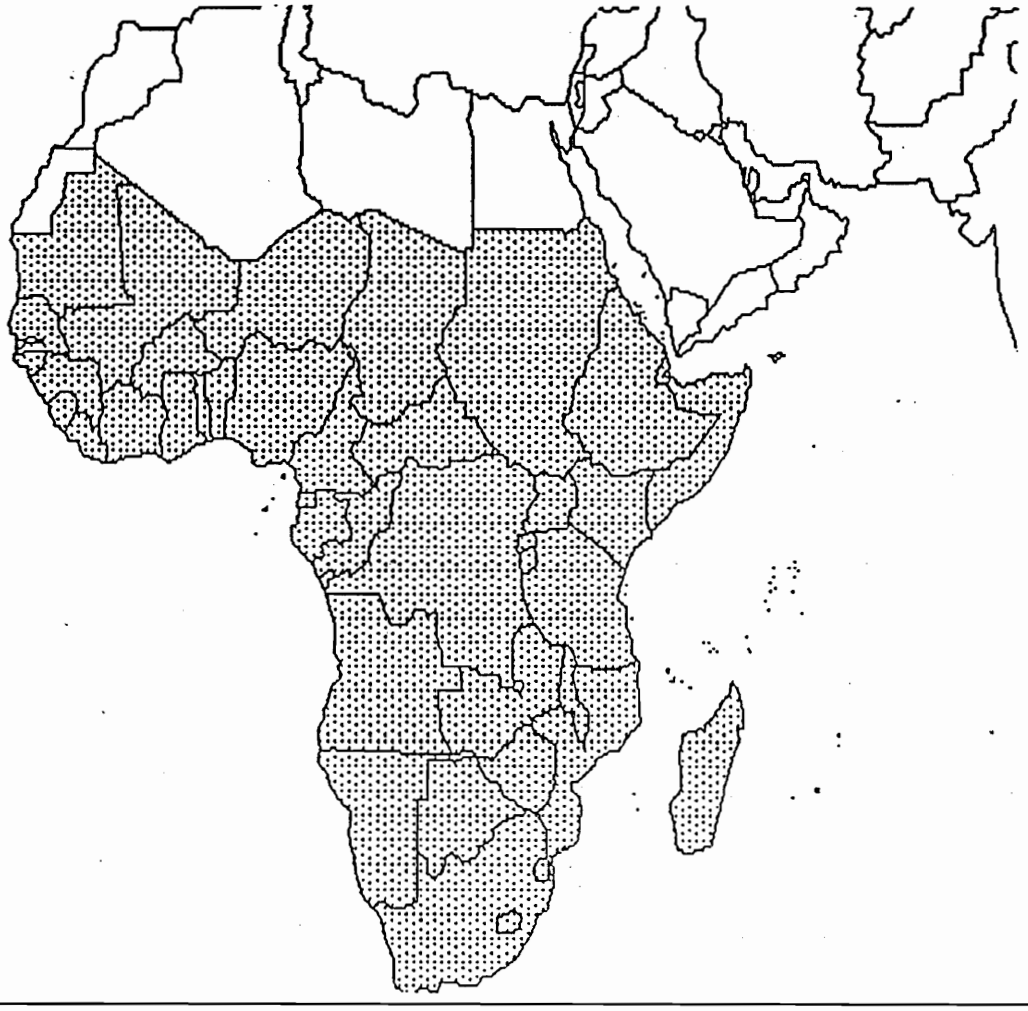
United States Agency for International Development
PDC-5517-I-00-0105-00

Planning and Analysis for Pest and Pesticide Management Activities in Sub-Saharan Africa: Options for the Africa Bureau



Submitted to:
USAID, Africa Bureau
Office of Analysis,
Research and Technical Support

Submitted by:
Tropical Research & Development, Inc.
October, 1991

United States Agency for International Development
PDC-5517-I-00-0105-00

Planning and Analysis for Pest and Pesticide Management Activities in Sub-Saharan Africa: Options for the Africa Bureau

Submitted to:
USAID, Africa Bureau
Office of Analysis,
Research and Technical Support

Submitted by:
Tropical Research & Development, Inc.
October, 1991

ACKNOWLEDGEMENTS

AFR/TR/ANR contracted with Tropical Research and Development, Inc. (TR&D) to undertake an analysis of options for pest management strategies and programs for Sub-Saharan Africa for the Africa Bureau (AFR). The assistance and graciousness of those who assisted the Project Team in carrying out the analysis is greatly appreciated.

TEAM MEMBERS

Robert J. MacAlister, Team Leader/Project Development Specialist
John A. Franklin, Plant Protection and Quarantine Specialist
Michael Watt, Tropical Crop Protection Specialist

CONSULTANTS

W.P. Kemp, Research Entomologist
Melvin D. Skold, Economist
William Olkowski, Integrated Pest Management/Biological Control Specialist

TABLE OF CONTENTS

ANNEXES

ACRONYMS

ADO	Agriculture Development Officer (USAID)
AELGA	Africa Emergency Locust and Grasshopper Assistance (Project No. AFR-0517)
AFR	Africa Bureau
A.I.D.	Agency for International Development (United States)
APAP	Agriculture Policy and Planning Project
APHIS	Animal, Plant Health Inspection Service (USDA)
ARTS	Office of Analysis, Research and Technical Support
CDIE	Center for Development Information and Evaluation (USAID)
CGIAR	Consultive Group on International Agricultural Research
CIDA	Canadian International Development Agency
CIMMYT	International Center for the Improvement of Maize and Wheat
CIP	International Center for Potatoes
CIRAD	Center for International Cooperation in Agricultural Research (Centre de Cooperation Internationale en Recherche Agronomique pour Development-France)
CRSP	Collaborative Research Support Project
DFA	Development Fund for Africa (USAID)
DWRC	Denver Wildlife Research Center
EEC	European Economic Community
EPA	Environmental Protection Agency (U.S.)
FAO	Food and Agriculture Organization
FARA	Division of Food, Agriculture and Resources Analysis
GIFAP	International Trade Association of Agricultural Chemical Manufacturers and Distributors (Belgium)
GTZ	German Technical Assistance Agency (Deutsche Gesellschaft fuer Technische Zusammenarbeit GmbH)
IAPSC	Inter-African Phytosanitary Council
ICIPE	International Centre of Insect Physiology and Ecology (Kenya)
ICRAF	International Council for Research in Agroforestry
ICRISAT	International Crop Research Institute for the Semi-arid Tropics
IITA	International Institute of Tropical Agriculture
IPM	Integrated Pest Management
IRAT	Research Institute for Tropical Agriculture and Field Crops (Institut de Recherches Agronomiques Tropicale et de Cultures Vivrieres-France)
IRRI	International Rice Research Institute
JICA	Japanese International Cooperation Agency
NACA	National Agricultural Chemicals Association
NARS	National Agricultural Research Services
NCPS	National Crop Protection Service
NPPS	National Plant Protection Service

NRI	Natural Resources Institute
OAU	Organization of African Unity
ODA	Overseas Development Administration (Britain)
OFDA	Office of Foreign Disaster Assistance (USAID)
OICD	Office of International Cooperation and Development (USDA)
OJT	On the Job Training
ONI	Office of Operations and New Initiatives
ORSTOM	Office for Overseas Technical and Scientific Research (Institute Francais de Recherche Scientifique et Technique pour le Development et Cooperation en Outre Mer-France)
PARTS	Policy, Analysis and Technical Support (Proposed project in Africa Bureau, A.I.D.)
PM	Pest Management
PRIFAS	Program of French Interdisciplinary Research Concerning Locust/Grasshoppers in the Sahel (Programme de Recherches Interdisciplinaires Francais sur les Acridiens du Sahel-France)
RFCP	Regional Food Crop Protection Program (USAID)
S&T	Bureau of Science and Technology (since October 1991, Bureau of Research and Development)
SANREM	Sustainable Agriculture and Natural Resource Management
SARCCUS	Southern African Regional Commission for the Conservation and Utilization of the Soil (South Africa)
SAS	Surveillance des Acridiens au Sahel (newsletter of PRIFAS)
SSA	Sub-Saharan Africa
TA	Technical Assistance
TR/ANR	former Africa Bureau (A.I.D.), Office of Technical Resources, Division of Agriculture and Natural Resources.
TPM	Tropical Pest Management
TPPI	Technical Projects and Program Implementation Division (Africa Bureau)
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNIDO	United Nations Industrial Development Organization
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WARDA	West Africa Rice Development Association
WHO	World Health Organization

Planning and Analysis for Pest and Pesticide Management Activities in Sub-Saharan Africa: Options for the Africa Bureau

EXECUTIVE SUMMARY

Introduction

AFR/TR/ANR contracted with Tropical Research and Development, Inc. (TR&D) to undertake an analysis of options for pest management strategies and programs for sub-saharan Africa for the Africa Bureau (AFR). The team included Robert J. MacAlister, Team Leader; John A. Franklin, Plant Protection and Quarantine Specialist; and Michael Watt, Tropical Crop Protection Specialist. The options analysis was carried out in July and August of 1991.

The team had the assistance of three short term consultants W.P. Kemp, Research Entomologist (author of annex 1); Melvin D. Skold, Economist (author of annex 2); and William Olkowski, Integrated Pest Management/Biological Control Specialist (author of annex 3). While the team took into consideration the recommendations of these consultants, the team wishes to make clear that the opinions expressed in these annexes are those of the individual consultants and do not necessarily represent the opinions of the team.

The Reorganization

This study was.commissioned by AFR/TR/ANR/NR at a time when both the Bureau and the Agency are undergoing major reorganizations. These changes have implications for the matters discussed in this report. Of great impact, for the report's purposes, will be the restructuring of activities within the Africa Bureau itself--particularly the way in which the Bureau will carry out its technical functions including those for pest management. Henceforth, many of the agriculture and natural resource support activities (hitherto carried out in AFR/TR/ANR) will be transferred with a reduced staff to the Environment Branch of the new Directorate of Food Security, Agriculture and Natural Resources (FARA) which will be a unit of the Office of Analysis, Research and Technical Support (ARTS).

TR/ANR's operational and project management functions are to be assumed by the Office of Operations and New Initiatives (ONI)--with FARA playing a facilitative, analytical, strategizing support role.

The Policy, Analysis, Research, and Technical Support (PARTS) project will be a six-year project which is currently being designed by A.I.D. to support strategic analyses and information activities needed by its clients (Africa Bureau, Missions, host-country governments, and local NGOs) in order to develop, implement, and measure the impact of A.I.D. supported agricultural and natural resources policies, programs, and projects in Sub-Saharan Africa. PARTS has adopted the Development Fund for Africa's (DFA) Strategic Objective Three - developing the potential for long-term increases in productivity - as its overarching theme guiding its project design. DFA's Strategic Objective Four - improving food security - underpins the PARTS design effort.

Purpose of the Report

The purpose of this report is to study major elements of pest management experiences in Africa over recent years, those of the Africa Bureau in particular, and make recommendations concerning future A.I.D. activities in pest management in Africa, where they should be located in the agency, and how they should be carried out.

The successes, the setbacks, and the changed circumstances confronting the work of the Bureau's PM staff, including the Bureau's experience with the AELGA project, have been reviewed. As a result, the team concluded that there is a continuing need to address many of these issues, to assess the opportunities and challenges that they will present during the years ahead, and to consider options for a strategy that might be followed.

The Link Between Pest Management and Sustainable Agriculture

There is general agreement that "pests" cause significant losses, from pre-population through post harvest, to agricultural crops and livestock in sub-Saharan African. For the purpose of this report "pests" are considered to include plant-feeding insects (including migratory insects such as locusts and armyworms), plant feeding mites, plant-feeding vertebrates including migratory and non-migratory birds and rodents, and plant diseases including nematodes and weeds.

Food Security

By identifying and prioritizing prospects for technological development in the area of pest management in African agriculture, this report defines how A.I.D. might best promote linking of pest management with other components of food security research and policy.

Natural Resource Management

Effective pest management is dependent on proper management of all other components of any sustainable agricultural system. These components include the management of soil, water, crop plants and livestock, non-crop vegetation, and non-crop beneficial organisms including wildlife, off-farm inputs and human resources. This study emphasizes this interdependence, seen as essential for sustainable pest management on one hand, and effective natural resource management on the other.

Agricultural Technology Development and Transfer

The development of the concept of IPM since the 1970's has led to increased need for non-chemical control technologies on one hand and less persistent, more specific pesticides on the other. However, without the successful transfer to farmers of any pest management technology (new or old), the effort made in its development is wasted. Consequently, the contribution which pest management can make to sustainable agricultural development, food security or balanced natural resource management will only take place if effective systems of communication with farmers can be established for the transfer of the technology.

Agricultural Business and Marketing

In the years immediately after the Second World War, the private sector made extremely significant contributions to pest management through the development and marketing of synthetic pesticides. Any consideration of the future development of pest management in Africa must include the part that the agrochemical industry will play in the continuing development of new pesticides. Accordingly, this study considers the opportunities offered through pest management activities for small business development in Africa, including the development of pest monitoring services, production facilities for beneficial insects and microbial pesticides, and cottage industries producing small-scale pest control tools.

Major Donors

In Sub-Sahara Africa (SSA), certain major donors have been important players over the last 10 years. A major donor is defined as having regularly undertaken pest management studies and projects, or having provided supplies and equipment regularly to selected organizations and host countries in Africa. The principal bi-lateral donors have been

Canada, France, Germany, Italy, Japan, the Netherlands, Norway, the United Kingdom, and the U.S.A. The major international donors include the Food and Agriculture Organization (FAO), the United Nations Development Programme (UNDP), the World Bank, the Islamic Development Bank (IDB), the Consultative Group on International Agricultural Research (CGIAR), and the European Economic Community (EEC).

Lessons Learned

The team noted many lessons to be learned after reviewing prior A.I.D. and other donor involvement in pest management programs. Unfortunately, a review of Pest Management (PM) project abstracts covering 10-15 years suggest that many lessons remain unlearned, i.e. experience gained has not been fully or adequately incorporated into subsequent project design effort. As one reviews the mid-term and final project evaluation abstracts, one is struck by the large number of "lessons learned" that are almost always managerial and not bio-technical in nature.

Major lessons identified as a result of the team's review and recommendations for responding to these include those listed below.

Lesson 1: Participatory Project Design Is Essential for Project Success

PM projects are sometimes designed and initiated with no real possibility of success because the target group was not involved in the design process. Good problem identification and a search for appropriate technical solutions is not enough. If the project is to be sustainable, it must have the support of the group it is supposed to assist.

Recommendation:

Those involved with project design must ensure that the group targeted for assistance has been consulted and that it supports the activity or activities to be financed by the project.

Lesson 2: Better Basic Information Is Needed Before Projects Are Designed

The basic data required (e.g., needs analysis [farmer/government], social-economic analysis, support elements, and fiscal base) does not always seem to be well defined nor in place before a project begins. Pest problem identification and resolution at the level

of the farmer, and with the involvement of the farmer, is an important component of the analysis processes. Experts are often not very well informed as to the process farmers use to minimize pest risk.

Recommendation:

The rolling design process used by the British for designing the Mali Millet Pest Control Project could serve as a useful model. The project lasted five years before the project's implementation plan reached its final form. While recognizing that A.I.D. cannot invest five years of time in gathering data for the design of each and every project, the team nevertheless urges that the agency be more rigorous in assuring project design teams possess sufficient information before decisions are made on approved projects.

Lesson 3: Subsistence Farmers' Economic Threshold Decisions Must Be Incorporated Into Project Design Processes

The willingness of some farmers to tolerate a reduction in yield as a result of insect attack suggests that it may be difficult to convince subsistence farmers to adopt IPM practices. New pest management strategies must be technically feasible and also offer a significant reduction in yield loss that will be worth the farmers' investment in terms of cash and labor expenditure (Conelly 1985).

Recommendation:

IPM development is a long term activity that needs to be continued by A.I.D. far into the foreseeable future. The team also recommends that CGAIR institutes such as the International Institute of Tropical Agriculture (IITA), the West Africa Rice Development Association (WARDA) and others with programs in SSA be involved in the type of IPM developmental activity which offers significant reduction in yield losses to the farmer.

Lesson 4: Farmer Access to Subsidized Treatments Reduces Their Incentive to Adopt Alternative Practices

Farmers who have access to cheap pesticides and treatments have little incentive to continue other more difficult or less effective pest control methods. Alternative solutions to a pest constraint are not likely to be seriously considered if an alternative such as pesticides is viewed as cheaper and more effective by the farmer or government.

Recommendation:

Pesticide users or recipients of free pesticide services need to pay for these materials so they have a more realistic means for comparing the cost of other available options. This theory should be tested in selected geographical areas.

Lesson 5: The Need for Long Term Training Needs to be Carefully Reviewed

It is not uncommon for PM projects, that have an academic training component, to find that they have sent their best people off to the university for the duration of the project. Often academic participants return just as a project is concluding or sometimes long after. This frequently means academic participants return to a program with high hopes, but few resources with which to work, since the donor has long since concluded their effort.

Recommendation:

The need for long term academic training should be very carefully reviewed. Projects should limit themselves, as much as possible, to qualified, existing host country nationals who have already received academic training. Academic training should only be offered when a specific need can be clearly demonstrated (e.g., extensive taxonomic work probably requires a M.S. level degree at least).

Lesson 6: Pest Management Teams Need to be more Interdisciplinary

Degree programs to the M.S. level (or Ph.D.) seem to be lacking in some specialty areas. Donor programs have trained mostly entomologists, IPM specialists, plant pathologists, and economists. There is also a need for:

1. Nematologists
2. Virologists
3. Weed scientists
4. Biological control specialists
5. Biologically trained agricultural economists
6. Vertebrate pest studies

Recommendation:

Consider extending the educational level of A.I.D.'s Sahel IPM/RFCP graduates by one year (or more) when it is possible to obtain the new area of specialty by adding on to previous programs. In the case of other disciplines such as weed science, long term degree studies will be required.

Lesson 7: There is a Need for Basic Resources to Conduct Research

Many donor-educated Africans working in the research system of SSA countries, lack some of the basic resources required to conduct research.

Recommendation:

U.S. trained cadre, particularly those within M.S. (thesis program) from the Sahel IPM/RFCP programs, should be given material assistance to help them undertake appropriate research.

Lesson 8: Host Country Commitment to, and Involvement in Projects Must Be Clearly Established

There is a need to verify host government commitment to a proposed project. Any project that brings some input, such as construction, salaries, training, or provides commodities, is perceived as providing benefits to the country. This is regardless of whether or not the project achieves its technical objectives. There is a need, in terms of sustainability, to ensure at the beginning of the project that the host government is genuinely committed to the proposed effort.

Recommendation:

Design host-country counterpart participation so that it is front-end loaded in order to host country commitment. Donors often never know what host countries can really provide until the donor refuses to proceed with project implementation until counterpart inputs are in place.

Lesson 9: Final Evaluations (EOPS) Are Insufficient

End of Project Status evaluations often do not indicate a project's long term impact. A project can look great at its official end, but if the buildings are later empty and staff is disbursed to other agencies, benefits might not have been sustained. Additionally, there is an indication that the RFCP/Sahel IPM projects in West Africa, for example, had long term benefits not noted in the final project evaluation (P. Matteson, 1990).

Recommendation:

A follow-up impact evaluation two years after a project terminates would be useful. The long term impact of most projects is best evaluated when the results of the project have a chance to be put into perspective after the donor's inputs have ceased.

Long term PM project impact evaluations could be funded by PARTS since the results would likely provide information that would be useful for the future design and implementation of IPM projects.

Lesson 10: Regional Projects Tend to Be too Complicated to Effectively Manage

Multi-country, multi-crop, multi-language efforts have inherent management problems. Additionally, A.I.D. missions do not like regional approaches. They prefer projects that can be under their direct supervision. If the project is not in the Mission's OYB, it is not given priority in terms of Mission time and resources.

Recommendation:

Aside from emergency activities which involve several countries, every effort should be made to keep PM projects bi-lateral.

Many of the recommendations made (on the basis of "lessons learned") fall into the management and project identification categories, and do not require PARTS funding to carry them out. The lessons learned, which do not necessarily relate directly to PARTS findings have been included here because they raise fundamental project design and implementation issues. A project which is technically sound will not succeed if it does not "fit" in its project environment. If the project does not incorporate beneficiary input into the design, if it does not address felt needs, and if it cannot be incorporated into the governmental and NGO structures already in place, it will be neither efficient nor effective.

RECOMMENDATIONS FOR AFRICA BUREAU PEST MANAGEMENT ACTIVITIES TO BE FUNDED BY PARTS OVER A PERIOD OF FIVE YEARS

The Need for an IPM Strategy

Recent experience in Africa, suggests that developing an appropriate strategy for conceiving and delivering IPM has not been as effective an activity as it should be. The reasons need to be carefully analyzed and taken into consideration when planning future A.I.D. pest management programs. Key factors include:

1. The perception that "integrated" pest management ("IPM") is either difficult to develop and implement, or is some form of "magic bullet" that will produce amazing results in short periods of time. This has commonly led to misunderstanding of "IPM" by politicians and administrators in particular, and has resulted in many instances from over ambitious efforts by western-trained scientists to attempt wholesale transfer of complex technology to developing countries.

2. Inappropriate government policies. The major problem lies in the unwillingness of many African governments to allocate reasonable levels of funding for agricultural development. At times, this approach is encouraged by donors through their preferential support for non-agricultural development.

3. Ineffective research and extension programs. Largely a result of the policies described above, research and extension services do not have the means to operate effectively, in terms of developing and deploying pest management programs or, for that matter, other appropriate agricultural technology.

Despite the disincentives mentioned above, many African researchers and extension specialists remain enthusiastic and interested in developing their countries' agriculture through improved pest management. Analysis will be needed as to how this assistance can best be given, including careful consideration of how, in the case of A.I.D., assistance can best match the technical and other resources available in the U.S. with identified needs.

The team believes that the results obtained from many of the activities recommended for PARTS funding will provide the information required for the Africa Bureau to develop an appropriate pest management strategy. As indicated in Section 4 of this report, the team

believes the pest management unit in FARA should have the responsibility for managing the implementation of the PM activities recommended for PARTS funding, and should then be charged with coordinating the development of an IPM strategy for the Africa Bureau.

In making the following series of recommendations on major pest management issues, for inclusion in the AFR Analytical Agenda, the team has taken into consideration lessons learned from previous, current, and projected A.I.D. and other donor involvement in pest management in Africa as summarized in Section II of this report. The authors of the study have attempted to keep firmly in mind the overarching principle that A.I.D. involvement cannot and should not attempt "to be all things to all people," but should concentrate rather, on long-term in-depth development in specific priority areas.

