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ENVIRONMENTAL ASSESSMENT

Environmental Assessment and Analysis of Pesticide Use in Banana Reclamation Project as part of Overall Hurricane Reconstruction Project (U.S.A.I.D./Jamaica)

Prepared for: U.S.A.I.D./Jamaica

USAID/Kingston
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Executive Summary

U.S.A.I.D./Jamaica will provide $4 million of low interest loans through which banana growers in Jamaica can rehabilitate plantings following the 12 September 1988 destruction of Hurricane Gilbert. The overall intent of banana reclamation is not solely to replace the production units and farms that existed before Gilbert; rather, it is to seek to fund activities with a high probability of success by investing in current technologies and cost effective production units. Both production credit and technical assistance will be a part of overall banana reclamation. The Jamaica Agricultural Development Foundation (JADF) most likely will be the organization managing farmer loans. U.S.A.I.D./LAC made a positive threshold determination that a high probability of pesticide purchase and use, as part of banana reclamation, existed. Thus, an Environmental Assessment was demanded.

Twenty-one pesticides (or additives) were identified by banana agriculturists as desirable for use under banana reclamation [5 herbicides; 8 fungicides; 2 insecticides; 1 nematicide; 3 with multiple function such as insecticide/nematicide or insecticide/acaricide/nematicide; 1 sprayable oil; and 1 spreader-sticker]. Of the 21 materials, 6 are EPA "restricted use" pesticides and are not recommended for use in the Banana Reclamation Project. These include Chlorothalonil (BRAVO), Ethoprop (MOCAP), Fenamiphos (NEMACUR), Fusilazole (PUNCH), Oxamyl (VYDATE), and Paraquat (GRAMOXONE). Two potential "general use" pesticides [Primiphos-ethyl (PRIMICID) and Tridemorph (CALIXIN)] are not registered by EPA for use on bananas and are therefore not recommended. Finally, one fungicide [Mancozeb (MANCOZEB)] had no established residue tolerances on bananas.

Guidelines are provided to place proviso language in the contract between A.I.D./Kingston and JADF which stipulates that JADF must monitor reasons why farmers take loans under banana reclamation. If such loans directly state or imply use of pesticides, JADF must monitor to insure that pesticides purchased and used are allowable and follow A.I.D. - EPA recommendations.

Two set-asides, for promotion of plant protection and chemical load determination in bananas, are presented. The first [total = $12,544] outlines pesticide use and safety training for 24 Jamaican small banana producers, with the assistance of Jamaican agricultural workers who participated in a 1988 TRAINING FOR TRAINERS course on "IPM and Pesticide Safety". These agricultural workers would then conduct future courses for additional banana producers. The second set-aside [total = $35,500] is aimed at determination of the environmental "chemical load" existing in Jamaica as a result of banana production and is modeled after a similar project completed recently in St. Lucia.

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Appendum 4 (CARDI Report on The Agrochemical Load on Banana Lands in St. Lucia)

Appendum 5 (SOW for Consultant to Conduct EA, Hurricane Reconstruction Project:USAID/Jamaica

LIST OF ACRONYMS AND ABBREVIATIONS

AIBGA	All Island Banana Growers' Association
AID	Agency for International Development
AID/LAC	AID Bureau for Latin America and the Caribbean
ARDO	Agricultural and Rural Development Office
CARDI	Caribbean Agricultural Research & Development Institute
CICP	Consortium for International Crop Protection
CFR	Code of Federal Regulations
EA	Environmental Assessment
EPA	Environmental Protection Agency
ERP	Emergency Rehabilitation Project
FY	Fiscal Year
IEE	Initial Environmental Examination
IPM	Integrated pest management
JADF	Jamaica Agricultural Development Foundation
JBPA	Jamaica Banana Producers' Association, Ltd.
LD50	Lethal Dose, Expressed in Milligrams of Pesticide per Kilogram of Body Weight, Required to Kill 50% of the Pest Population
LOP	Life of Project
MOA	Ministry of Agriculture
MOH	Ministry of Health
OFDA	Office of Foreign Disaster Assistance
PID	Project Identification Document
PPM	Parts per Million
RPAR	Rebuttable Presumption Against Registration (now termed the "Special Review" process)
S&T	Science and Technology
SOW	Scope of Work
USA or US	United States of America or United States
USAID	United States Agency for International Development
WHO/FAO	World Health Organization/Food & Agriculture Organization

BACKGROUND AND RATIONALE (from PID)

Hurricane Gilbert hit Jamaica with tremendous force on 12 September 1988 and created the island's worst calamity this century. Besides major destruction to the island's infrastructure (phone, electricity, etc.), a wide range of agricultural products were left desolated. Immediate disaster relief, via OFDA, and some $20 million from AID assisted the ERP and the re-construction of various infrastructural components. Congress earmarked $35 million in FY 1989 development assistance funds for additional disaster relief under the Post-Gilbert Reconstruction Project.

Jamaican agricultural losses to Gilbert have been estimated at $250 to $270 million US. Like phones and electrical systems, agricultural infrastructures were badly damaged. As a result, the food production capacity in Jamaica has been crippled. Assistance to small farmer tree crops (e.g., cocoa, coffee, pimento and mangoes) could be handled via the ongoing Hillside Agriculture Project. Various policy considerations prevented the financing of sugar, coconuts or citrus systems rehabilitation. The other two major production systems which could be assisted were bananas and poultry, and the present EA is aimed at the rehabilitation of Jamaican banana production.

The intent of banana reclamation is not solely to replace the production units and farms which existed before Gilbert; rather, it is to seek to fund activities with a high probability of success by investing in current technologies and cost effective production units. "Rehabilitation", in this sense, is not mere replacement but signifies modernization, improved efficiency and hopeful improvement over what existed before Hurricane Gilbert.

The agricultural component has two aspects: (1) production credit and (2) technical assistance.. The production credit will be provided as a grant financing to a non-profit financial intermediary with a strong track record in agriculture. This will most likely be JADF. This intermediary would agree to lend funds through a special Hurricane Gilbert Rehabilitation programs, with terms which would differ from normal lending. Upon completion of the Hurricane Project, the lender would be able to re-lend funds on normal terms.

The technical assistance will be for small farmer projects through grants with experienced implementing agencies such as the JBPA. Via both grants (through an intermediate lending institution) and technical assistance, this project cuts across various banana grower farm sizes, economic statuses and production capabilities and thus offers opportunity to not only reconstruct, but to modernize and make more efficient, Jamaican banana production.

Technical assistance and associated commodities would be procured through Handbook 13 grants with JADF and/or the JBPA. Through provision of $4 million to a lending institution such as the JADF, major subsectors in agriculture can be restored. In the case of bananas, the lending program would need complementary technical assistance. It would most likely target up to 1,000 small to medium size farmers in the parishes of St. Mary, Portland and St. Thomas--areas where small farmer production was hurt badly by Gilbert and which are also traditional banana growing regions. Port Antonio, which is the exporting port serving these areas, and the College of Agriculture, which has facilities in the same location, could be used for extension and research.

ENVIRONMENTAL ASSESSMENT (Background & Rationale for EA)

To meet its objectives, the Banana Reclamation Project, will require some pesticides. Bananas (grown commercially only in tropical zones) typically have required protection against a variety of pest species. This project may support operational pest control programs within which pesticides play a major or minor role. It is AID policy to try and use only pesticides that the EPA has registered for "general use" without restriction. In the US, pesticides in the general use category can be purchased and used without special permits. By contrast, "restricted" pesticides present high risks to humans or the environment and can be purchased only by persons who have been certified by law.

Project Location:	Jamaica
Name of AID Project:	Hurricane Reconstruction Project
Funding (LOP):	$35,000,000 ($4 million for banana reclamation)
Life of Project:	18 months
IEE Prepared By:	Charles R. Mathews Mission Environmental Officer
Date:	November 7, 1988
Recom. Threshold:	Negative Determination
Mission Concurrence:	William Joslin, Director November 16, 1988
Bureau Threshold:	Positive Determination John O. Wilson

Of the $35,000,000, the IEE indicates $4 million to be associated with grants to JADF. Within that is the planned work on the Banana Reclamation Project.

Prior to disbursement of AID funds into the Banana Reclamation Project, an Environmental Assessment (EA) for potential pesticide use in the project was required per AID's 22 CFR Part 216, Environmental Procedures, which provides guidance on pesticide use in AID projects. This EA was prepared in accordance with 22 CFR Part 216. It describes the pesticides and handling methods and sets forth procedures to minimize the adverse effects, as specified under Pesticide Procedures, Paragraph 216.3 (b) (1) (i) of 22 CFR Part 216C.

In the EA, the term "pest" includes any group of organisms --insects, bacteria, viruses, weeds, nematodes, snails, slugs, birds, rodents or others -- that adversely affect the production, preservation, or use of agricultural plants (including seed and planting stock) or harvested products. "Pesticide" is any chemical preparation used to kill, repel, mitigate, destroy, or stop the action of pest populations and includes the following: (1) insecticides (to control insects), (2) acaricides (to control mites), (3) herbicides (to control weeds), (4) fungicides (to control fungi, molds, etc.), (5) nematicides to control nematodes -- small roundworms), and (6) rodenticides (to control rodents).

1. EPA Registration Status of the Proposed Pesticides

In the USA, pesticides are registered by the Environmental Protection Agency. The EPA registers a pesticide product in one of two categories: "restricted use" or "general use". A restricted use pesticide is available for purchase and use only by pesticide applicators who have been certified by law. A general use pesticide, by contrast, is available for purchase and use by the general public. It is not AID policy to provide highly toxic pesticides to small farmers or to any agricultural group, regardless of economic, social or educational status, who has not undergone appropriate training and certification. Further, AID does not support the use of pesticides, regardless of toxicity level, that have not been registered by the EPA for use in the crops under consideration in any given project (in this case, bananas).

Tables 1 and 2 present pesticides which Jamaican banana growers were using before Hurricane Gilbert, use now, and desire to continue using under the Banana Reclamation Project. Pesticides listed in Table 1 (save footnoted exceptions) are considered appropriate for use; however, none of the pesticides listed in Table 2 (save one possible excepted formulation) is considered appropriate for use in the Banana Reclamation Project. Each is highly toxic and restricted in the USA. Criteria for determination of pesticide toxicity categories are provided in Table 4, page 17 of this EA.

