative safety to human health is an added benefit associated with the use of GUPs (General Use Pesticides) proposed by the project. GUP pesticide use should be promoted, as all GUP pesticides are considered *relatively* safer for general use, such as that by trained farmers. Restricted Use Pesticides—or RUPs—those with high toxicity, should only be used by very well trained and educated people who will use safety equipment and employ safe use practices.

Since there is little capital and cash available for pesticide purchase by most Guineans and especially by farmers, generic products and those less expensive but efficacious should continue to be imported and used.

Recommendations Based Upon Pesticide Selection Criteria

* *Encourage the continued importation of more pesticide choices to Guinea that comply with EU standards for safety and residue levels on imported products (the mango export companies working with GAMLA will monitor residue levels for export).*

----------End of Element b----------

<u>Pesticide procedures element c</u>: Extent to which the proposed pesticide use is, or could be, part of an IPM program. USAID policy promotes the development and use of integrated approaches to pest management and new technologies whenever possible. This section discusses the extent to which the proposed pesticide use can be incorporated into an overall IPM strategy, and is truly practical in the local culture.

IPM Program Issues and Discussion

History of IPM in Guinea on mangoes

For mangoes, there is little or no history of IPM tactics used in Guinea. Several of the international agricultural research centers (IARCs), like ICRAF, IITA and WARDA, and regional networking initiatives that link with these IARCs, like SAFGRAD, are active in Guinea, so some IPM philosophy and tactics for other crops is present.

One IPM tactic that could be tested in Guinea is the use of fruit fly traps, as follows:

According to the South African Agriculture site on mangoes at: http://www.nda.agric.za/docs/mangoA5/mango.htm, successful fruit fly control in mango orchards depends on a combination of the factors including: The use of traps to determine when a population build-up occurs, and insecticidal protein-bait poison sprays to kill flies.

"By making weekly counts of the number of flies in the traps, sudden increases in the population can be detected and chemical control can commence. Chemical control of adult fruit flies in mango orchards is based on weekly applications of poison bait on the trees." The poison bait contains a mixture of insecticide plus a lure plus water, as follows:

Insecticide/100 l water	Lure/100 l water
50 g trichlorfon SP	250 ml protein hydrolysate (417 g/l) (Nasiman)
	or
175 ml mercaptothion EC	250 ml protein hydrolysate (500 g/l) (Buminal)
	or
300 g mercaptothion WP	Dilute 1:1 & use 400 ml protein hydrolysate (750g/kg) (Hymlure)

	or 400 ml protein hydrolysate (425 g/l) (Hymlure ready)

"The poison bait is applied to the tree in the form of large-droplet sprays at a rate of 250 to 1,000 ml/tree, depending on tree size. It is not necessary to wet the whole tree; a section on one side of the tree will be adequate. Apply poison bait as soon as fly counts in the traps show a sudden increase. Poison baits should be applied long before the fruit starts coloring. A 10-day safety period must, however, elapse between the time of final application and harvesting."

IPM Tactics in General

IPM makes use of combinations of the following tactics: cultural (use of resistant varieties, crop rotation, variation in time of planting or harvesting, crop refuse destruction, pruning, planting trap crops), mechanical (hand destruction, exclusion by barriers, trapping), physical (heat, cold, humidity, traps, sound), and biological (introduction and/or protection of imported or indigenous natural enemies of pests, propagation and dissemination of microbial control agents).

IPM can also include use of: natural chemical methods (by using attractants, repellents, sterilants and growth inhibitors), genetic methods (propagation and release of sterile or genetically incompatible pests), and regulatory means (plant and animal quarantines, suppression and eradication programs) to the extent possible while permitting the safe integration of pesticides with farmers' traditional cropping and pest management systems.

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

- *In the long run*, IPM can be more effective then synthetic pesticides
- Larger orchards provide the perfect environment for the use of biological controls
- IPM is less damaging to essential soil health (needed worms, microbes, etc) and nutrient cycling
- IPM generally requires less capital investment, but longer time
- IPM can be used preventatively to eliminate or minimize the need for "responsive" controls (that is, applying pesticides after a pest outbreak occurs and much damage already has been done).

Table 4, in column 2, have IPM recommendations for practical ways to reduce the use of the pesticides accepted by this PERSUAP and approved by the Project IEE.

Recommendations Based Upon Pesticide Selection Criteria

* IPM plans should be written for each of the two orchard sizes of mangoes to be protected

A general IPM planning protocol for consideration and possible use in IPM training in Guinea is attached as Attachment 9.

Recommendations

* *As practical, through training, enhance understanding of and emphasis on Integrated Pest Management (IPM), with pesticide use as a last resort.*

IPM combines all tactics and tools available for pest management, and puts the focus on use of synthetic pesticides *only as a last resort*. The only non-pesticide action being taken by farmers in Guinea—found in Forécariah —is to use a mix of ash from cooking fires with water to put on plants to repel or control insects, with unknown success.

Since the mango orchards are so small in most cases and the plantation in Forécariah was abandoned by an international company, and the project life is about 2 years, it may not be possible or practical to establish IPM tactics during this project. Biological control of pests, like use of parasitoids to control scales, takes several seasons to build up and is likely not feasible for small family orchards found in Kindia. Parasites do well in large plantations where numbers can build up and where there is a ready food source.

The Future: Fruit fly control using baited insecticide-laden traps

In the USA, fruit fly control in apples for organic production is achieved by fruit fly traps placed in the orchard. And, South African mango producers use the same technology in mango orchards. This technology should be investigated for use on mangoes in Guinea.

* *Try fruit fly traps for population reduction without all of the pesticide residues.*

Fertilizing

By maintaining plant health, strength and energy, the plant is generally more capable to withstand some insect and disease attack and respond with its own chemical and other defenses. So, testing mango tree leaves for the correct nutrition and then applying what is needed will help to reduce some damage and repel or survive pest attack, in addition to increasing yields.

* *Maintain good plant nutrition and health by fertilizing and pruning.*

----------End of Element c----------

<u>Pesticide procedures element d</u>: Proposed method or methods of application, including the availability of application and safety equipment: This section examines in detail how the pesticide is to be applied and the measures to be taken to ensure its safe use.

Most pesticides in orchards will be applied by powerful motorized backpack sprayers—in order to reach the upper tree branches. Mango spore treatment in the processing facility is accomplished by having the mangoes go through a diluted fungicide solution. Some pesticide safety equipment exists at Forécariah from the previous commercial melon-growing enterprise. The project should take an inventory of existing equipment and condition, and supplement it for use by people there who are tasked with spraying the trees.

Since all pesticides will be applied "wet", that is diluted with water, as either emulsifiable concentrates (EC) or wettable powders (WP), a full suit of protective clothes including hat, goggles, respirator or mask, spray suit or protective clothes that are washed after each use, gloves and boots should be used. These are expensive—and likely beyond reach of most farmers—so perhaps several suits could be procured by the project services contract (to be taken from mango proceeds) and shared or rotated among demo farmers.

The following are some general measures that can be used to ensure safe pesticide use, and that need to be taught to farmers and other pesticide applicators—and followed up on or monitored closely by GAMLA and ARCA.

General mitigating potential pesticide dangers; measures to ensure safe use

If there are no feasible alternatives to pesticides, take the following measures to mitigate and reduce their risks to human health and the environment. Note that risk is a function of both toxicity and exposure. Reducing risk means (1) selecting less toxic pesticides and (2) selecting pesticides that will lead to the least human exposure before, during and after use. Also, for more detailed information on pesticides and use, refer to the chapter on Safer Pesticide Use, contained in these guidelines.

Reduce exposure time or the degree of exposure by:

Before using

Transport:

- separate pesticides from other materials being transported

Packaging:

- follow international and national norms and guidelines
- use packaging (small containers) adapted to local needs
- eliminate re-use of packaging materials

Storing:

- develop strict guidelines for village-level storage
- keep in dry and cool places
- keep pesticides well away from children
- ensure permanent, well-marked labeling
- follow and respect national norms
- use appropriate language and approved pictograms

Formulating:

- use appropriate type and concentration

During use

Training:

- should be continuous
- should identify level and audiences (distributors, farmers, transporters, etc.)

Use application equipment:

- should be adapted to user needs and possibilities
- should assure maintenance and availability of parts and service

Use protective equipment and clothing:

- should be adapted to local climatic conditions
- should be adapted to user needs and resource possibilities
- should eliminate exposure rather than just reduce it, if at all possible

Focus on "buffer zones" around the following:

- housing
- environment: water, sensitive areas

After using

- know, enforce, respect exclusion periods after application
- assure proper cleaning and rinsing off of:
  - applicators' preparation and application equipment
  - applicators' clothing
  - storage containers
- develop a workable monitoring and evaluation system for:
  - adherence to national and international policies regarding pest management and pesticides
  - health effects on applicators, the local population, and domestic animals
  - efficacy on target pests
  - impacts on environment: water, soils, etc.

– elimination of pesticide leftovers and containers

Application and Safety Equipment Issues and Discussion

Spraying can be quite straightforward on these on-farm demonstration and extension project sites. If spraying will be done by non-project staff, for example for emergency response to a locust plague or other epidemic, they need to use safety equipment on these project sites.

Recommendations Based Upon Application and Safety Equipment

* *Immediate (before the next season) training in safe handling and use*

Project staff who will use of oversee the use of pesticides require training in safe handling and use of insecticides. Very little of this training has been provided in the past in Guinea.

* *The production of safe use training materials and posters*

One way to remind applicators of safety issues is through the production and use of high quality training materials and safe use posters. These should be adapted or borrowed from other French-speaking countries for use in Guinea.

* *Procurement and use of protective clothing and safety equipment by all applicators*

Protective clothing and safety equipment needs to be provided for all pesticide handlers, users, applicators, and others present while application occurs. The project will need to have safety equipment on hand for use during application.

----------End of Element d----------

<u>Pesticide procedures element e</u>: 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 data associated with the proposed pesticide. In addition to hazards, this section also discusses measures designed to mitigate any identified toxicological hazards, such as training of applicators, use of protective clothing, and proper storage.

The acute and chronic human and environmental toxicological hazards are listed for each pesticide in Table 4. Primary and Special Concerns are also outlined for each pesticide. Use precautions outlined in these tables for each pesticide. There are several ways to mitigate exposure to humans. Some of the best examples are outlined below.

Mitigation of Human Toxicological Exposures

Most pesticide poisonings result from careless handling practices or from a lack of knowledge regarding the safer handling of pesticides. The time spent learning about safer procedures and how to use them is an investment in the health and safety of oneself, one's family, and others. Pesticides can enter the body in four major ways: through the skin, the mouth, the nose, and the eyes. A checklist is given below to help avoid these various routes of overexposure to pesticides.

To avoid dermal (skin) exposure

- Check the label for special instructions or warnings regarding dermal exposure
- Use recommended protective clothing and other equipment as listed on the label
- Do not re-enter the area until deposit has dried or re-entry interval is past

To avoid oral (mouth) exposure

- Check the label for special instructions or warnings regarding oral exposure
- Never eat, drink, or smoke, chew tobacco while working with any pesticide
- Wash thoroughly with soap and water before eating, drinking, smoking, or chewing tobacco
- Do not touch lips to contaminated objects (such as nozzles)
- Do not wipe mouth with contaminated hands or clothing
- Do not expose food, beverages, drinking vessels, or cigarettes to pesticides
- Wear a face shield when handling concentrated pesticides

To avoid respiratory (lungs) exposure

- Read the label to find out if respiratory protection is required
- If respiratory protection is required, use only an approved respiratory device
- Stay upwind during application

To avoid eye exposure

- Read the label to find out if eye protection is required
- If eye protection is required use goggles to protect eyes or a face shield to protect eyes and face
- Keep pesticide container below eye level when pouring

In addition to these common sense measures, there is a way to ensure protection against exposure to pesticides by the type of clothing required for different classifications of pesticides (the classification of each pesticide by EPA toxicity class I, II, III, or IV, and signal word DANGER, WARNING, CAUTION). Toxicity class and signal word is provided for each GAMLA pesticide in Table 4. Good protection is achieved by following the protective clothing and equipment guide.