Specific recommendations for the use of PARTS funds are made in connection with the following seven key issue areas identified by the team. The issue areas can be categorized as Issue-Oriented Research and Analysis (1,2,3,4), Analytical Tools and Methodologies (5,6), and Information Dissemination and Management (7).

1. Grasshopper/Locust-oriented Options Analysis
2. Weeds and Vertebrate Pests
3. Pesticide Management and Policy
4. Pest Risk Analysis
5. Pest Identification and Diagnosis
6. Farm Level Assessment and Studies
7. Information Management

Section III contains illustrative budgets for different levels of funding for pest management activities to be funded by PARTS, as recommended by this report. The estimated costs shown for each activity shown in this Executive Summary represent the high option for funding (as presented in tabular form on pp. 25-30, and pp.102-107).

ISSUE-ORIENTED RESEARCH & ANALYSIS

ISSUE 1: Grasshopper/Locust-Oriented Options Analysis

A.I.D. needs to make a decision about future pest management activities in Africa.

Discussion

A.I.D.'s response to any given pest problem will be governed by broad concerns that prioritize the regions and countries in which pest management activities should be undertaken, and establish broad budgetary, policy, and technical parameters with regard to the nature of the assistance that can be given. However, A.I.D. must keep in mind the magnitude of losses, both pre-and post-harvest, that are caused all the time by crop and livestock pests. This devastating loss in agricultural production has considerable impact on the lives of subsistence farmers in the least developed countries of Africa and diminishes the ability of these countries to feed their rapidly increasing populations. This activity which results in the reduction of crop loss by pests will have a very direct effect on food security in Sub-Saharan Africa (SSA).

Recommendation for PARTS FUNDING of options study

FARA should apply for PARTS funds to contract for an economic study to provide AID/AFR management information with which to make a decision relative to the future of U.S. involvement with grasshoppers/locusts in SSA. The decision should be made on the following options and recommend a funding level for the option chosen.

Option 1. No action/no funding.

Option 2. Funding for reaction only (e.g., plagues) and the type of reaction (e.g., pesticide control or food) to be noted.

Option 3. Proactive only-No Reaction. Proactive to include activities described in Section IV of this report.

Option 4. Proaction with a reduced involvement for Emergencies.

Note: As indicated in Section IV, A.I.D. has spent over $58 million between 1986-89 on pest management activities. Bilateral aid provided by donors during the same period exceeded $192 million. Given the size of the U.S. investment already made, AFR should resolve its position in the near future. FARA, with PARTS funding, can play an important role in contracting for the analysis needed to enable AFR to come to a decision.

Estimated cost $10,000

ISSUE 2: Weeds and Vertebrate Pests

Sub Issue 2A, "Classical" Bio-Control of Weeds

Discussion

Weed control in much of Africa relies on cultural practices - crop rotations, fallowing, burning, multiple cropping, use of clean seed, etc. - combined with primary and secondary tillage. Hand weeding, hopefully during the critical first four to eight weeks of crop growth, is the most important control strategy and most labor consuming.

Recommendation for PARTS Funding Concerning Bio-Control of Weeds

PARTS should support an analysis to identify promising target weeds for biological control in Africa, by bringing together experts on weed science in Africa with scientists from USDA and elsewhere familiar with bio-control technology. Such an expert consultation should aim at producing a target list of perhaps five weed species that cause widespread problems and for which there is scientific evidence that the introduction of parasites as pathogens might offer good chances of minimizing damage.

Estimated cost $40,000

Sub Issue 2B, Integrated Weed Management

Discussion

As well as assisting in the development of bio-control of weeds, it is further suggested that A.I.D.assistance focus on developing integrated weed management, including bio-control, in at least one of the important crop groups in Africa. Past assistance from both bilateral and multilateral sources has emphasized pest management in subsistence food crops, particular cereals, roots and tubers and legumes. Despite these efforts, yield losses are high, and have recently been estimated at between 20-100 percent under African conditions (Adegoroye et al., 1989).

Recommendation for PARTS funding concerning Integrated Weed Management in Vegetable Crops

As a first step, FARA (with PARTS funding) should commission one or perhaps two weed scientists with international reputations, (as well as African experience) to prepare and publish a thorough stand-alone study on integrated weed management in tropical and sub-tropical vegetables.

Estimated cost $70,000.

The results of these efforts will make an important contribution to knowledge of the appropriate technology required to combat weeds, and therefore also contribute to greater food security.

Sub Issue 2C, Control of Vertebrate Crop Pests in SSA

Discussion

The recommendation that PARTS funding should be used to analyze appropriate strategies for the management of vertebrate pests, (principally rodents and birds) in SSA is based on a number of important considerations, including:

- The perception by farmers in many parts of Africa that vertebrate pests - birds in particular - are among the most serious constraints to crop production.
- The very real losses that these pests cause in Africa.
- The lack of vertebrate pest management research or extension programs in Africa.
- The existence in the U.S. of the AID-APHIS Denver Wildlife Research Center (DWRC) which is recognized for developing methods and materials for vertebrate damage control.

Recommendation for PARTS funding concerning vertebrate pest management

PARTS should finance a series of expert consultations which would utilize the expertise available at DWRC and elsewhere, including Africa, to consider:

i) the current status of rodent problems in SSA with a view to outlining and prioritizing research needs.

ii) the future development of effective and environmentally sound control methods for the red billed quelea.

iii) research needs and strategies for the management of bird pests other than red-billed quelea. This should focus on loss assessment and on control techniques that farmers can use without dependency on large-scale control programs.

The recommendations of these consultations should then be used to guide AID/AFR in future TA for these areas.

Estimated cost $120,000.

These analyses will have implications for natural resource management and increased food security.

Additional needs identified as a result of undertaking A,B,C and requests from Missions are estimated at $190,000.

All of the data generated by the analyses recommended in issue 2 would provide better information for future project design. Accordingly, it would respond to the "lesson learned" that better information is needed for use in project design.

ISSUE 3: Pesticide Management and Policy Discussion: Pesticide Sector Assessment and Alternatives to Pesticides

Discussion

If in the last resort, pesticides are seen to be needed as part of a control strategy those that are most selective on the pest, least damaging to non target organisms and which rapidly biodegrade, should be the materials of choice. The possibility of using microbial and botanical pesticides, many of which are potential candidates for on-farm or local production in Africa, should be carefully considered. Broad spectrum, long-residual synthetic pesticides which have frequently been used in Africa, should be materials of last resort. The more effective regulation of pesticide use by joint activities of the public and private sector is vital.

Recommendation for PARTS Funding Concerning Predicting Areas of Increased Pesticide Use

An analysis to determine the likelihood of herbicide use increase in SSA should be undertaken. The analysis would attempt to identify other alternatives available to farmers.

Estimated cost $20,000 (assuming that the private sector will match this with $20,000). This effort has implications for the environment and agricultural business and marketing.

Recommendation for PARTS Funding Concerning Prostephanus truncatus

An analysis would be useful to identify the impact prostephanus truncatus has caused on maize storage, the extent to which pesticides are now employed as a result of this new pest, and the resultant residues and increased cost to farmers.

Estimated cost $35,000

Recommendation for PARTS Funding Concerning Impact of Pesticides on Areas of Continuous Use

Environmental studies could be undertaken by existing African facilities concerning the impact of pesticides in areas of continuous use. Areas where pesticides have had constant use could be compared with nearby similar areas without such usage. Comparisons such as aquatic life in drainage areas, wildlife, beneficials, etc. could be studied.

Note: Since this is a possible area that could be sensitive to certain nationals and pesticide manufacturers, careful thought should be given to any approach that is considered. Additionally, this study has strong implications for natural resource management.

Estimated cost $10,000

Recommendation for PARTS Funding Concerning Legislation and Regulations to Control Pesticides

When A.I.D. undertakes, assists with, or recommends certain structural readjustment programs such as the government leaving pesticide procurement, distribution and use to the private sector, then the involved Mission should be able to recruit through FARA the assistance necessary to aid the host government with drafting appropriate legislation.

Estimated cost $10,000.

This effort also has implications for the appropriate management of natural resources.

Recommendation for PARTS Funding Concerning Briefing Paper on Pearl Millet Mildew

A briefing paper should be developed for distribution to research workers and others on Pearl Millet Mildew caused by Sclerospora graminicola.

Estimated cost $10,000.

Recommendation for PARTS Funding Concerning Seed Treatment

Determine the potential of seed treatments and repellents in SSA as a cost-effective method for increasing production and reducing seeding rates through reducing pest caused constraints to crops. Identify specific geographic areas and crops where this technique could be applied.

Estimated cost $21,000.

Recommendation for PARTS Funding Concerning Warm Water Treatment of smuts

Test the potential of hot-water (actually warm water) treatments in SSA against several millet-sorghum smuts as an effective method of control.

Estimated cost $20,000.

The three previous recommendations have direct implications for the development of appropriate technology and its eventual transfer.

Recommendation for PARTS Funding Concerning Future use of Herbicides

PARTS should finance a study into the future use of herbicides, with particular reference to their use in SSA. Such a study should pay specific attention to:

- The impact of labor constraints on weeds in specific crops such as millet, maize and vegetables.
- Detailed projections on the future use of herbicides and other agrochemicals in SSA, including crops likely to be involved and the types and quantities of pesticides that would be used.

- The implications for subsistence farmers of the development of herbicide/herbicide-resistant crop variety packages.
- The likely environmental impact of increased herbicide use in SSA.
- The best way for SSA countries to provide for the safe and effective use of agrochemicals including herbicides, and ensure that the agrochemical seed industry provide acceptable levels of stewardship for the products that they get.

Estimated cost $25,000.

Additional needs identified as a result of undertaking the studies recommended and requests from Missions are estimated at $60,000.

Efforts should be made to involve the pesticide industry in this effort since it has direct implications for them and their future marketing.

ISSUE 4: Pest Risk Analysis

Sub Issue 4A, Economic Impact of Pest Risk Analysis

Discussion

A wide variety of new pest introductions into SSA have been occurring for decades on a regular basis. Most SSA countries lack the resources to protect themselves from these continuing threats.

Recommendation for PARTS funding concerning economic impact of new pest introductions

1. PARTS should finance a study to identify the extent of new pest introductions in SSA and their economic impact on Africa over the past twenty years.

2. A review of the quarantine procedures (or lack thereof) applied to movement of germplasm into/within SSA, and financed in whole or in part by USAID/AFR projects should be undertaken by a competent authority (e.g., plant quarantine officials of the U.S.).

3. If there is a problem (see 1 above) and U.S. safeguards are lacking or inadequate (see 2 above) then FARA, using funding from PARTS, should arrange to develop a set of procedures for inclusion in USAID procedural manuals.

Estimated cost $30,000

Sub Issue 4B, Detection of New Pests

Discussion

Early detection of new pests provides the possibility of eradication (very difficult at best but possible [e.g., screwworm]), or perhaps, a delay in the pest's spread, while methods are worked on to minimize the new pests impact on production (e.g., food security). This is particularly important where pesticides are frequently the only choice available until other pest control alternatives are developed (e.g., resistance, bio-control). Most SSA countries lack any organized systematic process for early detection.

Recommendation for PARTS funding concerning early detection of new pests

PARTS should finance a study on the need for national plant pest diagnostic laboratories and/or their potential for coordinating early detection efforts.

Estimated cost $5,000

II. ANALYTICAL TOOLS AND METHODOLOGIES

ISSUE 5: The Provision of Pest Organism Identification/Diagnostic Services is a Basic Requirement for Effective Pest Management In SSA

Discussion

The identification of the organisms involved in a pest problem is, as suggested elsewhere, an essential information need for farmers, extension agents and researchers. A means of providing these services in a cost-effective manner is therefore critical. This need for identification can be considered at various levels, including:

- The farmer, who needs to be able to identify the common major pests, or symptoms of their damage, in respect to the crops that he or she is cultivating.
- The village-level extension agent, who needs to be able to assist with the identification of problems not readily recognized by farmers.
- Crop protection extension specialists, who, employing the facilities available through plant health clinics or similar resources can, provide (where needed) more

accurate identification of pest organisms.

- Research services, which can provide authoritative identification of pest organisms in cases where it has not been possible for farmers or the extension services to do so.

- International pest identification services which are able, often at considerable cost, to identify pest organisms that cannot be authoritatively identified by the National Agricultural Research Service (NARS).

Recommendation for PARTS Funding Concerning Pest Identification and Diagnosis

It is at the level of NARS, and in terms of internationally available identification services, that it is recommended that PARTS should finance specific analytical activities designed to:

- Encourage and support the maintenance and development by NARS of their pest identification/diagnostic capabilities to provide services to farmers and extension agents for identification, and where practical, recommendations for control.

- Facilitate the utilization by NARS of pest identification services available outside Africa

Estimated cost $30,000.

This activity responds to the above mentioned "lesson learned"; that there is a need for more basic resources on the part of NARS to conduct research.

Recommendation for PARTS Funding Concerning Pest Alert Briefing Papers

1. A briefing paper on "new world screwworm", its economic importance, identification, preventing introduction, and procedures for submitting suspected specimens for identification should be prepared.

2. A briefing paper similar to the above should be prepared on the remaining major pests of cassava not yet known to occur in SSA.

Estimated cost $35,000

ISSUE 6: Farm Level Assessments/Studies

Sub Issue 6A, Underlying Crop Production Constraints

Discussion

Farmer level assessments/studies are needed to identify the underlying crop production constraints (e.g., biotic). There is a need to know the exact pest problems, and the actions being considered by farmers/villagers in their PM schemes for coping with the problems. It is necessary to understand farmers' perceptions of their problems, the resources they have available, and their willingness to employ them for PM. The results of these studies will contribute to our knowledge of the technology required to reduce cereal crop losses and its eventual transfer to farmers.

Recommendation for PARTS Funding Concerning Underlying Crop Production Constraints

1. Study the effectiveness of traditional methods for reducing cereal crop losses (e.g., millet) due to bird depredation. Study to include the village's division of labor and availability for this activity when needed. Also indicate labor constraints (if any), cost of labor, and impact of labor lost to other activities (e.g., harvesting, school, etc.)

2. Study the impact of labor constraints, if any, on weeding and its impact on production (e.g., yield/ha, number of ha that can be cultivated). Compare hand-hoe agriculture versus animal traction. Identify cost to farmer and competing labor demands for participants (particularly women and children) for:

a. Millet
b. Maize
c. Vegetable crops

Estimated cost $250,000

Sub Issue 6B, Seed Selection by Farmers

Discussion

The seed saving practices of small farmers in the SSA have not been studied sufficiently, though on-farm (saved) seed sources account for 80 per cent of the seed planted for main crops in Africa. In fact, the seed saving practices of small farmers have been viewed by many development specialists as posing a hinderance to agricultural development since its presence inhibits farmers' willingness to use seed supplied by governmental or private sector seed supply systems. There is the mistaken assumption that saved seed is "bad" whereas supplied seed is "good". This assumption has been shown to be false since subsistence farmers have been able to store supplied seed (including hybrids) after harvest so that production was about the same as when the first year when s/he purchased the seed.

Reference: James C. Delouche, Prepared for CIAT-Seed Unit Workshop, August 9-13, 1982.

Recommendation for PARTS Funding Concerning Seed Selection by Farmers

Carry out a study to determine how farmers select their seed stock for the following season and why they use the method they do. Determine if innovations are possible for improving farmer selection methods for resistance. Also survey the storage methods used for seed stock to see if methods used are appropriate to maintain reasonable germination rates and provide proper protection from stored product pests. Responses should be based on farmer interviews and observation.

Crops to consider:
- Millet
- Sorghum
- Rice
- Maize (composite)
- Cowpea
- Selected Vegetable crops

Estimated cost $122,000.

Since seed companies have a direct interest in this issue, they should be approached to participate. Their participation could also enhance their marketing activities and more participation by the private sector in this type of activity.

The data generated by these analyses would also provide better information for future project design, Accordingly, it would respond to the lesson learned that better information is needed for use in project design.

Sub Issue 6C, Crop Substitution

Discussion

As a means of pest management, many of the food crops grown by Africans are of foreign origin. They may be subjected to more serious pest problems than those that originated in Africa. In addition, the food crop may not be well adapted to the environment and they may react more severely to certain nematode insect or disease attacks.

Recommendation for PARTS Funding

1. Undertake a literature search and seek expert opinion in an effort to identify some substitute or supplementary cereals and vegetable crops that could be grown in different ecological zones in Africa.

2. Identify research stations, volunteer groups,etc. to test new crop growth habits, identify pest constraints and acceptability by nationals and expatriates.

3. Develop a briefing paper of results of the literature search.

Estimated cost $35,000.

The results of this effort would make an important contribution to identifying appropriate technology and its transfer.

Additional needs identified as a result of undertaking the studies recommended and requests from Missions are estimated at $200,000.

III. INFORMATION DISSEMINATION & MANAGEMENT

ISSUE 7, Effective Information Management is an Essential Component of the Development of Pest Management Strategies in SSA.

Discussion

In the forward to a recent study (Harris and Scott 1989), it is stated that "the supply of timely and authoritative information is perhaps more important for crop protection,

including plant quarantine, than for any other area of science." In the "front line" of those needing information is the farmer, who wants information that will enable him or her to make decisions regarding the control of pests which threaten his or her crops, and livelihood. They need to be able to make those decisions in a cost effective, practical way without endangering their health and immediate environment.

These information requirements of farmers depend very much on access to and interaction with, comprehensive extension support services which are able to identify and diagnose pest problems and provide farmers with the information they need to make pest control decisions. In this bridging role, extension agents need access to appropriate information about pest identification, biology, ecology and control.

Most plant protection information that is conveyed by extension agents and utilized by farmers is provided by basic, applied, and on-farm adaptive research activities conducted by IARCs, national government agencies, universities, and the private sector. While information about research on major pests in developed countries is accessible through available information systems, information on many important tropical and sub-tropical pests is in general, not so readily available to extension agents.

Certainly, providing information to extension agents will contribute directly to the transfer of agricultural technology to farmers.

The final level of information required is at the government monitoring and regulatory level. Various government agencies and institutions which have the function of ensuring sustainable food supplies by minimizing harmful pest damage, while simultaneously safeguarding human health, have need of appropriate information.

Recommendation for PARTS Funding

A. A supply of handbooks, manuals and other information materials needs to be made available to extension workers.

   Estimated cost $700,000.

B. Maps need to be supplied to the National Crop Protection Services in order to assist the proper planning and implementation of PM programs.

   Estimated cost $250,000.

C. The information needs of pest management researchers in SSA needs to be analyzed and appropriate steps to respond to them identified.

   Estimated cost $470,000.

D. National workshops should be used to identify in-country information needs and to discuss the results of in country PM projects. Workshop objectives would be to create extension and improve their effective work capacity.

Estimated cost $54,000.

E. An information system containing appropriate pest management methods relevant to SSA needs to be established, and appropriate methods of PM identified need to be transmitted to extension agents.

Estimated cost $26,000.

Table 1. Summary of Recommendations for Funding of Pest and Pesticide Management Analysis, Research and Technical Support Activities within ARTS/FARA,

Recommendations for Funding by PARTS: High Funding Level

STAFF ACTIVITY	TOTAL FUNDING	TOTAL BY ISSUE
Grasshoppers/Locust-oriented Options Analysis		
Options study for continued AFR grasshopper locust activity (IOR) 1/	$10,000	$10,000
Weeds and Vertebrate Pests (IOR)		
Bio control of weeds (A)	$40,000	
IWP for vegetables (B)	$70,000	
Control of vertebrate pests (C)	$120,000	
Additional needs identified as a result of undertaking A,B,C and requests from Missions	$190,000	$420,000
Pesticide Management & Policy (IOR)		
Predicting area of increased pesticide use	$20,000*	
Impact of Prostephanus truncatus	$35,000	
Impact of pesticides on areas of continuous use	$10,000	
Legislation and regulations to control pesticides	$10,000	
Briefing paper on Pearl Millet Mildew	$10,000	
Seed Treatments	$21,000	
Warm water treatment of smuts	$20,000	
Future trends for the use of herbicides	$25,000	
Additional needs identified as a result of undertaking studies mentioned above and requests from Missions	$60,000	$211,000
Pest Risk Analysis (IOR)		
Study of economic impact of new pest introduction since 1965 (A)	$30,000	
Early detection of new pest introductions (B)	$5,000	$35,000

* Assuming matching private sector funding of $20,000.00

Recommendations for Funding by PARTS: High Funding Level (continued)

Pest Identification-Problem Diagnosis (ATM) 3/		
Identification and diagnosis	$30,000	
Pest alert briefing papers	$35,000	$65,000
Farm Level Assessments and Studies (ATM)		
Underlying crop production constraints (A)	$250,000	
Seed selection by farmers (B)	$122,000	
Crop substitution (C)	$ 35,000	
Additional needs identified as a result of undertaking A,B,C and requests from Missions	$200,000	$607,000
Information Management (IDM) 2/		
Supply printed material to extension workers (A)	$700,000	
Maps for NCPS (B)	$250,000	
Information needs of PM researchers (NPPS/senior staff) (C)	$470,000	
Workshops and conferences (D)	$54,000	
Development of an information system(with CAB/AGRICOLA data bases)	$26,000	$1,500,000

1/IOR=Issue Oriented Research and Analysis Component of PARTS
2/IDM=Information Dissemination and Management Component of PARTS
3/ATM=Analytical Tools and Methodologies

Table 1. Continued

Recommendations for Funding by PARTS: Medium Funding Level

STAFF ACTIVITY	TOTAL FUNDING	TOTAL BY ISSUE
Grasshoppers		
Options study for continued AFR grasshopper locust activity (IOR) 1/	$10,000	$10,000
Weeds and Vertebrate Pests (IOR)		
Bio Control of Weeds	$40,000	
IWP for vegetables	$70,000	$110,000
Pesticide Management and Policy (IOR)		
Predicting area of increased pesticide use	$20,000	
Briefing paper on Pearl Millet Mildew	$10,000	
Seed Treatments	$21,000	
Warm water treatment of smut	$20,000	$71,000
Pest Risk Analysis (IOR)		
Study of economic impact of new pest introduction since 1965	$30,000	
Early detection of new pest introductions	$5,000	$35,000
Pest Identification and Diagnosis		
Identification and diagnosis		
Pest alert briefing papers		$100,000
Farm Level Assessments and Studies (ATM)		
Underlying crop production constraints	$250,000	
Seed selection by farmers	$22,000	
Crop substitution	$35,000	$307,000
Weeds and Vertebrate Pests (IOR)		
Bio control of weeds	$40,000	
IWP for vegetables	$70,000	$110,000