TABLE 1

Pesticides Available in Jamaica and Proposed for Use in Bananas. Also shown are the EPA Registration Category and Toxicity Category. Signal Words and Specific Toxicities are Listed Elsewhere.

Common Name and (Brand Name)	Toxicity Category	Action	EPA Registration Category
Ametryne (GESAPAX)	III	Herbicide	General
Benomyl (BENLATE)[1]	III	Fungicide	General
Carbofuran (FURADAN)*	II	Insecticide Acaricide Nematicide	General*
Chlorpyrifos (DURSBAN)	II/III	Insecticide	General
Dalapon (DALAPON)	II	Herbicide	General
Glyphosate (ROUNDUP)	II	Herbicide	General
Imazilil (IMAZILIL)	II	Fungicide	General
Mancozeb (MANCOZEB)**	III	Fungicide	General
Primiphos-ethyl (PRIMICID)[2]	II	Insecticide	
Propicanazole (TILT)	III	Fungicide	General
Simazine (GESATOP-Z)	III	Herbicide	General

Table 1, continued.

Spraytex Oil			
Spreader-Sticker (TRITON)			
Thiabendazole (MERTECT)	III	Fungicide	General
Tridemorph (CALIXIN)[2]	III	Fungicide	

*Granular formulations of Carbofuran are not restricted, but all concentrate suspensions and wettable powders 40% and greater are. Furadan 10% granules (10G) are proposed here.

**According to The Pesticide Chemical News Guide: Citrus and Tropical Fruits, June 1, 1989, pp. 200-203, all pesticides listed here, except Mancozeb, have established residue tolerances in bananas. Maneb, a closely related fungicide, does have established residue tolerances in bananas.

[1]Use approved subject to adherance to USA labelling provisions.

[2]Not registered by EPA for use in bananas. Vended by International companies in Jamaica. These should not be used in the Banana Reclamation Project.

TABLE 2

Restricted and/or U.S. Prohibited Pesticides Currently Used in Jamaica Banana Culture

Chlorothalonil (BRAVO), a fungicide**
Ethoprop (MOCAP), an insecticide/nematicide
Fenamiphos (NEMACUR), a nematicide
Fusilazole (PUNCH), a fungicide*
Oxamyl (VYDATE), an insecticide/nematicide
Paraquat (GRAMOXONE), a herbicide

**The type formulation determines whether this pesticide is restricted. The BRAVO 500 formulation is a Category II pesticide with acute oral and dermal toxicities both >10,000 mg/kg. BRAVO 500 is recommended for use in the Banana Reclamation Project. Label restrictions demand that BRAVO 500 be applied only through an irrigation system, making it of questionable utility in Jamaica (especially for small farmers).

*According to The Pesticide Chemical News Guide: Citrus and Tropical Fruits, June 1, 1989, pp. 200-203, all pesticides listed here, except Fusilazole, have established residue tolerances in bananas.

Primiphos-ethyl (PRIMICID) and Tridemorph (CALIXIN) [Table 1] are potential General Use pesticides; however, neither has been registered by the EPA for use in bananas. Thus, these 2 pesticides should not be used in the Banana Reclamation Project. Jamaica's Pesticide Advisory Commission (MOH) is aware that PRIMICID and CALIXIN have not been registered by the EPA and that pesticides listed in Table 2 are RESTRICTED USE pesticides.

The structure of the Banana Reclamation Project is such that two organizations (AIBGA and JBPA) will be recipients of loans for replacement, expansion and improvement of banana plantings. AIBGA has classically represented small farmers and has had to depend upon the Jamaican government for monies to make available to small farmers as loans or to purchase inputs at wholesale prices. In contrast, JBPA is an international investment corporation which, relatively speaking, is capital rich and can purchase inputs and/or make loans to banana farmers. JBPA has recently encompassed some small farmers and is seeking to expand its "small farmer influence" under the Banana Reclamation Project. The relevant point is that the JBPA and its large holder clients represent more sophisticated use of pesticides. They have (and more often properly use) safety equipment & clothing for applicators, receive routine in-field training from experienced crop protection specialists, etc. AIBGA clients represent small farmers with classical lack of capital to purchase safety equipment or obtain certifiable training in pesticide safety. AID/S&T/Washington will follow its stated policy and, per 22 CFR Part 216, avoid the use of restricted pesticides. AID/Kingston would be responsible for monitoring use patterns and verifying training and use of safety equipment when any pesticides are used. Training for the small banana farmers is discussed in a later section of this EA.

Paraquat is used widely in Jamaica, and there is no known substitute per se. A partially effective alternative is the herbicide glyphosate (ROUNDUP). Use of glyphosate would greatly reduce the hazards (see Table 3, page 16 for comparison in toxicity between glyphosate and paraquat). Research in Cook Islands (South Pacific) has shown that, when mixed with the common fertilizer urea, glyphosate is effective at reduced rates and therefore less costly. This AID project affords an opportunity to test this approach in Jamaica and to seek other cost effective alternatives, both chemical and non-chemical, to paraquat and other pesticides that present high risks. While labor intensive, hoeing, mulching, etc. may present viable options for small farmers. The other pesticides listed in Table 2 (one possible exception in footnote **), are highly toxic and cannot be used in the USA without a restricted use permit. Holders of such permits had to undergo special training and certification. Again, it is AID policy not to provide highly toxic or unregistered pesticides to small farmers -- nor to others who have not had appropriate training and certification.

The old RPAR process is now designated as "Special Review" to gather information and stimulate public debate about a pesticide being scrutinized because of supposed adverse effects on human health or the environment. If at the end of this process the risks are found to outweigh the benefits, the pesticide may be cancelled (banned) or greatly restricted in the USA. All the pesticides listed in Tables 1 and 2 have been (or currently are being) submitted to further data collection on such criteria as chronic effects, ground water contamination, effects on non-targets, etc. The EPA Office of Pesticide Programs (TS-767C), as of September 30, 1988, issued its "Status of Chemicals in the Special Review Program, Registration Standards Program, Data Call-in Program, and Other Registration Activities" report (1988). All pesticides in Tables 1 and 2 were in that report. As of this writing, however, none have been cancelled. AID/S&T/Washington will be the final authority on the 1989 status of all pesticides listed in this report.

This project will sponsor an effective training component on pesticide safety and will, via proviso language in JADF loan arrangements, insist that purchase and use of protective equipment and clothing be a stipulation to anyone taking loans from JADF where pesticides are to be used. In addition, the project will provide considerable technical assistance in pesticide management to seek safe, cost effective pesticide application methods.

As stated in footnotes (Tables 1&2), all but two of the pesticides listed have received values for "residue tolerances". A residue tolerance is the amount (expressed in parts per million) of pesticide that may legally and safely remain in or on any raw farm products at the time these products are sold for consumption by humans or livestock. Another aspect of this project is the opportunity to promote the

effective technical ability of the Jamaican government to be able to monitor residue tolerances in bananas (and thus the capability in other export crops, too). This would appear critically important in such capital intensive, export oriented crops as bananas.

2. The Basis for Selection of the Proposed Pesticides

After discussions with USAID/Jamaica staff, Janice Reid (CARDI), Ann Lewis & Michael Ramsay (JBPA), Mr. Glenton Cole (small banana farmer, Portland Parrish), Mr. Harry Percy & Mr. Brian Crosby (general manager & agricultural officer, respectively, St. Mary Banana Estates, Ltd., St. Mary's Parrish), Ms. Jean Dixon (Director, Jamaica Banana Board), Mr. Nicky Jones (Managing Director, Eastern Banana, Ltd.) and Mr. Seymore Stewart (AIBGA), the lists in Tables 1 and 2 were prepared. All pesticides listed in Tables 1 and 2 are currently used in bananas in Jamaica. Not all are promoted by the Banana Board, AIBGA and JBPA; however, all are used in bananas. All are registered for use in Jamaica, are locally available and are effective. Those pesticides listed in Table 2 are currently available, but are considered too toxic for use in this project.

3. Extent to which the Potential Pesticide Use is Part of An Integrated Pest Management Program

Reliance on pesticides alone is expensive and rarely gives lasting control. Pests often become physiologically or behaviorally resistant to pesticides used extensively. Such resistant strains offer serious consequences to both farmer and the general public. Resistance is most likely to occur in areas where sole reliance is placed on pesticides and the use is heavy.

Experience worldwide has shown that the best way to avoid pest resistance and also to increase and sustain agricultural production is to employ a variety of control tactics, including biological (predator, parasite and pathogen natural enemies of pests), genetic, physical and legislative. This multi-tactic, balanced approach is termed integrated pest management (IPM).

Under IPM, crops are regularly monitored (called "scouting") for presence of pests, natural enemies and other factors which may influence a decision concerning a control measure. Pesticides are applied only if pest populations have exceeded unacceptable density levels and there is reasonable assurance that pesticide use will be profitable and non-disturbing to the environment.

It is AID policy to promote IPM. In a February 18, 1988 report (see Appendum 1) of the Committee on Health and Environment & The Conservation Foundation (on behalf of USAID),a list of 6 conclusions and 6 associated recommendations were made as "Opportunities to Assist Developing Countries in the Proper Use of Agricultural and Industrial Chemicals". Recommendation 3 (page 8) states "AID should increase its use of Integrated Pest Management (IPM) significantly, with the goal of making IPM its primary pest management approach. Achieving this goal will require improved implementation and more support for research and training, and would have a catalytic effect on other donors."

The IPM concept is having some impact in Jamaican agriculture. Multi-tactic approaches can now be found in bananas. Removal of disease infected plant parts from banana plantings and physical barriers over fruit bunches to protect against thrips are examples of cultural controls. In reality, however, Jamaica banana producers have few problems with insect pests. Some thrips damage does occur but is tolerable and does not "show" on ripened fruit. In addition to the thrips, banana stalk borers are a problem. There is published evidence (Stephens, 1983, see Appendum 2) that biological control can be used effectively in bananas. Relative to insects, overuse of pesticides caused resurgence of pest populations which diminished after a reduction in insecticide usage.

The major pest problem in Jamaican bananas is from Yellow Sigatoka. Note that most of the pesticides listed in Tables 1 and 2 are fungicides which are used extensively to control this pest problem. Planting resistant banana varieties is a potential alternative to fungicides. Jamaican banana growers could be encouraged to import and screen banana suckers for their resistance to Yellow Sigatoka. This project

can stimulate such efforts. Cultural practices of "clean fields" have been effective against many plant diseases, and this practice is an integral part of at least the larger banana holdings in Jamaica. Currently, however, the mainstay of plant disease control in Jamaican bananas is the use of fungicides.