Protective Clothing and Equipment Guide

	Label Signal Words		
Formulations	Caution	Warning	Danger
Dry	Long-legged trousers and long - sleeved shirt; shoes and socks.	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves.	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves; cartridge or canister respirator if dusts in air or if label precautionary statement says: Poisonous or fatal if inhaled.
Liquid ***most GAMLA pesticides*	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat.	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; rubber gloves. Goggles if required by label precautionary statement. Cartridge or canister respirator if label precautionary statement says: Do not breathe vapors or spray mists. or Poisonous if inhaled.	Long-legged trousers and long-sleeved shirt; rubber boots, wide-brimmed hat; rubber gloves, goggles or face shield. Canister respirator if label precautionary statement says: Do not breathe vapors or spray mists, or Poisonous if inhaled.
Liquid (when mixing)	Long-legged trousers; long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves;	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; rubber	Long-legged trousers and long-sleeved shirt, rubber boots, wide-brimmed hat, rubber gloves,

	rubber apron.	gloves; goggles; or face shield; rubber apron. Respirator if label precautionary statement says: Do not breathe vapors or spray mist , or Poisonous (or fatal or harmful) if inhaled.	goggles or face shield. Canister respirator if label precautionary statement says: Do not breathe vapors or spray mists , or Poisonous if inhaled.
Liquid (when mixing the most toxic concentrates) ***like cyfluthrin*	Long-legged trousers; long-sleeved shirt; boots, rubber gloves, water proof wide-brimmed hat.	Water repellant, long-legged trousers and long-sleeved shirt, rubber boots; rubber gloves; rubber apron; water-proof wide-brimmed hat, face shield, cartridge or canister respirator	Water-proof suit, rubber gloves, water-proof hood or wide-brimmed hat.

Long-legged trousers and long-sleeved shirt, rubber boots, wide-brimmed hat, rubber gloves, goggles or face shield. Canister respirator if label precautionary statement says: 'Do not breathe vapors or spray mists', or 'Poisonous if inhaled'. Check Label Signal Word (Pesticide Signal Words also found in Table 4).

Mitigating Toxicological Hazards Issues and Discussion: Recommendations Based Upon Toxicological Hazards

* *Avoid damage to environment through training to avoid non-target ecosystems*

IPM and safe use training should be components or training modules on how to mitigate exposure of non-target organisms to pesticides.

* *Get training in proper use of protective equipment and safe use of pesticides*

All project personnel who handle, supervise, or spray pesticides will require safe use training.

* *Develop or adapt posters on use of safety equipment*

For many project using pesticides, posters exist to remind users of safety concerns and equipment. Such posters, in French, should be ordered and posted where pesticide workers can see and review them. This can be done as part of a training program.

----------End of Element e----------

<u>Pesticide procedures element f</u>: Effectiveness of the requested pesticide for the proposed use: This section of the PERSUAP requires information similar to that provided in item b, but more specific to the actual conditions of application. This section also considers the potential for the development of pest resistance to the proposed pesticides.

The one pest in Guinea that is likely to be very resistant to many pesticides is white fly. The rest of the pesticides will need to be tested for effectiveness as the project progresses.

Since pesticides are little-used in the past in Guinea, project staff and ARCA contract staff will need to monitor pest control to check for signs of pest resistance and pesticides that do not work at the recommended dose. As moderate pest infestation and little or moderate pesticide use is expected on this on-farm demonstration and extension project, resistance will likely not be an issue for some time—probably beyond the project life—but can be monitored by observing the lack of action of any of the pesticides.

Pesticides Effectiveness Issues and Discussion

Lack of effectiveness of pesticides used in this project will likely not be an issue for this on-farm demonstration and extension project, but they should be monitored for efficacy or lack of efficacy, and changed if needed.

Recommendations Based Upon Pesticide Effectiveness

* *Rotate pesticides to reduce the build-up of resistance*

The project has several fungicides available for rotation to avoid resistance, but only has 2 insecticides. As more insecticides are registered and imported, the project scientists can check the danger level and USEPA registration status and make amendments to this PERSUAP.

* *Monitor resistance by noting reduction in efficacy of each pesticide product*

Project staff can monitor the kill rate of the pesticides for any reduction in efficacy; and can communicate with neighboring farmers and extension agents, to determine when pesticide rotation is called for.

----------End of Element f----------

<u>Pesticide procedures element g</u>: Compatibility of the proposed pesticide use with target and non-target ecosystems: This section examines the potential effect of the pesticide on organisms other than the target pest (for example, the effect on bee colonies in the spray area). Non-target species of concern also include birds, fish, aquatic organisms, and beneficial insects. The potential for negative impact on non-target species should be assessed and appropriate steps should be identified to mitigate adverse impacts.

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

Many pesticide breakdown products are themselves toxic, and each may also have a significant half-life. Since pesticides break down in soil, light and water, there are half-lives for exposure to each of these factors. In the soil, types and numbers of microbes present, water, oxygen, temperature, pH, and soil type (sand, clay, loam) all affect the rate of breakdown. Most pesticides also break down, or photo-degrade, with exposure to light. Lastly, pesticides can be broken down, or hydrolyzed, with exposure to water.

Table 4 address the potential impacts of each pesticide on aquatic organisms, fish, birds, bees, beneficial insects, and surface and ground water contamination. Please refer to these tables to see the impacts and suggestions for mitigating these impacts.

Non-target Organisms Issues and Discussion

Since pests and pesticide use will likely be low to moderate on the project on-farm demonstration and extension sites, there should be little impact to non-target organisms.

Recommendations Based Upon Non-target Organisms

* *Follow the information contained on the pesticide labels and also the information in Table 4 carefully to avoid killing non-target and beneficial organisms.*

* *Try to not use insecticides on flowering mangoes, or if necessary, use them early in the morning or preferably late in the afternoon when bees do not forage and wind conditions are calm.*

----------End of Element g----------

<u>Pesticide procedures element h</u>: Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils: This section examines issues such as the potential for contamination of surface and groundwater sources.

There are no national parks or protected areas near the mango demonstration sites, so flora and fauna are not likely to be major issues. However, at Forécariah there is a lake and at Kankan there is the Milo River and lakes that have aquatic fauna and edible fish, so care should be taken to avoid runoff into these bodies of water. Further, do not permit the lake or the Milo River—or any body of water—to be used for washing sprayers, empty containers or spray clothes.

The climate at Forécariah is lowland wet tropics, whereas the sites at Kindia and Kankan are progressively dryer and higher in altitude and more inland.

Most orchards are significantly far from water sources and water tables, so the risk is likely low that water will be contaminated. Soils throughout the demo sites are as follows: histosols and gley soils. The coastal plain is overlaid by sedimentary deposits; the middle lands around Kindia are composed of ancient metamorphic rock and has been exposed to leaching and erosion so the soils are relatively infertile. Kankan is savannah, with rocky soils.

Each pesticide has physical characteristics, such as solubility in water, ability to bind to soil particles and be held (adsorbed) by soil so they do not enter the soil water layers and the ground water table, and their natural breakdown rate in nature. This data can be found for the pesticides proposed for use on the project by checking each pesticide on the PAN website: http://www.pesticideinfo.org. The water solubility, soil adsorption and natural breakdown rates, if available, are included at the bottom of the webpage for each parent chemical.

In general, pesticides with water solubility greater than 3 mg/liter have the *potential* to contaminate groundwater; and pesticides with an adsorption coefficient of less than 1,900 have the *potential* to contaminate groundwater. And, pesticides with an aerobic soil half-life greater than 690 days or an anaerobic soil half-life greater than 9 days have the potential to contaminate groundwater. Pesticides with a hydrolysis half-life greater than 14 days have potential to contaminate groundwater.

The detailed environmental, hydrological, and soil conditions at the project' on-farm demonstration and extension sites will be collected by scientists for GAMLA. Further, the potential for surface and ground water contamination for each pesticide are addressed in Table 4. Look to this table to determine contamination potential and use with care.

Groundwater Contamination Issues and Discussion

Most of the proposed pesticides are not potential ground water contaminants. If used during the dry season, the potential for contamination is further is reduced. Do not apply pesticides, sprayers, or empty containers near or in water. See Table 4 for issues with water contamination by pesticide.

Recommendations Based Upon Groundwater and Environmental Contamination

* *Continue to utilize pesticides with low ground water contamination potential*

As one of the criteria for selection of pesticides, determine the potential for risk of surface and ground water contamination at each site, and choose pesticides based upon little contamination potential.

----------End of Element h----------

<u>Pesticide procedures element i</u>: Availability of other pesticides or non-chemical control methods: This section identifies other options for control of pests and their relative advantages and disadvantages.

There is little potential for use of non-chemical controls that the farmer can afford at this time in Guinea for mangoes. Fertilizing, pruning, and cleaning the orchards will help reduce the incidence of disease organisms.

Non-Chemical Control Methods Issues and Discussion

Other methods such as use of fruit fly traps are discussed above.

Recommendations Based Upon Non-Chemical or Reduced-Chemical Control Methods

* *If practical, research and try traps for fruit fly control and continue good sanitation and begin fertilization of orchards.*

----------End of Element i----------

<u>Pesticide procedures element j</u>: Host country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide: This section examines the host country'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, the proposed action could result in greater harm to the environment.

Guinea is a developing and rapidly evolving country in Africa, and it is in the process of registering pesticides, though there are still very few choices of pesticides for farmers. Due to the relative paucity of historical pesticide use in Guinea in fruit and mango, there is not a lot of sophisticated experience dealing with pesticide storage and disposal issues.

Farmers at Forécariah have had some experience handling and storing pesticides safely and were aware of some of the issues. With some more training, all on-farm demonstration and extension project farmers will become better aware of risks from misuse or mishandling of pesticides.

Most farmers in Guinea, in the absence of a special locked place to store pesticides, will store them in a 'secure' location in the house, since they have value. *It is really critical that children have no access to these pesticide products, the application equipment and the safety equipment and spraying clothes.*

Recommendations Based Upon Regulations and Compliance

* *Train farmers immediately on safety issues before mango flowering in November—and before the first spraying for Anthracnose.*

----------End of Element j----------

<u>Pesticide procedures element k</u>: Provision for training of users and applicators: USAID recognizes that safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly acute in developing countries, where the level of education of applicators may typically be lower than in developed countries.

Training in IPM and Safe Use are of paramount importance for Guineans using pesticides. This is especially true due to the dearth of training received to date.

Training Issues and Discussion

To date, surprisingly, there has been very little training in IPM or pesticide Safe Use in Guinea. Such training (of trainers) should commence before the next field season, that is, before the end of 2005 which is onset of flowering.

Recommendations Based Upon Training in IPM and Safe Use

* *Immediate pesticide Safe Use training required for GAMLA project staff*

Training can occur via a train-the-trainer format, whereby supervisors are trained for 2-3 days, followed by training for actual applicator and laborer staff for the following 2-3 days.