1/IOR = Issue Oriented Research and Analysis Component of PARTS
2/IDM = Information Dissemination and Management Component of PARTS
3/ATM = Analytical Tools and Methodologies

Table 1. Continued
Recommendations for Funding by PARTS: Medium Funding Level (continued)

Pesticide Issues (IOR)		
Predicting area of increased pesticide use	$20,000*	
Briefing paper on Pearl Millet Mildew	$10,000	
Seed Treatments	$21,000	
Warm water treatment of smuts	$20,000	$71,000

* Assuming matching private sector funding of $20,000.
1/IOR=Issue Oriented Research and Analysis Component of PARTS
2/IDM=Information Dissemination and Management Component of PARTS
3/ATM=Analytical Tools and Methodologies

Table 1. Continued
Recommendations for Funding by PARTS: Low Funding Level

STAFF ACTIVITY	TOTAL FUNDING	TOTAL BY ISSUE
Grasshoppers		
Options study for continued AFR grasshopper locust activity (IOR) 1/	$10,000	$10,000
Weeds and Vertebrate Pests		
Bio-Control of Weeds	$40,000	$40,000
Pesticide Management and Policy		
Predicting area of increased pesticide use	$20,000*	
Briefing paper on Pearl Millet Mildew	$10,000	
Seed Treatments	$21,000	
Warm water treatment of smuts	$20,000	$71,000
Pest Risk Analysis		
Study of economic impact of new pest introduction since 1965	$30,000	
Early detection of new pest introductions	$5,000	$35,000
Pest Identification and Diagnosis		
Identification and diagnosis	$45,000	
Pest alert briefing papers	$5,000	$50,000
Farm Level Assessments and Studies (ATM)		
Underlying crop production constraints	$100,000	
Seed selection by farmers	$22,000	
Crop substitution	$35,000	$157,000
Information Management (IDM) 2/		
Supply printed material to extension workers	$223,000	
Maps for NCPS	$60,000	
Information needs of PM researchers/(NPPS/senior staff)	$265,000	
Workshops and conferences	$27,000	$575,000

* Assuming matching private sector funding of $20,000.
1/IOR=Issue Oriented Research and Analysis Component of PARTS
2/IDM=Information Dissemination and Management Component of PARTS
3/ATM=Analytical Tools and Methodologies Component of PARTS

Table 1. Continued

Summary of Total Costs ($) for All Issues at High, Medium, and Low Funding Levels

	HIGH	MEDIUM	LOW
Total for All Issues	2,883,000	1,551,000	726,000
Plus 20% Inflation Over 4 Years	576,000	310,000	72,000
Grand Total	$3,459,000	$1,861,000	$798,000

Personnel for Pest Management Unit in FARA one G.S. 14 and two G.S. 13's for one year $386,000

Personnel mentioned above for five years	$1,930,000
Plus 20% Inflation Over 4 Years	$ 386,000
Grand Total	$2,316,000

(this figure includes salaries, fringes, travel and per diem)

The mechanisms for carrying out these activities include: using PARTS funds to buy-in to appropriate S&T projects; contracts with OICD/USDA for programmatic and short term assistance; and work orders with IQCs. Once the results of many of the analyses recommended in Section III are available, it is recommended that the Africa Bureau and the Missions consider the advisability of developing bi-lateral project to utilize proven integrated pest management interventions.

RECOMMENDATIONS FOR THE ASSIGNMENT OF PEST MANAGEMENT FUNCTIONS IN A.I.D.

Food, Agriculture, and Resources Analysis (FARA)

For the Environmental Branch of FARA, it is recommended that the responsibilities of the pest management staff include monitoring those activities dealing with pest management funded by the PARTS project; arranging for technical assistance requested by the Missions and REDSOs to undertake the development of pest management strategies, policies and programs; actions required to develop a long range integrated pest management strategy for the Bureau; undertaking sectoral assessments including follow up impact evaluations; and undertaking prototype activities to test out broad concepts which can be useful in more than one country.

In order to perform the tasks recommended above for the pest management unit, the pest management staff will require a senior pest management specialist and two additional officers to carry out the various technical liaison, information dissemination and analytical functions enumerated above. One of these officers would specialize in information management and training needs analysis. These personnel can probably best be obtained through the AFR/RSSA with USDA.

The cost for these personnel over a five year period is projected to be $2,316,000.00

Office of Operations and New Initiatives (ONI)

The responsibilities of the Technical Projects and Program Implementation Division (TPPI) of the new Office of Operations and New Initiatives (ONI) (in the African Bureau) will include managing the Bureau's portfolio of regional technical operations and training projects; and the coordination of support for emergencies that affect more than one country or region.

With reference to the existing AELGA project, it is recommended that AELGA's activities for grasshopper/locusts be transferred to ONI, once it becomes an operating entity. This recommendation includes activities sponsored by the AELGA project such as bio-modeling and environmental studies, bio-control activities, and greenness maps. These "activities" support National/Regional and International Locust/Grasshopper Control programs and are designed to assist national program managers and their efforts to improve existing operational programs.

The present AELGA project should look to the world class grasshopper program directed and coordinated by the USDA, for technical assistance and information. It involves numerous state departments of agriculture and universities. The program also maintains contacts internationally in such areas as bio-control. The current AELGA project should provide funding for on-going bio-control activities at (Montana State University), and other transitional costs until future grasshopper/locust activities can be funded under a new project in ONI.

The activities of the AELGA project impact a variety of countries and donors. Activities which are fragmented under several different administrative units cannot be well coordinated. Therefore, it is imperative that one person in ONI be named IPM Coordinator. The AELGA project manager could serve as Coordinator. The Coordinator must be the contact person for the U.S. effort in integrated pest management activities, (e.g., work plan, networking with other donors and international coordination, technical support, etc.). The coordinator's responsibilities will also include marshalling U.S. responses to emergencies.

It is anticipated that the IPM coordinator will have frequent occasion to call upon the pest management unit in FARA for the types of technical assistance that this unit is equipped to deliver, or arrange for from other agencies of the U.S. Government, universities and contractors. In this connection, FARA is encouraged to keep in mind that the resources available in other agencies of the U.S. Government represent a rich resource of experience and knowledge which should be fully utilized.

Assuming that the outcome of the economic study concerning future A.I.D. grasshopper/locust activity (recommended in Chapter 3.0) is positive, there should be a follow-on grasshopper/locust effort in AFR, in the form of a new project with a single project manager held responsible for the implementation of these efforts within ONI. Again, the pest management unit of FARA, because of its previous experience with managing AELGA, its experience in responding to emergencies, its technical capabilities, and its access to technical assistance outside of A.I.D., can be of continuous assistance to those involved with pest management operations in ONI. It is recommended that one pest management position be established through the AFR/RSSA with USDA to provide a project manager for AELGA and other IPM activities in ONI.

Pesticides and Their Management

It is recommended that ONI project management establish (well in advance of emergencies) procedures for procurement, determining staffing needs, resolving transport needs and, establishing usage procedures for a limited number of pesticide that are most

apt to be used/purchased. They will also have to resolve security, safety and relevant impact issues. Disposal, etc. should be dealt with in the context of the existing AELGA project by ONI. Simulations should be run periodically to test reaction time and identify problem areas for improvement.

Pre-planning should also include identifying emergency response and technical advisory teams. Databases with information useful for responding to emergencies should be reviewed and updated periodically.

Bureau of Science and Technology (S&T)

Operating on the theme that long range research, (as distinct from short term studies and analysis) should be carried out by S&T, it is recommended that FARA could use funds from PARTS to finance research through buy-ins to appropriate S&T Collaborative Research and Support Projects (CRSPs), other appropriate cooperative agreements, and grants or PASAs which S&T has or will negotiate.

1.0 INTRODUCTION

1.1 The Reorganization

This study was commissioned by the Bureau for Africa, at a time when both the Bureau and the Agency were undergoing major reorganizations. These changes have implications for the matters discussed in this report.

Of particular concern with respect to the evolving Agency reorganization, will be the realignment of responsibilities and functions between A.I.D.'s Science and Technology Bureau (reorganized as "Research and Development") and the technical offices of the Africa Bureau such as TR/ANR.

Of even greater impact, for our purposes, will be the restructuring of roles and activities within the Africa Bureau itself, particularly the way in which the Bureau will carry out its technical functions, including those for pest management. Henceforth, many of the agriculture and natural resource support activities (hitherto carried out in AFR/TR/ANR) will be transferred with a reduced staff to the Environment Branch of the new Directorate of Food Security, Agriculture and Natural Resources (FARA) which will be a unit of the Office of Analysis, Research and Technical Support (ARTS).

TR/ANR's operational and project management functions are to be assumed by the Office of Operations and New Initiative (ONI) with FARA playing a facilitative, analytical, strategizing support role.

1.2 Purpose of the Report

The purpose of this report is to study major elements of pest management experiences in Africa over recent years, those of the Africa Bureau in particular, and to make recommendations concerning future A.I.D. activities in pest management in Africa, where they should be located in the agency, and how they should be carried out.

The is intended to provide lessons learned and recommendations which are general in nature and are for the general edification of interested parties. A more specific objective of this report is to suggest how pest management activities in Sub-Saharan Africa can be supported by A.I.D., with particular reference being given to the upcoming Policy, Analysis, Research, and Technical Support (PARTS) project. This six-year project currently being designed by A.I.D. to support strategic analyses and information activities, is needed by its clients (Africa Bureau, Missions, host-country governments, and local

NGOs) in order to develop, implement and measure the impact of A.I.D. supported agricultural and natural resources policies, programs, and projects in Sub-Saharan Africa. PARTS has adopted the DFA's Strategic Objective Three - developing the potential for long-term increases in productivity - as its overarching theme guiding its project design. DFA's Strategic Objective Four - improving food security - also underpins the PARTS design effort.

Coincidentally, the structural changes mentioned in the introduction, follow a period of upsurge and invasion by grasshoppers and desert locusts in the late 1980's. The invasion led to a massive multi-donor international effort in which A.I.D., including the Bureau for Africa (largely through the AELGA project) and the Office of Foreign Disaster Assistance (OFDA), played major roles. With the infestations currently in recession, this is an ideal time for donors, experts and the vulnerable countries themselves to consider and plan longer term pest and pesticide strategies and locust/grasshoppers mitigative measures for the future.

The successes, the setbacks and the changed circumstances confronting the work of the Bureau's PM staff have been reviewed. As a result, the team concluded that there is a continuing need to address many of these issues, to assess the opportunities and challenges that they will present during the years ahead, and to consider options for a strategy that might be followed.

1.3 The link between pest management and key priorities for the Office of Analysis, Research and Technical Support analytical agenda.

1.3.1 Sustainable Agriculture

There is general agreement that "pests" cause significant losses to agricultural crops and livestock in sub-Sahara Africa during the pre-and post-harvest periods, diminishing agricultural production. For the purpose of this report, "pests" are considered to include plant feeding insects (including migratory insects such as locusts and armyworms); plant feeding mites; plant-feeding vertebrates, including migratory and non-migratory birds, and rodents; plant diseases, including nematodes; and weeds.

The real level of economic losses caused by these pests in Africa is currently unknown, but significantly. They are in many instances perceived by African farmers to be serious constraints to increased agricultural production. It must, however, be noted that farmers' perceptions of the relative importance of these pest problems in many instances differ greatly from those of extension workers, researchers, and those engaged in technical assistance programs. For example, many African farmers consider weeds and vertebrate

pests to be the most serious problems affecting crop production. On the other hand, research activities, (both at the national and international level) and technical assistance programs, including those of A.I.D., have tended to focus on insect pests and, to a lesser extent, plant disease problems.

African farmers have traditionally attempted to reduce losses caused by pests by:

- Selecting and using crop varieties that have stable tolerance to pest problems.
- Using cultural methods that minimize pest losses, such as intercropping, adjusting planting dates, and hand weeding;
- Using naturally occurring pesticides; and
- Adopting crop storage methods that limit pest damage.

During and following the colonial period, in some parts of Africa, considerable effort was made towards further reducing pest losses in both crops and livestock. These efforts largely focused on the commercial and export sectors of African agriculture (although these sectors produce less than five percent of Africa's food), and emphasized the use of pesticides. The chemical control of insect pests and diseases of cocoa in West Africa is a good example of this type of activity. In general, commercial agriculture continues to be a relatively heavy user of chemical controls.

Since the 1970s, increasing realization worldwide of the problems associated with reliance on pesticides has led to development of the concept of "integrated pest management" (IPM). Additionally, more recently and in a broader sense, the long term social economic and environmental shortcomings of high-input agriculture have led to a greater appreciation of the place that IPM can play in promoting low-input agriculture that is sustainable over the long-term. Since low input agriculture is less expensive for small farmers, such considerations are clearly relevant to the development of sustainable agriculture in Africa, particularly as the needs of low-resource farmers in Sub-Saharan Africa are better understood and addressed.

The definition of "integrated pest-management" and "sustainable agriculture," now frequently used terms, is a matter of considerable debate. Frequently both terms are used as "catch-phrases," without any real understanding of the practical implications that should underlie them. For the purposes of this report, the definition of IPM developed by the U.S. Congress' Office of Technology Assessment will be used: "the optimization of pest control measures in an economically and ecologically sound manner, accomplished

by the coordinated use of multiple tactics to assure stable crop production and to maintain pest damage below the economic injury level while minimizing hazards to humans, animals, plants and the environment." The team also liked a simpler definition provided by the highly successful FAO Rice IPM Program in southeast Asia: "the farmers best rnix of control and tactics, taking into account yields, profits and safety."

What constitutes "sustainable agriculture" is currently receiving great attention. There is growing acceptance of this concept which is based on human goals, and on understanding the long-term impact of our activities on the environment and other species. Use of the sustainable agriculture approach guides our application of prior experience and the latest scientific advances to create integrated, resource-conserving, equitable farming systems. These systems reduce environmental degradation, maintain agricultural productivity, promote economic viability in both the short and long term, and maintain stable rural communities and quality of life (Francis & Youngberg, 1990).

In a practical way, in order to assess the sustainability of farming changes proposed for Africa, Upton (1987) recommends asking if the proposed change:

- Helps secure an adequate and assured food supply,
- Increases cash income to meet other material needs,
- Reduces risk in an uncertain environment,
- Increases leisure time and provides more time for other non-agricultural activities (e.g., education, social activities, political participation),
- Makes provision for the future, for old age and the welfare of the community,
- Increases status and respect within the community for those adopting the change.

From both a conceptual and practical level, it can be seen that pest management has a significant role to play in increasing agricultural production and thereby contributing to the development of sustainable agricultural systems in Africa. Accordingly, this study, as stated in the Scope of Work, will define the "planning and analysis...needed to determine the options, priorities nature and scope of appropriate...activities in pest and pesticide

management in support of agricultural sustainability in sub-Saharan Africa."

The PARTS project design team has adopted DFA's third and fourth strategic objectives as its overarching theme in its project design process. The project will support strategic analyses and information activities needed by project clients (Africa Bureau, Missions, host-country governments, and NGOs) in order to develop, implement, and measure the impact of A.I.D. sponsored agricultural and natural resource policies, programs, and projects in Sub-Saharan Africa. The project goal is to develop and implement more effective development strategies, policies, programs and projects. PARTS' purpose is to increase the utilization of information and analysis for A.I.D. sponsored agricultural and natural resource policies, programs, and projects.

Pest management, especially IPM, can play a clear role in helping to meet each of DFA's and PART"s strategic objectives. The link between IPM and sustainable agriculture also involves food security, natural resources management, agricultural technology development and transfer, and agricultural business and marketing which responds to DFA's strategic objectives four, three, and two respectively.

1.3.2. **Food Security**

Although most African governments have national food self-sufficiency, or at least self-reliance as a policy objective, in practice what they attempt to achieve is a state of "food security." This encompasses a number of interrelated aspects:

- Availability of food, hopefully assured by a combination of sources including domestic production, security reserves, imports, food aid and trade;
- Access to food, assured by production for home consumption, market distribution and other transfer mechanisms; and
- Utilization of effective food-processing storage and nutrition technologies.

Among the important constraints that have been identified as limiting the capacity of national agricultural sectors in Africa to feed their populations, is the lack of improved technologies to increase production. The contribution that improved pest management technologies and strategies could make to balancing the food security "equation," particularly in relation to food production and storage, have been to a large extent under-emphasized in most food security assessments. The reasons for this may in part be due to the lack of disciplinary and institutional interaction between crop protection and food security decision makers. This report will, by identifying and prioritizing prospects for

technological development in the area of pest management in African agriculture, attempt to define how A.I.D. might best promote the linkage of pest management with other components of food security research and policy.

1.3.3 Natural Resource Management

The development of integrated pest management, as an important component of sustainable agricultural production, has occurred as part of an emerging recognition that agricultural production and environmental management must share common, rather than competing goals. Effective pest management is dependent on and interwoven with proper management of all other components of any sustainable agricultural system. Components of such a system include the management of soil, water, crop plants and livestock, non-crop vegetation, non-crop beneficial organisms including wildlife, off-farm inputs, and human resources.

1.3.4 Agricultural Technology Development and Transfer

The development of the concept of IPM since the 1970's has led to increased need for non-chemical control technologies on one hand and less persistent, more specific pesticides on the other. This need results in a process of redefinition and reappraisal of existing technologies, along with the development of new pest management technologies. In this connection, the possibilities of the private sector being involved in the development and extension of these technologies needs to be fully explored.

This report attempts to achieve, in terms of A.I.D. support to pest management in Africa, a balance between the two aspects of pest control mentioned in the paragraph above, by ensuring that the pest management "wheel" is not continually reinvented, while at the same time making full utilization of new and potentially valuable technological developments.

Underpinning these considerations will be the clear understanding that without the successful transfer to farmers of any pest management technology (new or old), the effort made in its development will have been wasted. Consequently, the contribution which pest management can make to sustainable agricultural development, food security or balanced natural resource management can only occur if effective systems of communication with farmers and other actors in the production chain are established.

1.3.5 Agricultural Business and Marketing

In the years immediately after the Second World War, the private sector made extremely significant contributions to pest management through the development and marketing of

synthetic pesticides. The private sector continues to be active in the marketing of pesticides.

Any consideration of the future development of pest management in Africa must address the part that the private sector will play in the future supply of crop protection inputs in Africa, the continuing development of new pesticides, increasing levels of stewardship of existing and new products, and the development of new technologies including those involving biotechnology. Additionally, this study will consider the opportunities offered through pest management activities for small business development in Africa, including the development of pest monitoring services, production facilities for beneficial insects and microbial pesticides, and cottage industries producing small-scale pest control tools.

2.0 PAST EXPERIENCE AND LESSONS LEARNED

2.1 Summary of the Africa Bureau and other donor involvement in pest management in Sub Saharan Africa

Over the past 5-10 years a wide range of pest management issues have been addressed by a number of donors, through a variety of mechanisms. In some instances, it has been directly through specific studies (e.g., France/O. senegalenis, GTZ/Neem) or longer term bi-lateral agreements with staff located in the host country for the duration of the project such as the National Plant Protection Service (NPPS/Togo:GTZ, Cereals Research Project/Cameroon:USAID). In other cases, donors (usually foundations and national governments) have been indirectly involved through established (or by establishing International Agricultural Institutes (e.g., International Institute of Tropical Agriculture, Ibadan Nigeria (IITA), and the West Africa Rice Development Association, Bouake, Ivory Coast (WARDA).

2.1.1 Major Sub Saharan Africa Donors

In sub-Saharan Africa (SSA) several donors have been major players over the last 10 years. A major donor is defined as regularly having several pest management associated studies/projects or having provided supplies/equipment regularly to selected organizations/host-countries throughout Africa.

2.1.1.1 Governments: (Listed alphabetically)

Canada

The Canadian International Development Agency (CIDA) has interests in both pre/post harvest pest management. Canada participated actively in West Africa in the last emergency grasshopper/locust program by supplying single-engine aircraft. CIDA has also supported several national plant protection services in West Africa. Some films and publications are available, particularly on post-harvest storage.

France

CIRAD (Centre de Cooperation Internationale en Recherche Agronomique pour le Development), Montpellier, France was established in 1984 as a center for international cooperation in agricultural research. It is oriented toward development. CIRAD is composed of eleven (11) departments. Examples include:

(1) IRAT (Institut de Recherches Agronomiques Tropicale et des Cultures Vivrieres) - a research institute founded in 1960 for tropical agriculture and food crops (including vegetables). They are also involved in providing training courses and have developed a series of illustrated fact sheets. There is an African orientation to their work. They also publish L'Agronomie Tropicale, a journal that includes plant protection, in French (English/Spanish summaries).

(2) PRIFAS-GERDAT (Programme de Recherches Interdisciplinaires Francais sur les Acridiens du Sahel) - a center established in 1975 for research on grasshoppers/locusts and their associated ecology. Most of PRIFAS work is in Africa. They also publish a newsletter that has collected and distributed grasshopper/locust related information. This newsletter SAS (Surveillance des Acridiens au Sahel) is published in both French and English. Training is offered and a number of publications are available.

(3) There are 9 other combined departments (besides those listed above), that cover a variety of commercial crops, forestry, agricultural machinery, animals, etc.

ORSTOM (Institute Francais de Recherche Scientifique et Technique pour le Development et Cooperation en Outre Mer). ORSTOM conducts basic research in a variety of areas, not all of which are agricultural. In Dakar there is a major laboratory for plant nematodes. They have undertaken nematode surveys in a number of countries in West Africa. In Abidjan the laboratory worked on whitefly transmission of Africa mosaic of cassava among other things.

Germany

GTZ (Deutsche Gesellschaft fur Technische Zusammenarbeit GmbH), Eschbon, Germany, is a government-owned agency that works "in the field of technical cooperation." GTZ conducts a variety of pest management projects both pre and post harvest. Their activities have included support for National Plant Protection Services in several SSA countries, biological control efforts in several countries, and the conduct of numerous workshops. They also have published numerous well illustrated publications in French and English that have received wide distribution. Other activities have included:

- Natural Insecticides from Plants
- Pesticide-Residue Analysis
- Bird Damage in Cereal Production
- Plant Protection Advisory Services in Fruit and Vegetable Growing.