Sigatoka resistance to fungicides has been a serious problem in bananas in various parts of Latin America. "Pesticide Management" (resistance management) schemes are required to counter the problem and usually involves rotating sprays between fungicides that have somewhat different modes of action (ways they kill fungi). Fungicide rotation usually lengthens (sometimes over long periods) the effectiveness of the mainstay fungicide (in Jamaica, the mainstay is Benomyl). Larger producers now practice this resistance management and ad hoc (not routinely or systematically) monitor both weather and banana plants for determination of when to spray. Under dry weather, the next time for application may be skipped if no signs of Yellow Sigatoka appear. Routine analysis of Yellow Sigatoka for signs of resistance to frequently used fungicides should be an integral practice in Jamaica. An anticipation (rather than a hindsight awareness) allows proper action to be taken in timely fashion.

The Scope of Work (SOW) that preceded indicated that the EA should be planned with reference to the recent DOMINICA BANANA COMPANY PROJECT (AID Project Number 538-0083). The two projects appear, however, to be quite different. While both projects are aimed at re-vitalization of bananas, the Dominica Project Paper and its associated EA focus exclusively on fungicides and oils usable against Sigatoka. No list of pesticides is provided in the EA, and normal tables containing EPA Registration Status, Signal Words, Pesticide Activity and oral & dermal toxicities are missing. No training was indicated, as the determination was that all application would be performed by experienced pilots working for private companies.

The situation in Jamaica is different. Individual farmers, in addition to private companies, will be involved. The banana pest complex in Jamaica differs from the banana pest complex in Dominica. Various types of pesticides will be used in Jamaica, and training (for small farmer clients) will be an essential ingredient of the Jamaica Banana Reclamation Project.

At best, only ad hoc (haphazard) monitoring of pest levels presently occurs in Jamaican bananas. Lack of information on pest infestation levels does not permit the timely use of pesticides. Ad hoc monitoring has "worked" (especially during extended dry periods) in Jamaica because the more virulent Black Sigatoka is not present in Jamaica. In Central America (where Moko disease and Black Sigatoka are major problems), many banana plantation managers must supervise teams of agronomos who rove routinely throughout orchards, remove trees infected with Moko disease, dip machetes in bactericidal solutions between cuttings and burn infected plant parts. Control of Black Sigatoka demands intensive use of fungicides and calculated "resistance management" to avoid resistance of diseases to fungicide use. Jamaica may well get Black Sigatoka and/or Moko Disease in the future. Producers need to be prepared to deal with them. Mere fungicide "resistance management" will not be sufficient should Moko Disease arrive in Jamaica. This project should encourage and support increased, routine scouting of Jamaican banana plantations in a systematic fashion. Increasing banana grower sensitivity to the need for routine, systematic monitoring of pest levels will be excellent preparation for future problems, will more efficiently detect arrival of new pest species and will increase the effectiveness of fungicides used against the now present Yellow Sigatoka and other pest species.

Past experience in AID projects show that increases in use of the IPM approach can only be accomplished by budgetary "set asides" so that, within the term of the project, there is assurance that needed testing and technical assistance will be accomplished. Short term technical assistance from plant protection specialists in the USA, in a collaborative effort with local plant protection scientists, is considered to be a key part of the process. Only in this way can there be assurances of longer term success. Relative to bananas, the pest management activities should focus, at a minimum on:

a) identification and screening of new banana varieties with resistance to current and potential pest problems

b) increased capabilities at routine, systematic monitoring of bananas and summarization of such sampling data

c) identification, training and use of appropriate personnel to work in bananaculture

d) training of workers and farmers in proper and safe use of pesticides, including calibration of application equipment, label understanding, safety, application equipment maintenance, and Jamaican laws governing pesticides

e) sensitization of farmers as to advantages of an integrated pest management program

f) increased capability to monitor banana fruit for residues of pesticides, an element of ever increasing importance worldwide for export crops

g) quantification of the "agrochemical load" in Jamaican bananas--both for information in bananas and as a model for future studies in a wide variety of Jamaican crops

The nature of this project, however, is such that the LOP is only 18 months. Insufficient time exists to establish extensive research and education programs. Paramount in importance, however, is the training of pesticide users. In this area, the Banana Reclamation Project could have a lasting effect on Jamaican agriculture.

A TRAINING FOR TRAINERS course on "Integrated Pest Management and Pesticide Safety" was held (15-23 April 1988) at the Ministry of Agriculture's Twickenham Park Training Facility, Jamaica. Appendum 3 presents the flysheet of the training manual developed for the course, course itinerary, and a trip report filed with CICP and AID that included an evaluation of the course. Also included is a list of the course's 28 participants. Interestingly, none of the 28 trainees came from the Banana Board or any agricultural activity overtly associated with banana production. The present project affords AID and Jamaican agriculture an opportunity to train Jamaican banana farmers and banana pesticide applicators and, at the same time, utilize Jamaicans who have previously undergone technical training in IPM and pesticide safety. Such a course would provide the "multiplier effect' used as justification for the training outlined in Appendum 3 which was conducted following 1986 EA's for AID's Agricultural Research and Hillside Agriculture projects. Such training would appear feasible, cost effective, timely and much needed in the present Banana Reclamation Project and offers promise to produce a cadre of trained banana workers at a time when bananaculture is being reconstructed in Jamaica. The following project funds should be allocated for the training.

Technical Assistance (from USA)

20 person-days @ $260/day ..... $ 5,200

Travel/Per Diem (based on round trip air

fare to Jamaica and $106/day for 10 days) .... $ 2,260

Materials (preparation/duplication of training

materials and field guides) ..... $ 1,000

Per Diem for Jamaica Participants

(4 x 7 days x $25/day) ..... $ 700

Indirect Cost to USA Institution

40% on $8,460 ..... $ 3,380

TOTAL TRAINING COSTS $12,544

The April 1988 course (Appendum 3) produced 28 trainees. The above budget calls for utilizing four of these individuals to assist in two field oriented training courses aimed at small banana producers in Jamaica. This budget would allow 10 days preparation of training field exercises and any written materials and allow up to two USA trainers to be in Jamaica for a total of 10 days (five days each). Proposed are two, 3 day training sessions at sites to be selected by Jamaica agricultural workers so as to be central to various groups of small farmers. Emphasis would not be on classroom activities; rather, emphasis would be on experiential field demonstrations and training in pesticide label reading, use of safety equipment, back-pack and mist blower calibration, etc. This would be very much a "hands-on" training session. If banana extensionists were present, useful written materials could be shared which, in turn, could be used by those extensionists to tailor future training materials for Jamaican farmers. This emphasis on small banana farmers stems from awareness that workers on large banana company plantations receive in-field training, have access to safety equipment and are monitored by agricultural managers. Small farmers, typically, do not have access to proper safety equipment.

The idea is to hold initial training for 24 farmers, using two lead trainers and four Jamaicans who participated in the 1988 course. Then, the four Jamaicans could hold additional training sessions (without foreign assistance) using the techniques and materials produced for the 1988 course and THIS course. In this way, a wider array of farmers would receive training.

This budget also assumes that AID, in collaboration with appropriate Jamaican agricultural organizations, would provide the following for each of the two, 3 day training sessions: (1) one full set of complete protective clothing (suit, boots, masks, gloves, etc.); (2) completely functional back-pack spray system with variety of nozzle fittings; (3) a range of pesticides (which are unmixed); (4) a completely functional mist blower with all fittings and power (either self-propelled, tractor pulled, etc.); and (5) source of water, mixing containers and at least two functional stop watches.

A second "set-aside", pertaining to determination of total "agrochemical load" in Jamaican bananas, is discussed under part 12 of this EA (The Provisions made for Monitoring the Use and Effectiveness of the Pesticides).

It is strongly recommended that this project set aside a total of $12,544 (above) + $35,500 [part 12 of this EA] (total = $48,044) for the training and pesticide assessment outlined. The long term pay-offs would appear high for a mere fraction of project funds.

4. The Proposed Methods of Application, Including Availability of Appropriate Application and Safety Equipment

Pesticides will be applied in the following ways: (1) back-pack sprayers for herbicides and some soil fumigants, (2) in-field mist blowers for fungicides, (3) aerial application of fungicides, and (4) soil incorporation of granular pesticides.

Applicators working for large companies have access to protective clothing. Small farmers either do not have access to such protection or do not typically use it. The nature of the Banana Reclamation Project is that there are no project personnel per se. This program is a loan program, allowing farmers to re-construct and expand acreage of bananas destroyed by Hurricane Gilbert. Thus, the typical statement of EA's that "this project will provide and enforce the use of all appropriate protective devices and clothing for project personnel" is meaningless in this particular case. This project should insist that each small farmer utilizing the loan availability be required to purchase protective clothing, noting that he or she will be monitored by appropriate project management (or extension agent) for its use. While such monitoring will be difficult to manage, the Project Manager's responsibility is to see that pesticides are transported, stored, mixed, applied, and disposed of properly as specified on the pesticide's label. Further, the Project Manager should derive methods for increasing the probability that (especially) small farmers obtain and use protective clothing during pesticide application. Proviso language in the JADF grant from AID will stipulate that JADF must monitor the reasons farmers are taking loans and, when such loans imply or directly state the use of pesticides, JADF must monitor to see that no restricted use pesticides are purchased with loan monies. Such monitoring also can determine farmers eligible for training on pesticide use and safety.

The Project Manager will see to it that the project follows the principles of safe pesticide management as outlined in "The World Bank Guidelines for Selection and Use of Pesticides". From time to time, the Regional Bureau Environmental Officer will provide to the mission current AID/W interpretations of these guidelines. Based on appropriate label statements on the pesticide pack, the Proejct Manager will enforce all recommendations, rates and frequency of application, time of application, and the number of days before harvest the pesticide may be applied. Failure to meet label standards will be grounds for the Project Manager's cancellation of specific grants (loans) or contracts let under the auspices of this project.

Pesticides should be stored in their original containers in a facility specifically designed for that purpose. The facility should be locked with keys assigned ONLY to authorized personnel. A sign reading "DANGER: PESTICIDE STORAGE AREA" should be posted. Enforcing this for small farmer clients will be difficult, but should be a part of the Project Manager's mandate. Pesticides should never be stored near food, animal feed, animals or drinking water. The storage place should be in an area protected from tropical storms and fire hazards. Recipients of reconstruction loans from this project should be advised of these regulations and informed they will be routinely monitored for adherence.