----------End of Element k----------

Pesticide procedures element l: Provision made for monitoring the use and effectiveness of each pesticide. Evaluating the risks and benefits of pesticide use should be an ongoing, dynamic process.

GAMLA project staff will, through a contract with ARCA, monitor pesticide efficacy and effects to the environment on an on-going basis and switch to alternative pesticides as the need arises.

Monitoring Issues and Discussion

The project is sufficiently limited in the area cultivated and anticipated pests such that monitoring should be feasible. Program site managers will monitor for efficacy against pests and impact on beneficial organisms.

Recommendations Based Upon Monitoring

* *Simple monitoring plans will be drawn up by site managers*

Site managers will be responsible for drawing up simple monitoring plans, to collect data on reduction in efficacy and any other known environmental impacts leading to a change to a new or different pesticide. This will be reported to USAID, as a small section, along other reporting requirements.

3.0 Safe Use Action Plan (SUAP)

Here, major recommendations found in the PER are repeated for action planning and implementation by project partners, especially ARCA.

Immediately,

* *Train farmers immediately on safety issues before mango flowering in November—and before the first spraying for Anthracnose.*

GAMLA project pesticide applicators—especially farmers—require training in safe pesticide handling, calibration, use and disposal.

* *Use of safe handling and use of safety equipment and practices*

Keep all pesticide containers, mixed pesticide, sprayed pesticide, pesticide sprayers, and empty pesticide containers away from children. Ensure safe storage—in a clean dry location *away from children*, handling and use practices as outlined in the PER, and transfer knowledge on use of safety equipment and reasons for use. Do not permit children to come near pesticides, sprayers, or pesticide spray drift. Send children away while pesticides are used. Warn children about pesticide dangers. Keep pesticide drift away from houses or habitation. Use pesticides only with safety equipment. Spray only when conditions are calm (no wind, such as early morning or late afternoon) and no rain is forecast and honeybees are not foraging. Children should not enter freshly-sprayed areas.

* *As practical, through training, enhance understanding of and emphasis on Integrated Pest Management (IPM), with pesticide use as a last resort.*

Use or test the IPM protocol provided in the PER, and research mango IPM in other countries for ideas to test.

* *Procurement and use of protective clothing and safety equipment by all applicators*

Protective clothing and safety equipment needs to be provided for all pesticide handlers, users, applicators, and others present while application occurs. The project will need to have safety equipment on hand for use during application.

During Mango Flowering,

* *Try to not use insecticides on flowering mangoes, or if necessary, use them early in the morning or preferably late in the afternoon when bees do not forage and wind conditions are calm.*

As Time Becomes Available,

* *Encourage the continued importation of more pesticide choices to Guinea that comply with EU standards for safety and residue levels on imported products.*

* *IPM plans with simple recommendations should be written for each of the two orchard sizes of mangoes to be protected*

* *Try fruit fly traps for population reduction without all of the pesticide residues.*

* *Produce safe use training materials*

One way to remind applicators of safety issues is through the production and use of high quality training materials and safe use posters. These should be adapted or borrowed from other French-speaking countries for use in Guinea.

* *Avoid damage to environment through training to avoid non-target ecosystems*

IPM and safe use training should be components or training modules on how to mitigate exposure of non-target organisms to pesticides.

* *Develop or adapt posters on use of safety equipment and safe methods*

For many project using pesticides, posters exist to remind users of safety concerns and equipment. Such posters, in French, should be ordered and posted where pesticide workers can see and review them. This can be done as part of a training program.

* *Rotate pesticides to reduce the build-up of resistance*

The project has several fungicides available for rotation to avoid resistance, but only has 2 insecticides. As more insecticides are registered and imported, the project scientists can check the danger level and USEPA registration status and make amendments to this PERSUAP.

* *Monitor resistance by noting reduction in efficacy of each pesticide product*

Project staff can monitor the kill rate of the pesticides for any reduction in efficacy; and can communicate with neighboring farmers and extension agents, to determine when pesticide rotation is called for.

* *Follow the information contained on the pesticide labels and also the information in Table 4 carefully to avoid killing non-target and beneficial organisms.*

* *Simple monitoring plans will be drawn up by site managers*

Site managers will be responsible for drawing up simple monitoring plans, to collect data on reduction in efficacy and any other known environmental impacts leading to a change to a new or different pesticide. This will be reported to USAID, as a small section, along other reporting requirements.

Continuously,

* *Continuously search for alternate pesticides (to those recommended for use by this PERSUAP) as additional choices increase over time, and are EPA-approved.*

* *As needed or on an annual basis, update changes (additions or subtractions) to the list of pesticides and communicate these changes to USAID for amendment of the PERSUAP.*

* *CRAF produce quick reference guides or fact sheets for each pesticide and each use or pest to keep on hand at the project office and field sites.*

A quick reference guide will be useful for pesticide decision-makers to refer to for each approved pesticide, as they make pesticide choice decisions.

* *Continue to utilize pesticides with low ground water contamination potential*

As one of the criteria for selection of pesticides, determine the potential for risk of surface and ground water contamination at each site, and choose pesticides based upon little contamination potential.

* *Maintain good plant nutrition and health by fertilizing and pruning.*

As applicable, each of these action plan elements should be put into action plans, as practical, *by each implementing partner,* following the example action plan:

Steps	Start	End	Who
Train farmers	Nov 10	Nov 30	
Buy safety equipment	Nov 8	Nov 8	

Etc…….

Note: Action plans work best if produced by each implementer for practical reasons and buy-in, and need full backing and support—and follow up—from upper management.

Economic Analysis of Cost-Benefit of Pesticides

Estimations des charges dues aux traitements phytosanitaires d'1 ha de verger de mangue paysan

Introduction

Les estimations de coûts sont faites pour des vergers de manguiers âgés de 10 à 20 ans (moyenne 15 ans) dans la zone de Kindia avec une conduite traditionnelle des techniques culturale dont : (i) densités de plantation élevées (150 à 170 arbres/ha – 160 en moyenne –), (ii) zéro fertilisation, (iii) zéro traitement phytosanitaire, (iv) 1 nettoyage occasionnel…

Méthodologie

I. Estimation des coûts de traitements phytosanitaires

Les coûts sont estimés suivant 2 scénarios :

Scénario 1 : le producteur demande des prestations payantes d'un agent privé de traitement phytosanitaire (APTP) formé à cet effet. Les charges comprennent : le coût des fongicides et insecticides, le coût du carburant pour l'appareil de traitement, le déplacement et les frais de prestation de l'agent.

Charges scénario 1 :

1. fongicides : chlorothalonil : 3 kg x 40000 FG =	*120000 FG*
Kocide 101 : 1 kg x 60000 FG =	*60000 FG*
2. insecticide : Sarefos : 2 L x 30000 FG =	*60000 FG*
3. carburant lubrifiant : essence : 15 L x 3800 FG =	*57000 FG*
4. déplacement de l'agent : 3 déplac x 10000 FG =	*30000 FG*
5. frais de prestation de l'agent : 3 x 15000 FG =	*45000 FG*
Total charges scénario 1	***372000 FG***

Scénario 2 : le producteur assure lui-même le traitement. Les charges comprennent dans ce cas : le coût des fongicides et insecticides, le coût du carburant pour l'appareil de traitement, la main d'œuvre (familiale soit elle), l'amortissement de l'équipement de traitement.

Charges scénario 2 :

1. fongicides : chlorothalonil : 3 kg x 40000 FG =	*120000 FG*
Kocide 101 : 1 kg x 60000 FG =	*60000 FG*
2. insecticide : Sarefos : 2 L x 30000 FG =	*60000 FG*
3. carburant lubrifiant : essence : 15 L x 3800 FG =	*57000 FG*
4. main d'oeuvre : 3 h/j x 3 traitemts x 5000 FG =	*45000 FG*
5. amortissement[1] de l'atomiseur :	*50000 FG*
Total charges scénario 2	***392000 FG***

[1] 1 atomisseur = 1000000 FG (amorti sur 5 ans). Amortissement annuel = 200000 FG. Amortissement pour 3 mois d'utilisation dans la campagne = 50000 FG

II. Estimation des productions

II.1. Estimation de la production d'1 verger paysan traditionnel non traité

Nombre moyen d'arbres =	160
Production brute/arbre =	35 kg
Production totale brute =	5600 kg

Production commercialisable (35% de la production brute) = 2240 kg
Nombre de cageots commercialsables[2] = 112 cageots

II.2. Estimation de la production d'1 verger paysan traditionnel traité[3]
Nombre moyen d'arbre = 160
Production brute/arbre[4] = 45 kg
Production totale brute = 7200 kg
Production commercialisable (85% de la production brute) = 6120 kg
Nombre de cageots commercialisables = 306 cageots

III. Rentabilités :

III.1. verger paysan traditionnel non traité
Coût de traitement = 0 FG
Valeur de la production = 112 cageots x 2000 FG = 224000 FG
Bénéfice = 224000 FG

III.2. verger paysan traditionnel traité
Scénario 1
Coût de traitement = 372000 FG
Valeur de la production = 306 cageots x 2000 FG = 612000 FG
Bénéfice = 612000 – 372000 FG = 240000 FG

Scénario 2
Coût de traitement = 392000 FG
Valeur de la production = 306 cageots x 2000 FG = 612000 FG
Bénéfice = 612000 – 392000 FG = 220000 FG

Tableau récapitulatif

Libellé	Verger paysan non traité	Verger paysan traité	
		Scénario 1	*Scénario 2*
Nombre d'arbres	160	160	160
Production brute/arbre	35	45	45
Production totale brute (kg)	5600	7200	7200
Production totale commercialisable (kg)	2240	6120	6120
Nombre de cageots	112	306	306
Valeur de la production commercialisable (FG)	224000	612000	612000
Coût de traitement	0	372000	392000
Bénéfice	224000	240000	220000

[2] Le poids d'1 cageot de mangue est estimé à 20 kg

[3] Le verger est traité 3 fois avec un fongicide et un insecticide.

[4] L'augmentation de la production après les traitements des arbres dans les vergers paysans est estimée à 30%.

Attachment 1: Terms of Reference

Guinea Agribusiness Marketing Linkage Activity

Scope of Work, Consultant Qualifications

Develop a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP)

For Activity No. 2 of the Special Activity Fund

The activities to be carried out under this scope of work are centered on complying with USAID's environmental regulations for Activity No. 2 of the GAMLA Special Activity Fund (SAF). Specifically, it will be required to prepare a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) for Activity No. 2 of the SAF. Activity No. 2 is to install and maintain mango demonstration plots, provide improved mango varieties and train small-scale producers in orchard maintenance practices. The work will be carried out by the centre de Recherche Agronome de Fulaya (CRAF), one of several research centers in Guinea under the Agriculture Research Institute of the Ministry of Agriculture. A description of Activity No. 2 is included in Annex I to this SOW.

Here is an excerpt of an overview of the USAID pesticide procedures:

"If USAID's resources are proposed for any activities that will involve assistance for the procurement or use, or both, of pesticides, planners must take into account these procedures. "Use" is interpreted broadly to include the handling, transport, storage, mixing, loading, application, clean up of spray equipment, and disposal of pesticides, as well as the provision of fuel for transport of pesticides, and providing technical assistance in pesticide management. In contrast, support to limited pesticide research and pesticide regulatory activities are not subject to scrutiny under the pesticide procedures.