Japan

The major effort of the Japanese International Cooperation Agency (JICA) has been the contribution of pesticides, application equipment and vehicles to national plant protection services (NPPS). Generally, little back-up support and training accompanies the contribution. Support such as spare parts, training materials in local languages, and assistance in disposal of excess pesticides is seldomly provided. A six-month training program (in English) on plant protection was held in Japan in 1990 for some Africans.

The Netherlands

Dutch programs are handled through International Cooperation, Netherlands Ministry of Foreign Affairs. The Netherlands have established and supported a Plant Protection Training Center in Niger. This center, which serves the Sahel, has operated for a number of years and includes African instructors. They also support the Sahel Institute's "P.V. Info" (a newsletter on plant protection) which was initially funded by the USAID/Regional Food Crop Protection Program (RFCP). Additionally, they have plans to assess the environmental impact of pesticides in the Sahel (PENSA Project). As a crop, potatoes are an area of interest.

United Kingdom

There exists a substantial reservoir of Africa based skill/knowledge within Britain's Overseas Development Administration's (ODA) Natural Resources Institute (NRI). This includes considerable expertise on grasshoppers/locusts, stored products, weeds, and biological control.

However, for the last ten years or so, the U.K. has funded only a limited number of projects. Most units of NRI have sought project financing outside the British government which has led to a considerable diminution of their activities in Africa. They have published a series of PANS handbooks. These cover pest problems on a specific crop (e.g., rice, bananas, etc.). They have been well received. Hopefully the series will be updated, expanded to other crops and translated into French. It is unfortunate that an apparent lack of finances seems to limit work on this series and a wider distribution of these handbooks. Providing financial support for this series of handbooks would be preferable to creating a new series elsewhere (e.g., USA).

U.S.A.

A.I.D. has undertaken numerous activities in pest management in the areas of plant, animal, and human health (see Annex 4 for further discussion). These activities fall into the following categories:

a. Responding to several types of emergencies,

b. Long term approaches designed to reduce problems via genetically manipulated resistance or adoption,

c. Integrated pest management (mostly without pesticide involvement),

d. Human Resources Development, this effort usually involved supporting candidates for academic degrees (B.S.-Ph.D.) and extended short courses.

For references a, b, and c above, many activities were accompanied by institutional building including construction, commodity procurement and training (e.g., frequently academic).

2.1.1.2 International Organizations.

Food and Agriculture Organization of the United Nations (FAO)

Since the 1960s, FAO has made a major effort to develop and establish IPM programs in Africa at the international, regional and national level (Schuehan 1989). International Code of Conduct on the Distribution and Use of Pesticides is an example of a current (1986) international initiative.

Another international initiative by FAO has been the International Plant Protection Convention. This effort is designed to organize the countries of the world to adopt a standardized approach to prevent the spread of exotic (new) plant pests to uninfected areas. A current initiative in Africa is to attempt to standardize and establish pesticide legislation in SSA. This is especially important to the private sector which finds it difficult to work in a region where every country has a different set of regulations, particularly where the market may be marginal anyway.

Other United Nations agencies whose activities involve IPM

Other UN agencies whose activities involve IPM activities include: the United Nation's Development Programme (UNDP), which contributes to CGIAR Institutes and finances many FAO-operated projects; United Nations Environmental

Programs (UNEP) concerned with environmental aspects; United Nations Industrial Development Organization (UNIDO) in relation to the manufacture of pesticides and application equipment; and the World Health Organization (WHO) concerned with the vectors of human disease.

World Bank

The World Bank has recently prepared an "Operational Directive (on) Agricultural Pest Management" which, when implemented, will make IPM a central strategy for all World Bank agricultural development lending that includes pest control components. This directive represents an important step forward from the Bank's previous guidelines which only considered pesticide use.

Consultative Group on International Agricultural Research (CGIAR)

The Consultative Group on International Agricultural Research (CGIAR) is a group of international institutes located around the world including the following:

- **The International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria.**

  A number of countries (including the United States), several foundations, U.N.D.P, and the World Bank provide core funding. Most of their principle research programs are crop centered. These include: (1) Grain legumes; (2) Maize; and (3) Root, Tuber and Plantains. IITA maintains a germplasm collection and a library. Most IITA activities have been designed to improve production of their mandated crops (see above).

  Most of IITA's scientists are located at Ibadan; although some are situated at the substations of (Onne, Nigeria/Cotonou, Benin). Others are with selected regional and collaborative national programs throughout Africa. The Benin facility concentrates on biological control. Here the initial effort was on Cassava mealybug. More recently they have expanded to pathogens that attack grasshoppers.

  IITA's primary emphasis is to help the family farmer improve their production of IITA's mandated crops in the lowland humid and subhumid tropics of West and Central Africa.

- **West Africa Rice Development Association (WARDA), Bouake, Ivory Coast.**

  This organization has undergone a number of changes both administratively and structurally in the past several years. It works on rice improvement with facilities located in Ivory Coast (upland rice), Sierra Leone (mangrove rice) and Senegal (irrigated rice). Recently their mandate has been extended to cover most of Africa.

- **Others**

  (1) International Crop Research Institute for the Semi-arid Tropics (ICRISAT), Hydrabad, India with a Sahelian center in Niger. Like most other CGIAR Institutes, they emphasize the production aspects of their mandated crops, groundnut, millet, and sorghum.

  (2) International Center for the Improvement of Maize and Wheat (Centro International de Mejoramiento de Maiz y Trigo-CIMMYT), Mexico. Mandated crop work is maize, wheat and triticum. They support some work in Africa, particularly East Africa.

  (3) International Rice Research Institute (IRRI), Laguna, Philippines. They were established in 1960 and have an international mandate for rice. They are noted for having initiated a successful IPM program for rice production in South East Asia. This program is frequently referred to as a model for IPM in Africa. However, it may be difficult to apply directly since rice has a greater focus as a "cash crop" than does millet or sorghum in much of Africa.

  (4) International Center for Potatoes (CIP), Lima, Peru concentrates on Irish and sweet potatoes. They have a number of support programs in Africa, predominantly in East Africa. Like the other institutes, they have training programs and training materials such as manuals for insect and disease identification and control.

European Economic Community (EEC)

The European Economic Community finances a variety of projects including agriculture. These projects seem to vary widely. They have provided grants for pesticides to individual countries. As a donor they were a major contributor to the 1985-89 grasshopper/locust program. The EEC needs to be included in more PM meetings relative to Africa.

International Council for Research in Agroforestry (ICRAF)

Located in Narobi, Kenya, this council promotes agroforestry systems for better land use. Various reports, a journal and a newsletter are published.

The International Centre of Insect Physiology and Ecology (ICIPE)

The International Centre of Insect Physiology and Ecology (ICIPE) was established in 1970 and is located in Nairobi, Kenya. ICIPE conducts basic research on tropical pests of crops and livestock disease vectors.

A number of activities have been undertaken by ICIPE over the past years. They have ranged from basic studies on termite pests of agricultural land to efforts at the integrated pest management (IPM) of crop borers. The ICIPE core research program is concerned with tropical insect pests of crops and vectored livestock diseases.

Several of these activities merit special attention:

a. There is a Regional Postgraduate Program in Insect Science. This is a collaborative training program between ICIPE and a number of African Universities.

b. A program exists for identifying opportunities for graduate thesis work through an arrangement with non-African universities.

c. ICIPE has been serving as the "host" for the "Association of African Insect Scientists," an African-wide (mostly SSA) association of entomologists.

d. ICIPE underwrites (in part) PESTNET, a "newsletter" and training program. This is a cooperative effort by a number of African institutions coordinated by ICIPE that is intended to:

   (1) Generate pest (insect/tick) management information within Africa,

   (2) Exchange information and experience between participating institutions,

   (3) Test methodologies and technologies for validity in Africa,

   (4) Encourage the development of scientific pest management in Africa by training.

2.1.1.3 Regional/Africa-Wide Organizations

Inter-African Phytosanitary Council (IAPSC)

The Inter-African Phytosanitary Council is mandated by the Organization of African Unity (OAU), and has responsibility for Africa-wide approaches to plant quarantine, bio-control and other PM issues, including responsibility for pesticide legislation, new pest introductions and other African approaches to PM. Although their resources are limited, they do occasionally have some budgeted funds for technical services and publications. They are located at Yaounde, Cameroon. Questions have been raised about their effectiveness.

Southern African Regional Commission for the Conservation and Utilization of the Soil (SARCCUS)

Located in Pretoria, South Africa, this Commission has a standing Committee for Plant Protection.

Other

ECOWAS and SADCC, two regional economic organizations have hosted occasional conferences on pest management. They represent a potential communication channel for future pest management activities.

Also, various universities, foundations and PVO's located in donor countries have been involved with helping donor countries to implement PM efforts.

GIFAP/NACA

GIFAP, based in Belgium, is the international trade association of agricultural chemical manufacturers and distributors. National Agricultural Chemicals Association (NACA) is the U.S. representative to GIFAP. GIFAP has produced several well illustrated training materials including posters and a manual in several languages. They are capable of providing a wide range of technical support on pesticide related issues. They should be included in any discussion relative to storage, warehouse management, safety training, disposal issues, etc. Warehouse blueprints, pesticide specification assistance, and printed materials (e.g., warehouse pesticide management inventory file cards, posters, etc.) are all areas where this group can provide assistance.

The proceeding discussion has attempted to highlight those major players who have an interest in Africa with a capacity to participate in PM. The regional organizations, FAO and OAU, while many times short on resources, do often offer an "umbrella" under which

to operate, particularly for topics of multi-country interest. Unfortunately the effectiveness of a regional organization is often dependent on their Director and available resources.

Additional information regarding donors can be found in:

- James, Clive: Implementation of Integrated Pest Management (IPM) in the Third World--ISSN Related to Institutional Aspects (Draft), 1989.
- van Alebeek, F.A.N.: Integrated Pest Management--A catalogue of Training and Extension Materials (1989).

2.2 Lessons Learned

Many lessons have been learned from prior A.I.D. and other donor involvement in pest management programs. Improvements in procedures and approaches should be a logical extension of the numerous evaluations A.I.D. has conducted at great expense. Unfortunately, after reviewing abstracts of PM projects covering 10-15 years, it appears many lessons still need to be learned.

The primary point gleaned from a review of mid-term and final evaluation is that the "lessens learned" are almost always managerial (calling for revisions in project design or implementation) and not biotechnical. A summary of conclusions arranged by category follows:

2.2.1 Pest Management Project Design Issues

Issue: Project Beneficiaries are not involved in the project design process.

PM projects are often designed and initiated with no real possibility of success because the target group is not involved with the design. Good problem identification and a search for appropriate technical solutions is not enough. If a project is to be sustainable, it must have the support of the group it is supposed to assist.

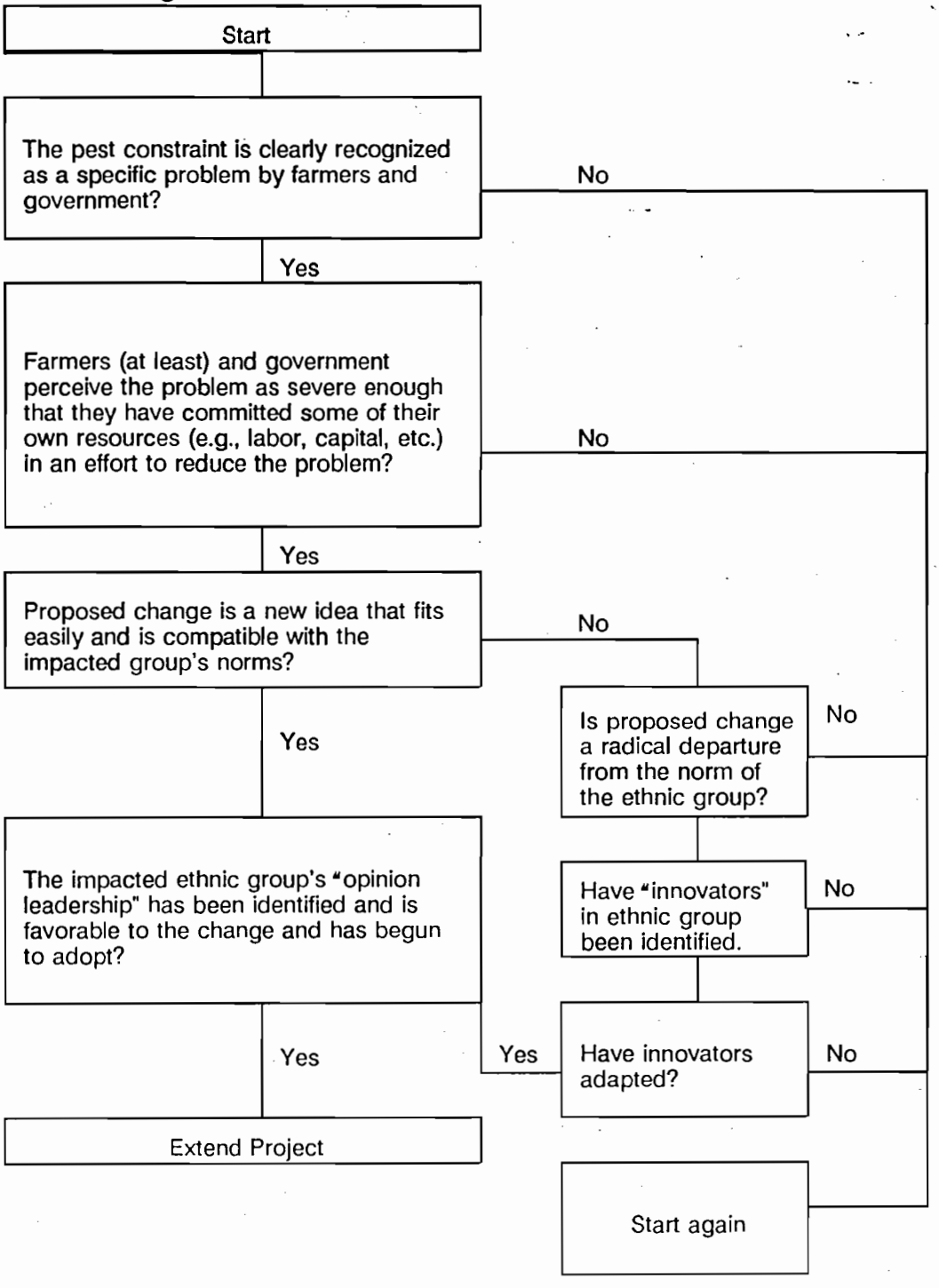
Social science research has identified specific processes by which change occurs in various societies. The probability for success can be enhanced and predicted with some reliability if these processes are understood. All too often these processes are not respected when designing A.I.D. projects.

Recommendation:

While the following is an obvious oversimplification of the work of Havelock, E. Rogers and others, it is nevertheless representative of a well studied process that could be used to judge and predict the potential for success of various PM activities.

A simple algorithm follows (Figure 1) that illustrates an analytical process that could be applied to test the potential for adaption of proposed PM changes at the farmer level.

Figure 1. Decision Flow Chart to Assess the Potential for Adoption of Pest Management Practices at the Farmer Level.



Issue: Better basic information needed before project design

The basic data required (e.g., needs analysis [farmer/government], social-economic analysis, support elements, and fiscal base) does not always seem to be well defined nor in place before a project begins. Consequently, projects have been approved which contain implementation elements which have not clearly identified the problem to be addressed. In such cases the solution proposed is questionable. Problems need to be identified which have a measurable impact on agricultural production. Better analysis is needed to establish specific needs and problems, possible solutions, sequencing, and the environmental constraints (e.g., social, religious, government regulations, economic, customs, values).

Recommendation:

The analytical/prototype process used by the British for designing the Mali Millet Pest Control Project could serve as a useful model. The analytical process of five years was followed by a project proposal. (Note: the work was in one country, on mostly one crop with one set of pest constraints (insects), considerable farmer input and a multi-disciplinarian team). While recognizing that A.I.D. cannot invest five years time in gathering data for the design of each and every project, the team nevertheless urges the agency to be more rigorous in assuring that proper information is in hand before decisions are made on approving projects.

Issue: Proper identification of pest problems

Properly identifying pest problems and then identifying viable responses for coping with the problem which the farmer would be willing to adopt, has been a problem in some previously A.I.D. sponsored projects.

Recommendations:

Specific possibilities would seem to exist for involving international institutes (as an expert resource) with farm level analysis. The institute could help to identify and design a solution acceptable to a producer (farmer). This type of involvement would be of particular interest to the institute in countries where it does not already have a presence. The following are specific suggestions.

A. Identify countries in SSA where cassava is grown but little or no extension of IITA PM expertise is employed. Strategy: Ask IITA for a list of such countries.

B. Analyze pest constraints to production (e.g., economic analysis, farmer perceptions, etc.) in cassava in one or more countries on above list. Use IITA as an expert resource to identify appropriate cost effective strategy adoptable by farmers. Test same. Will farmers adopt practice?

C. Repeat as above (B) for: Storage losses of yam (Dioscorea alata) due to moth attack.

Issue: Difficulty of persuading farmers to adopt IPM practices

"The willingness of some farmers to tolerate a significant reduction in yield as a result of insect attack suggests that it may be difficult to convince subsistence farmers to adopt IPM practices. New pest management strategies must be technically feasible and also offer a significant reduction in yield loss that will be worth the farmers' investment in terms of cash and labor expenditure" (Conelly 1985).

Conelly (1987) also notes that "...the development of resistant varieties of maize and sorghum, biological control and intercropping appear to be more promising alternatives to pesticide use." The team supports the view that alternatives to pesticide use against grasshopper/locusts, birds, rats and a few other very specific problems, need to be vigorously investigated.

Recommendation:

The team suggests that A.I.D. continue these efforts and that PARTS fund an analysis for ways to improve the development process which flows from problem identification to breeding, to seed multiplication, to associated culture for the crop (in the farmer's context), to adaption by the farmer. In Chapter 3.0 of this report we make some specific recommendations for PARTS funding.

IPM development is a long term activity that needs to be continued by A.I.D. far into the foreseeable future. The team also recommends that CGAIR institutes such as IITA, WARDA and others with programs in SSA be involved in the type of IPM developmental activity outlined above.

Issue: Farmer perception of major pests may differ from those of outsiders

Farmer perceptions of their major pest constraints may not match the results of surveys by outsiders. (Lock 1989) found in Mali that: "Not one project farmer (of 104) cited Heliocheilus as a pest in 1989, despite average infestation rates among millet heads of between 50% and 70%." (Conelly 1985) also noted in Kenya that, "farmer failure to

recognize the sorghum shoot-fly...." as a serious pest in the area was contrary to survey data.

Recommendation:

Extension workers and farmers should work together to establish priorities and mutual understanding and trust, and to exchange information which will help identify the real problem.

Issue: Free or cheap access to pesticides provides little incentive to use other methods

Farmers who have access to free or cheap pesticides and treatments have little incentive to continue other more difficult or less effective pest control methods. Alternative solutions to a pest constraint are not likely to be seriously considered if an alternative such as pesticides is viewed as easier or cheaper and more effective by the farmer or government.

Recommendation: Pesticide users or recipients of free pesticide services need to pay for these materials so they have a more realistic means for comparing other options available. This theory should be tested in selected geographical areas.

Issue: The farmer needs to be involved with the process of analyzing the problem

Pest problem identification and resolution at the level of the farmer and with the involvement of the farmer, is an important component of the analysis process. "Experts" are often not very well informed as to the process farmers use to minimize pest risk. African subsistence farmers have developed strategies that take risk and uncertainty into account. The "Mali Millet Pest Control Project (Agricultural Economics Report) highlights the difficulty of improving upon existing SSA farmer PM strategies and decision-making (Lock 1989).

Recommendation:

Circulate the above mentioned report to Agriculture Development Officers's (ADOs) in SSA and to others who are concerned with introducing IPM in the context of African subsistence agriculture. Economic studies should be undertaken, which compare actual costs and the cost of various alternatives, versus benefits gained. Chapter 3.0 has some specific recommendations.

Issue: Understanding the host country bureaucracy

Sometimes donors have difficulty understanding how functions are allocated in the host government. Part of the problem donors have is that the task of National Plant Projection Services (NPPS) has only been loosely defined (Brader 1988) in many developing countries, and many donors don't even understand their own nation's service let along that of a developing country. This lack of understanding, particularly the distinctions between National Plant Protection Service (NPPS) and Research has led to some A.I.D. PM projects being placed in an inappropriate lead agency in the host government.

For example, the A.I.D./FAO IPM project was placed in NPPS in one country and in research in another. The NRI/Mali Millet Pest Control Project (Lock 1989) was implemented through the NPPS when it appears Research was the appropriate group. This project, for the first five years, was even called Research and Development. It was managed by U.K. personnel from a research institute.

Recommendation:

The host government lead agency needs to be carefully chosen in close consultation with the appropriate officials in the host government. The projected relationship required with other host government organizations during project implementation needs to be clearly worked out in advance. Failure to work within the proper government system has blocked project implementation progress more than once in situations where a host country institution felt they were being intentionally by-passed, and accordingly they refused to cooperate as a result. PM project managers have done themselves and the host-government a disservice by failing to operate within the existing system, even when it initially appears expedient to by-pass it.

2.2.2. **Project Implementation Issues**

Issue: The need to carefully review whether long term training is really needed

It is not uncommon for PM projects with an academic training component to find they have sent the best host country personnel off to the university for the duration of the project. Accordingly, the project can struggle for years with less competent staff. In Francophone Africa it can take one year or more to identify and obtain government clearances for a possible academic participant. At least another 5 years could pass for a B.S. degree, if English was required, and then another 2 1/2 to 3 years for a M.S. That means an absence of perhaps 8 or 9 years. It is not uncommon for academic participants to return just as a project is concluding or sometimes (e.g., for five year

projects) long after. This frequently means academic participants return to a program with high hopes but few resources to work with, since the donor has long since concluded their effort.

Recommendation:

The need for long term academic training should be very carefully reviewed. Projects should limit themselves, as much as possible, to qualified, existing host country nationals. Most countries already have many college graduates upon which to build a program. For many graduates, specific short-term, on-the-job (OJT) training may prove to be more valuable for the project than long academic absences.

Academic training should only be offered when a specific need can be clearly demonstrated (e.g., extensive taxonomic work probably requires a M.S. level degree at least). A considerable number of people have been educated academically in the Sahel and other regions of SSA both by the host government and through donor assistance. These people should be sought for A.I.D. PM activities rather than automatically offering long term training to new individuals.