Empty containers should never be reused - there is no practical method for removing all of the toxic residues

Liquid containers should be treated as follows: empty the container's content into the spray tank, drain in a verticle position for 30 seconds. Refill the container 1/4 full, rinse and pour into the tank, drain. Repeat rinsing and draining three times. Use the rinse water in the sprayer. Punch several large holds in the container's bottom. Bury the container in a designated land disposal site on high ground away from water.

Containers and small quantities of leftover pesticides should be buried in pits in the soil about 1/2 meter deep. Bottoms and sides of the pits should be lined with lime, carbon, charcoal, or organic matter such as leaves, straw or other plant debris. Any of these materials is a good absorbent and facilitates breakdown of the chemical. The pits should be refilled and mounded above ground level with the soil. Empty paper containers and bags also should be buried in similar burial pits. The project will initiate an intensive training program in pesticide safety and management for at least the small farmer recipients of loans under the Banana Reclamation Project.

5. Acute and Long Term Chronic Hazards, either Human or Environmental, Associated with the use of Pesticides and Measures Available to Mitigate the Hazards

All pesticides are potentially hazardous to humans and the environment and should be treated with caution regardless of their relative toxicity. The potential health hazard depends on the toxicity and the amounts swallowed, absorbed or inhaled. the relative toxicity of a pesticide can be found by examining its LD50 value which is the amount of the chemical necessary to kill 50% of the test animal population (usually laboratory rates, but sometimes rabbits and/or guinea pigs). It is expressed in the weight of pesticide per unit weight of body (mg/kg) when swallowed (oral toxicity), absorbed through the skin (dermal toxicity) or inhaled. The latter value, inhalation toxicity, is usually expressed in parts per million per unit volume of air.

Pesticides with the lowest LD_{50} values are potentially the most toxic to humans. Ingestion of just a few drops to a teaspoon of a pesticide with an oral LD_{50} value of less than 50 might be sufficient to kill an adult person. An adult would probably have to consume 16 tablespoons or 1/2 kilogram or more of a pesticide with an oral LD_{50} of 5,000 before dying. However, the pesticide's formulation, percentage active ingredient, and other factors determine its actual hazard level. Rodenticides (rat poisons), for example, have low oral toxicity values but would be considered only moderately hazardous to humans because their pellet formulations contain only about 2% active ingredients.

Acute oral and dermal LD_{50} values of the proposed pesticides are shown in Table 3. Acute toxicity results from a severe case of poisoning due to a single dose of exposure to the pesticide. Oral and dermal toxicities of the six restricted pesticides (from Table 2) are also shown in Table 3. While they are not recommended for use in the Banana Reclamation Project, their toxicities can be viewed in Table 3.

Table 4 shows EPA's "signal word" for each proposed pesticide. These words have been assigned by levels of toxicity and appear on the labels of EPA registered pesticides. Table 4 gives criteria for signal word designations. Pesticides assigned the signal word "DANGER" are highly toxic compounds and are not recommended by EPA for general use. Materials showing the words "WARNING" or "POISON" also present a high potential hazard to the user.

As noted in section 1, all of the pesticides in Tables 1 and 2 have undergone (or are undergoing) further data collection by the EPA. For example, Benomyl (BENLATE) is suspected of causing reduction in non-target animal populations, causing mutagenicity (genetic mutations), teratagenicity (birth defects), causing reproductive effects in humans and of being a hazard to wildlife. National Technical Information Service (NTIS) notice #PB83-148189 "requires use of either cloth or commercially available disposable dust masks by mixer/loaders of benomyl intended for aerial application...". Further data collection on some of the pesticides in Tables 1 and 2 has been completed and conclusions have been to "defer requirements to standard". Others are mid-process in the collection of groundwater contamination data, chronic data or some other facet. As stated earlier, none have been cancelled (banned) as of this writing.

The proposed pesticides are generally non-persistent and, if used in accordance with their labels, should present no unusual hazards to the natural environment (see Section 7). This project will share with the Pesticide Advisory Commission (Ministry of Health) information concerning toxicity of pesticides and procedures for mitigating hazards.

TABLE 3

Toxicity of Pesticides Available in Jamaica and Proposed* for Use in Banana Reclamation Project

Common Name and (Brand Name)	Acute LD50 Oral	Acute LD50 Dermal	EPA Signal Word
Ametryne (GESAPAX)	1,750	>10,000	CAUTION
Benomyl (BENLATE)	>10,000	>10,000	CAUTION
Carbofuran (FURADAN)	11	10,200	WARNING/DANGER**
Chlorpyrifos (DURSBAN)	96-270	2,000	WARNING/CAUTION
Chlorothanonil (BRAVO)*	>10,000	>10,000	WARNING/DANGER
Dalapon (DALAPON)	970(tech) 7,570(salt)	----	WARNING
Ethoprop (MOCAP)*	61.5	2,000	WARNING/DANGER
Fenamiphos (NEMACUR)*	5	80	DANGER
Fusilazole (PUNCH)*[2]	1,110	> 2,000	DANGER
Glyphosate (ROUNDUP)	4,300-4,900	----	CAUTION
Imazilil (IMAZILIL)	------	----	WARNING
Mancozeb (MANCOZEB)[2]	11,200	>15,000	CAUTION
Oxamyl (VYDATE)*	37	2,960	DANGER
Paraquat (GRAMOXONE)*	150	----	DANGER
Primiphos-ethyl (PRIMICID)[1]	192	1,000-2,000	WARNING
Propicanazole (TILT)	1,517	> 4,000	CAUTION
Simazine (GESATOP-Z)	>5,000	> 3,100	CAUTION
Spraytex Oil	------	----	-------
Spreader-Sticker (TRITON)	------	----	-------
Thiabendazole (MERTECT)	3,100	----	CAUTION
Tridemorph (CALIXIN)[1]	980	----	CAUTION

*From Table 2, a RESTRICTED USE pesticide and should not be used in the Banana Reclamation Project.

**See TABLE 4 for explanation. More than one signal word indicates a difference in formulation (dry vs. liquid) or percentage active ingredient.

**WARNING = granules
DANGER = liquid (liquid formulations cannot be used in this project)

[1]not registered by the EPA for use on bananas

[2]no residue tolerances established for use in bananas

TABLE 4

Toxicity Category of Proposed Pesticides by Hazard Indicator

Hazard Indicators	I*	II	III	IV
Oral LD_{50}	50 mg/kg or less	50-500mg/kg	500-5,000	>5,000mg/kg mg/kg
Inhalation LD_{50}	.2 mg/liter or less	.2-2 mg/liter	2.0-20	>20 mg/liter mg/liter
Dermal LD_{50}	200 mg/kg or less	200-2,000	2,000-20,000 mg/kg	>20,000 mg/kg mg/kg
Eye Effects	Corrosive; corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days;irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No irritation
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours
EPA Signal Word	"DANGER"	"WARNING"	"CAUTION"	"CAUTION"

*The Word "POISON" and also a picture of a skull-and-crossbones appear on the labels of EPA registered pesticides in Category I.

In the case of Mancozeb (MANCOZEB), residue sampling will be undertaken according to established FAO/WHO Codex procedures and arrangements for analysis and submission of data to the FAO Joint Meeting on Pesticides will be made. ST/AGR/AP can provide assistance with sampling protocols, needed steps to obtain FAO/WHO review, and arrange for needed collaboration with pesticide manufacturers. Ultimately, this process should lead to the establishment of Jamaican tolerances. Such procedures will be imperative for export crops destined for foreign markets.

6. The Effectiveness of the Identified Pesticides for the Proposed Uses

The pesticides listed earlier have been evaluated under a variety of conditions including those of the Caribbean region and found to be effective for the purposes intended in the project. However, cost effectiveness of these various materials has not been rigorously tested. This project should encourage analysis of the cost effectiveness and conduct cost/benefit analyses of all inputs into bananas. The aforementioned "set aside" for determination of the agrochemical load in bananas (Appendum 4) would represent a positive step in this direction. AID/Kingston, in collaboration with Jamaican agricultural agencies, might wish to consider additional "set asides" to specially contract this type of work. Such was also suggested in the 1986 Hillside Agriculture and Agricultural Research Projects.

7. Effect of the Identified Pesticides on the Target and Non-Target Ecosystems

The pesticides are generally non-persistent and, if used correctly and according to their labels, should present no unusual hazards to the target or natural ecosystem. Applying higher dosages, shrinking intervals between applications, spraying during windy conditions, storing or disposing carelessly or rinsing equipment and/or containers in rivers would have harmful effects.

Most suggested insecticides (and some fungicides) are toxic to some of the natural enemies and bees, especially if applied at high rates. Thus, populations of natural enemies and bees residing in treated areas would likely decrease. Further, the threat of buildup of genetically resistant strains of insects, plant diseases, weeds and nematodes always exists.

Some of these problems are unavoidable when pesticides are used. Minimal adverse effects result only when pesticides are used in combination with other control tactics in an IPM program and when users are educated to the hazards and proper use of the materials. In cases where pest control is necessary, the project will emphasize to those taking loans for banana reconstruction IPM and pesticide management and, through special training on these subjects, foster a more rational use of the materials.

8. Conditions under which the Pesticides are to be used Including Climate, Flora, Fauna, Geography, Hydrology and Soil

Jamaica lies ca. 500 miles southeast of the USA and ca. 90 miles south of Cuba, lying between the 17th and 18th parallels of latitude. It is the third largest island in the Caribbean, being ca. 146 miles long by 51 miles at its broadest point (ca. 4,411 square miles in area). Jamaica possesses a total population of ca. 2.34 million, the overwhelming majority being of African origin. Minorities of whites, Chinese, East Indians, Jews, Syrians, and nationals of neighboring republics make the remainder of Jamaica's populous.

Mountains cover ca. 80% of Jamaica's surface, with the highest being the Blue Mountains in the island's eastern area. These mountains reach a maximum altitude of ca. 7,402 feet. Climate is humid and tropical (21 - 27 deg. C), rainfall is seasonal (April-June, September-November) and ranges from 50-150 inches/year depending upon location (77 inches/year average). Coastal regions offer sandy beaches and several natural inlets.