USAID finances pesticides only on a case-by-case basis (and not on the basis of an approved commodity list) and then only after specific additional evaluation that would consider the potential benefits conferred by the use of the proposed pesticide, such as in a PERSUAP. **The kinds of factors to be considered in such an assessment should include, but not necessarily be limited to, the following (22 CFR 216.3 (b)(1)(i)(a-l):**

1. USEPA's registration status of the requested pesticide(s);
2. basis for selection of the requested pesticide(s);
3. extent to which the proposed pesticide use is part of an IPM;
4. proposed method or methods of application, including availability of appropriate application and safety equipment;
5. any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to reduce such hazards, if not eliminate them;
6. effectiveness of the requested pesticide(s) for the proposed use;
7. compatibility of the proposed pesticide(s) with target and non-target ecosystems;
8. conditions under which the pesticide(s) are to be used, including climate, flora, fauna, geography, hydrology, and soils;

9. availability and effectiveness of other pesticides or non-chemical management methods;
10. requesting country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide(s);
11. provisions made for training of users and applicators; and,
12. provisions made for monitoring the use and effectiveness of the pesticide(s).

USAID's pesticide procedures require that any proposed use of pesticides be limited to products that are registered, without restrictions, for the same or similar uses in the U.S. by USEPA. Any proposed pesticide use that does not conform to such standards needs to be subject to an Environmental Assessment or Environmental Impact Statement. Pesticides cancelled or suspended by USEPA are never approved for use in a USAID project. Similarly, products classified as Restricted Use Pesticides by USEPA are almost never approved for use in USAID projects.

As an example, if a country requested financing for pesticides, it would be encouraged to use products registered for the same or similar uses in the United States. If no such products existed, the environmental review requirements would become progressively more stringent as one moved from previously registered to never registered pesticides.

It is important to understand that the term "restricted" refers to changes in product uses required by the USEPA as a condition to renew or re-register a product. In contrast, the pesticides listed ... are those which, in the United States, may only be purchased or applied by well-trained and officially *certified* applicators or under their direct supervision on the basis of health and/or environmental risk criteria."

Annex II to this SOW provides the PERSUAP Guidance for Pesticide Programs with Action Plan, while Annex III shows a PERSUAP sample outline.

The work described herein will be carried out by a team of two consultants: an international consultant from Chemonics' home office, assisted by a field consultant in Guinea. The International consultant will write the PERSUAP, while the local consultant will provide field information from Guinea as input for the report.

A Times New Roman font, size 12 is must be used for the text of the report. The report should be written in English.

Level of effort:

A level of effort of six working days for each consultant is authorized for this study.

GAMLA PERSUAP Consultant qualifications

Qualifications of the Local Consultant – Data Collection Specialist

Extensive local experience in crop, pest and pesticide management in the agricultural sector.

Relevant degree.

The proven ability to work as part of a team.

The proven ability to collect the most up-to-date and state-of-the-art primary information.

Responsible for researching and writing most of the local background information. Responsible for preliminary research in preparation for the TDY of the international consultant.

Qualifications of the International Consultant

At least 10 years of international experience in crop, pest, and pesticide management in the agricultural sector.

Previous experience writing USAID PERSUAPs.

Ability to access and interpret the U.S. Environmental Protection Agency's (EPA) most recent pesticide registration data, and other databases.

Ability to manage a local consultant. Good communication and writing skills.

Responsible for overseeing the Local Consultant, sufficiently training and tutoring the local consultant on doing pesticide searches and evaluations according to USAID's Regulation 216 requirements. Responsible for the analysis of approved pesticides by the 12 USAID Regulation 216 elements (part 5 of the IPPMSUAP) and the SUAP (part 6 of the IPPMSUAP).

Relevant degree.

French language capability.

Annex I to SOW

Special Activities Fund, Activity No. 2

Install and Maintain Mango Demonstration Plots, Provide Improved Mango Varieties, and Train Small-Scale Producers in Orchard Maintenance Practices

Title: Install and maintain mango demonstration plots, provide improved mango varieties and train small-scale producers in orchard maintenance practices.

Background: SIPEF, a Belgium importer of fruit and vegetables with fruit production operation in West Africa is presently the only large-scale exporter of fresh mangoes from Guinea. The company operates a mango packing and cold storage facility at Dabuya, in the heart of the Kindia mango processing area. SIPEF purchases ripe mangoes from small-scale producers in the area. The mangoes are selected, packed and cooled at its Dabuya station and exported by refrigerated sea container to Europe. The company's exports are presently constrained by the limited availability of export-quality mangoes in the Kindia area, of the varieties that are in high demand in Europe.

The underlying problem is that most of SIPEF's suppliers have only a few trees and provide absolutely no maintenance to their mango groves. Consequently, most of the fruit that is available cannot be exported since it is damaged by insects and disease. Furthermore, much of the fruit is not of export variety and therefore has no external markets.

Guinea is fortunate in that its production season (March – June) falls within the European market window, and its mango exports are highly prized by European consumers. Consequently, there is a ready market for additional mango exports.

Proposed activity: It is proposed to contract with the Centre de Recherche Agronome de Fulaya (CRAF), one of several research centers within the Agriculture Research Institute of the Ministry of Agriculture, to establish and maintain demonstration plots within the five mango production zones around Dabuya where SIPEF purchases its fruit for export. CRAF will establish and maintain a total of 10 hectares of demonstration plots within the five zones over the remaining life of the GAMLA project, which will provide direct benefits to the small-scale producers for the next two production seasons. The demonstration plots will be used to provide training in good orchard maintenance practices for SIPEF's mango suppliers. A total of 25 lead producers will be trained prior to the first harvest season (March 2006 – June 2006). Before the start of the second season (March 2007 – June 2007) the 25 lead producers will train, under the guidance of CRAF, an additional 250 mango producers. In addition to its demonstration and training activity, CRAF will establish plant nursery to produce Kent and Keats varieties of mango plants that will be provided, on a cost sharing basis, to the mango producers associated with SIPEF. These plants will be used for grafting onto existing mango trees and thereby convert the groves into producers of export varieties of mangoes. Grafting techniques will be part of the demonstration and training activities as well. The SAF budget contemplates the production of approximately 10,000 plants, a sufficient number to convert 100 hectares of producing mangos into export varieties.

SIPEF will actively participate in this activity. First, the company will establish a quality bonus scheme whereby those participating producers who provide superior quality fruit will be rewarded. Second, SIPEF will establish an orchard maintenance fund that will be used to finance to finance orchard maintenance for its associated producers during the growing season. The cost of maintaining the orchard of an individual farmer will be deducted from the payments to that farmer for the fruit purchased by SIPEF. A memorandum of understanding (MOU) will be written for the signature of representatives of SIPEF, CRAF, and the GAMLA project spelling out their respective role and responsibilities.

The budget for this special activity is included in the annex to this SAF description.

Justification: This special activity will work to remove one of the constraints that limit the availability of export-quality mangoes in Guinea. With improved orchard maintenance and the use of export mango varieties, greater quantities of export-quality fruit will be produced by the farmers to be exported by SIPEF, which will benefit both parties.

Demonstration and training will also provide long term benefits to the participating farmers by improving their capabilities as mango growers.

Administration: The GAMLA project will contract directly with CRAF to carry out the work of establishing and maintaining the demonstration plots, training the farmers, establishing the nursery and delivering the mango plants to the farmers. SIPEF will collaborate closely with this activity. The GAMLA office manager will oversee the entire administrative process.

Attachment 2: Work Plan and Schedule

Friday, October 21, 2005	Do web searches on mango production
Saturday, October 22, 2005	Do web searches on mango production, begin travel
Sunday, October 23, 2005	Travel to Guinea
Monday, October 24, 2005	Meet GAMLA staff and consultants
Tuesday, October 25, 2005	Travel to Kindia to interview SIPEF staff & farmers
Wednesday, October 26, 2005	Travel to Forécariah to interview farmers
Thursday, October 27, 2005	Meet local pesticide sales companies, training local consultant in pesticide searches, do writing
Friday, October 28, 2005	Guinean and International Consultants meet, write, begin return travel
Saturday, October 29, 2005	More return travel
Wednesday, Novermber 2	Finish return travel
Thursday, November 3	Do web searches, communicate, write
Friday, November 4	Do web searches, communicate, write
Saturday, November 5	Do web searches, communicate, write, edit

Attachment 3: Persons Met, Resource People, Collaborators

GAMLA/Conakry
Tom Easterling
Bangaly Sylla

Chemonics/DC
Geoffrey Livingston
Kristin O'Planick
Elisha Moore Delate
Andre Mershon

USAID
John Mullenax

Consultants
Mamadou Condé

Pesticide Sales Offices
SPIA Conakry : Mamady Saran Oularé
SPIA Kindia : Famany Kanté
SAREF international: AREF Abou Khalil

SIPEF
Yaya Toure
Staff of SIPEF

Farmers
Kindia: El hadj Younoussa Camara
Momo Soumah PAOL

Forécariah: El hadj Fodé Siakha Sankhon

FRUILEG Export
Siaka Kaba

CRAF
Director Moustapha DONZO

Attachment 4. Recommended Distribution

USAID/ Guinée	NRM Team Leader	Stephen Morin
	CTO	John Mullenax
	Director	Annette Adams
USAID/WARP	REO	Rob Clausen
Chemonics	Supervisor	Geoffrey Livingston
	Manager	Kristin O'Planick
	Associate	Andre Mershon
	Associate	Elisha Moore-Delate
GAMLA	COP	Tom Easterling
	OM	Bangaly Sylla
ARCA/GAMLA		
CRAF	Directeur	Moustapha Donzo
	Scientific Coordinator	Ousmane Kolèah Soumah
CRAB	Directeur	Morodian Sangaré
SIPEF	Africa Region	Thomas Hillenbrand
	Guinea Coordinator	Yaya Touré
First Produce	Country Director	Andy Gibson
	Coordinator Guinea	Sidiki Diané
FRUILEG	PDG	Siaka Kaba
SAREF International	PDG	AREF Abou Khalil
SPIA	PDG	

Attachment 5: Primary Websites for Pesticide Searches

http://www.pesticideinfo.org (PAN most complete pesticides database)
http://extoxnet.orst.edu/pips/ghindex.html (Extoxnet Oregon State database)
http://www.epa.gov/ecotox/ (EPA Ecotox Database)
http://www.cdpr.ca.gov/docs/epa/m2.htm (link to OPP site)
http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg (EPA Registr.Eligib.Decisions)
http://www.epa.gov/pesticides/biopesticides/ai/all_ais.htm (EPA regulated biopesticides)
http://www.epa.gov/opppmsd1/RestProd/rupjun02.htm (EPA restricted use pesticides)
http://www.epa.gov/pesticides/health/tox_categories.htm (EPA Toxicity Classifications)
http://www.epa.gov/opppmsd1/PPISdata/index.html (EPA pesticide product information)
http://www.chemfinder.camsoft.com (chemical database & internet search, free & fee)
http://www.hclrss.demon.co.uk/index.html (compendium of pesticide common names)
http://www.agf.gov.bc.ca/pesticides/f_2.htm (all types of application equipment)

Electronic information on pesticides was collected by the consultant using several websites: www.epa.gov for compliance; www.who.int/ipcs/publications/pesticides for WHO classification; www.kellysolutions.com for formulations registration status information; www.greenbook.net and www.cdms.com for efficacy information and Material Safety Data Sheets found on pesticide labels; as well as the PAN www.pesticideinfo.org and EXTOXNET http://extoxnet.orst.edu/pips/ghindex.html websites for specific toxicological, registration and environmental data.