Issue: Out of country short term training

PM training out of country is popular with participants. It is not unusual for one day's per diem out of country to exceed the participant's monthly salary. Serious questions need to be raised about the merit of out-of-country training, except perhaps for all but the most senior staff. In any event, the subject matter of the training should be related to an identified job skill deficiency of the host-country employee.

Recommendation:

Use training out-of-country as a reward for good job performance in addition to resolving an identified skill deficiency. Financing "junket" travel discourages good performance by other PM workers.

Issue: Lack of trained "backups"

There is a lack of trained "backups" for many PM positions in Africa. Projects often train one staff member only for a specific task. If that person leaves, there is no one to take their place.

Recommendation:

Project management should plan and arrange for appropriate training of backups.

Issue: PM teams need to be more interdisciplinary

Establishing interdisciplinary PM teams is difficult if only entomologists are trained by PM projects. Degree programs to the M.S. level (or Ph.D.) seem to be lacking in some specialty areas. Donor programs have trained mostly entomologists, IPM specialists, plant pathologists, economists, etc. There is also a need for:

1. Nematologists
2. Virologists
3. Weed scientists
4. Biological control specialists
5. Biologically trained agricultural economists
6. Vertebrate pest studies

Recommendation: Consider extending the educational level of A.I.D.'s IPM/RFCP graduates by one year or more when it is possible to obtain the new area of specialty by adding to previous studies. In the case of other disciplines such as weed science, long term degree studies will be required.

Issue: More researchers working on grasshoppers are needed

Many SSA countries (but not all) have a trained cadre of staff for the NPPS that was financed largely through donor programs. However, even though a given country spends considerable resources on grasshopper/locust activities there is a lack of cadre in research who work full-time or even part-time on grasshoppers.

Recommendation:

Consideration should be given by donors to helping host-country Agricultural Research Institutions establish a position which concentrates on grasshopper research and providing training and resources as needed.

Issue: Need for basic resources to conduct research

Many donor-educated Africans working in the research system of SSA countries, lack some of the basic resources required to conduct research. U.S. trained cadre, particularly those M.S., Sahel IPM/RFCP sponsored individuals, should be identified and

then given priority consideration for small grant assistance to help them undertake appropriate research.

Issue: Trends of the moment

Projects once underway can be influenced by the trends of the time particularly in pest management. Examples include: everything should have an IPM approach (even if one solution is enough to resolve a major pest constraint); or IPM means no pesticides and biological control should take precedence over other methods. These are all issues that buffeted the RFCP and the Sahel IPM projects and resulted in lowered morale and mid-course changes in approach.

Recommendation:

A small group of carefully selected broadly based people with Africa/developing country work experience in pest management, economics, sociology, research, extension and applied pest management could help FARA review and identify potential PM thrusts in Africa. This could be done annually and could include the private sector, PVO's, Peace Corps, university and public agency representatives. The group could meet once a year for 2 or 3 days.

Issue: Realistic indicators of host country interest

Donors often vie for an opportunity to carry out what they view as "their" mandate to help or protect the host country(s) in question. All are driven by a variety of vested interests and approach their "mandate" by providing assistance within that context or bias. SSA host-country officials understand this, at least at the upper levels. SSA countries where A.I.D. has been involved are usually resource poor. The host-country seldom refuses any overture that will result in resource input since they can point to the input, at least politically, as part of the government's effort to improve the country. Exceptions might be those proposals that threaten, in their perception, the countries stability from a political or religious point of view.

Consequently, any project that brings some input, such as construction, salaries, or training and provides commodities (e.g., vehicles, spare parts, fuel), is perceived as providing benefits to the country. This is regardless of whether or not the project achieves its technical objectives.

While some national governments (often through the Ministry of Planning) have attempted to coordinate donor input, it often has resulted in little more than a registration list. In some countries, the host government has been reluctant to see donors meeting. They

seem to fear that this might lead to a donor reducing those inputs which the donor regards as redundant.

Recommendation: Donors need to have indicators that the host-government is really interested. Putting resources up front (prior to project start) such as a specific budget, qualified personnel, vehicles and fuel, help donors measure government's real interest. Donors often never know what host countries can really provide until the donor refuses to continue project implementation until counterpart inputs are in place.

2.2.3 General Management/Administration Issues

Issue: Donor coordination

Attempting to coordinate the mosaic of donors and their areas of interest and associated resource base, has proven difficult. There are often many participants involved in pest management within a given country or region, each with their own approach. As a result, word of mouth, informal meetings, etc., are usually inadequate to plan and develop comprehensive donor or host government coordination. A more formal arrangement is required to assure that duplication is limited and that there is a common approach. Each donor should know where they fit and how they relate to each other.

Recommendation:

Host countries should consider designating one senior government official and a national institute (and/or in some cases a donor) as the "lead" for dealing with a defined PM problem (project) from the beginning to the termination of efforts. The main responsibility of the "designated" host country official, with the lead donor representative, would be to coordinate not only multi-donor inputs, but to help establish and coordinate the national effort toward a specified PM problem's resolution. The possibility of establishing a coordinating committee chaired by the host country coordinator would be considered.

Issue: Conflicts between donors

Conflicts between donors is another question which needs to be addressed. Donors tend to have some more or less specific geographic areas of interest and often a preference for specific countries where they tend to concentrate their involvement. These choices are often shaped by history, language, geographic proximity, commercial ties, crop familiarity, national self-interest, and past successes. Another important factor is where they perceive the need to be the greatest and where there also exists a reasonable opportunity to be ultimately successful.

Recommendation:

Team approaches can be an important means for resolving relationships between donors. For example, the recent use of country coordination committees for dealing with the grasshopper/locust emergency does provide a useful model and reference on which to build a number of specific country-wide action committees.

Regional coordination can often be best handled through a recognized and accepted regional organization such as the Sahel Institute. International organizations such as the FAO also have a role to play. Technically based committees already exist to some extent on a regional basis. Recent efforts on the development of pesticide legislation involving FAO and regional organizations is a recent example of such an effort.

Issue: The need for follow up impact evaluations

Follow up impact evaluations about two years after the project completion date would be useful. A project can look great at its official end, however, if the buildings are later empty and staff is disbursed to other agencies (it is important to know).

Additionally there is an indication that the RFCP/Sahel IPM projects in West Africa, for example, had long term benefits not noted in the final project evaluation (P. Matteson, 1990). This was noticed during the grasshopper/locust outbreak of the 1980's when RFCP trained participants played a major role in their countries' grasshopper/locust control efforts. Their English language skills permitted, for example a greater involvement of Americans in Francophone Africa than in previous locust/grasshopper outbreaks. Follow up impact evaluations proved an appropriate vehicle for gauging a project's long term impact.

Recommendation:

There is a need for gauging the longer term impact of projects. A follow-up impact evaluation two years after the project terminates would be useful. The long term impact of most projects is best evaluated when the results of the project have a chance to be put into perspective after the donor's inputs have ceased.

Long term PM project impact evaluations could be funded by PARTS since the results would likely provide information that would be useful for the future design and implementation of IPM projects.

Issue: The complications of multi-country projects

Multi-country, multi-crop, multi-language efforts have inherent management problems. In a regional project, trying to satisfy each country participating, which naturally wants an equal share of the pie, is a very difficult task. As a consequence, A.I.D. missions do not like regional approaches. They prefer projects that can be under their direct supervision. Ultimately, the Regional Project Manager is subject to the priorities of the Mission Director in the country where the project manager is located. If the project is not in the Mission's OYB, it does not get any priority in terms of Mission time and resources.

Recommendation:

Aside from emergency activities which involve several countries, every effort should be made to keep PM projects bi-lateral.

Issue: Possibilities for regional projects

Once a bi-lateral prototype activity has had a successful extension experience for 1 or 2 years with clear evidence of farmer adaption, then the possibility of a regional project can be explored. When the decision is taken to explore a regional approach, project designers need to be aware that different regional organizations may be competing with each other to participate. Accordingly, decisions will need to be taken regarding how these organizations will productively participate in project implementation.

Recommendation:

Consider expanding successful national projects to a regional scope only after a prototype has been tested at the bi-lateral level. During the bi-lateral effort, regional organizations should be informed regularly of progress and what is happening. They need to be prepared to assist with the extension of the activity to other countries if the prototype works out.

There may also be a role for the private sector in transferring a successful approach from one country to another. Transfer of a PM package should include at least one experienced manager/technician who is associated with the prototype at the bi-lateral level. This participation is highly desirable to help get the package underway in a new country, preferably in an adjoining country where the greatest similarity exists.

Issue: U.S. degree equivalency

There is a lack of recognition in some SSA (e.g., Francophone) countries of U.S. degree of equality with some European countries (e.g., France). In SSA (e.g., Central/West Africa), pay is often a function of education level rather than merit. As a result, there is frequently a problem with employee incentives to perform. Instead there is a scramble for degrees and certificates.

Recommendation:

PM managers should determine if their counterparts' American degrees place them on the same level as host country colleagues who hold university degrees from Europe. If not, they should discuss with the Mission Director what steps could be taken to consult with the appropriate host country authorities about the need to modify the system for evaluating the equivalency of American degrees.

Issue: Staff continuity

There is a problem of staff continuity throughout the SSA, both in host governments and donor agencies. For example, A.I.D. generally rotates most of its direct hire personnel in and out of a mission, in and out of bureaus, and between Washington and foreign countries on a regular three-year basis. Other donors also practice personnel rotation and host country officials frequently change.

Consequently, once a network is finally established (of who-is-who-and what they do), the employee is then transferred and much of the information about the network is lost. The next responsible person will probably start all over again. In the larger countries, only the most aggressive project manager and/or ADO will be able to identify most of the individuals/organizations that share interests. Knowledge of what the host country and donors have done in the past, what they are currently doing, and what they are thinking about or planning to do in the future that might impact on A.I.D. pest management related activities within a given country, is often very difficult to keep track of, particularly if the donor has no physical in-country presence.

This situation is compounded by the fact that donors often contract out the implementation of their PM projects. This is particularly true of A.I.D. Thus the contractor may not only be new to SSA but they may be undertaking activities in a foreign land for the first time, in a new culture, without previous contacts, and in addition have a problem with the language.

Recommendation:

The reduction of direct hire technical staff over the past 15 years, and replacement by a contract system has had some adverse consequences. They include loss of SSA experience, language capability and the networking needed to help enhance the team approach required so often for success. A.I.D. should review its personnel rotation policy in this light.

3.0 RECOMMENDATIONS FOR THE AFRICA BUREAU ANALYTICAL AGENDA FOR PEST MANAGEMENT TO BE FUNDED BY PARTS

3.1 Introduction

The purpose of this section of the report is to present recommendations for issues which warrant analytical input using PARTS funding (see Table, pp.102-107 for tabular presentation of recommended pest management funding for PARTS).

In making recommendations for major pest-management issues that might be considered as part of the AFR Analytical Agenda and for support by PARTS, this study has attempted to keep in mind a number of general considerations in regard to pest management which it believes to be important. When addressing a pest problem, it is necessary to first ask a number of questions:

- Has the problem been adequately defined and characterized?
- How serious is the problem and what priority should it receive in terms of pest management activities?
- What pest management tactics should be employed?
- What strategy should be used to utilize these tactics effectively?

Each of these matters require considerable analytical input with careful evaluation of the end results.

Perhaps the first level of definition required in respect to any given problem is the time-frame in which a response is needed, for example, should the problem be classified as an "emergency"? The importance of ensuring effective responses to perceived emergencies is discussed elsewhere. However, it is evident that both host country governments and providers of TA (including A.I.D.) tend to react to so-called emergencies, where the economic justification for doing so may be less than well understood, (see Annex 2). On the other hand they fail to adequately respond to losses of at least 40 percent from other causes that are occurring all the time to all crops in Africa (Cramer 1967).

A.I.D.'s response to any given pest problem will be governed by broad concerns that prioritize the regions and countries in which pest management activities should be undertaken, and establish broad budgetary, policy and technical parameters with regard to the nature of the assistance that can be given. Factors taken into consideration when

deciding on the response will include such important matters as the relationship of pest management to food security, natural resource management, agricultural business/marketing, and women in development. However, most importantly, the team urges A.I.D. to keep in mind the magnitude of losses, both pre-and post-harvest, that are caused all the time by crop and livestock pests. This devastating loss in agricultural production has considerable impact on the lives of subsistence farmers in the least developed countries of Africa while diminishing the ability of these countries to feed their rapidly increasing populations.

It is clear that individual A.I.D. Missions need to be able to both effectively analyze the host country's needs in terms of pest management, and develop appropriate technical assistance responses to these needs. One of FARA's major activities should be to assist in this process. Below are enumerated the main criteria for the analytical activities:

1. As full an understanding as possible of the needs, priorities and aspirations of the principal and ultimate "clientele" at whom the assistance is aimed should be accomplished. In the African context, this must be the subsistence farmers who grow more than 95 percent of Africa's food, and who store and process a large part of this food on farms. If needs are not identified in consultation with the farmers, the technologies that are developed from the resulting technical assistance will almost certainly not be accepted by farmers, regardless of the technical, financial, environmental, or other benefits they may appear to confer. Accordingly, unless the farmers are appropriately consulted, conceptual and practical sustainability will be impossible to achieve.

2. An understanding should be gained of the importance of post-harvest operations (storage, processing, transport, etc.) in subsistence agriculture, and the magnitude of crop loss that can occur at this stage.

3. An understanding and appreciation should be reached of the host country's priorities, both in a technical and developmental sense. Hopefully the technical priorities will be identical with those of the farmers, however, it is important to realize that often this may not be so. For instance, as described elsewhere, African farmers in many cases consider weeds and vertebrate pests to be the most serious constraints to production. National crop protection services have, on the other hand, traditionally focused on insect and plant disease problems.

   Also, while appreciating the role that technical assistance delivered through PVO/NGOs can play, the reality is that host country institutions remain the principal channel through which technology can be developed and delivered to farmers. Therefore, if these institutions do not function effectively, or if donors fail to

understand how they function, or if they do not consider that technical assistance is a joint activity driven by the host country's priorities and aspirations, then again the sustainability of any development that may result will be in jeopardy.

4. The economic importance of a particular pest management problem should be understood. While conventional methods of crop assessment, cost-benefit analyses, etc. can be used to develop such an understanding, the difficulties inherent in economic analysis of traditional farming systems (Dommen 1988) and the overlying importance of socio-economic considerations must be taken into full account. (see discussion on Annex 2.)

These technical options include the following.

A. An understanding of the technical options should be reached in regards to the "tactics" that could be employed to address any given pest problem. In a general sense these are well understood. However, if sustainable, environmentally sound pest management programs are to be developed which will be acceptable to African subsistence farmers, they must do more than use pesticides more cost-effectively. Past "IPM" have failed in this regard.

B. Understanding, using, and hopefully improving traditional farming practices that reduce pest populations must be given the highest priority. The development and otherwise acceptable use of crop varieties that show pest resistance is in this respect, an extremely valuable tactic, although the limitations of its use, particularly that of genetic stability, need to be understood.

C. Biological control of pests inevitably occurs at some level whenever pesticides do not inhibit it, and most non-chemical control tactics will encourage biological control agents that occur naturally. In some instances it may be possible to manipulate the environment so as to encourage the establishment and reproduction of these naturally occurring biocontrol agents within a habitat, or particularly, in the case of introduced pests, to develop "classical" biological control, in which introduced natural enemies are used. The recent control of the mango mealybug in West Africa is a good example of classical biological control--although the initial costs may be high, this type of control is sustainable because it is achieved and maintained at little or no cost to the farmer, to the government, or to the environment.

D. More recent innovative approaches to pest management, such as the use of pheromones for insect pest monitoring, mating disruption of sterile male release techniques for insect control, and the products of genetic engineering and

biotechnology have great potential. However, it must be kept in mind that developmental costs for these technologies are generally very high. Accordingly, their use may be beyond the reach of African farmers and their governments, without considerable donor inputs.

E. In developed countries the use of regulatory control measures ranging from plant and animal quarantines to mandated land and water use practices, (such as enforced crop rotation or planting dates), often supplement other tactics. However, experience suggests that the use of these in Africa today is very problematic. Common sense dictates that exclusion of new pests from the whole or part of the continent by plant and animal quarantines in particular is highly desirable. To successfully implement such policies will require very careful analysis and innovative, imaginative technical and organizational support.

F. If in the last resort, pesticides are seen to be needed as part of a control strategy, those that are most selective on the pest, least damaging to non target organisms and which rapidly biodegrade, should be the materials of choice. The possibility of using microbial and botanical pesticides, many of which are potential candidates for on-farm or local production in Africa, should be carefully considered. Broad spectrum, long-residual synthetic pesticides which have frequently been used in Africa, should be materials of last resort, the more effective regulation of pesticide use by joint activities of the public and private sector is seen as a vital component of this strategy.

3.2 Developing a Strategy

Once the tactics appropriate to a particular pest problem have been defined, a management strategy must be developed so that they can be used effectively by farmers. Traditionally, this strategy has often been developed at a country site-specific level by the national agricultural research services (NARS). It has been generally channeled through the national crop protection services, and thence to farmers via national agricultural extension services, although this pattern varies from country to country. The private sector should play a key role in the provision of inputs, and in ensuring that these inputs, particularly pesticides, are used safely and effectively.

Recent experience in Africa, however, suggests that developing an appropriate strategy for conceiving and delivering IPM has not been as an effective activity as it should be. The reasons need to be carefully analyzed and taken into consideration when planning future A.I.D. pest management programs. Key factors would appear to include:

1. The perception that "integrated" pest management (IPM) is either difficult to develop and implement, or is some form of "magic bullet" that will produce amazing results in short periods of time. This has commonly led to misunderstanding of "IPM" by politicians and administrators in particular, and has resulted in many instances from over-ambitious efforts by western-trained scientists to attempt wholesale transfer of complex technology to developing countries.

   Experience for instance with rice in southeast Asia has shown that if IPM is presented in ways which are not complex and are understood and accepted by traditional farmers, the technology can be successfully introduced. Central African pest management programs for cotton developed in the 1970's incorporating local cultural practices, use of resistant varieties and pesticide application based on simple farmer monitoring systems (Beeden 1972) provides another excellent (and often overlooked) example of an effective "integrated" pest management program that was accepted by farmers.

2. Inappropriate government policies. The major problem lies in the unwillingness of many African governments to allocate reasonable levels of funding for agricultural development. At times, this approach is encouraged by donors through their preferential support for non-agricultural development. This lack of government support is also reflected in mismanagement and inadequate salaries, an environment that provides researchers and extension personnel with little incentive to develop and deploy effective pest management programs. The heavy subsidization of pesticides, again often supported by donors, is a further disincentive to the development of IPM programs in many African countries.

3. Ineffective research and extension programs. Largely as a result of the policies described above, research and extension services do not have the means to operate effectively, in terms of developing and deploying pest management programs or, for that matter, other appropriate agricultural technology. The situation is made worse in many instances by such factors as deficiencies in education and training, poor research planning and inappropriate research direction, and the lower salaries and less respect paid to extension personnel as compared to research staff.

3.3 Future Pest Management Programs

Despite the disincentives mentioned above, many African researchers and extension specialists remain enthusiastic and interested in developing their countries' agriculture through improved pest management. It should be the donors' aim to provide assistance and direction that will assist them effectively to do this. Analysis will be needed as to how

this assistance can best be given, including careful consideration of how, in the case of A.I.D. assistance, to best match the technical and other resources available in the U.S. with these needs.

In this regard, the U.S. is well placed to assist host country IPM programs in a number of key areas. In particular, there would seem to be possibilities for the effective use for this purpose of the resources of USDA on a more long-term programmatic basis than has occurred until now. Examples of this type of assistance, some of which are discussed elsewhere, might be:

- Insect pest identification, through USDA-ARS ability to draw on the outstanding resources of the Smithsonian Institute as well as other specialized collections and taxonomists in the U.S.

- Information dissemination through the USAID-OICD Technical Inquiries Group.

- Development of plant and animal quarantine policy and operations through USDA-APHIS.

- Biological control programs for insect pests and weeds, through ARS and APHIS.

- Integrated pest management of locusts and grasshoppers, including remote sensing, biomodelling and bio-control.

- Vertebrate pest management, through the Denver Wild Life Research Center, a unique facility operated through APHIS, and whose international programs are threatened with closure.

- Forest pest management, through USDA's Forest Service.

These resources and others available through other AID sources (FEWS, S&T CRSP's, PSTC and other programs), through government agencies other than USDA (USGS, EPA, etc.), universities, PVO/NGO's, and the private sector must be utilized with careful analysis primarily to assist host country governments develop site-specific pest management programs that are accepted by subsistence farmers.

Inputs for these programs must be coordinated at all times, and where appropriate, integrated with those of other donors. In this regard, and based on past experience as described in Chapter 2.0 the team recommends that A.I.D. be very cautious about regional initiatives. These efforts are best left in the hands of multilateral organizations such as FAO and the IARC's.

3.4 Recommendations for PARTS Funding

In making the following series of recommendations on major pest management issues for inclusion in the AFR Analytical Agenda, this study has also taken into consideration previous current and projected A.I.D. and other donor involvement in pest management in Africa as summarized in Chapter 2.0 of this report. It has attempted to keep firmly in mind the overarching principle that A.I.D. involvement cannot and should not attempt "to be all things to all people," but should concentrate rather on long-term in-depth development in specific priority areas.

As mentioned above, the PARTS project is currently being designed to support strategic analysis and information activities for a variety of clients: Africa Bureau Missions, host country governments, and local NGOs to support natural resource management and agriculture projects in Sub-Saharan Africa.

The following specific recommendations are made in response to the following seven major issues/areas:

- Grasshoppers/Locust Activities
- Weeds and Vertebrate Pests
- Pesticide Management and Policy
- Pest Risk Analysis
- Pest Identification and Diagnosis
- Farm Level Assessment and Studies
- Information Management

A total budget for the funding recommendations of the report is found on Table 1, Summary of Recommendations for Funding of Pest and Pesticide Management Analysis, Research and Technical Support Activities within ARTS/FARA on pages 102-107.

3.4.1 Issue 1, Grasshoppers/Locust Activities

A.I.D. needs to make a decision about future pest management activities in Africa.

Discussion

A program for the control of Locust/Grasshoppers has been in effect in Africa for decades. Admittedly the quality of this program has varied widely from region to region and country to country. People who have responsibility for country/regional programs do exist. There are established procedures. These programs have followed a basic cyclic pattern of survey-detection/monitoring/evaluation, and control (if required). The

Locust Handbook, prepared by the Anti-Locust Research Centre, London in 1966 with U.N. financing, and since revised, expands in more detail on this basic control pattern.