Rich soil (70+ soil types) and abundant rainfall make Jamaica well suited for agriculture, and agriculture employees ca. 40 - 50% of the Jamaican populous. Farmers generally have small holdings and limited capital. More than 80% of the land in Jamaica can be classified as "hillside agriculture", and there are >120,000 hillside Jamaican farmers. The typical farm and rural family is composed of ca. 4.2 persons; thus, ca. 1/3 of the island's population depends directly on the small farm sector. Typical crop mixtures are bananas, scattered fruit trees, assorted vegetables, and a subsistence root crop (e.g., yam). Most holdings include some fallow land and livestock.

9. Availability and Effectiveness of other Pesticides or Nonchemical Control Methods

Proposed pesticides, as well as others, are available through commercial outlets in Jamaica.

Use of clean (disease free) planting material, use of field sanitation, constant screening for resistant plant material and other cultural practices can reduce pest severity. Development and use of routine, scientifically-based field scouting can assist in early detection and timely treatment of pest problems. The use of multiple tactics (and routine field scouting) will be crucial in the future if Jamaica becomes infested with insects and diseases far worse than now attack Jamaican bananas. AID should work with the Jamaican Banana Board to vitalize and maintain a scientifically based research program on bananas -- looking for environmentally safe methods of pest control.

10. Jamaica's Ability to Regulate or Control the Distribution, Storage, Use and Disposal of the Requested Pesticides

A large issue in the two EA's performed in Jamaica in 1986 was the fact that the Jamaica Pesticide Control Act of 1975 was not enforced. Such is still the case in 1989. Mr. Lester Woolery (pharmacist) remains chairman of the so-called "Woolery Commission" and has responsibility for governing the importation, sale, distribution, storage, etc. of pesticides. Still, pesticide applicators in Jamaica have no registration procedure and there are no enforced restrictions on anyone obtaining a restricted pesticide (i.e., one which the EPA would label as restricted). Enforcement of pesticide registration, monitoring and certification of pesticide users remains a pertinent issue in Jamaica.

11. The Provisions made for Training of Users and Applicators of Pesticides

Training in IPM, field scouting and safe use of pesticides (including label reading, mixing, safety procedures, storage and disposal) will be supported by this project. It will be aimed principally at small farmers, as they are the ones without routine access to this information in a formal way. Training is detailed elsewhere (Part 3) in this EA.

12. The Provisions made for Monitoring the Use and Effectiveness of the Pesticides

The Project Manager, in collaboration with the Pesticide Advisory Commission, will monitor use of pesticides in the project and insure that they are being handled correctly and safely.

For the fungicides Fusilazole (PUNCH) and Mancozeb (MANCOZEB), pesticide residue analyses will be facilitated and actively promoted by the Project Manager. Conducting residue analysis on this fungicide should be a part of this overall project and can be accomplished in concert with CARDI and UWI facilities where equipment is in place for such analysis.

A second set-aside appears relevant to Jamaican agriculture and is associated with determination of the "agrochemical load" in bananas. Reference was made in 1986 EA's (Hillside Agriculture and Agricultural Research) and in the 1988 training course to the fact that no quantitative studies exist in Jamaica to determine just how much pesticide and fertilizer is used and resides on a per kilogram basis. Dr. John L. Hammerton has performed such studies in St. Lucia bananas (see Appendum 4) with interesting results. Such studies in Jamaica bananas could provide a model for expansion to other crops and establish a much needed database in Jamaica for determination, among other items, of where to monitor for pesticide and fertilizer residues, which agricultural workers need routine acetyl cholinesterase tests for health protection and how much profit exists per crop as a function of unit agrochemical added. This database is lacking in Jamaica and, in fact, in most countries. Jamaica could provide a genuinely useful model to be mimicked elsewhere. This project should set aside the following budget and target expenditures at determination of the agrochemical load on bananas:

M.S. level employee

full time for 1 year	$10,000
travel allowance (car rental, public transport, mileage, etc.) @$1,500 per month	$18,000
1 IBM PC/XT [or equal] (640mb memory, 40 mb hard disk, 2 floppy disk drives, color graphics card, color monitor) + WordPerfect 5.0, DOS 3.1, Lotus 1 2 3 and statistical pkg	$ 6,000
1 printer	$ 1,500
TOTAL BUDGET	$35,500

This budget would dedicate a full time individual for one year to the collection of "agrochemical load" data in bananas. The computer system would allow a self-contained spread sheet and graphics package for data analysis and presentation and could be the central data storage unit for agrochemical load information. While any number of central locations would suffice, housing this individual at CARDI, with its regional mandate, would seem appropriate. Initial housing in the offices of the Jamaican Banana Board, with a move to CARDI for expansion (should such be determined to be appropriate at the end of 1 year) would also be feasible. At the end of a single year, AID and relevant Jamaican agencies could determine the usefulness of such data and either discontinue the study or expand to additional crops. Such information could be shared by computer linkage, by published manuscripts, by memos or via the UWIDITE network as information in formal classes pertaining to agriculture.

C. Requests for Additional Pesticides and/or Information

If the Project Manager or any relevant personnel determine a need for pesticides not in Table 1 or if they need additional information about the pesticides or EA procedures, they should notify USAID/Jamaica. This AID office can contact AID's Bureau of Science and Technology, Office of Agriculture, for any needed assistance. Before any actual use by farmers of pesticides not in Table 1, specific labels and compounds must be reviewed by the Bureau Environmental Officer.

D. Contributions

This EA was prepared by Dr. Carl S. Barfield, Professor of Entomology, University of Florida, as a Consultant to the Consortium for International Crop Protection, College Park, Maryland. The following persons in Jamaica were consulted for information used in preparing the EA:

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Mr. Harry Percy
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Eastern Bananas, Ltd.

Mr. Nicky Jones

Jamaican Banana Board

Dr. Jean Dixon

All Island Banana Grower's Association

Mr. Seymore Stewart

The SOW for preparation of this EA and the EA page numbers on which each item in the SOW may be located are provided in Appendum 5.

APPENDUM 1

The Conservation Foundation

OPPORTUNITIES TO ASSIST DEVELOPING COUNTRIES IN THE PROPER USE OF AGRICULTURAL AND INDUSTRIAL CHEMICALS

Report of the
Committee on Health and Environment

Volume 1

Prepared by

The Committee on Health and Environment
and
The Conservation Foundation

on behalf of the

U.S. Agency for International Development

FINAL REPORT
FEBRUARY 18, 1988

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Affiliated with World Wildlife Fund

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EXECUTIVE SUMMARY

This report examines opportunities to assist developing countries in the proper use of agricultural and industrial chemicals, and in the development and use of safer alternatives. The conclusions and recommendations primarily are based on the Committee on Health and Environment's review of the U.S. Agency for International Development's (A.I.D.'s) role. Many of the conclusions and recommendations are useful for other international development assistance agencies as well.

The Committee concluded that problems in developing countries related to chemicals and pesticides are growing; that A.I.D. has exemplary environmental regulations regarding pesticide and chemical provision and use; and that the Agency needs to take stronger actions to help developing countries ameliorate the adverse side effects of pesticide and chemical use.

CONCLUSIONS

Conclusion #1: Misuse and excessive use of pesticides and chemicals are significant and widespread problems in developing countries.

The use of pesticides and industrial chemicals in developing countries has increased rapidly in recent decades (1). Properly used, these products contribute to economic development, increase productivity in the agricultural and industrial sectors, and improve health and welfare. Improperly used, however, these benefits are reversed and societies incur losses through human illness, environmental damage, and economic costs.

People in developing countries use only 25% of the world's pesticides, yet they suffer half of the acute poisonings reported worldwide and between 73% and 99% of the deaths (2). Pesticide resistance among insect pests is a major problem in developing

countries. It subverts efforts to increase agricultural production and to reduce the incidence of vector-borne diseases. There is convincing evidence that pesticides and chemicals cause substantial damage to forests, fisheries, and other economically important natural resources (3). Finally, rapid industrialization in some parts of the developing world increases risks to humans and the environment from leaks, accidents, and routine emissions during formulation, transport, storage, and disposal of chemicals. Although expensive to correct, effective planning and implementation of laws can reduce these risks.

> Conclusion #2: A variety of interlocking political, economic, health, and environmental factors contribute to and result from the misuse of pesticides and other chemicals.

In developing countries, a number of factors tend to heighten the risks to health and environment as pesticides and chemicals are produced, used, stored, and disposed. Some of these factors are related to economic conditions and government policies. For example, subsidies of pesticides by developing countries, intended to promote agricultural development, often encourage excessive use of pesticides. Other contributing factors include lack of education among workers, many of whom are women and children; lack of information on hazards and alternatives; increased susceptibility of workers to toxins because of generally poor health; and inadequate regulatory policies and enforcement structures.

> Conclusion #3: A.I.D. is constrained by a number of factors in its ability to address the problems of chemical and pesticide misuse. One significant impediment is the inconsistent implementation of environmental policies among U.S. Government agencies operating overseas.

countries. It subverts efforts to increase agricultural production and to reduce the incidence of vector-borne diseases. There is convincing evidence that pesticides and chemicals cause substantial damage to forests, fisheries, and other economically important natural resources (3). Finally, rapid industrialization in some parts of the developing world increases risks to humans and the environment from leaks, accidents, and routine emissions during formulation, transport, storage, and disposal of chemicals. Although expensive to correct, effective planning and implementation of laws can reduce these risks.

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In developing countries, a number of factors tend to heighten the risks to health and environment as pesticides and chemicals are produced, used, stored, and disposed. Some of these factors are related to economic conditions and government policies. For example, subsidies of pesticides by developing countries, intended to promote agricultural development, often encourage excessive use of pesticides. Other contributing factors include lack of education among workers, many of whom are women and children; lack of information on hazards and alternatives; increased susceptibility of workers to toxins because of generally poor health; and inadequate regulatory policies and enforcement structures.

> Conclusion #3: A.I.D. is constrained by a number of factors in its ability to address the problems of chemical and pesticide misuse. One significant impediment is the inconsistent implementation of environmental policies among U.S. Government agencies operating overseas.

Some of the factors that constrain A.I.D. include the differing needs and levels of development of the countries it assists, the difficulty of implementing programs in accordance with multiple U.S. and international policy objectives, administrative difficulties imposed by the Agency's size and global nature, and budget constraints.

Coordination of environmental policies can be particularly difficult with other U.S. agencies that have different mandates. For example, A.I.D. and the Department of Agriculture have recently been involved in a debate over the environmental procedures that should be followed in a Mediterranean fruit fly eradication program in Central America. This and other international programs of the U.S. Government that have environmental implications are guided only by Executive Order 12114, which leaves a variety of key issues unresolved and is vulnerable to being rescinded by a future Administration.