Hard copy information on toxicity class and nontarget hazard was referenced from technical manuals reviewed in the U.S. such as The Pesticide Manual by Tomlin (1997), Farm Chemical Handbook (2005), Agricultural Chemicals Books by Thomson (1995-8), The Agrochemicals Handbook by the Royal Society of Chemistry UK (1991), The UK Pesticide Guide by the British Crop Protection Council (1998), and The UK Pesticide Guide (1999).

CABI Site for Crop Protection Compendium (CPC)
http://www.cabi.org/compendia/cpc/index.htm to enter CABI CPC for crop/pest reccs.

Pesticide Toxicity to Honey Bees
http://www.entm.purdue.edu/Entomology/ext/targets/e-series/EseriesPDF/E-53.pdf
http://www.ohioline.osu.edu/hyg-fact/2000/2161.html (Ohio State Extension site)

Pesticide Toxicity to Natural Enemies (Beneficials)
http://www.ipm.ucdavis.edu/PMG/r108900111.html

Biological Pesticides List
http://www.koppert.com (a Dutch biologicals company doing business internationally)
http://www.biobest.be (a Belgian biologicals company doing business internationally)
http://www.epa.gov/pesticides/biopesticides/ai/all_ais.htm (EPA's biopesticide list)
http://www.bio-bee.com/english/welcome.html (a biopesticide company in Israel)

PERSUAPs Sites
http://www.encapafrica.org/sectors/pestmgmt.htm (PERSUAPS guidance)
http://www.wateriqc.com/millenium_conference/Proceedings/powerpoint_presentations/Day_4/1030rossier.pps#285,10,Critical Pesticide Management Issues (EA History PPT)

International Conventions
http://www.pops.int/ (POPs website)
http://www.pops.int/documents/convtext/convtext_en.pdf (POPs Convention text)
http://www.chem.unep.ch/pops/pdf/redelipops/redelipops.pdf (reduce & eliminate POPs)

methyl-bromide site
http://www.epa.gov/ozone/mbr/harmoniz.html

www.wateriqc.com/millenium_conference/Proceedings/powerpoint_presentations/Day_4/1030rossier.pps#285,10,Critical Pesticide Management Issues

Country-Specific Issues Sites

http://www.afamin.net/regionalenglish/apidia.htm (Guinea Pesticide Suppliers)
http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_324.pdf (Agriculture in Guinea)
http://www.fao.org/es/ess/compendium_2004/pdf/ESS_GUI.pdf (FAO Obsolete Pesticides)
http://saref.net/index_fichiers/page0001.htm (SAREF Pesticides Available in Guinea)
http://www.spia-sa.com/english/ainsecticides.html (SPIA Pesticides available in Guinea)

WHO and Malaria Sites
http://www.who.int/ctd/whopes/specifications.htm (WHOPES evaluated pesticides)
http://www.who.int/mediacentre/factsheets/en/
http://www.whosea.org/malaria/hist.htm
http://www.who.int/entity/en/ (who site map)
http://www.who.int/ctd/whopes/ (WHOPES home site)
http://www.unep-wcm.org/protected_areas/ (Agroecological zones)
http://www.mara.org.za/ (Mapping malaria risk in Africa)
http://skonops.imbb.forth.gr/AnoBase/ (Anopheles database)
http://www.who.int/tdr/ (Malaria research and training)
http://www.malaria.org.za/ (Malaria in Southern Africa)
http://www.rbm.who.int/ (Roll back malaria home site)
http://www.iwmi.cgiar.org/textonly/health/malaria/ (water management techniques)
http://www.paho.org/english/hcp/hct/mal/malaria.htm (PAHO malaria site)
http://www.iwmi.cgiar.org/sima/index.asp (CGIAR systemwide initiative on malaria, ag)
http://www.malaria.org/pressreleases.html (malaria foundation international)
http://www.chem.unep.ch/pops/ivm/ (Partnership for IVM in Africa)
http://www.unep.org/gef/content/index.htm (UNEP/GEF page)
http://www.theglobalfund.org/en/ (Global Fund to Fight AIDS, TB and Malaria)

Audio-Visual IPM and SPU resources
http://entweb.clemson.edu/pesticid/publictn/resource.htm

Attachment 6: Guinea Pesticide Legislation

Textes régissant l'usage des produits phytopharmaceutiques

Les législations concernant les produits phytopharmaceutiques varient considérablement d'un pays à l'autre suivant surtout les restrictions apportées à la vente, la distribution et l'usage des composés. Les législations spécifiques ont d'abord été introduites aux Etats Unis et au Canada et visaient à protéger le consommateur contre la désinformation à propos des produits et n'étaient pas étendues aux problèmes concernant les mesures de sécurité nécessaires pendant l'usage afin de protéger les récoltes, les manipulateurs ou l'environnement.

Dans notre pays, la loi régissant la gestion des pesticides est issue de la Convention Internationale pour la Protection des Végétaux (à laquelle nous avons adhéré le 22 Mai 1991) a été adoptée le 6 Août 1992 sous le numéro L/92/028/CTRN et son décret d'application D/94/044/PRG/SGG du 22 mars 1994.

Depuis, en harmonie avec les autres pays membres du projet Homologation Interafricaine Phytosanitaire (HIP) à savoir le Bénin, la Côte d'Ivoire, le Ghana, le Togo dont la Guinée est partie prenante, un certain nombre de textes d'application ont été élaborés et adoptés par le Ministre en charge de l'Agriculture.
Ce sont notamment :

Loi L/92/028/CTRN du 06 Août 1992 instituant la législation sur les pesticides a été promulguée en 1992.
Objectif : la mise en œuvre d'une politique nationale à l'égard des produits phytopharmaceutiques (pesticides) et, notamment, le contrôle de l'importation, de la mise sur le marché, de l'étiquetage, de l'utilisation, de l'expérimentation, du stockage et de l'élimination des produits périmés ainsi que de la fabrication, de la formulation, du conditionnement ou du reconditionnement et du transport desdits produits.

Le Décret D/94/044/PRGSGG portant application de la Loi, est daté du 22 Mars 1994.
Objectif : définir le rôle de la Division Protection des Végétaux dans l'application de la Loi. Situer les attributions du Comité National des Pesticides et sa composition, fixer la procédure d'homologation, les infractions et pénalités.

Arrêté n° 095/6205/MAEF/SGG/95 du 07 Novembre 1995 portant nomination des membres du Comité National des Pesticides ; récemment modifié par l'Arrêté n° 5071/MAE/SGG/99 du 14 Septembre 1999.

Arrêté n°5710/MAEF/SGG/96 relatif aux mesures transitoires d'application d'homologation des pesticides.

Arrêté n° 5711/MAEF/SGG/96 du 03 octobre 1996 relatif aux dossiers d'homologation des pesticides.

Objectif : fixer le contenu des différents dossiers relatifs à l'homologation des produits phytopharmaceutiques conformément aux dispositions de la loi L/92/028/CTRN et de son décret d'application n°D/94/044/PRG du 22 mars 1994 ci haut référencés.

Arrêté n° 5712/MAEF/SGG/96 du 03 octobre 1996 relatif à l'agrément professionnel requis pour l'application des pesticides par des prestataires de service.

Objectif : définir les conditions d'application des produits phytopharmaceutiques par des prestataires de service conformément aux dispositions de la loi instituant la législation sur lesdits produits et de son décret d'application.

Arrêté n° 5713 /MAEF/SGG/96 du 03 octobre 1996 relatif à la protection des travailleurs exposés aux produits phytopharmaceutiques.

Objectif : fixer les mesures relatives à la protection des travailleurs exposés aux risques liés à la manipulation des produits phytopharmaceutiques, conformément aux dispositions prescrites par la loi légiférant sur les pesticides et de son décret d'application.

Arrêté n° 5714/MAEF/SGG/96 du 03 octobre 1996 relatif à la licence professionnelle requise pour l'importation, le reconditionnement et la mise sur le marché des pesticides.

Objectif : conformément à la loi régissant les produits phytopharmaceutiques et de son décret d'application en vigueur, et fixer les conditions d'importation, de reconditionnement et de mise sur le marché desdits produits.

Arrêté n° 5715/MAEF/SGG/96 du 03 octobre 1996 relatif à l'expérimentation des pesticides en vue de l'homologation.

Objectif : fixer les conditions de réalisation de l'expérimentation des produits phytopharmaceutiques en vue de l'homologation conformément à la loi y afférent et de son décret d'application.

Arrêté n° 5716/MAEF/SGG/96 du 03 octobre 1996 relatif à l'étiquetage et l'emballage des pesticides.

Objectif: fixer les conditions d'étiquetage et d'emballage des produits phytopharmaceutiques homologués, bénéficiant d'autorisation provisoire de vente ou destinés à l'expérimentation conformément aux dispositions de la loi L/92/028/CTRN du 06 août 1992 et de son décret d'application.

Arrêté n° 315/MAE/SGG/2000 relatif à l'autorisation provisoire de vente.
Objectif : fixer les conditions dans lesquelles une spécialité phytopharmaceutique peut être autoriser à la commercialisation bien qu'elle nécessite encore des compléments d'étude, mais dont la toxicité reste dans les limites connues, l'efficacité suffisamment établie et dont l'emploi ne semble pas entraîner d'inconvénient notable dans les conditions normales d'utilisation.

Arrêté n° 316/MAE/SGG/2000 portant mensures et dispositions à prendre pour le transport, le stockage et la distribution des produits phytopharmaceutiques.
Objectif : fixer les mesures et dispositions à prendre pour le transport, le stockage et la distribution des produits phytopharmaceutiques par :

- les firmes et usines de fabrication des produits phytopharmaceutiques,
- les importateurs et distributeurs de produits phytopharmaceutiques.

Arrêté n° 317/MAE/SGG/2001 du 1er Février 2001 relatif à la liste des produits bénéficiant de mesures transitoires pour l'homologation.
Objectif : publier la liste de produits phytopharmaceutiques auxquels sont accordés la procédure accélérée pour l'homologation.

Arrêté n° 2395/MAE/SGG/2001 du 06 Juin 2001 portant restriction et/ou interdiction d'usage de substances actives en agriculture.
Objectif : établir, diffuser la liste des substances actives qui seront d'usage interdit et/ou réglementé en agriculture sur tout le territoire de la République de Guinée.

Ces informations sont disponibles sur le réseau Isysphyt et leur accessibilité est subordonnée à un abonnement semestriel ou annuel.
En examinant les textes régissant la gestion des produits phytopharmaceutiques en Guinée on s'aperçoit que les principaux objectifs sont de :

1- Protéger les personnes qui pourraient être exposées à de gros risques pendant la fabrication, la formulation, le conditionnement, le transport, le stockage et/ ou l'utilisation.

2-Assurer un bon emballage, qui comporterait la classification du composé quant aux risques, et éviter la contamination directe des aliments et du fourrage

à n'importe quel stade compris entre la fabrication ou la formulation et l'usage de produit en plein champ.

3- Mettre en garde, en cas de besoin, contre une contamination involontaire des récoltes non traitées, des animaux, du sol et de l'eau.

4-Protéger l'acheteur contre les produits de qualité inférieure, périmés ou non autorisés ou contre les avis trompeurs marqués sur les étiquettes ou les annonces publicitaires.

Une autre mesure visée est celle d'assurer que les résidus issus de l'utilisation des produits phytopharmaceutiques sur/ou dans les denrées alimentaires et les fourrages, dans la mesure où il y en aurait, soient à des niveaux acceptables et ne représentent aucun danger pour les consommateurs.