More recently USAID's Locust/Grasshopper Operations Guidebook (revised for 1989), while expanding in more written detail, reflects in general terms the operational aspects of the A.I.D. program. Particularly, the program is impacted by U.S. Government regulation. This is more a book of guidelines than a program operational manual. For example: The "Guidebook" notes: "Inspectional Procedures should be established...." (p. VII-16). This is not the same as precisely what the Inspectional Procedures actually are, and what an employee must do. In the African context, many of these procedures have not yet been spelled out.

Control operations for grasshoppers and locusts can entail a variety of population suppression methods (on-going/proposed changes), refinements in procedures, allocation of resources and impact a variety of countries and donors.

When reflecting on a locust grasshopper control program, the following must be understood and factored into donor's decision making processes:

1. Duplication of donor activities can be avoided if these activities are coordinated by a single contact point in each country.

2. Donor input should be supportive and designated to "improve" upon what currently exists.

3. Interventions must be designed and implemented in collaboration with host country nationals who direct their countries locust/grasshopper programs.

4. SSA national programs have two completely different program tracks which can be lead by different government agencies (e.g., National Plant Protection Service/Agr. Research, etc.).

   These tracks are:

   A. Short term: (could be measured in years, dependent on the problem) Immediate and urgent government efforts to control a pest species that is beyond the capability of single individuals or small groups of individuals to resolve. Lead agency: NPPS.

   B. Long term: A program that would lead to the pest species of concern losing its status as a pest, or more likely a program that would require only minor, periodic inputs by the farmer (e.g.,

biological control). Lead Agency: Research.

5. Locust Control Operations Handbook must be updated and maintained.

6. Pesticide User's Guide must be periodically updated and revised.

7. A review of appropriate pesticides for grasshopper/locust use in Africa should be made. Such a review must include storage, environmental considerations, and container disposal conducted on an ongoing basis.

8. Periodic workshops and planning sessions for review (in Africa) of progress and evaluation of ongoing USAID and other donor/in-country studies/reviews are essential.

9. Targeted pest species need to be more narrowly defined.

Recommendation for options study

FARA should apply for PARTS funds to contract for a study as needed to establish for AID/AFR management the basis for a decision relative to the future of U.S. involvement with grasshoppers/locusts in SSA. The decision on a course of action should center on the following options and recommend a funding level.

Option 1. No action/no funding.

Option 2. Funding for Reaction only (e.g., plagues) and the type of reaction (e.g., pesticide control or food) to be noted.

Option 3. Proactive only-No Reaction. Proactive to include activities described in Chapter 4.0 of this report.

Option 4. Proaction with a reduced involvement for Emergencies.

The recommendation is option 4. ONI should be responsible for the program. This program has already received $58 million between 1986-89 (bilateral aid from the international donor community exceeded $192 million during the same period). Given the size of the U.S. investment already made. AFR should resolve its position in the near future. FARA with PARTS funding can play an important role in contracting for the analysis needed to enable AFR to come to a decision.

Estimated cost $10,000

3.4.2 Issue 2, Weeds and Vertebrate Pests

A.I.D.should focus on assistance with the development and integrated pest management of weeds and vertebrate pests, and to a lesser extent the management of insect pests and plant diseases except for breeding/tissue culture trial program and emergency pest outbreaks.

Discussion

As suggested elsewhere in this report, many farmers would consider that weeds and vertebrate pests (principally birds and rodents) are much greater constraints to crop production than are insect pests or diseases affecting crops in Africa. This in a large part reflects the fact that control of weeds and birds in particular require very large inputs of labor.

Weeding accounts for between 30-50 percent of the total labor requirement for crop cultivation in Africa (Akobondu 1987); much of this work is done by hand and by women. Additionally, the major part of preplanting land cultivation is aimed at reducing subsequent weed cultivation. Bird scaring, in cereal crops in particular, often take more work days than weeding, the damage that still occurs, as with rodents, is often great. Despite these farmer perceptions, and the very real losses that these pests cause, pest management activities in Africa continue to focus on control of insect pest and diseases. The reasons for this include:

- Emphasis during the colonial era on insect pest and disease management in plantation crops.
- The education and experience of western-trained pest management specialists.
- The emphasis by IARC's on breeding for pest and disease tolerance as the main strategy for pest management in subsistence crops.
- The difficulties associated with the development of control methods for vertebrate pests and perennial weeds in particular.
- The perception that labor constraint are not serious problems in African agriculture.
- The failure of development activities to consider the perceptions and priorities of farmers, and to involve them in technology development and transfer.
- The failure of development strategies to adequately consider the part that women and children play in agricultural development in Africa.

3.4.2.1 Sub Issue 2A, "Classical" Bio-control of Weeds

Discussion

Weed control in much of Africa relies on cultural practices - crop rotations, fallowing, burning, multiple cropping, use of clean seed, etc. - combined with primary and

secondary tillage. Hand weeding, hopefully during the critical first four to eight weeks of crop growth, is the most important control strategy and most labor consuming.

Despite these efforts yield losses are high, and have recently been estimated at between 20-100 percent under African conditions (Adegoroye et al., 1989). The reasons for these losses (e.g., the constraints to effective weed management), are various and complex. Many lie in the general problems of agricultural development in Africa, others in specific technological constraints. A few need highlighting.

- The increasing problem in some area of rural Africa of inadequate and unreliable labor supply.
- The technical problems associated with the control of some weeds, e.g., Striga, many perennial grass weeds, and some aquatic weeds.
- The lack of trained weed scientists in Africa.
- The high cost and general unavailability of herbicides as an alternative to hand weeding.

On one hand, the development of better weed management can clearly contribute to increased agricultural production, on the other relatively little attention has been paid to this subject in Africa. A.I.D. can assist in changing the current situation.

Firstly, A.I.D. can promote the development of biological weed control as a component of integrated management of key problem species. Worldwide, the biological control of weeds through the introduction of insect pests and pathogens specific to particular species has been successful, at times spectacularly so, in many situations for both annual and perennial weeds (Charudattan and Walher 1982; Rosenthal et al., 1984).

Instances range from the control of prickly pear in Australia during the early years of this century to current efforts by USDA to control a number of important weeds including leafy spurge, knapweed and skeleton weed. This so-called "classical" biological control is most commonly attempted against introduced weeds, and many of the serious pest species in Africa fall into this category. If successful, this method can control specific weeds at relatively low cost, at no risk to man, animals or the environment, and in a way that can be fully integrated with cultural and chemical control methods.

Despite these obvious advantages, little work on weed biocontrol has been carried out in Africa. This in part reflects the comparatively high development costs involved. A.I.D. should carefully analyze the possibilities of assisting in the development of biocontrol programs. Such an analysis could benefit from the extensive experience and facilities (both in U.S. and overseas) that are available through USDA.

Recommendation concerning biocontrol of weeds

PARTS should support an analysis to identify promising target weeds for biological control in Africa, by bringing together experts on weed science in Africa with scientists from USDA and elsewhere familiar with biocontrol technology. Such an expert consultation (in the order of 10 scientists for a period of one week) should aim at producing a target list of perhaps five weed species that cause widespread problems and for which there is scientific evidence that the introduction of parasites as pathogens might offer good chances of minimizing damage. The consultation should in each case be able to indicate the modalities that might be best used to develop such programs, and after examining these findings, FARA could assist with the preparation of appropriate project proposals for each target pest.

Estimated cost $40,000

3.4.2.2 Sub Issue 2B, Integrated Weed Management

Discussion

As well as assisting in the development of bio-control of weeds, it is further suggested that USAID assistance focus on developing integrated weed management, including bio-control, in at least one of the important crop groups in Africa. Past assistance from both bilateral and multilateral sources has emphasized pest management in subsistence food crops, particular cereals, roots and tubers and legumes. Vegetables, both indigenous and exotic, have been largely ignored by donors. It is in many respects surprising, in that:

- Vegetables are grown by virtually every African subsistence farming family.
- Vegetable cultivation is the particular concern of women.
- Vegetables make an essential contribution to human nutrition in Africa.
- Vegetables provide, or could provide, a valuable source of cash income for many farmers.
- It is recognized that in many instances production is seriously affected by pests including weed problems.

As with most other crops in Africa, weed management in vegetables is a combination of cultural control combined with weeding by hand or hoe. Crop losses are often high. The fact that vegetables in some instances provide cash incomes for farmers has meant that

some use of herbicides has occurred.

There is real scope for the introduction of improved technologies, including biological control, soil solarization; cover and intercropping; live, dead and all elopathic mulching, and more effective herbicide use into integrated vegetable weed management systems. It is also believed that technologies used elsewhere, particularly in Asia, may have direct relevance to African conditions.

Recommendation concerning Integrated weed management in vegetable crops

As an initial step FARA (with PARTS funding) should commission one or two weed scientists with international reputations, (as well as African experience) to prepare and publish a thorough stand-alone study on integrated weed management in tropical and sub-tropical vegetables. Such a study would serve two purposes:

- provide a standard, up-to-date, reference on weed management in tropical and sub-tropical vegetables.
- provide guidelines to priority areas for development of integrated vegetable weed management in Africa.

On the basis of this study FARA would then assist with the preparation of proposals for further study into integrated weed control strategies for one or two priority vegetable crops in Africa.

Estimated cost $70,000

3.4.2.3 Sub Issue 2C, Control of Vertebrate Crop Pests in Sub Saharan Africa

Discussion

The recommendation that PARTS funding should be used to analyze appropriate strategies for the management of vertebrate pests, (principally rodents and birds) in SSA is based on a number of important considerations, including:

- The perception by farmers in many parts of Africa that vertebrate pests - birds in particular - are among the most serious constraints to crop production.
- The very real losses that these pests cause in Africa, although as with other crop pests, in precise figures are difficult to determine. One bird pest alone - the red-billed quelea - causes losses equivalent to several million dollars annually to both subsistence and large-scale agriculture in the semi-arid regions of over 25 African

countries. Other, non-migratory, bird pests cause heavy losses to cereal crops in the higher rainfall areas.

The scaring of birds from cereal crops perhaps requires more labor than any other single farming operation. Rodents cause damage pre-and/or post-harvest in almost all crops, and these losses in Africa unquestionably total at least $100 million annually. Additional loss occurs through contamination during storage, and many rodents are also important in the spread of animal and human disease. Other vertebrate pests are known to cause significant losses - in tropical West Africa primates are important pests in many crops, and have, in some countries been the subject of extensive control operations in the past.

- The lack of vertebrate pest management research or extension programs in Africa. This generally reflects historical emphasis on insect pest and crop disease management; perceived, and perhaps real difficulties in developing effective management methods for these pests; and finally a lack of trained and experienced vertebrate pest management specialists in Africa. Only in the case of red-billed quelea has there been any substantial attempt made in terms of ecological research and development of control strategies (but despite major international efforts, researchers are far from developing a truly effective environmentally sound approach to protecting crops from damage by this species).

- The existence in the U.S. of the AID-APHIS Denver Wildlife Research Center (DWRC) which in the words of a recent evaluation of the USAID-S&T PASA with DWRC, is a "pioneer world class research institution (that) is recognized throughout the globe for developing methods and materials for vertebrate-damage control" and indeed "is the only facility in the world currently that provides integrated technical assistance, research training and extension in the management of vertebrate pests to agriculture." (Hankins and Jackson 1989). Despite this wide recognition of DWRC expertise, its International Programs Research Section is threatened with closure when the USAID-S&T PASA ends.

Recommendation Concerning Vertebrate Pest Management

Therefore, in order to more clearly define future vertebrate pest management strategies in Africa, PARTS should finance a series of expert consultations that would utilize the expertise available at DWRC and elsewhere, including Africa, to consider:

i) the current status of rodent problems in SSA with a view to outlining and prioritizing research needs. Special consideration would be given to the development of methods for the management of indigenous African pest species (such as the Nile rat, the multimammae rat and the cane rat) at a farming systems scale, and to questions of coordinating research activities

so that they provide the most benefit and least duplication.

ii) the future development of effective and environmentally sound control methods for the red billed quelea. This should focus on requirements for the:

- Determination of susceptible crop areas and damage,
- Identification of quelea populations within a region,
- Assessment of the environmental impacts of control techniques,
- Implementation of integrated pest management,
- Training and institutionalization activities.

iii) research needs and strategies for the management of bird pests other than red-billed quelea - this should focus on loss assessment and on control techniques that farmers can use without dependency on large-scale control programs.

The recommendations of these consultations should then be used to guide AID/AFR in future technical assistance for these areas. It is strongly recommended that any such assistance must, because of the necessary ecological basis for all vertebrate pest management, be of a long-term nature and use the resources of the DWRC to the full.

Estimated cost $120,000

Additional needs identified as a result of undertaking A,B,C and requests from Missions are estimated at $190,000.

3.4.3 **Issue 3, Pesticide Management and Policy**

Some perceive pesticides as all bad, and while historical examples exist to illustrate the "adverse impact" of chemicals, examples also exist to illustrate the "good" they have done. The appropriateness of using pesticides, or one of several other approaches (or combination thereof), should be determined on the basis of what is best under the circumstances (both short/long term). Ideally the results would be a win-win situation for everyone/everything affected. More frequently however, the result is simply the best possible compromise under the circumstances.

Governments help resolve the conflicting interests, of science and society which are often conflicting and competing interests. A responsible decision-maker (e.g., farmer, control program director, legislator) will arrive at a conclusion that considers not only the impact on themselves but also on others.

For the purpose of this report, in the context of pesticide usage, two assumptions are made:

1. The decision-maker (e.g., farmer, program manager) chose pesticides deliberately as a result of some process of deliberation. A deliberation which included alternative solutions to the problem that he/she had, or expected to have (e.g., treatment for some animal/plant diseases).

2. The decision-maker has a responsibility to society and must accept responsibility for his/her actions beyond their immediate area of responsibility (e.g., farm, designated control area). "Trust me" is not enough. Governments impose restrictions/regulations and direct their employees to monitor society to assure compliance for the common good.

How and why are pesticides chosen?

1. Ideally pesticides are chosen when one has determined that the circumstances that prevail (urgency, labor available, alternative choices, impact on the environment, economics, etc.) indicate this control technique is the best choice, all things considered.

2. The use of pesticides as a control method has/or should also include:

   A. Cost per unit/area which is a factor of pesticide cost, amount of area to be covered, application method, etc.,

   B. What chemical(s) is or could be available in time,

   C. Environmental impact considerations, etc. (e.g., pollinators, aquatic environment, chemical stability, etc.),

   D. Urgency,

   E. Timing (e.g., plant stage, time of day, etc.),

   F. Location and proximity of sensitive areas,

   G. Loading, clean-up requirements, transport,

H. Safety and public relations and much more.

Experienced managers of pesticide-based control programs have spent a considerable part of their lives trying to arrive at the best conclusions. In principle, a single farmer has more constants under their control and an easier decision to make than the director of a control program where the greater land area poses a wide variety of conditions and a greater number of people watching every move. That however may not be true if the decision maker has studies and expert staff to guide his/her decision making process.

If Pesticide Use is Inappropriate in SSA, then:

1. AFR programs should help farm managers with alternative choices to pest problem resolution (e.g., resistance, substitute crops/more varied cropping, environment modification, etc.) and

2. When pesticides are chosen, help should be given to the farm manager to assist his/her decision process so pesticides are used as safely as possible, and no more than the absolute minimum amount is used with minimum frequency.

3. The farmer understands the economics/benefits of the alternatives as compared to pesticides.

The following section will discuss why pesticides are chosen by a farm manager over other methods, and why pesticides tend to be used in emergencies by national control program directors. What can be done to assist these managers in developing/having other choices? First management AFR) must accept that:

1. Pest problems have existed before pesticides came into "common" usage after World War II.

2. Pesticides can cause problems such as ground water contamination which needs to be addressed.

3. Some pest problems may constrain or threaten aquatic/agro production to such an extent, that to preserve food security, pesticides may need to be employed urgently when alternative choices are unavailable, or are inadequate for the "threat."

4. If a pest/pest complex poses an economically important constraint on agricultural production that is unacceptable, managers will chose a set of options to reduce the constraint. This is done within the context of their knowledge, skill, available options, perceived threat to their security, available resources, time limitations, etc. (thus, for example, if labor is not adequate for weeding, herbicides may be used

instead, assuming funds are available).

Recommendation Concerning Predicting Areas of Increased Pesticide Use

Predicting Areas of Increased Pesticide use in SSA.

Several studies report labor as a major constraint in hand-hoe agriculture (Norman, Simmons, Hays 1982). They indicate that in Northern Nigeria the major pest constraint, where labor is an issue, appears to be weeding. We suggest an analysis to determine the likelihood of herbicide use increase in SSA. If so, to what extent? The analysis would attempt to identify other alternatives available to farmers. The crops that are most likely to be involved (e.g., maize, vegetables) and the most likely affected countries should also be noted.

Estimated cost $20,000 (It is assumed that the private sector will match this with $20,000)

Recommendation Concerning Prostephanus truncatus

In much of Africa, procedures for the storage of maize have been changing due to the introduction (see New Pest Introductions) of the larger grain borer Prostephanus truncatus. It was first found and identified in the United Republic of Tanzania. The U.S. was blamed (rightly or wrongly) for this introduction which has spread to West Africa. An analysis would be useful to identify the impact it has caused on maize storage, the extent to which pesticides are now employed as a result of this new pest, and the resultant residues and increased cost to farmers.

Estimated cost $35,000

Recommendation Concerning Impact of Pesticides on Areas of Continuous Use

Environmental studies could be undertaken by existing African facilities concerning the impact of pesticides in areas of continuous use. Areas where pesticides have had constant use, such as cash crops, could be compared with nearby similar areas without such usage. Comparisons such as aquatic life in drainage areas, wildlife, beneficials, etc. could be studied.

Note: Since this is a possible area that could be sensitive to certain nationals and pesticide manufacturers, careful thought should be given to any approach that is considered.

Estimated cost $10,000

Recommendation Concerning Legislation and Regulations to Control Pesticides

When A.I.D. undertakes, assists with, or recommends certain structural readjustments such as the government leaving pesticide procurement, distribution and use to the private sector, then the involved USAID mission should be able to recruit through FARA the assistance necessary to aid the host government with drafting appropriate legislation including provisions controlling the use of pesticides in order to protect the people of the involved country. Under such circumstances, PARTS could finance an analysis of legislation to protect the public which the private sector would be obliged to respect. The lead taken by FAO relative to the pesticide legislation MSSA should be respected and supported.

Estimated cost $10,000

Recommendation Concerning Briefing Paper on Pearl Millet Mildew

A briefing paper should be developed for distribution to research workers and others on Pearl Millet Mildew caused by Sclerospora graminicola. Identification of the disease, economic impact, progress of breeding programs, major institutes involved and seed treatments including systemics, (e.g., Metalaxyl) along with the potential increase in frequency of adaptation of tolerant phenotypes of the disease (Andrews 1984) and need to combine with other strategies (e.g., resistance), the "briefing paper" should be in French/English and in a 3-ring binder format to facilitate storage and recovery as needed.

Estimated cost $10,000

Recommendation Concerning Seed Treatment

Determine the potential of seed treatments and repellents in SSA as a cost-effective method for increasing production/and reducing seeding rates through reducing pest caused constraints to crops. Identify specific geographic areas and crops where this technique could be applied. Some plant pathologists argue that seed treatments result in greater production gains than any other application of a pesticide, while resulting in less adverse impact on the environment than the usual pesticide applications.

Estimated cost $21,000

Recommendation Concerning Warm Water Treatment of Smuts

Test the potential of hot-water (actually warm water) treatments in SSA against several millet-sorghum smuts as an effective method of control (personal communication, Dr. Hebert, N.C. Univ., and J. Franklin).

Estimated cost $20,000

Recommendation Concerning Future use of Herbicides

Herbicides currently account for more than 40 percent of the world's pesticide sales and about 50 percent of global pesticide use. Approximately 20 to 25 percent of the market is in the developing world, although little routine use occurs in subsistence farming in Africa. It is probable that herbicides will, in the future, play an even more dominant part in the world market including the SSA market. The reasons for this are various, but include:

- The increasing unavailability and unreliability of labor, the basis of hand-hoe agriculture, including weeding, in SSA (Normans et al., 1982).
- Structured adjustment in a number of SSA countries, including a number of 1A or 1B priority countries for USAID assistance; which should contribute to increased earnings for farmers, a more stable economic environment and greater participation of the private sector.
- The removal of subsidies, in the past applied to insecticides in particular.
- The rapid development of biotechnology.

One important development is the creation of gene products conferring resistance to insects and pathogens, as a result of which the relative usage of insecticides and fungicides are likely to stabilize or decrease. On the other hand, the use of herbicides will almost inevitably increase as herbicide resistance genes are incorporated into crop varieties, and agrochemical companies focus on the sales of seed-herbicide packages. These products are already becoming available, and the pesticide industry's acceptance of these trends is evidenced by increasing investment into biotechnology, plant breeding and seed production.

These developments have very significant implications for the future of pest management in Africa and other least developed regions, and, particularly in relation to the part that the agrochemical and seed industries can play in plant protection. Reasons for this include:

- The very great influence that major companies can exert, from a private sector viewpoint, in SSA countries not experienced in dealing with large international companies.

- The biotechnical and economic implications of "packaging" plant protection into seed products, the dangers are well illustrated by the ravages of southern corn blight in the U.S. in 1969-70.

PARTS should finance a study into the future use of herbicides, with particular reference to their use in SSA. Such a study should pay specific attention to:

- The impact of labor constraints on weeds in specific crops such as millet, maize and vegetables.

- Detailed projections on the future use of herbicides and other agrochemicals in SSA including crops likely to be involved and the types and quantities of pesticides that would be used.

- The implications for subsistence farmers of the development of herbicide/herbicide-resistant crop variety packages.

- The likely environmental impact of increased herbicide use in SSA.

- The best way for SSA countries to provide for the safe and effective use of agrochemicals including herbicides, and ensure that the agrochemical seed industries provide acceptable levels of stewardship for the products which they market.

It is believed that such a study would provide valuable insights and guidelines on both the future effect of such biotechnological developments on pest management in African farming, and on the environmental impact of pesticide use in Africa. In order to provide a balanced view of this subject, the study should be carried out by at least one person from within the pesticide industry and one person from outside the industry. It is not anticipated that such a study would lead to any specific future activities, except perhaps the establishment of a procedure for the effective monitoring of future developments.