> Conclusion #4: A.I.D.'s environmental and pesticide regulations and policies are exemplary, but the Agency needs to implement them more effectively.

Twelve years ago, A.I.D. instituted its environmental procedures (22 CFR 216). The procedures' purpose was to "ensure that environmental factors and values are integrated into the A.I.D. decision-making process" (4). Since then the Agency has steadily increased its efforts with respect to pesticide and chemical problems in developing countries. For example, it conducts environmental evaluations of proposed projects; avoids providing highly toxic pesticides, especially to small farmers; conducts training programs on safe pesticide use; and funds research on alternative practices. It has also reduced the quantity of pesticides and industrial chemicals it provides through its overseas projects. In the industrial sector, A.I.D. has funded a project to bring U.S. industrial safety experts to visit their counterparts in developing countries. A.I.D.'s policies have set a precedent for other donors, some of which

have recently taken steps to develop guidelines on pesticide use in their own programs.

While A.I.D.'s policies are exemplary, they have not yet been implemented fully. In part this is due to the fact that pesticides and chemicals are readily available from other sources if A.I.D. refuses to provide them or places strict limitations on their use. In part it is also due to the fact that the Agency needs to reconsider various aspects of its regulations and improve its field capability to implement environmentally sound projects. The intensification of agriculture and the rapid pace of industrialization in many developing countries are increasing the risks of chemical misuse and accidents. The Committee on Health and Environment believes that A.I.D. and other international donors will be called on to take stronger actions in the future to help developing countries ameliorate the adverse side effects of pesticide and chemical use.

> Conclusion #5: Promotion of Integrated Pest Management is an A.I.D. policy, and the Agency has initiated some IPM programs. However, IPM is not yet the mainstream strategy of its agricultural and vector control programs, and more empirically grounded research on IPM is needed.

IPM involves the use of a variety of pest control methods, including physical, biological, genetic and other controls, as well as pesticides. In agricultural settings, IPM relies on the concept of an economic threshold of crop damage, below which the cost to control a pest is greater than the benefits of doing so. Integrated disease control is a similar concept that applies to the use of various control methods for insect disease vectors.

While A.I.D.'s policies support IPM as a concept, the Agency tends to use IPM in special projects, rather than integrating it into its general agricultural development and vector control programs.

Conclusion #6: The importance of pollution problems caused by chemical industries is increasing rapidly in many developing countries. A.I.D. is well positioned to help developing countries address these problems because of its long-standing presence in developing countries and its access to U.S. expertise in pollution control technology.

A.I.D. is only one of many U.S. and international organizations with the responsibility to address problems related to the use, production, and disposal of chemicals. Further, the Agency's size and budget require that its role be limited. Nonetheless, the Agency's long-standing relationships with institutions and individuals in developing countries, its position as an influential international donor, and its policy commitment to environmentally sound development allow it to have an important influence. A.I.D.'s ability to assist developing countries by drawing on the United States' private and public sector capabilities in pollution control are another asset.

RECOMMENDATIONS

The six recommendations in this report anticipate the demands of the future, while drawing on lessons learned in the twelve years of A.I.D.'s experience with its environmental regulations and policies. Combined, the picture that emerges is one of multiple opportunities for both A.I.D. and the rest of the international development assistance community to make a decisive contribution to the mitigation of damages from pesticide and chemical misuse. The recommendations suggest that the Agency expand its influence by working with other groups, and enhance the effectiveness of its own development assistance programs. However, A.I.D., and particularly the Missions located in host countries, should continue to take the lead in choosing, from among the many identified problems, those that most need to be addressed in their specific countries.

The Committee expects that modifications in A.I.D.'s programming and administration of its resources, rather than budget increases, are necessary to implement most of these recommendations. The interested reader should consult chapter 3 of this report for more details regarding specific examples and implementation suggestions.

> Recommendation #1: **A.I.D. and other donors should work to strengthen and increase the number of constituencies in multiple sectors and levels of society which actively support safe and environmentally sound use of pesticides and industrial chemicals in developing countries.**

As noted earlier, pesticide and chemical problems are complex and interlocking; they have economic, environmental, and political dimensions that cut across agricultural, health, and other sectors. Therefore, any viable strategy for addressing them must enlist the support of groups in all these sectors. Influential groups ("constituencies") for safe and sustainable uses of chemicals and pesticides include host-country governments, industries, nongovernment organizations, the research community, U.S. agencies, and international agencies. Such groups can conduct and support a wide range of constructive activities, and working with them is consistent with the Agency's overall commitment to build institutions and human resources in developing countries. Examples of activities that A.I.D. can help constituents to undertake include educating the public, training workers, modifying national or state policies that may encourage overuse, studying ecological effects of farming practices, providing technical assistance, and implementing or monitoring international guidelines.

> Recommendation #2: **A.I.D. should enhance the effectiveness of its agricultural and health programs that affect or involve pesticide or chemical use.**

Actions to enhance the effectiveness of A.I.D.'s own assistance programs that relate to the problems of chemicals and pesticides should be a priority because A.I.D.'s greatest opportunity to effect change is through the activities it controls directly. Furthermore, A.I.D.'s credibility -- and thus its influence with other constituencies -- is enhanced by demonstrated examples of success at achieving development objectives while minimizing adverse ecological and health impacts.

Particular actions the Agency should take include the following:

- Improve the capability of its professional staff to address environmental issues.

- Expand efforts to obtain the perspectives of project beneficiaries, and evaluate projects for environmental consequences.

- Reduce the administrative burden (though not the thoroughness) of its environmental and pesticide procedures.

- Consider increasing the share of its budget allocated to projects designed specifically to address pesticide or chemical problems in the agricultural and health sectors.

- Strive to apply its environmental regulations and pesticide policy in Agency-supported projects in which pesticides and chemicals are provided by non-Agency sources, e.g. where A.I.D. is a minor donor to a multi-donor effort.

- With the assistance of an advisory group, reconsider whether or under what conditions providing safe

pesticides through nonproject assistance might increase the Agency's ability to promote proper use of pesticides. (This might be the case because there is substantial evidence that other countries readily provide pesticides when the U.S. will not.)

Recommendation #3: A.I.D. should increase its use of Integrated Pest Management (IPM) significantly, with the goal of making IPM its primary pest management approach. Achieving this goal will require improved implementation and more support for research and training, and would have a catalytic effect on other donors.

The Committee and other experts agree that IPM and integrated disease control, if properly managed, are more sound from an economic, agricultural, public health, and environmental perspective than approaches that use chemicals as the primary means of control. Moving IPM from the demonstration phase to the general approach used by A.I.D. and other donors is now critical.

Bringing IPM into the mainstream of the Agency's activities, and indeed, making it a higher priority for all international donors, will require A.I.D. and other donors to support more training and research. Training might be targeted at other trainers, for example, agricultural extension workers in host countries. Research must be supported at a higher level; one good way to do this is to conduct agricultural development projects such that scientifically useful information on IPM will be obtained. Attention should be paid to designing projects with longer timeframes, collecting data from control plots that use chemical-intensive methods, developing economic thresholds for more crops, and evaluating all projects from both a technical and a sociological standpoint.

Recommendation #4: In cooperation with other U.S. agencies and the private sector, A.I.D. should prepare a long-term plan for its role in preventing and mitigating problems associated with activities involving industrial chemicals in developing countries.

A.I.D. and other international donors are increasingly being called on to assist developing countries to ameliorate problems resulting from their rapidly expanding use and production of industrial chemicals. For example, the Agency can help develop accident contingency plans, assist in identifying and cleaning up hazardous wastes, and train industrial workers in occupational health and safety. Because the situation is complicated by the social and economic differences between the three main geographic areas of the developing world, and because A.I.D.'s resources for such activities are likely to continue to be limited, a long-term plan will help target the Agency's resources and maximize their impact.

Recommendation #5: A.I.D. should report to Congress every two years, beginning in 1989, on its progress toward implementing the recommendations in this report and on future opportunities to address pesticide and chemical issues in developing countries.

The Committee believes that the issues raised in this report are sufficiently important to merit discussion in broader U.S. Government policy-making circles.

Recommendation #6: Congress should provide clear policy guidance to U.S. Government agencies regarding the provision to, and use of, agricultural and industrial chemicals in developing countries. The Executive Branch should then implement that policy in a consistent fashion.

The efforts of all U.S. agencies internationally would be more successful and cost-effective if they were governed by consistent policies regarding the provision and use of chemicals to developing countries. A number of examples of inconsistencies have arisen over time, some of which cannot be satisfactorily resolved by agencies that have different mandates. Therefore, the Committee recommends that Congress direct the Office of Technology Assessment (OTA) to study the problem, and then draw on OTA's findings to provide clear policy guidance. The Executive Branch should then coordinate activities and approaches so that the policy is implemented in a consistent fashion.

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Ecological upset and recuperation of natural control of insect pests in some Costa Rican banana plantations[1]

Resumen. Los ecosistemas en el suroeste de Costa Rica cambiaron drásticamente después de que se desarrollaron las plantaciones bananeras. Excepto por el daño causado por 2 insectos, el daño causado a las plantaciones bananeras por especies potenciales de plagas nativas fue mínimo antes de que se aplicaran insecticidas. Después que se iniciaron los tratamientos con insecticidas en los años 1950's aparecieron nuevas plagas en cantidades devastadoras. Se estudiaron la parte bionómica, los controles naturales y químicos de las plagas. Parásitos y predadores de las especies de las plagas presentes fueron fácilmente colectados en áreas no tratadas, pero los agentes de control natural fueron suprimidos en las plantaciones de banano rociadas con plaguicidas. En 1973 todas las rociaduras con insecticidas fueron canceladas. Rápidamente las plagas disminuyeron. En un período de 2 años, un ecosistema balanceado en las áreas bananeras fue restabilizado otra vez y muchas plagas prácticamente desaparecieron. Luego de 10 años se ha obtenido un eficaz control de estas plagas por medios naturales, sirviendo ahora como modelo, demostrativo de la confiabilidad de tal estrategia.