En vue de réaliser ces objectifs, tous les produits phytopharmaceutiques mis à la vente doivent être homologués ou bénéficier d'une Autorisation Provisoire de Vente et le numéro d'homologation ou d'Autorisation Provisoire de Vente porté sur l'étiquette. Celle-ci devra fournir en langue française des informations complètes ainsi qu'il suit :

- Le nom commercial ou la désignation du produit;
- Le nom et l'adresse du fabricant du pesticide;
- Le numéro de l'Autorisation Provisoire de Vente ou d'homologation du pesticide;
- La nature du produit et son mode d'action;
- Le type de préparation;
- La quantité nette de produit;
- Le nom et la quantité de chaque matière active;
- Les usages (cultures, organismes nuisibles, doses ou concentrations d'emploi, stade d'application ou délai de carence) pour lesquels le produit est agréé et les conditions peut être utilisé ou doit, au contraire, être exclu conformément à la décision d'agrément;
- Les instructions d'emploi (en cas de restriction d'usage, la mention "Réservé à usage professionnel" est porté sur l'étiquette);
- Les incompatibilités physico-chimiques avec d'autres produits phytosanitaires et engrais;
- La date de fabrication;
- Les informations appropriées sur la stabilité au stockage et la durée de conservation;
- Les indications de risque d'intoxication par une bande colorée et un symbole conformes aux recommandations de l'O.M.S.;

- La nature des risques particuliers sous forme de phrases types choisies de manière appropriée parmi celles figurant en annexe 1 du présent arrêté;
- Les précautions à prendre pour la protection de l'homme, des animaux et de l'environnement sous forme de phrases types choisies de manière appropriée parmi celles figurant en annexe 2 du présent arrêté;
- Les instructions pour les premiers soins en cas d'intoxication;
- Les instructions pour l'élimination en toute sécurité du pesticide et de son emballage.

Le Comité National des Pesticides donne son avis au Ministre en charge de l'Agriculture sur l'opportunité d'expérimenter, autoriser provisoirement à la vente, homologuer, refuser et/ou retirer du marché un produit phytopharmaceutique chaque fois que cela est nécessaire.

Attachment 7: Guinea Registered Products

LISTE DES PRODUITS HOMOLOGUES EN GUINEE

A la date du16 Juin 2005

INSECTICIDES

N°	Spécialités commerciales	Nom du Fabricant	Substances actives	N° d'Enregistrement	N° d'Homologation	Date d'Homologation	N° d'Arrêté d'Homologation
1	Anibal	Aventis	Fenobucarb	050/CNP/2000	In001/2001	06/06/2001	2352/MAE/SGG/2001
2	Phaser 500 EC	Aventis	Endosulfan	049/CNP/2000	In002/2001	06/06/2001	2363/MAE/SGG/2001
3	Décis 25 EC	Agro Evo France	Deltamethrine	053/CNP/2000	In003/2001	06/06/2001	2354/MAE/SGG/2001
4	Regent 5 GR	Aventis	Fipronil	024/CNP/1997	In004/2001	06/06/2001	2390/MAE/SGG/2001
5	Sherphos 280 EC	Aventis	Cypermethrine + Triazophos	027/CNP/1997	In005/2001	06/06/2001	2391/MAE/SGG/2001
6	Polytrine C 180	Novartis	Profenofos + Cypermethrine	004/CNP/1996	In006/2001	06/06/2001	2357/MAE/SGG/2001
7	Polytrine C 186	Novartis	Profenofos + Cypermethrine	003/CNP/1996	In007/2001	06/06/2001	2359/MAE/SGG/2001
8	Polytrine C 330	Novartis	Profenofos + Cypermethrine	005/CNP/1996	In008/2001	06/06/2001	2353/MAE/SGG/2001
9	Polytrine C 336	Novartis	Profenofos + Cypermethrine	002/CNP/1996	In009/2001	06/06/2001	2355/MAE/SGG/2001
10	Nurelle D36/150 EC	Dow Agroscience	Cypermethrine + Chlorpyrifos	007/CNP/1996	In010/2001	06/06/2001	2364/MAE/SGG/2001
11	Nurelle D36/300 EC	Dow Agroscience	Cypermethrine + Chlorpirifos	008/CNP/1996	In011/2001	06/06/2001	2362/MAE/SGG/2001
12	Dursban 5 PP	Dow Agroscience	Chlorpyrifos éthyl	054/CNP/2000	In012/2001	06/06/2001	2392/MAE/SGG/2001
13	Dursban 480 EC	Dow Agroscience	Chlorpyrifos éthyl	055/CNP/2000	In013/2001	06/06/2001	2394/MAE/SGG/2001
14	Padan 4 G	Takeda/Ch	Cartap hydrochloré	033/CNP/1998	In014/2001	06/06/2001	2358/MAE/SGG/2001

15	Sumicidin10 EC	Sumitomo	Fenvalerate	069/CNP/2001	In015/2001	06/06/2001	2389/MAE/SGG/2001
16	Sumi 8 GR	Sumitomo	Diniconalzole	029/CNP/1998	In016/2001	06/06/2001	2388/MAE/SGG/2001
17	Talstar 27 EC	Tomen	Bifentrine	039/CNP/1999	In017/2001	06/06/2001	2397/MAE/SGG/2001
18	Sumicombi 30 EC	Sumitomo	Fenvalerate + Fenitrothion	068/CNP/2001	In018/2001	06/06/2001	2360/MAE/SGG/2001
19	Elsan 50 EC	Nissan – Ch	Phentoate	073/CNP/2001	In019/2001	06/06/2001	2365/MAE/SGG/2001
20	Marshal 10 G	FMC	Carbosulfan	065/CNP/2000	In024/2001	06/06/2001	2377/MAE/SGG/2001
21	Furadan 5 G	FMC	Carbosulfan	071/CNP/2001	In025/2001	06/06/2001	2356/MAE/SGG/2001
22	Regent 50 SC	Aventis	Fipronil	023/CNP/1997	In023/2001	06/06/2001	2361/MAE/SGG/2001
23	Cyhalone 10 EC	Zeneca	Cyhalothrine	079/CNP/2002	In028/2001	23/01/2002	0060/MAE/SGG/2002
24	Rocky 500 EC	Calliope	Endosulfan	102/CNP/2002	In031/2001	23/01/2003	0062/MAE/SGG/2003
25	Unden 75 WP	Bayer	Propoxur	076/CNP/2002	In027/2001	23/01/2003	0067/MAE/SGG/2003
26	Actellic 50 EC	Zeneca	Pirimiphos methyl	078/CNP/2002	In036/2001	23/01/2003	0068/MAE/SGG/2003
27	Baythroid 50 EC	Bayer	Cyfluthrine	077/CNP/2002	In037/2001	23/01/2003	0069/MAE/SGG/2003
28	Diazinon 60 EC	Nippon K	Diazinon	108/CNP/2002	In029/2001	23/01/2003	0070/MAE/SGG/2003
29	Sumithion 50 EC	Sumitomo	Fenitrothion	067/CNP/2001	In030/2001	23/01/2003	0071/MAE/SGG/2003
30	Cypercal P 720 EC	Calliope	Cypermethrine + Profenofos	102/CNP/2002	In032/2001	23/01/2003	0078/MAE/SGG/2003
31	Tricel 48 EC	Excel I. Ltd	Chlorpyriphos	110/CNP/2002	In039/2002	27/03/2003	1418/MAE/SGG/2003
32	Win-Mal 57%	Stimulus Management	Malathion	176/CNP/2004	In0045/2004	08/02/2005	594/MAEEF/SGG/2005
33	Win-Chlor 20%	Stimulus Management	Chlorpyriphos	177/CNP/2004	In0046/2004	08/02/2005	595/MAEEF/SGG/2005
34	Win-Cyper 10%	Meghmani Indus. Ltd	Cypermethrin	175/CNP/2004	In0044/2004	08/02/2005	593/MAEEF/SGG/2005
35	Calfos 720 EC	Calliope France	Profenofos	173/CNP/2004	In0042/2004	08/02/2005	583/MAEEF/SGG/2005
36	Conqueste C 88 EC	Calliope France	Acetamipride+ cypermethrine	174/CNP/2004	In0043/2004	08/02/2005	582/MAEEF/SGG/2005

37	Attakanic 344 SE	Calliope France	Cypermethrine+ Imidaclopride	172/CNP/2004	In0041/2004	08/02/2005	584/MAEEF/SGG/2005
38	Sarifos	Helicom Corporation	Chloropyrifos ethyl	167/CNP/2004	In0040/2004	08/02/2005	590/MAEEF/SGG/2005
39	Imidacloprid 10% WP	Rennong P. Tianjin Chin	Pyridine	001/CNP/2005	In001/2005	09/06/2005	2747/MAEF/SGG/2005
40	Amoban 45% EC	Rennong P. Tianjin Chin	Ammonium	002/CNP/2005	In002/2005	09/06/2005	2748/MAEF/SGG/2005
41	Acetamiprid 3% SL	Rennong P. Tianjin Chin	Pyridine methylène	003/CNP/2005	In003/2005	09/06/2005	2746/MAEF/SGG/2005
42	Beta-Cypermetrhine	Rennong P. Tianjin Chin	Toluene + Chlore	004/CNP/2005	In004/2005	09/06/2005	2742/MAEF/SGG/2005
43	Fempropathion 28% SL	Rennong P. Tianjin Chin	Tuolene + Chrysanthène	006/CNP/2005	In005/2005	09/06/2005	2743/MAEF/SGG/2005
44	Hexaflumuron 5% EC	Rennong P. Tianjin Chin	Fluore d'urée	007/CNP/2005	In006/2005	09/06/2005	2744/MAEF/SGG/2005
45	Semiamitraz Chloride 85%	Rennong P. Tianjin Chin	Acide chlorhydrique	0010/CNP/2005	In007/2005	09/06/2005	2745/MAEF/SGG/2005
46	Semiamitraz Chloride 25%	Rennong P. Tianjin Chin	Acide chloridrique	0012/CNP/2005	In009/2005	09/06/2005	2740/MAEF/SGG/2005
47	Amitraz 64% + 8%	Rennong P. Tianjin Chin	Acetone+ toluène + xylène	0011/CNP/2005	008/2005	09/06/2005	2741/MAEF/SGG/2005
48	Amitraz 20% SL	Rennong P. Tianjin Chin	Acetone+ toluène + xylène	0013/CNP/2005	0010/2005	09/06/2005	2730/MAEF/SGG/2005