Estimated cost $25,000

Additional needs identified as a result of undertaking the studies recommended and requests for Missions are estimated at $60,000.

3.4.4 Issue 4, Pest Risk Analysis

3.4.4.1 Sub Issue 4A, Economic Impact of New Pest Introductions

Discussion

A wide variety of new pest introductions into SSA have been occurring for decades on a regular basis. Most SSA countries lack the resources to protect themselves from these continuing threats. Even the U.S. has been accused of introducing new pests into SSA, (e.g., larger grain borer and weeds) through PL 480 cereal donations. Many donors, including USAID financed projects, regularly move germplasm into and within Africa.

Many Africans and others believe that the major international agricultural institutes and donors may be creating more pest problems than they solve through unrestricted germplasm movement. Most germplasm movement in SSA is underwritten by donors. Donors need to be concerned over the potential introduction of new pests through their project(s), particularly if a new pest become established, and is traced to a specific donor.

The introduction of cassava mealybug P. manihoti and cassava green mite M. tanajoa combined "can cause yield losses as high as 80%, with an average 30% considered a conservative figure" (Source: p.30 IITA Annual Report and Research Highlights 1987/88). Add to these yield losses the cost of a biological control program that cost millions of dollars, and with just one crop and two pests there exists a combined cost of enormous proportions. Many people have asked the question (that drowns out the biocontrol program of IITA): Who or what institution did this to Africa?

Donors who feel they comply with a host-country's regulations, by obtaining a certificate, ignore the inability of the host-country to effectively verify any alleged inspection, treatment, etc. In short, most Africans know a piece of paper often means very little. It is the actions that the piece of paper (phylosanitary certificate from the country of origin) represents, that count.

Recommendation Concerning Economic Impact of New Pest Introductions

1. PARTS should undertake a study to identify the extent of new pest introductions into SSA and their economic impact on Africa over the past twenty years. Noted should be the impact of such introductions on crop production stability, (e.g., food security), research gains and increased pesticide use (e.g., environmental impact). Also noted should be the most likely means of introduction (e.g., germplasm, transport, etc.) followed by the pest.

2. A review of the quarantine procedures (or lack thereof) applied to movement of germplasm into/within SSA, and financed in whole or in part by USAID/AFR funded projects should be undertaken by a competent authority (e.g., plant quarantine officials of the US). This review should determine if existing procedures are satisfactory, follow established internationally recognized procedures, and comply with the intent of the International Plant Protection Convention (IPPC) to which the U.S. is a signatory.

3. If there is a problem (see 1 above) and U.S. safeguards are lacking or inadequate (see 2 above) then FARA, using funding from PARTS should arrange to develop a set of procedures for inclusion in USAID procedural manuals. These USAID regulations might be modeled after USAID Pest Management Guidelines (or be so included) and include such procedures as: competent authority review of any USAID project where germplasm will be moved inter-country. This could also include, for a given project: establishing between quarantine authorities in the U.S. and the host country an acceptable set of procedures.

   Note: Donors should insist, as a condition of crop improvement project financing, that proper safeguards are being taken by the host government to safeguard their projects research gains.

Estimated cost $30,000

3.4.4.2 Sub Issue 4B, Detection of New Pests

Discussion

Early detection of new pests provides the possibility of eradication (very difficult at best but possible [e.g., screwworm]), or perhaps, a delay in the pest's spread, while methods are worked on to minimize the new pests impact on production. This is particularly important where pesticides are frequently the only choice available until other pest control alternatives are developed. Most SSA countries lack any organized systematic process for early detection.

Recommendation concerning early detection of new pests

PARTS should finance a study on the need for national plant pest diagnostic laboratories and their potential for coordinating early detection efforts. This would be in addition to their regular diagnostic activities.

The team recommends that such facilities be part of "research institutions." In most SSA countries research institutions would coordinate periodic surveys in the areas of ports-of-

entry, research stations and agriculture projects, where new introductions would be most likely. The research institutions would also be responsible for maintaining national pest listings and coordinating the initial identification of a new potential "pest" and the immediate alert of appropriate authorities (NPPS, IAPSC, FAO).

Estimated Cost $5,000

3.4.5 **Issue 5, Pest Identification Diagnosis.**

Discussion

A knowledge of the identification of organisms involved in a pest problem is, as suggested elsewhere, an essential information need for farmers, extension agents and researchers. A means of providing these services in a cost-effective manner is therefore critical. This need for identification can be considered at various levels, including:

- The farmer, who needs to be able to identify the common major pests, or symptoms of their damage, in respect to the crops that he or she is cultivating.
- The village-level extension agent, who needs to be able to assist with the identification of problems not readily recognized by farmers.
- Crop protection extension specialists, who, employing the facilities available through plant health clinics or similar resources can, using named specimens and simple diagnostic procedures, provide (where needed) more accurate identification of pest organisms.
- Research services, which can provide authoritative identification of pest organisms in cases where it has not been possible for farmers or the extension services to do this. This level of expertise is particularly needed in respect to those organisms causing plant diseases where specialized laboratory methods are often essential. The identification of nematodes and plant viruses are examples of this need.
- International pest identification services which are able, often at considerable cost, to identify pest organisms that cannot be authoritatively identified by NARS.

The first levels of this process, farmer and extension agent, can probably be best assisted by the provision of information as outlined above.

Recommendation concerning Pest Identification and Diagnosis

It is at the level of NARS, and in terms of internationally available identification services, that it is recommended that PARTS should finance specific analytical activities designed to:

- Encourage and support the maintenance and development by NARS of their pest identification/diagnostic capabilities to provide services to farmers and extension agents for identification, and where practical recommendations for control. A number of SSA countries already have considerable resources that can assist with this task, often in the form of collections established during the colonial era. Assistance to maintain, update, and utilize these collections may in many cases be of real value. The apparent increasing possibilities for the Republic of South Africa being used by other African countries as a technical resource for pest identification as well as other pest management information needs deserves careful analysis in this respect.

- Facilitate the utilization by NARS of pest identification services available outside Africa. The U.S. through USDA, the Smithsonian Institute and other institutions is well placed to assist. CABI (U.K.) and CIRAD/ORSTOM (France) are examples of other bilateral organizations with substantial resources; and some IARC's provide valuable identification services, e.g., IRRI for rice insects and ICRISAT for legume viruses.

USDA, through the activities of ARS, already provide internationally recognized insect identification services that are available to NARS in SSA. It is therefore recommended that the USDA should be commissioned to study:

- How existing USDA pest identification services can be best utilized by NARS in SSA on a continuing basis.

- What additional services are needed, and if USDA or other US based resources can be utilized to meet these requirements.

- How national pest identification/diagnostic laboratories could be best maintained and developed, and utilized; their function in their early detection of introduced pests and in maintaining national pest listings should be matters of particular concern.

Again it is suggested that the on-going provision and support for pest identification services could be a legitimate use of PARTS funds, and therefore that this analytical study should provide cost estimates for such on-going support.

Estimated cost $30,000

Recommendation Concerning Pest Alert Briefing Papers

1. A briefing paper on "new world screwworm," its economic importance, identification, preventing introduction, and procedures for submitting suspected specimens for identification will be prepared. This would be in a 3 ring binder format, (in Portuguese, French and English) for management, agricultural schools, and all veterinarians in SSA. If this is being done/or has been done by FAO then a duplication by USAID would be unnecessary.

2. A briefing paper similar to the above should be prepared on the remaining "major" pests of cassava not yet known to occur in SSA. This would be printed in color as needed and in cooperation with IITA, CIAT, and IAPC. Distribution would be to management, agricultural schools, all research workers in root/tuber crops, volunteers (Peace Corps, Dutch Volunteers, church groups, etc.), extension and plant protection service employees who work in areas where cassava is grown. It would to be in Portuguese/English/French and in a 3-ring binder format. Most likely CIAT could prepare (with IITA input) the document, with distribution under the Inter-African Phytosanitary Council (IAFC) umbrella. The objective would be to provide a model mechanism for one crop that could assist in early detection and improve concerns for introduction. The same type of approach could be used later for additional crops.

Over the past 2 decades several major pests of cassava have been introduced into SSA (e.g., cassava mealybug, green spider mite, bacterial blight). Most likely this occurred through exchange of cassava stem cuttings. "All of the 17 most important pests (of cassava) are found in the Americas; 12 of these are present in Africa and 5 can be found in Asia." (J.C. Lozano and B.L. Noit). It is recognized that some pests of Cassava, not known to occur in Africa, may be considered minor elsewhere (e.g., cassava/mealybug was considered a minor pest). "Minor" pests should be included if there is a likelihood of transport on cuttings and/or natural enemies that keep it under control are not known in cassava production areas of Africa.

Estimated cost $35,000

It is estimated that needs identified as a result of undertaking A and B plus requests from the Missions will cost an additional $35,000

3.4.6 Issue 6, Farm Level Assessments and Studies on Opportunities for Success in Integrated Pest Management

3.4.6.1 Sub Issue 6A, Underlying Crop Production Constraints

Discussion

1. Farmer level assessments/studies are needed to identify the underlying crop production constraints (e.g., biotic). There is a need to know the exact pest problems, and the actions being considered by farmers/villagers in their PM schemes for coping with the problems. It is necessary to understand farmers' perceptions of their problems, the resources they have available and their willingness to employee them for PM. There is also a need to determine if perceived problems are real (based on scientific study), and are there problems they do not recognize.

   Studies should consider the farmer's social system. The farmer level assessments/studies should probably be undertaken in areas where studies (sociological) already exist. Time studies should be included. These enquiries will help determine where labor is being applied, it is being used for pest management. The analysis will also have to include where labor forms a constraint, particularly when the demand, such as weeding, is inadequate for the need. The results of these studies should bear in mind that villages of different ethnic groups may have different approaches to their agricultural practices. Consequently the results of studies should recognize and look for differences in PM between such groups.

   How to best help the farmer impact the noted biotic constraints should be considered a second area of study. This second area of study looks for alternative solutions to a particular or a group of constraints and the pros/cons of each proposed solution from the farmers perspective. Families will inevitably have constraints not previously identified. Subsistence farmers' perceptions of a problem are not necessarily the same as those perceived by western science. Research addressing local perceptions about what should and can be changed through human intervention must be conducted.

   In some cases the solutions recommended will represent only minor modifications to existing practices. Studies in "change theory" indicate these are most likely to be adopted. Those that are perceived as being much different, will be more difficult, if not impossible, to extend. In fact, these changes may go through a long process involving "risk takers, opinion leaders, etc.," before being adopted, if at all.

In some cases, where a problem exists as identified by the assessment team but is not perceived as being a problem (an important production constraint), there may be a need to demonstrate the extent of the problem and the relationship to the extension worker and the farmer.

Even in developed countries, nematodes and some virus caused diseases cause subtle effects that are not well understood by farmers. Since these plant pests are not readily seen, and the affected plant's decline may be attributed to other causes or not even noticed until its too late. Consequently; the studies need to be more comprehensive than just reacting to farmers perceptions.

Note: Testing of various solutions/prototype over a wider area (geographically and within other ethnic groups) might be ARTS/PARTS or undertaken by an appropriate mission, CRSP, etc. depending on the activity and if no other organization for prototype testing can be identified (e.g., other donors, regional organizations).

Recommendation Concerning Underlying Crop Production Constraints

Study the effectiveness of traditional methods for reducing cereal crop losses due to bird depredation. The study should include the village's division of labor and availability for this activity when needed. It should also indicate labor constraints cost of labor, and impact of labor lost to other activities (e.g., harvesting, school, etc.) See Issue: Control of Vertebrate Crop Pests in SSA.

2. Study the impact of labor constraints, if any, on weeding and its impact on production (e.g., yield per ha. number of ha. that can be cultivated). Compare hand-hoe agriculture versus animal traction. Identify cost to farmer and competing labor demands for participants (particularly women and children) for:

a. Millet
b. Maize
c. Vegetable crops

Estimated cost $250,000

3.4.6.2 Sub Issue 6B, Seed Selection by Farmers

Recommendation concerning seed selection by farmers

Carry out a study to determine how farmers select their seed stock for the following season and why they use the method they do. Determine if improvements are possible for improving farmer selection methods for resistance. Also survey the storage methods used for seed stock to see if methods used are appropriate to maintain reasonable germination rates and provide proper protection from stored product pests. Are there any improvements that are economically based, feasible and likely to be adopted? What barriers to adoption of changes in seed selection and seed storage exist? Responses should be based on farmer interviews and observation.

Crops to consider: Millet
Sorghum
Rice
Maize (composite)
Cowpea
Selected Vegetable crops

Estimated cost $122,000

Note: ICRISAT provided RFCP what they considered an appropriate seed selection method for farmers (millet/sorghum). One team member has noted that one farmer in Senegal was using a method that seemed to pre-select millet for downy mildew Sclerospora graminicola.

3.4.6.3 Sub Issue 6C, Crop Substitution

Discussion

As a means of pest management, many of the food crops grown by Africans are of foreign origin. As a result, they may be subjected to more serious pest problems than those that originated in Africa. In addition, the food crop may not be well adapted to the environment and they may react more severely to certain nematode, insect or disease attacks.

In theory, substituting one crop with many pest problems for one of fewer pest problems and/or adding a crop can increase plant diversity. In theory this creates a more stable environment and reduces the risk of catastrophic loss.

Several examples of crop substitution illustrate this technique. In the U.S. peanuts were substituted for cotton (boll weevil) and in Cameroon rubber was substituted for cocoa

(black pod). This is not a new concept.

Recommendation Concerning Substitution Possibilities:

PARTS should fund an analysis which deals with the questions mentioned below.

Are there native food crops that could be substituted or improved? Native origin crops often have fewer demands for external inputs (e.g., pesticides) and/or fewer unacceptable pest constraints. Are there plants elsewhere in the world that could have use in Africa (subject to a particular ecological zone)?

Finger millet is grown in East/Central Africa but not as widely in West Africa. Hungry rice/fonia, Digitaria is grown in West Africa but not as widely in East Africa. Why? The Camberene Horticultural Station, Dakar, Senegal has been working with traditional vegetables for years. Is there any promising work that would have application elsewhere in Africa?

Africans eat a wide range of plants, are any of them resistant to grasshopper attack? Are any of these native vegetables capable of attracting expatriate consumers, if the bitterness was bred out?

Specifically, PARTS should fund the following.

1. Undertake a literature search and seek expert opinion in an effort to identify some substitute or supplementary cereals and vegetable crops that could be grown in different ecological zones in Africa. Review and catalog plants used in the Sahel or a similar ecological zone world wide that might be considered in SSA. Look in areas not already catalogued (according to the literature) throughout SSA.

2 Identify research stations, volunteer groups, etc. to test new crop growth habits, identify pest constraints and acceptability by nationals and expatriates.

3. Develop a briefing paper on results of the literature search (1.A above) for managers, volunteer groups, others. Describe new crop/traditional plant characteristics, pests, ecological zone, and propagation method. If possible note potential expatriate acceptance in the market place. Also note source of further information, seed source, etc. And quarantine requirements. It should be prepared in French/English and punched for a 3-ring binder.

Estimated cost $35,000

Additional needs identified as a result of undertaking A,B, C and requests from Missions are estimated at $200,000

3.4.7 Issue 7, Information Management, an Essential Component of the Development of Pest Management Strategies in Sub Saharan Africa.

Discussion

In the forward to a recent study (Harris and Scott 1989) it is stated that "the supply of timely and authoritative information is perhaps more important for crop protection, including plant quarantine, than for any other area of science." This section of the report will therefore briefly attempt to define the levels at which this information is required, the type of information needed at each level, and finally make some specific recommendations as how FARA with PARTS funds could assist in its provision and delivery.

In the "front line" of those needing information is the farmer, who wants information that will enable him or her to make decisions regarding the control of pest threatening his or her crops and livelihood. They need to be able to make those decisions in a cost-effective, practical way without endangering their health and immediate environment.

These information requirements of farmers depend very much on access to, and interaction with, comprehensive extension support services able to identify and diagnose pest problems and provide farmers with the information they need to make pest control decisions. In this bridging role, extension agents need access to appropriate information about pest identification, biology, ecology and control. Also, IPM and the deployment of biocontrol agents will involve extension agents in monitoring and crop-loss assessment activities, all requiring relevant information.

Most plant protection information that is conveyed by extension agents and utilized by farmers is provided by basic, applied and on-farm adaptive research activities conducted by IARCs, national government agencies, universities and the private sector. These research activities are heavily dependent on access to information contained in technical journals, textbooks, etc. It is apparent that while information about research on major pests in developed countries is accessible through available information systems, information on many important tropical and sub-tropical pests is in general not so readily available.

The final level of information required is at the government monitoring and regulatory level. Various government agencies and institutions who have the function of ensuring sustainable food supplies by minimizing harmful pest damage, while simultaneously safeguarding human health, have need of appropriate information.

The various levels of information needs described above are clearly so inter-related that the whole system will not function if any component, any link in the chain, is weak. How can USAID/AFR through PARTS help to ensure the strength of this process?

3.4.7.1 Sub Issue 7A, A Supply of Handbooks, Manuals and Other Information Material Needs to be Made Available to Extension Workers.

Discussion

Recently published compendiums of information (Franklin 1987; van Alebeek, 1989) have demonstrated that there already exists a wide range of publications dealing with pest management that would be of practical use to extension workers in SSA. These are in both printed and audio-visual forms the field experience of the team members supports us of the real value of such information sources. A classic example of this type of publication is the small handbook published by the International Rice Research Institute (IRRI) entitled "Field Problems of Tropical Rice." This has now been published in cooperation with NPPS through multiple editions in 21 languages; the Vietnamese edition alone for example by 1989 had reached 194,000 copies. However, generally the people who would need and use this information in SSA do not have access to it.

Recommendation to Supply Publications to Extension Workers

FARA (with PARTS funding) could make an important impact in pest management in Africa by providing for the updating and reprinting of existing pest management extension publications, particularly those published by USAID funded projects, such as:

- Zummo, N. Sorghum diseases in West Africa: An illustrated text.
- Prot., J.C. Les nematodes parasites des cultures maraîchéres: introduction aux nematodes phytoparasites.
- Terry, P.J. Some common cropweeds of West Africa and their control.

When carrying out this task, expertise available through IRRI and USDA should be utilized to make detailed recommendations as to how selected publication could best be reprinted using PARTS and other donor assistance.

Estimated cost $700,000

3.4.7.2 Sub Issue 7B, The Provision of Maps to The National Crop Protection Services (NCPS)

Discussion

It is well recognized that maps of adequate scale (usually at least 62,500) are required for proper planning, execution and evaluation of pest management survey and control programs (including L/GH programs), and that in many instances these do not exist, or for a variety of reasons, are not readily available to NCPS in the quantities needed.

Recommendation Concerning a Survey to Define Needs of NCPS' for Maps

It is therefore recommended that PARTS undertake a survey in selected countries to accurately define the need of NCPS, as well as USAID supported projects, in terms of operational maps, and then prepare a country by country listing/detailing the type of maps that are available, together with information on sources (in-country, out-of country, commercial, military, etc.).

Estimated cost $250,000

3.4.7.3 Sub Issue 7C, Information Needs of Pest Management Researchers in Sub Saharan Africa.

Discussion

As indicated in the introduction to this section of the report, both extension agents and farmers rely to a very large extent on information provided by research services. Additionally, the information needed by government monitoring and regulatory agencies largely originates from the same source. The efficient supply of information to research sources is therefore an essential link in the information chain, but as with pest management extension information, most researchers in SSA have access to only extremely restricted amounts of the information that is essential for their work.

The U.S. is in a position to make a valuable contribution to solving this problem. Available information on a particular pest problem, is often sufficient to enable an "interim" pest management package to be put together, while at the same time providing the basis on which further research and management needs can be assessed. Such a process can be particularly important in the case of problems not readily diagnosed and understood by farmers and extension workers, for example those caused by nematodes or viruses. The need is then to ensure that this information is accessible to pest management specialists in SSA.

Recommendation Concerning the Information Needs of PM Researchers

Three distinct aspects of potential need be analyzed:

1. The Use of CD-ROM Technology to Provide Information

   CD-ROM is an acronym for Compact Disk Read Only Memory which is essentially an electronic technology that provides an inexpensive, timely and secure way to store and distribute large amounts of information. Its application to the dissemination of PM information has recently been reviewed by Lindsey and Novak (1989), who suggest that the medium is most useful when:

- The overriding requirement is data dissemination,
- The data can be presented in digital form and is between 100 and 660 megabytes in size,
- The data set is stable and can be updated periodically,
- The budget available for information distribution is limited.

Because of these characteristics an additional number of relevant databases are becoming available in the CD-ROM format, including AGRICOLA, those of CABI, and increasingly those of the IARC's. If the information in those databases was readily available to researchers and other clientele in SSA, a large part of their information needs should be met. It is recommended that PARTS finance an analytical exercise to determine how CD-ROM technology could be best utilized in this respect. In particular the possibility of providing the hardware and software necessary in ten SSA countries, (for instance in the Mission offices of USAID) should be studied. The development of such facilities would enable USAID to provide, at relatively low cost, vast amounts of information in not only the PM field but in a myriad of other developmental areas of concern to SSA countries.

This study should be undertaken by an information management specialist from USDA, together with an outside consultant familiar with the application of CD-ROM technology. The study should include cost estimates of not only the provision of hardware and software, but also the long-term operation of the facilities, which is suggested represent a legitimate FARA/PARTS function.

- The More Effective use of the Services of USDA/OICD Technical Inquiries Group for the Dissemination of PM Information and other Information Sources.

While access to appropriate databases through CD-ROM technology would do much to improve availability of PM information at a national level, a number of other readily addressable needs remain. These include the need to:

(a) Provide users of CD-ROM systems with copies of original articles, or with access to "informal" literature sources,

(b) Ensure that PM studies generated by USAID financed projects are reported in the scientific literature,

(c) Address the need for a greater general awareness of available information on PM in African crops,

(d) Provide for adequate current information dissemination between African PM scientists.

Additionally PARTS should finance the following specific initiatives:

(a) Analyze/evaluate the state of research/studies publication as conducted on PM through USAID funding. Determine how best to get project results published (e.g., Journals, Conference Proceedings, etc.) and into widely used abstracting services and data bases and, particularly those accessible by African scientists (e.g. CAB, Agricola). The adage that one can not build on information one does not know about is true. AID should make sure it is contributing to the African pool of scientific knowledge on PM. Publication in Tropical Pest Management should be a first consideration for publication of African P.M. research/studies/reports that are USAID funded. The FAO Plant Protection Bulletin" would be a good second choice.