Banana plantations were developed by the United Fruit Company during the 1940-50's in alluvial plains north and east of Golfo Dulce in southwest Costa Rica. Prior to 1938, this area was a virgin wilderness of evergreen lowland forest with almost no human habitation (1). According to L. R. Holdridge's classification of life zones, the zone was a tropical wet forest

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1 Project developed when the author was Experimental Director for Compañía Bananera de Costa Rica, Golfito, Costa Rica.

(11). Gros Michel bananas were planted in the Rio Terraba-Rio Sierpe Valley near Palmar, the Rio Esquinas-Rio Piedras Blancas area, the Coto Valley, and the Colorado-Laurel District along the Panama border near Rio La Vaca and Rio Colorado. Heavy rainfall occurs in these zones between April and December but a dry season persists during January through March. Annual rainfall averages 3 593 mm in Palmar, 5 354 mm in Piedras Blancas-Esquinas, 3 712 mm in Coto and 3 237 mm in Laurel along the Panama border. When the last virgin soils were planted with the Cocos variety of banana in Coto in 1962, approximately 30 000 hectares of forest had been felled during the previous 2 decades for banana production. Within 5 years after planting, many of these cultivations were abandoned because of Panama disease, *Fusarium oxysporum* Schlecht. f. sp. *cubense* (E. F. Smith) Snyder and Hansen.

The banana plantations represented a drastic ecological change from a climax forest ecosystem to a monoculture crop. Once banana plantations became established, a new ecosystem evolved. Within this new ecosystem, native potential insect pests were kept in balance by natural control agents. Thus, insect damage to bananas was minimized up to the mid-1950's.

Before the mid-1950's, only 2 insect species were considered economically important. The banana corm weevil, *Cosmopolites sordidus* Germar, was introduced in banana corms shipped in for plant propagation. Larvae cause damage by boring into the corm. The species is present throughout banana-growing areas of the world (15, 19). A native thrips, *Chaetanophothrips orchidii* (Moulton), a parthenogenic species, causes a "red rust" blemish on the peel of the fruit by feeding between adjacent banana fingers (15, 16, 20). Attempts to control these 2 pests in the 1950's resulted in drastic ecological upsets which set off a chain reaction of unfavorable events that lasted into the early 1970's.

Cause and effect

The mass application of dieldrin granules in 1954 by airplane over 12 000 hectares of bananas for the control of the red rust thrips resulted in rapid and complete control. Dieldrin spray and granules were also applied to the base of banana plants for controlling the banana corm weevil. Within a few months after dieldrin granules were applied by air, an epidemic of the banana stalk borer, *Castniomera humbolti* (Boisduval), suddenly appeared and resulted in heavy losses. This lepidopterous larva bores through the pseudostem and weakens the trunk (3, 12). Similar epidemics of *Castniomera* on the Atlantic coast of Costa Rica were reported by Lara (12, 13, 14). Another lepidopterous pest, *Platynota rostrana* (Walker), suddenly appeared and caused great losses of fruit by feeding between banana fingers (2, 17).

Before 1958, Sigatoka leaf spot, *Mycosphaerella musicola* Leach, was controlled with Bordeaux spray, a copper sulphate-lime mixture, which was sprayed onto the leaves from the ground at high volumes every 7 days (23). Several studies suggested that Bordeaux spray partially inhibited the development of several defoliators (17, 24, unpublished data). In 1958, high volume Bordeaux spray was replaced by low volume fungicidal orchard oil sprays applied by air (23). Dieldrin was added to aerial oil spray for the control of red rust thrips. Previously, dieldrin and other chlorinated hydrocarbon pesticides were sprayed onto the fruit through a Sigatoka hose spray system (24).

During 1954-58, severe ecological damage to the banana ecosystem resulted in unprecedented outbreaks of banana insect pests particularly in 1958. Most entomologists blamed this upset on the mass use of insecticides. Non-entomologists tended to blame the switch from Bordeaux to orchard oil sprays. but this concept was not supported by Harrison's studies on pests and parasites in oil-sprayed areas (6). Similar ecological disturbances had developed in banana plantations in Honduras and Panama simultaneously (unpublished data). By 1959, 4 more research entomologists were employed to study pest outbreaks in Costa Rica and elsewhere.

Entomologists focuses on the bionomics, natural and chemical control of current pests. Table 1 lists the major lepidopterous banana defoliators. Numerous natural control agents were collected from many pests (5, 6, 7, 8, 9, 10, 21). Natural control agents were collected from pests in banana farms, but beneficial species were constantly suppressed by pesticide applications. However, parasites and predators were readily collected from marginal zones between banana farms and the forest. Roth made a study on 23 species of ants in the Palmar plantations (18). Ants were credited with helping to control *C. humbolti* (13, 17). Also, several *Pleidole* ant species are hosts of the parasitic eucharid wasp, *Orasema costaricensis* Wheeler & Wheeler, which causes blemishes on fruit by ovipositing into the peel (15).

Resistance to dieldrin by ceramidia caterpillars, *Antichloris viridis* Druce, in the Esquinas District was reported by R. V. Roig (unpublished data). R. D. Caid reported dieldrin resistance in banana corm weevils in Palmar and Coto in 1963 (unpublished data).

Table 1. Major lepidopterous banana defoliators, Golfito Zone, Costa Rica, 1959.

Common Name	Family	Genus	Species	Author	References
Ceramidia	Syntomidae	*Ceramidia*	*butleri*	Moschler	5, 6, 8, 9, 15, 17, 24
	Revised to:				
Ceramidia	Ctenuchidae	*Antichloris*	*viridis*	Druce	4
West Indian bagworm	Psychidae	*Oiketicus*	*kirbyi*	Guilding	21
Saddleback	Limacodidae	*Sibine*	*apicalis*	Dyar	7, 22
Bluenose	Limacodidae	*Sibine*	*nr. horrida*	Dyar	22
Owleye	Nymphalidae	*Caligo*	*memnon*	Felder	7
Owleye	Nymphalidae	*Opsiphanes*	*tamarindi*	Felder	7

In 1959, dieldrin was replaced by carbaryl (Sevin), which controlled all of the current defoliators except the West Indian bagworm, *Oiketicus kirbyi* Guilding, which was controlled by toxaphene and *Bacillus thuringiensis* Berliner. During the 1960's, high infestations of bagworms and ceramidia were common. Ceramidia were constantly treated with aerial applications of Sevin. Some areas in Coto received 12 treatments in 1962. During that year, 87 000 kg of 85% Sevin were sprayed. Ceramidia were treated when infestations averaged about 5 larvae per leaf but counts frequently reached 50 larvae per leaf. In 1963, US$ 220 000 were spent on caterpillar control (unpublished data).

The ecosystem once again changed when the remaining Gros Michel and Cocos varieties were chopped down because of their susceptibility to Panama disease. From 1964-69, abandoned farms were replanted with the Panama disease-resistant variety, Valery.

Results and conclusions

In the mid-1960's, Ostmark demonstrated that the banana plant could tolerate much more insect defoliation without causing premature ripening and loss of fruit weight (unpublished data, 15). Despite this important finding, insecticide spraying continued out of a general fear of any larval infestations. Gradually, more caterpillars per leaf were tolerated and fewer treatments were made by the early 1970's. In 1973, a decision to stop all insecticide sprays was enforced in the entire Golfito banana division. Soon after the ban, insect pests rapidly decreased. Within 2 years after insecticides were halted, a balanced banana ecosystem became restabilized again and most of the previous pest species nearly disappeared. Only occassional minor infestations of *Sibine* or *Oiketicus* appeared but such populations were tolerated without the thought of treatments. Natural control agents reduced the pests below economic thresholds within 1-3 generations with little or no fruit loss. *Antichloris*, *Caligo*, and *Platynota* were rarely seen. *C. sordidus* decreased to an average of less than 1 weevil per trap. Red rust thrips damage was prevented by the use of plastic bags placed on the fruit. The banana aphid, *Pentalonia nigronervosa* Coquerel, previously caused severe sooty mold in the fruit and insecticide-treated plastic bags had to be used to control the pest in the 1960's. Since sprays ceased, the aphid and sooty mold problem decreased to low levels and treated fruit bags were no longer needed for aphid control.

Banana farms in the Golfito zone have not been sprayed with insecticides since 1973. After 10 years, successful control of insect pests by natural means now serves as a model demonstrating the feasibility and reliability of such a strategy.

Summary

Ecosystems in southwestern Costa Rica changed drastically after banana plantations were developed. Except for damage by red rust thrips and corm weevils, damage to bananas by native potential pests species was minimal before insecticides were applied. After insecticide treatments were initiated in the 1950's, devastating outbreaks of new pests appeared. The bionomics, natural and chemical control of pests were studied. Parasites and predators of pest species were common in non-treated environments but natural control agents were suppressed in banana plantations sprayed with pesticides. In 1973, all insecticide sprays were stopped. Soon after, insect pests decreased. Within 2 years, a balanced banana ecosystem became restabilized again and many former insect pests nearly disappeared. After 10

years, successful control of insect pests by natural means now serves as a model demonstrating the reliability of such a strategy.