HERBICIDES

N°	Spécialités commerciales	Nom du Fabricant	Substances actives	N° d'Enregistrement	N° d'Homologation	Date d'Homologation	N° d'Arrêté d'Homologation
1	Atoll	Aventis	Isoxaflutole + Atrazine	051/CNP/2000	He001/2001	06/06/2001	2371/MAE/SGG/2001
2	Rilof 395 EC	Ciba-Geigy	Piperophos + Propanil	001/CNP/1996	He002/2001	06/06/2001	2373/MAE/SGG/2001
3	Ronstar 25 EC	Aventis	Oxadiazon	021/CNP/1997	He003/2001	06/06/2001	2366/MAE/SGG/2001
4	Ronstar PL 2	Aventis	Oxadiazon + Propanil	018/CNP/1997	He004/2001	06/06/2001	2375/MAE/SGG/2001
5	Garil 480	Dow Elanco	Triclopyr + Propanil	047/CNP/1999	He007/2001	06/06/2001	2372/MAE/SGG/2001
6	Satunil 60 EC	Kumiai Chemical	Benthiocarbe + Propanil	040/CNP/1999	He009/2001	06/06/2001	2367/MAE/SGG/2001
7	Stomp 500 EC	Cyanamide	Pendimetaline	038/CNP/1999	He010/2001	06/06/2001	2368/MAE/SGG/2001
8	Sanglypho liquide	Sankyo	Glyphosate	035/CNP/1998	He011/2001	06/06/2001	2369/MAE/SGG/2001
9	Chass 500 EC	Cyanamide	Pendimetaline + Propanil	034/CNP/1998	He012/2001	06/06/2001	2374/MAE/SGG/2001
10	Primagram 500 EC	Ciba-Geigy	Atrazine + Metolachlore	064/CNP/2000	He013/2001	06/06/2001	2370/MAE/SGG/2001
11	Califor G	Calliope	Prometryne + Fluometuron + Glyphosate	093/CNP/2002	He024/2001	23/01/2003	0061/MAE/SGG/2003
12	Roundup 360 SL	Syngenta	Glyphosate	020/CNP/1997	He/2001	23/01/2003	0065/MAE/SGG/2003
13	Touchdown	Zeneca	Glyphosate trimesium	080/CNP/2002	He015/2001	23/01/2003	0066/MAE/SGG/2003
14	Glycel 41 SL	Excel I. Ltd	Glyphosate	107/CNP/2002	He017/2001	23/01/2003	0073/MAE/SGG/2003
15	Callitraz 90 WG	Calliope	Atrazine	094/CNP/2002	He018/2001	23/01/2003	0074/MAE/SGG/2003
16	Tempra 800 SC	Calliope	Diuron	099/CNP/2002	He019/2001	23/01/2003	0075/MAE/SGG/2003

17	Rical 345 EC	Calliope	Propanil + Thiobencarbe	103/CNP/2002	He020/2001	23/01/2003	0076/MAE/SGG/2003
18	Calriz	Calliope	Propanil + Trichlopyr	104/CNP/2002	He023/2001	23/01/2003	0077/MAE/SGG/2003
19	Calliherbe 720SL	Calliope	2,4 D	096/CNP/2002	He021/2001	23/01/2003	0079/MAE/SGG/2003
20	Tempra 90 WG	Calliope	Diuron	091/CNP/2002	He022/2001	23/01/2003	0059/MAE/SGG/2003
21	Herbi-Total SL	Helicom Corp. Japon	Glyphosate	165/CNP/2003	He025/2001	24/11/2003	9576/MAE/SGG/2003
22	Herbi-Riz EC	Helicom Corp. Japon	Butachlor + Propanil	166/CNP/2003	He026/2001	24/11/2003	9530/MAE/SGG/2003
23	Topranil 48%	Meghmani Indus. Ltd	Propanil	215/CNP/2004	He0036/2004	08/02/2005	597/MAEEF/SGG/2005
24	Toprazine 50% SC	Meghmani Indus. Ltd	Atrazine	214/CNP/2004	He0035/2004	08/02/2005	581/MAEEF/SGG/2005
25	Passtou 500 EC	Helicom Corporation	Pendimethaline	212/CNP/2004	He0033/2004	08/02/2005	596/MAEEF/SGG/2005
26	Toprazine 80%	Meghmani Indus. Ltd	Atrazine	213/CNP/2004	He0034/2004	08/02/2005	580/MAEEF/SGG/2005
27	Pendimethaline	Pilarquim (Sanghai)	Pendimethaline	210/CNP/2004	He031/2004	08/02/2005	591/MAEEF/SGG/2005
28	Glyphosate	Pilarquim (Sanghai)	Glyphosate	211/CNP/2004	He0030/2004	08/02/2005	592/MAEEF/SGG/2005
29	Pendimethaline 500 EC	Rallis India Ltd	Pendimethaline	171/CNP/2004	He0029/2004	08/02/2005	585/MAEEF/SGG/2005
30	Atrazione 500 SL	Helicom Corporation	Atrazine	167/CNP/2004	He0032/2004	08/02/2005	589/MAEEF/SGG/2005
31	Sarmex 80 WP	Helicom Corporation	Diuron	168/CNP/2004	He0028/2004	08/02/2005	588/MAEEF/SGG/2005
32	Herbi-Maïs	Helicom Corporation	Alachlor + Atrazine	167/CNP/2004	He0027/2004	08/02/2005	587/MAEEF/SGG/2005
33	Pilarmetryn 80% WP	Pilarquim Co. China	Ametryn	216/CNP/2004	He0037/2004	09/06/2005	2752/MAEF/SGG

34	Pilaratra 50% WP	Pilarquim Co. China	Atrazine	217/CNP/2004	He0038/2004	09/06/2005	2751/MAEF/SGG
35	Pilardax 10% WP	Pilarquim Co. China	Bensulfuron – methyl	218/CNP/2004	He0039/2004	09/06/2005	2754/MAEF/SGG
36	Pilarmetryn 50% WP	Pilarquim Co. China	Ametryn	219/CNP/2004	He0040/2004	09/06/2005	2750/MAEF/SGG
37	Pilardic 25% EC	Pilarquim Co. China	Dichlofob - methyl	220/CNP/2004	He0041/2004	09/06/2005	2753/MAEF/SGG
38	Butylate 72% EC	Rennong P. TianjinChin	Huile d'amindon	0014/CNP/2005	He001/2005	09/06/2005	2738/MAEF/SGG
39	Quizalofop - Pethyl	Rennong P. TianjinChin	Acide acetique +dichlorophenox	0015/CNP/2005	He002/2005	09/06/2005	2737/MAEF/SGG

FONGICIDES

N°	Spécialités commerciales	Nom du Fabricant	Substances actives	N° d'Enregistrement	N° d'Homologation	Date d'Homologation	N° d'Arrêté d'Homologation
1	Aliette WP	Aventis	Fosetyl Aluminium	025/CNP/1997	Fo001/2001	06/06/2001	2381/MAE/SGG/2001
2	Pelt 70 WP	Roussel Uclaf	Methyl-Thiophanate	059/CNP/2000	Fo002/2001	06/06/2001	2380/MAE/SGG/2001
3	Bravo 720 SC	Sygenta	Chlorothalonil	105/CNP/2002	Fo003/2002	23/01/2003	0064/MAE/SGG/2003
4	Sartop	Helicom Corporation	^Methylthio-phanate	169/CNP/2004	Fo004/2004	08/02/2005	586/MAEEF/SGG/2005
5	Mancozeb 80% WP	Rennong P. Tianjin Chin	Manganèse+ Zinc	005/CNP/2005	Fo001/2005	09/06/2005	2736/MAEF/SGG
6	Mancozeb 85% WP	Rennong P. Tianjin Chin	Manganèse+ Zinc	0016/CNP/2005	Fo004/2005	09/06/2005	2734/MAEF/SGG
7	Zineb	Rennong P. Tianjin Chin	Manganèse+ Zinc	008/CNP/2005	Fo002/2005	09/06/2005	2735/MAEF/SGG
8	Fosetyl Aluminium	Rennong P. Tianjin Chin	Triphosphate d'Aluminium	009/CNP/2005	Fo003/2005	09/06/2005	2733/MAEF/SGG

INSECTICIDES - NEMATICIDES

N°	Spécialités commerciales	Nom du Fabricant	Substances actives	N° d'Enregistrement	N° d'Homologation	Date d'Homologation	N° d'Arrêté d'Homologation
1	Mocap 20 G	Aventis	Ethoprophos	011/CNP/1997	In-Ne001/2001	06/06/2001	2379/MAE/SGG/2001
2	Témik 10 G	Aventis	Aldicarb	052/CNP/2001	In-Ne002/2001	06/06/2001	2378/MAE/SGG/2001
3	Oncol 5 GR	Otsuka/Calliope	Benfuracarb	066/CNP/2001	In-Ne003/2001	06/06/2001	2393/MAE/SGG/2001
4	Oncol 10 GR	Otsuka	Benfuracarb	074/CNP/2001	In-Ne035/2002	23/01/2003	0072/MAE/SGG/2003
5	Endocel 35 EC	Excel I. Limited India	Endosulfan	109/CNP/2002	In-Ac038/2002	27/03/2003	1410/MAE/SGG/2003

REGULATEUR DE CROISSANCE

N°	Spécialités commerciales	Nom du Fabricant	Substances actives	N° d'Enregistrement	N° d'Homologation	Date d'Homologation	N° d'Arrêté d'Homologation
1	Ethrel	Aventis	Ethephon	058/CNP/2000	Re001/2000	06/06/2001	2376/MAE/SGG/2001

RODENTICIDES

N°	Spécialités commerciales	Nom du Fabricant	Substances actives	N° d'Enregistrement	N° d'Homologation	Date d'Homologation	N° d'Arrêté d'Homologation
1	Racumin	Bayer	Coumatétralyl	106/CNP/2002	Ro001/2002	23/01/2003	0063/MAE/SGG/2003
2	Comando	Excel I. Limited India	Phosphure de Zinc	112/CNP/2002	Ro002/2003	27/03/2003	1419/MAE/SGG/2003

FUMIGANTS

N°	Spécialités commerciales	Nom du Fabricant	Substances actives	N° d'Enregistrement	N° d'Homologation	Date d'Homologation	N° d'Arrêté d'Homologation
1	Celphos	Excel I. Limited India	Phosphure d'Aluminium	111/CNP/2002	Fu001/2002	27/03/2003	1417/MAE/SGG/2003

Conakry, le.....

Le Chef de Division Protection des Végétaux
(Premier Vice Président du Comité National des Pesticides)

Moriba PIVI

Le Directeur National de l'Agriculture
(Président du Comité National des Pesticides)

Abdoul Karim CAMARA

Attachment 8: Guinea Prohibited and Controlled Use Products

Substances actives interdites

N°	Dénomination	Famille
01	2 ,4,5 – T	Dérivés phénoxy
02	Aldicarbe	Acide carbamique
03	Aldrine	Organochloré
04	Aminotriazole	Triazole
05	Binapacryl	Dérivés benzéniques
06	Cadusafos	Organophosphoré
07	Camphéchlore	Organochloré
08	Captachlore	Organochloré
09	Captafol	Phtalimide
10	Chlordane	Organochloré
11	Chlordecone	Organochloré
12	Chlordimeforme	Formamidine
13	Chlorfenvinphos	Organophosphoré
14	Chlormephos	Organophosphoré
15	Chlorobenzilate	Organochloré
16	Chloropicrine	Organophosphoré
17	Crimidine	Pirimidine
18	Cyhéxatine	Organotin
19	DDT	Organochloré
20	Déméton	Organophosphoré
21	Dialiphos	Organophosphoré
22	Dicofol	Organochloré
23	Dieldrine	Organochloré
24	Dienochlore	Organochloré
25	Dimefox	Organophosphoré
26	Dinosèbe	Composé nitré
27	Disulfoton	Organophosphoré
28	DNOC	Phénols
29	Endrine	Organochloré
30	Ethoprophos	Organophosphoré
31	Fenamiphos	Organophosphoré
32	Flocoumafen	Coumarine
33	Fonofos	Organophosphoré
34	HCH	Organochloré .
35	Heptachlore	Organochloré
36	Hexachlorobenzene	Dérivé aromatique
37	Lindane	Organochloré
38	Mercuriques (composés)	Inorganique
39	Methamidophos	Organophosphoré
40	Methidathion	Organophosphoré
41	Methomyl	Carbamate
42	Methoxychlore	Organochloré
43	Mirex	Organochloré
44	Monocrotophos	Organophosphoré
45	Nitrofene	Diphényl
46	Paraquat	Ammonium quaternaire
47	Parathion-éthyl	Organophosphoré
48	Parathion-methyl	Organophosphoré

49	Pentachlorophenol	Organochloré
50	Phentoate	Organophosphoré
51	Phorate	Organophosphoré
52	Phosphamidon	Organophosphoré
53	Piclorame	Dérivé de l'acide piclolinique
54	Prothoate	Organophosphoré
55	Quintozène	Dérivé nitré
56	Strobane	Organochloré
57	TCA	Acides organiques halogénés
58	Télodrine	Organochloré
59	Terbufos	Organophosphoré
60	Trichloronat	Organophosphoré

Substances actives à usage réglementé

N°	Dénomination	Famille
01	Azinphos-éthyl	Organophosphoré
02	Azinphos-méthyl	Organophosphoré
03	Brodifacoum	Hydroxy-4-coumarine
04	Bromadiolone	Hydroxy-4-coumarine
05	Bromophos-éthyl	Organophosphoré
06	Carbofuran	Carbamates
07	Chlorophacinone	Dérivé de l'indanédione
08	Coumachlore	Coumarine
09	Cyhalothrine	Pyréthrinoïde
10	Fenvalerate	Pyréthrinoïde de synthèse
11	Ferbame	Dithiocarbamate ,organo-féreux
12	DDVF (dichlorvos)	Esters phosphoriques
13	Dicrotophos	Organophosphoré
14	Difenacoum	Hydroxy-4-coumarine
15	Diphacinone	Chlorophacinone
16	EPN	Organophosphoré
17	Monolinuron	Urées substituées
18	Pyrazophos	Pyrazolopyrimidine

Attachment 9: A General IPM Planning Protocol

IPM Program Planning and Design

The design of an IPM program can be developed with all of the fundamental parts of any good management plan. The vital parts of a plan include a definition of the targeted primary (small or large-holder farmers) and secondary (marketers, processors, transporters, and consumers) beneficiaries, implementation partners (farmers, laborers, extension personnel, national, regional and international organizations), listed production constraints (problem identification) and IPM strategies for dealing with them.

Elements of IPM Program

Since IPM is not generally an active part of crop production in Guinea, a basic understanding of the steps or elements needed in an IPM program is addressed below.

Step 1: Evaluate and use non-pesticide management options first.
Use both preventive and responsive/curative options that are available to manage pest problems. Farmers may prevent pests (and avoid requiring pesticides) by the way they select plants, prepare the site, plant and tend growing plants. Along with prevention, farmers may respond to or cure the problem via physical, mechanical or biochemical methods.

General Preventive Interventions:

Plant selection

- choose pest-resistant strains
- choose proper locally-adapted plant varieties
- diversify plant varieties or inter-crop plants
- provide or leave habitat for natural enemies

Site preparation and planting

- choose pest-free or pest-avoidance planting dates (e.g., early planting in rainy season avoids stem borers in cereals)
- enhance/provide shade for shade-grown crops
- assign crop-free (fallow) periods and/or rotate crops
- install buffer zones of non-crop plants and/or physical barriers
- improve soil health
- use and appropriate planting density
- rotate crops
- low-till, no-till

Plant tending/cultivation practices

- fertilize and irrigate appropriately
- remove weeds while small and before sowing crop

Responsive/Curative Interventions:

Physical/mechanical control

- remove or destroy diseased plant or plant parts & pests
- weed
- install traps

Biochemical control

- pheromones (very effective, but not currently easily accessible or economical, however, they are becoming more so)
- homemade botanical pesticides
- repellents

Biological control

- release or augment predators
- release or augment parasites/parasitoids
- release or augment microbial pesticides

Step 2: Assess IPM Needs and Establish Priorities. In planning IPM project consider crop protection needs, farmers' perceptions of pest problems, pesticide use history and trends, availability of IPM technology, farming practices, access to sources of IPM expertise, support for IPM research and technical assistance, and training needs for farmers and project field extension workers.

Next, identify strategies and mechanisms for fostering the transfer of IPM technology under various institutional arrangements, mechanisms, and funding levels. Define what is available for immediate transfer and what may require rapid and inexpensive adaptation and validation research. During the planning stages of an IPM program, the inputs from experienced IPM specialists will be extremely useful. If possible, set up an initial planning workshop to help define and orient implementation activities, and begin to assign individual responsibilities.

Step 3: Learn and value farmers' indigenous IPM tactics, and link with and utilize all local resources/partners. Most farmers are already using their own forms of IPM, many of which are novel, self-created, adapted for local conditions, and many of which work well. These include: mechanical and physical exclusion; crop rotation, trap crops, cover crops, and green manures; local knowledge of strategic planting or harvesting times; water, soil and fertilizer resource management; intensive intercropping with pest-repellent plants; leaving refuge habitat for natural enemies; soil augmentation and care leading to healthy nutrient cycling; transplanting; and weeding.

Accurate assessments of these farmer technologies, as well as of actual losses due to different constraints in farmers' fields are a must, before designing a crop production and pest management program. Crop loss figures provided by small and large farmers alike, and thus projected and reported by international organizations, are often inaccurate, and thus overestimated.

Step 4: Identify key pests for each target crop. Although hundreds of species of organisms can be found in a crop at any one time, only a few of them may cause substantial crop losses, and be considered pests. Become familiar with the key pests of

target crops, whether they are primary or secondary pests, how to positively identify them. Monitor their population size, the kind of damage that they cause, and their life cycle. These usually amount to a relatively small number of species on any one crop and can include any combination of insects, pathogens, weeds, diseases, and vertebrates. A few other species, known as secondary or occasional pests, attain damaging status from time to time; especially if over-spraying occurs and kills natural predators that naturally regulate their populations.

The vast majority of insect species found in any one crop are actually predators and parasites of the plant-feeding species. Many small-holder farmers are not aware of these distinctions and must be taught to correctly identify the more common beneficial species, as well as pests, found in their crops. Incorrect identification of beneficial insects, predators or neutral insect species, may lead to unnecessary pesticide applications. This diagnostic phase requires sampling and careful observation. Usually, most key pests are fairly well known by local farmers and government extension personnel. However, a few species may be poorly known or understood because they occur at night, are hidden, or small. These include soil-inhabiting species such as nematodes and insect larvae (wireworms, white grubs, cutworms), mites, and pathogens (viruses, bacteria, mycoplasma, fungi). In addition, farmers usually do not understand the role of some insects as vectors of plant diseases.

Step 5: Do effective activities and training to promote IPM. A number of activities are very effective in promoting IPM in developing countries:

Learning-by-doing/discovery training programs
The adoption of new techniques by small- and large-holder farmers occurs most readily when program participants acquire knowledge and skills through personal experience, observation, analysis, experimentation, decision-making and practice. First, frequent (usually weekly) sessions are conducted for 10–20 farmers during the cropping season in farmers' fields by trained instructors or extension agents. Because these IPM training sessions take place in the farmers' own environment, (1) they take advantage of the farmers' own knowledge; and (2) the farmers understand how IPM applies to their own farms.

Of these IPM training sessions, four or five analyze the agroecosystem. They identify and describe conditions such as soil type, fertility, and needs, weather, crop stage, each pest, their natural enemies, and relative numbers of both. Illustrations and drawings are provided, as necessary. Extensionists apply a Socratic method, guiding farmers with questions to discover important insights and supplying information only when absolutely necessary.

Farmers may also experiment with insect zoos where they can observe natural predators of their pests in action and the impact of pesticide on both. Knowledge and skills necessary for applying IPM are best learned and understood through practice and observation, understanding pest biology, parasitism, predation and alternate hosts; identifying plant disease symptoms; sampling population size; and preparing seed beds.

Recovering collective memory
Pest problems often emerge because traditional agricultural methods were changed in one way or another, or lost. These changes can sometimes be reversed. This approach uses group discussions to try to identify what changes might have prompted the current pest problem.

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).

Demonstration project
Subsidized experiments and field trials at selected farms can be very effective at promoting IPM within the local community. These on-farm demonstration and extensions demonstrate IPM in action and allow comparison with traditional synthetic pesticide-supported cultivation.

Educational material-Guinea
In many countries, basic written and photographic guides to pest identification and crop-specific management techniques are unavailable or out of date. Such material is essential. Videos featuring graphic pictures of the effects of acute and chronic pesticide exposure, and interviews with poisoning victims can be particularly effective. A study in Nicaragua found videos to be the most important factor in motivating farmers to adopt IPM.

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.

Organic food market incentive
Promoting organic certification for access to the lucrative and rapidly growing organic food market can be a strong incentive to adopt IPM.

Step 6: Partner successfully with other IPM implementers. Many IPM project consist of partnerships between two or more organization, e.g., donors, governments, PVOs and NGOs. If these partnerships are not forged with care, the entire project may be handicapped. 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 important that partners articulate a common, detailed *vision* of IPM, centered on the crops and conditions the project will encounter.

Confirm partner institutions' commitment
Often, organizations make commitments they do not intend to (or are unable to) fulfill completely. 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 program. 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.** Large partner organizations should have staff with expertise in IPM who are assigned specifically to IPM work. In strong partnerships, these staff members are actively involved in the partnership.

Step 7: Monitor the fields regularly. The growth of pest populations usually is related closely to the stage of crop growth and weather conditions, but it is difficult to predict the severity of pest problems in advance. The crops must be inspected regularly to determine the levels of pests and natural enemies and crop damage. Current and forecast weather should be monitored. Farmers, survey personnel, and agricultural extension staff can assist with field inspections. They can train other farmers to be able to separate pests from non-pests and natural enemies, and to determine when crop protection measures, are necessary.

Step 8: Select an appropriate blend of IPM tools. A good IPM program draws from and integrates a variety of pest management techniques. IPM does not require predetermined numbers or combinations of techniques, nor is the inclusion or exclusion of any one technique required for IPM implementation. 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. When dealing with crops that are already being treated with pesticides, IPM should aim first at reducing the number of pesticide applications through the introduction of appropriate *action thresholds*, while promoting appropriate pesticide management and use practices and shifting to less toxic and more selective products and non-chemical control methods. In most cases, NGOs/PVOs will probably need to deal with low to moderate levels of pesticide use. Either way, an IPM program should emphasize preventive measures and protect a crop, while interfering as little as possible with the production process.

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: Monitor and Evaluate. First, develop data collection tools, and then collect baseline data at the beginning of the project to identify and determine the levels of all variables that will need to be tracked. These may include numbers and types of pests, predators, and soil microorganisms; relative numbers of all non-target animals (birds, lizards, etc.) that may be negatively impacted if pesticides are used; soil and water samples to determine levels of pesticide residue; soil samples to learn dominant soil types and to predict soil nutrition, requirements, and fertilizer/pesticide activities; pesticides, application and safety equipment available; and, amounts and type of training received by target audiences.

Develop methods for measuring the effectiveness of each IPM tactic used, and of their sum in reducing pest damage and crop losses. Also, develop methods for monitoring environmental health (maintaining and encouraging high levels of predators and soil microorganisms) and human health if pesticides are used. Kits are available for determining the level of cholinesterase-inhibiting pesticides to which farmers and applicators have been exposed. Make checklists for farmers to use when applying pesticides that indicate the type of application and safety equipment used, and the rates at which pesticides were applied.