August 8, 1983

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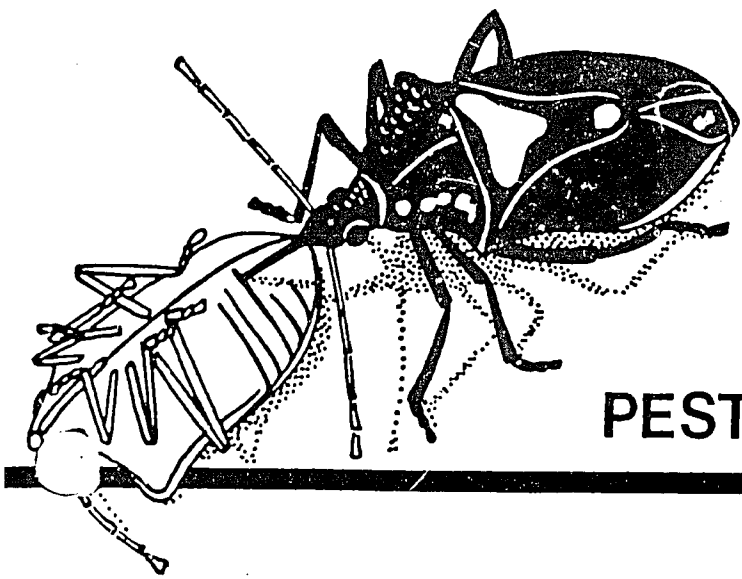
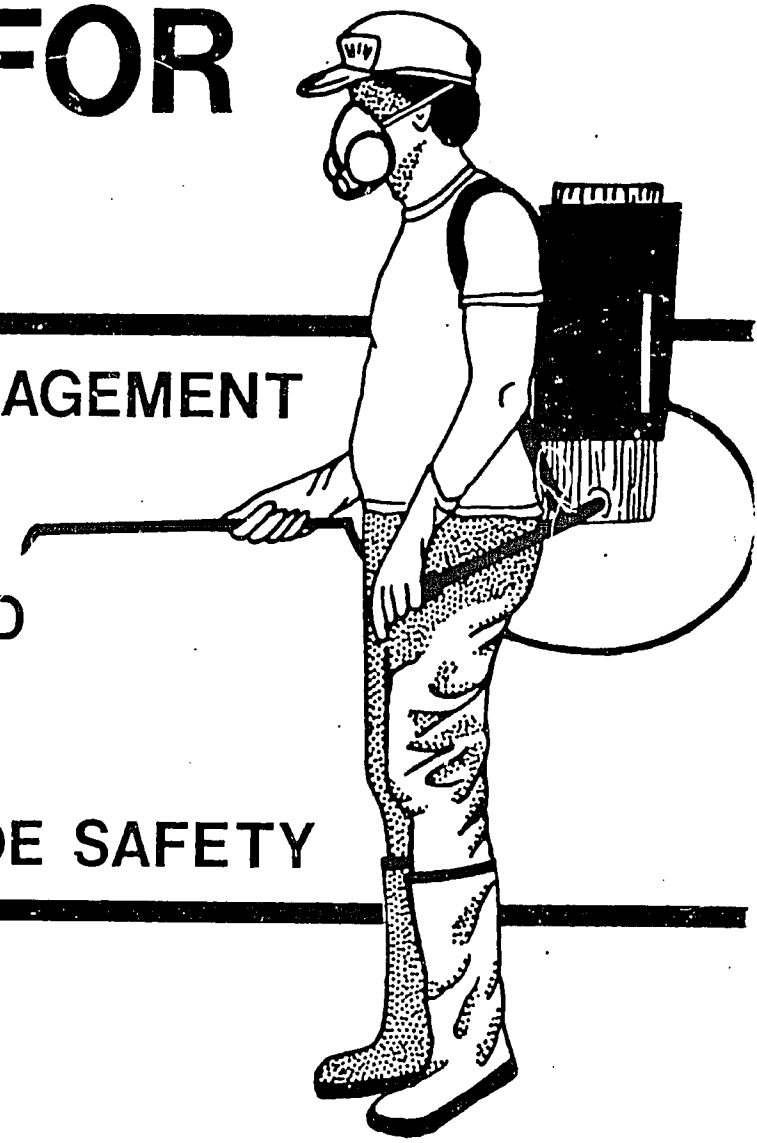
ADDENDUM 3

USAID/Jamaica/Kingston presents

TRAINING FOR TRAINERS





INTEGRATED PEST MANAGEMENT

AND

PESTICIDE SAFETY

ORGANIZED BY:

The Consortium for International Crop Protection
College Park, MD, USA

PRINCIPLE TRAINERS:
DR. CARL S. BARFIELD
DR. JOHN R. STRAYER
PROFESSORS OF ENTOMOLOGY
UNIVERSITY OF FLORIDA, GAINESVILLE, FL, USA

APRIL 15-23, 1988
TWICKENHAM PARK
TRAINING CENTER
JAMAICA, WI

Integrated Pest Management and Pesticide Safety
Training for Trainers Short Course
April 18-23, 1988
Twickenham Park, Jamaica, WI

Background

The Training for Trainers short course is the result of two Environmental Assessments prepared by Dr. Carl S. Barfield, July, 1986, while on assignment for the Consortium for International Crop Protection. USAID/Jamaica's Agricultural Research and Hillside Agriculture Projects both demand participant training in pesticide safety. The Environmental Assessments were accompanied with an initial proposal for a training course in IPM and Pesticide Management.

The ultimate purpose of this short course it to produce card carrying, certified pesticide users who (1) understand the relevance of safe pesticide use to environmental and pest management issues and (2) can train future pest management practitioners in the issues germane to IPM and safe use of toxic pesticides. This would have maximum effectiveness only if the appropriate Jamaican agency (which is in charge of certifying pesticide users in Jamaica) would be present at the end of this course to administer the appropriate test to all participants.

Since there are no official pesticide user certification procedures (stipulations of the Jamaican 1974 Pesticide Act not yet in force), such will not be possible. However, certificates of attendance for the course should be provided to all trainees and should depict at least the broad subjects covered in the course.

Course Objectives

The objectives of this Training for Trainers in Integrated Pest Management and Pesticide Safety are:

1. to educate and train a cadre of future trainers in the principles, philosophies, methods and case studies of Integrated Pest Management;

2. to educate and train a cadre of future trainers in the types, formulations, application methods, safe storage, and safety issues of pesticide use;

3. to give some practical experience in methods associated with pest management and pesticide application;

4. to examine trainee comprehension of the concepts, methods and principles offered in the course; and

5. to prepare all trainees to become future trainers in the principles, methods and application of Integrated Pest Management and pesticide useage.

Training Schedule

Sunday, April 17 Trainees arrive at Twickenham Park, register, take up residence and engage in informal discussions with principal trainers; the USAID appointed local arrangements individual will be on site by 9am on this day to receive participants, coordinate room assignments, answer local arrangements questions and make sure all are registered.

Monday, April 18

7:00 - 8:00 am	Breakfast
8:00 - 8:30 am	Course introduction (objectives, overview, logistics, testing & general procedures)
8:30 - 10:00 am	Module 1: Integrated Pest Management
10:00 - 10:30 am	Discussion/Questions
10:30 - 12:00 noon	Module 2: Agromedical Concerns in Jamaica
12:00 - 1:30 pm	Lunch
1:30 - 2:00 pm	Discussion/Questions
2:00 - 3:30 pm	Module 3: State of Pest Control in Jamaica
3:30 - 4:00 pm	Discussion/Questions
4:00 - 6:00 pm	Time for reading and informal discussions
6:00 - 7:00 pm	Dinner
7:30 - 9:00 pm	Self-paced study/CAI modules/Discussions

Tuesday, April 19

7:00 - 8:00 am	Breakfast
8:00 - 9:00 am	Module 4: Pesticide Laws & Certification in Jamaica
9:00 - 9:30 am	Discussion/Questions
9:30 - 10:00 am	Break
10:00 - 11:30 am	Module 5: Sampling
11:30 - 12:00 noon	Discussion/Questions
12:00 - 1:30 pm	Lunch
1:30 - 4:00 pm	Module 6: Economic Injury Levels and Thresholds
4:00 - 6:00 pm	Time for reading and informal discussions
6:00 - 7:00 pm	Dinner
7:30 - 9:00 pm	Self-paced study/CAI modules/Discussions

Wednesday, April 20

7:00 - 8:00 am	Breakfast
8:00 - 9:00 am	Module 7: The Pesticide Label
9:00 - 9:30 am	Discussion/Questions
9:30 - 10:00 am	Break
10:00 - 11:00 am	Module 8: Pesticide Nomenclature
11:00 - 11:30 am	Discussion/Questions
11:30 - 1:00 pm	Lunch
1:00 - 3:30 pm	Module 9: Pesticide Formulation/Application Equipment
3:30 - 4:00 pm	Discussion/Questions
4:00 - 6:00 pm	Time for reading and informal discussions
6:00 - 7:00 pm	Dinner
7:30 - 9:00 pm	Self-paced study/CAI modules/Discussions

Thursday, April 21

7:00 - 8:00 am	Breakfast
8:00 - 9:00 am	Module 10: Calibration of Application Equipment
9:00 - 9:30 am	Discussion/Questions
9:30 - 10:00 am	Break
10:00 - 11:30 am	Module 11: Pesticide Applicator Safety
11:30 - 12:00 noon	Discussion/Questions
12:00 - 1:30 pm	Lunch
1:30 - 3:30 pm	Module 12: Storage, Disposal and Clean-up of Pesticides
3:30 - 4:00 pm	Discussion/Questions
4:00 - 6:00 pm	Time for reading and informal discussions
6:00 - 7:00 pm	Dinner
7:30 - 9:00 pm	Self-paced study/CAI modules/Discussions

Friday, April 22

7:00 - 8:00 am	Breakfast
8:00 - 9:00 am	Module 13: Scouting and Practical Use of EIL/ET Values
9:00 - 9:30 am	Discussion/Questions
9:30 - 10:00 am	Break
10:00 - 12:00 noon	EXAMINATION OVER WEEK'S CONTENT
12:00 - 1:30 pm	Lunch
1:30 - 3:30 pm	Time for reading and self-paced study
3:30 - 5:00 pm	Discussion of exam results/Preparation for field trip
5:00 -	Free time

Saturday, April 23

6:30 - 7:30 am	Breakfast
7:30 - 9:00 am	Travel to field
9:00 - 12:00 noon	Field exercises/demonstrations
12:00 - 1:00 pm	Lunch
1:00 - 3:00 pm	Field exercises/demonstrations
3:00 - 4:30 pm	Return to Twickenham Park
5:00 pm	Course ends

Filed 4/26/88 to CICP

TRIP REPORT

TRAINING FOR TRAINERS: IPM AND PESTICIDE SAFETY

18 - 23 April, 1988

Twickenham Park Training Facility

Spanish Town, Jamaica, W.I.

Friday, April 15

9:35am -- departed Gainesville on Piedmont 811

10:35am -- arrived Miami

1:30pm -- departed Miami on Eastern 921

2:08pm -- arrived Kingston, Jamaica

4:00pm -- had meeting with Mark Nolan (USAID), Joe Suah (Director, Hillside Agriculture Project) and the 3 Jamaican Trainers (Janice Reid, CARDI; Lester Woolery, MOH; and Florence Young, MOA)

Spent night in Kingston

Saturday, April 16

departed Kingston for Spanish Town and the Twickenham Park Training Facility; set up computer software; finalized lecture notes, slides and overhead materials

Sunday, April 17

students began to arrive, register, receive Training Manuals and take up residence at Training Facility (see attachement for list of participants)

Monday, April 18 to Friday, April 22

Course offered according to CICP-AID/Kingston contract and exactly as specified in Training Manual sent to CICP before course; field trip on Saturday, April 23 was cancelled due to lack of student interest -- they claimed they had not been informed that all day Saturday was required.