(b) The current USAID Development Information Services Clearinghouse is an adequate source of information on PM related USAID projects. The availability of the system should be publicized in order to ensure its more widespread use.

(c) PARTS should consider developing a scheme to underwrite publication costs for selected works if accepted by a reputable journal. Project sponsored work should be underwritten by the project routinely.

(d) Much good work has been published but has not been widely distributed. ARTS should therefore contact Tropical Pest Management (TPM) staff and determine if a special run of:

(1 Selected African PM articles from TPM could be reprinted, and bound, on specific subjects. ARTS would purchase copies for wide distribution to researchers, senior NPPS and Extension staff, and other workers on PM who have a need for the information (e.g., Peace Corps, Agricultural Schools, Regional African newsletters, donor counterparts, etc.).

(2 A special African edition of Tropical Pest Management, once a year, for Africa work. Cost to be borne by ARTS for a set number of copies. This would serve as a mechanism that could lead in time to an African Scientific Journal for PM. Distribution would be as above.

(e) Books and journals are almost non-existent at many SSA Institutions. PARTS funds could be use for purchasing at least 2 journal subscriptions (one for NPPS/1 for Research) for Tropical Pest Management and Plant Disease Reporter. These journals would probably serve the greatest number of people even in Francophone Africa. For copies of papers from other journals, the USAID system contracted via USDA-OICD Technical Inquiries Group could be used.

Additionally, selected books, compendiums, etc., should be procured once a year and distributed, two copies (1 to NPPS, 1 to Research) to each SSA country. Copies could include:

- IPM (see Annex 3, page 9 Recommendation 8): Suggested instead is procurement of existing documents on similar subjects from IRRI, FAO, University of California, others

- American Phytopathological Society-Plant Disease Compendiums

- Two special printings of selected articles from scientific journals on IPM of specific covering animal and plant pests in Africa and India. Each printing (separate edition) to be in English/French.

Much of this procurement (except for the special printing) could be handled through the USAID approved: American Overseas Book Company, N.Y., N.Y.

(f) A good PM textbook written by Africans using African examples and illustrations (in both English and French editions), would be useful for a wide audience including Agricultural schools, extension workers, etc. FARA should consider establishing the format, through discussions with the Association of African Insect Scientists, the East Africa Weed Association and selected plant pathologists, economists and sociologists to produce such a text using mostly/entirely African authors. Cost of publication, translation and distribution to be borne by USAID and perhaps the EEC.

(g) Publication of national and/or Regional Pest Lists are needed. The limiting factor is often lack of funds. The list would be prepared by the involved country or region. Cost of the printing would be by PARTS.

Estimated cost $470,000

3.4.7.4 Sub Issue 7D, Workshops and Conferences are Expensive and often Produce Questionable Results

Discussion

Conferences and workshops have had little measurable impact. If PARTS is to consider financing this type of activity, objectives for the conference (clearly measurable) must be exactly defined in advance. People should only be invited to attend if it can be determined in advance that they clearly can put to good use the content of the conference or workshop.

Recommendation Concerning Workshops

Preference should be given to national workshops rather than regional workshops. National workshops can be much more specific in content and can focus on resolving underlying management issues of IPM projects or the design/implementation of a specific PM-IPM program in the country where the workshop is taking place.

A very appropriate use of national workshops could be the promotion of the utilization of a recently installed CD-ROM system. Such a workshop could teach people how to use the system and demonstrate for them what the system can do for them. Also explain how hard copies (photocopies) can be obtained through USAID--USDA/OICD system.

National workshops could also be used to identify information problems in the country, and to discuss the results of PM projects specific to the country.

Estimated cost $54,000

3.4.7.5 Sub Issue 7E, The Development of an Information System on Appropriate Pest Management Methods Relevant to Sub Saharan Africa.

Discussion

There is potential for considerable impact to be derived from an effort to collect, analyze and provide access to information on pest management methods appropriate to the needs of subsistence farmers in SSA. The information identified should include:

- Traditional farming practices (both in Africa and elsewhere) that relate to PM, including sociological studies,
- Other sustainable agricultural techniques affecting PM,

- Other appropriate pest management methods, particularly biological and biocontrol approaches.

Technical and non-technical literature worldwide would have to be used as the principal sources of information, reinforced by individual interviews, correspondence, etc. Electronic database management systems are ideal vehicles for locating, compiling and sorting such large volumes of information, and provide for regular updating and expansion. Indexed, book-sized documents can easily be created from such data bases, copied and bound, and presented for distribution. Such documents would have a wide target audience, including farmers, extension agents, researchers in Africa and world-wide and planners/administrators.

Recommendation Concerning Development of an Information System

PARTS should fund the development of a database building on the data already available from CAB and AGRICOLA, aimed at producing a publication on appropriate pest management methods for SSA. The data base should be translated into French. It should be printed and a trial distribution should be made in 10 countries in Africa. Subsequently, the publication should be evaluated for its usefulness and effectiveness (through questionnaires, correspondence and field studies), and for its regular updating. The effectiveness of the publication may also be judged by the (commercial) demand for the product outside the initial target countries.

There is an opportunity for considerable and important PM information to be exchanged between those with a need--the user of the information systems, as defined above--and a provider/coordinator, who in this case would be FARA/PARTS. The immediate impact that above-described activities could provide indicates that their implementation should receive high priority for PARTS funding.

Estimated cost $26,000

Table 1. Summary of Recommendations for Funding of Pest and Pesticide Management Analysis, Research and Technical Support Activities within ARTS/FARA,

Recommendations for Funding by PARTS: High Funding Level

STAFF ACTIVITY	TOTAL FUNDING	TOTAL BY ISSUE
Grasshoppers/Locust-oriented Options Analysis		
Options study for continued AFR grasshopper locust activity (IOR) 1/	$10,000	$10,000
Weeds and Vertebrate Pests (IOR)		
Bio control of weeds (A)	$40,000	
IWP for vegetables (B)	$70,000	
Control of vertebrate pests (C)	$120,000	
Additional needs identified as a result of undertaking A,B,C and requests from Missions	$190,000	$420,000
Pesticide Management & Policy (IOR)		
Predicting area of increased pesticide use	$20,000*	
Impact of Prostephanus truncatus	$35,000	
Impact of pesticides on areas of continuous use	$10,000	
Legislation and regulations to control pesticides	$10,000	
Briefing paper on pearl millet mildew	$10,000	
Seed Treatments	$21,000	
Warm water treatment of smuts	$20,000	
Future trends for the use of herbicides	$25,000	
Additional needs identified as a result of undertaking studies mentioned above and requests from Missions	$60,000	$211,000
Pest Risk Analysis (IOR)		
Study of economic impact of new pest introduction since 1965	$30,000	
Early detection of new pest introductions	$5,000	$35,000

Table 1. Continued
Recommendations for Funding by PARTS: Medium Funding Level (continued)

Pesticide Issues (IOR)		
Predicting area of increased pesticide use	$20,000*	
Briefing paper on pearl millet mildew	$10,000	
Seed Treatments	$21,000	
Warm water treatment of smuts	$20,000	$71,000

* Assuming matching private sector funding of $20,000.
1/IOR=Issue Oriented Research and Analysis Component of PARTS
2/IDM=Information Dissemination and Management Component of PARTS
3/ATM=Analytical Tools and Methodologies

Table 1. Continued
Recommendations for Funding by PARTS: Low Funding Level

STAFF ACTIVITY	TOTAL FUNDING	TOTAL BY ISSUE
Grasshoppers		
Options study for continued AFR grasshopper locust activity (IOR) 1/	$10,000	$10,000
Weeds and Vertebrate Pests		
Bio Control of Weeds	$40,000	$40,000
Pesticide Management and Policy		
Predicting area of increased pesticide use	$20,000*	
Briefing paper on pearl millet mildew	$10,000	
Seed Treatments	$21,000	
Warm water treatment of smuts	$20,000	$71,000
Pest Risk Analysis		
Study of economic impact of new pest introduction since 1965	$30,000	
Early detection of new pest introductions	$5,000	$35,000
Pest Identification and Diagnosis		
Identification and diagnosis	$45,000	
Pest alert briefing papers	$5,000	$50,000
Farm Level Assessments and Studies (ATM)		
Underlying crop production constraints	$100,000	
Seed selection by farmers	$22,000	
Crop substitution	$35,000	$157,000
Information Management (IDM) 2/		
Supply printed material to extension workers	$223,000	
Maps for NCPS	$60,000	
Information needs of PM researchers/(NPPS/senior staff)	$265,000	
Workshops and conferences	$27,000	$575,000

* Assuming matching private sector funding of $20,000.
1/IOR=Issue Oriented Research and Analysis Component of PARTS
2/IDM=Information Dissemination and Management Component of PARTS
3/ATM=Analytical Tools and Methodologies Component of PARTS

Table 1. Continued

Summary of Total Costs ($) for All Issues at High, Medium, and Low Funding Levels

	HIGH	MEDIUM	LOW
Total for All Issues	2,883,000	1,551,000	726,000
Plus 20% Inflation Over 4 Years	576,000	310,000	72,000
Grand Total	$3,459,000	$1,861,000	$798,000

Personnel for Pest Management Unit In FARA one G.S. 14 and two G.S. 13's for one year $386,000

Personnel mentioned above for five years	$1,930,000
Plus 20% Inflation Over 4 Years	$386,000
Grand Total	$2,316,000

(this figure includes salaries, fringes, travel and per diem)

The mechanisms for carrying out these activities include: using PARTS funds to buy-in to appropriate S&T projects; contracts with OICD/USDA for programmatic and short term assistance; and work orders with IQCs. Once the results of many of the analyses recommended in Section III are available, it is recommended that the Africa Bureau and the Missions consider the advisability of developing bi-lateral project to utilize proven integrated pest management interventions.

4.0 RECOMMENDATIONS FOR THE ASSIGNMENT OF PEST MANAGEMENT FUNCTIONS IN A.I.D.

4.1 Introduction

As was noted in Chapter 1.0 this study, was commissioned by the Bureau for Africa, at a time when both the Bureau and the Agency were undergoing major reorganizations. These organizational changes have implications for the report's recommendations for the assignment of pest management functions in A.I.D. The report has focussed particularly on the assignment of responsibilities and functions of AFR/TR/ANR, ONI and A.I.D.'s Science and Technology Bureau (reorganized as "The Research and Development Bureau").

Of even greater relevance for this study, has been the restructuring of roles and activities within the Africa Bureau itself, particularly the way in which the Bureau will carry out its technical functions. Henceforth, the offices (presently grouped within AFR/TR/ANR and being restructured as The Office of Analysis, Research and Technical Support (ARTS)) will play a more facilitative, analytical, strategizing, impact measuring role as opposed to one of direct support and services to the field missions. Another factor is that support and service for regional projects are scheduled to be carried out in the Africa Bureau by the new office of Operations and New Initiatives (ONI).

It is against this background that this section of the report makes recommendations for the assignment of pest and pesticide management activities (within A.I.D.) in support of agricultural sustainability in Sub-Saharan Africa.

4.2 Office of Analysis, Research and Technical Support (ARTS)

The major functions of The Office of Analysis, Research and Technical Support (ARTS) will include providing analytical and technical leadership to the Africa Bureau, supporting field missions in strategy and program development, and measuring the impact of strategies and programs. ARTS will also be responsible for liaison within and outside A.I.D. on non-country specific economic issues and sharing information and disseminating economic research and analysis findings throughout the Bureau and the Agency and with other donors and host governments.

ARTS will include a Directorate for Food, Agriculture and Resource Analysis (FARA). FARA will serve as the Bureau's focal point for policy and sector analysis activities in food security, agriculture, and natural resources. It will be responsible for technical analytical initiatives to support the development of sector and sub-sector strategies, Mission CPSPs, and impact assessments. Also, within FARA, there will be an Environmental Coordinator responsible for assuring the African Bureau's compliance with environmental regulations.

In addition, the Environmental Coordinator who directs FARAs activities in the field of pest management will supervise FARA's pest management staff.

PARTS funds will be used to fund FARA's analytical agenda, and more specifically to finance the following type of activities related to pest/pesticide management.

- Analytical programmatic research
- Field mission support in strategy development
- Program impact measurement
- SSA problem identification and analysis
- Mission requested assessments/reviews
- Policy assessment
- Non-project program progress measurement (e.g., monitoring and forecasting, prediction)
- Assessment of new technologies
- Supportive technical/information collection and dissemination (e.g., networking with other agencies of the US. Government).

4.2.1 Food Agriculture and Resources Analysis

Within the Environmental Branch of FARA, it is recommended that the responsibilities of the pest management staff include monitoring those activities dealing with pest management funded by the PARTS project, arranging for technical assistance requested by the Missions and REDSOs to undertake the development of pest management strategies policies and programs, actions required to develop a long range integrated pest management strategy, undertaking sectoral assessments, and prototype activities to test out broad concepts which can be useful in more than one country.

Once the reorganization in AFR is complete, and responsibilities of the pest management unit in FARA defined, FARA should send a cable to all Missions calling to their attention the capabilities of the pest management unit to provide and/or arrange for technical assistance for the tasks assigned to FARA. This cable should also make clear the modalities for buying in to the PARTS project to obtain assistance from the pest management unit. FARA should also use ADO conferences, and other appropriate opportunities, to acquaint ADO's with FARA's revised capabilities.

In order to perform the tasks recommended in this report, the pest management staff will require a senior pest management specialist and two additional officers to carry out the various technical liaison, information dissemination and analytical functions enumerated above. One of these officers would specialize in information management and training needs analysis. These personnel can probably best be obtained through the AFR/RSSA with USDA.

The mechanisms for carrying out these responsibilities will also include using PARTS funds to buy in to appropriate S&T projects, contracts with OICD/USDA for programmatic and short term assistance, and work orders with IQCs.

4.3 Office of Operations and New Initiatives (ONI)

The responsibilities of the Technical Projects and Program Implementation Division (TPPI) of the new Office of Operations and New Initiatives (ONI) in the African Bureau will include managing the Bureau's portfolio of regional technical operations and training projects and the coordination of support for emergencies that affect more than one country or region.

With reference to the AELGA project, projects which already exist represent operational entities. Accordingly, AELGA's activities for grasshopper/locusts should be transferred to ONI once ONI become an operating entity. This recommendation includes activities sponsored by the AELGA project such as bio-modeling and environmental studies, bio-control activities, and greenness maps. These "activities" support National/Regional and International Locust/Grasshopper Control programs and are designed to assist national program managers and their efforts to improve existing operational programs. These control operations can entail a variety of population suppression methods (on-going/proposed changes), refinements in procedures, allocation of resources, and impact a variety of countries and donors.

Activities which are fragmented under several different administrative units cannot be coordinated well. Therefore, it is imperative that one person in ONI be named IPM Coordinator. Right after the reorganization the AELGA project manager could serve as Coordinator. The Coordinator must be the contact person for the U.S. effort in integrated pest management activities, (e.g., work plan, networking with other donors and international coordination, technical support, etc.). The coordinator's responsibilities will include marshalling U.S. responses to emergencies.

Activities with which the present AELGA project should be concerned, include an already existing grasshopper program in the U.S. with a wide range of activities coordinated by the USDA. The program involves numerous states and universities which maintain international contacts in areas such as bio-control. This world class program should be accessed. The current AELGA project should provide funding for on-going activities, bio-control, (Montana State University) and other transitional costs until the grasshopper/locust activities can be funded under a new operational program in ONI.

It is anticipated that the IPM coordinator located in ONI will have frequent occasion to call upon the pest management unit in FARA for the types of technical assistance that this unit is equipped to deliver or arrange for from other agencies of the U.S. Government,

universities, and contractors. In this connection, FARA is encouraged to keep in mind that the resources available in other agencies of the U.S. Government represent a rich resource of experience and knowledge which should be fully utilized.

In addition to recommending the project management of AELGA be transferred to ONI, there should be a follow-on grasshopper/locust effort in AFR, in the form of a new project with a single project manager held responsible for the implementation of these efforts within ONI. Again, the pest management unit of FARA can be of continuous assistance to those involved with pest management operations in ONI because of its previous experience with managing AELGA, its experience in responding to emergencies, its technical capabilities, and its access to technical assistance outside of A.I.D..

The new grasshopper/locust project should have access to a Technical Consultative Committee composed of not more than five (preferably three) people. Members would include representatives of institutions with long term experience such as USDA-APHIS/ARS, Univ. of Montana, in short and long term suppression of grasshoppers/locusts. Committee expertise should also involve economics and sociology. A multi disciplinary approach is fundamental. A Technical Consultative Committee would help assure that project design and implementation has access to some of the best experienced expertise and resources available in the U.S. (see Annexes 1 and 2, Kemp/Skold).

Such an effort located in ONI assumes a decision on the part of the African Bureau that:

1. It is satisfied that certain specifically designated locust and grasshopper species (see List) in Africa are of sufficient importance to warrant the expenditure of USAID/AFR funds. See report by Melvin D. Skold attached (Annex 2).

2. And AID/AFR concludes that the option of no action or reacting only to "disasters" is not appropriate.

3. Or AID/AFR concludes that a combination of proactive actions (that support the international effort) and reactive actions (to a lesser financial degree than before over the next 5-10 year period) is appropriate.

As recommended in Chapter 3.0 of this report, PARTS funds, could be used to assist management with the analytical process required to arrive at a policy and a decision regarding the extent of project funding needed over the next 5-10 years.

4.3.1 Pesticides and Their Management

4.3.1.1 Future Operations

Emergency response activity require ONI's future attention, will address dealing with pesticides and their disposal. In the future, emergency control managers will need to be concerned with the type of considerations outlined below.

Managers will need to bear in mind the type of considerations listed below since many problems that arise during emergency programs are the result, not of pesticides themselves, but of poor advance planning by management.

Before pesticide procurement occurs, managers should address issues such as:

- urgency/timing,
- endangered species,
- available application equipment,
- storage/safeguarding,
- effect on non-target species,
- characteristics of use,
- application safety,
- spills,
- employee skills, knowledge,
- formulation,
- host country regulations,
- sensitive areas (e.g., waterways, drainage, ponds, crops, livestock, human habitation, pollination, etc.),
- container disposal,
- effectiveness on target species,
- phytotoxicity,
- cost,
- pesticide transfer from container,
- estimated acres/hectares to be treated,
- pesticide availability/alternatives,
- corrosiveness.

Those responsible for emergency programs will need to work with the host country grasshopper/locust control program managers and help them in advance with the identification of, and resolution of these problems. U.S. involvement relative to a pesticide of choice, its provision and related issues should be resolved well in advance (prior to the next emergency). ONI should give priority to this question.

4.3.1.2 Past Operations

There are certain issues (remaining from past USAID involvement in pest control programs) that are beyond the capability of the host country to resolve.

Some criteria need to be applied to establish USAID/AFR responsibility and priority for the proper storage and control of pesticides which remain from past/on-going pesticide involved control programs-U.S and non U.S..

Perhaps a country could qualify for USAID emergency assistance when a host country has unused stockpiles of chlorinated hydrocarbons (i.e., endrin, aldrin, dieldrin, heptachlor, chlordane, etc.), that have long life, and when the host-country lacks the resources for proper disposal and the donor and/or company can't be identified. Such a situation would represent "clear and present danger."

The ONI project management of AELGA is also going to have to resolve outstanding questions concerning U.S. procured pesticides for the 1985-89 grasshopper/locust program. We understand that A.I.D. procurement was largely malathion ULV and Seven 4-Oil. We further understand that the main pesticide issue to be resolved is associated with Seven 4-Oil, due to the "setting-up" of this material.

We recommend that if pesticides were U.S. procured for locust/grasshopper programs prior to the 1980's campaign, that AELGA resolve the disposition of these pesticides. It may be advisable to treat these pesticides as an "emergency." The original procurement records may be difficult to locate - if at all. The chemicals may be difficult to identify due to co-mingling of containers. It is expected that most purchases went to East Africa since U.S. involvement previously was largely limited to that area due to language barriers in Central/West Africa (French) and a more active OCALAV.

While other pesticide issues may arise in the future, pre-planning should anticipate these in advance. Emergency response teams/technical advisory teams and databases should be identified and updated periodically as needed for various emergencies such as:

- insect (e.g., grasshopper/locust) outbreaks.
- rat/bird outbreaks.
- new pest introductions (potential outbreak).

It is recommended that ONI project management establish, well in advance of emergencies, procedures for procurement, determining staffing needs, resolving transport, establishing usage procedures for a limited number of pesticide that are most apt to be used/purchased. They will also have to resolve security, safety and relevant impact (environmental) issues. Disposal, etc. should be dealt with in the context of existing operational program (e.g., grasshopper/locust) by ONI. Simulations should be run periodically to test reactive time and identify problem areas.

Once the results of many of the analyses recommended in Chapter 3.0 are available, it is recommended that the Africa Bureau and the Missions consider the advisability of developing regional and bi-lateral project to utilize proven integrated pest management

interventions.

It is recommended that one pest management position be established through the AFR/RSSA with USDA to provide a project manager for grasshoppers and locust activities in ONI.

FARA can facilitate the transfer of operating responsibilities to ONI through the analysis recommended in Chapter 3.0 and by promptly turning over all appropriate files, and arranging for the AELGA project manager to brief the person in ONI who will be handling pest management questions. Obviously, the new AELGA project manger in ONI will have frequent need to continually consult the former project manager in FARA.

4.4. Bureau of Science and Technology (S&T)[1]

Operating on the theme that long range research, (as distinct from short term studies and analysis) should be carried out by S&T, it is recommended that FARA could use funds from PARTS to finance analytical studies through buy-ins to appropriate S&T CRSPS, other appropriate cooperative agreements, and grants or PASAs which S&T has negotiated.

Unfortunately, one of the S&T activities with potential for pest-pest management field support is in the process of winding down. The S&T project in Vertebrate Pest Management (furnished through the Denver Wildlife Research Center of USDA) has conducted field work and training at the request of a number of Missions and host governments. This project is coming to an end, although work in Chad will continue through the AELGA project.

On the other hand, S&T has sponsored several commodity-oriented CRSPS which include consideration of pest and pesticide issues. These can be drawn upon for research and analysis in the following fields: millet/sorghum, beans, cowpeas, peanuts and small ruminants. We are pleased to note that the Consortium for International Crop Protection, a grouping of several universities, which provided pest and integrated pest management services and training in response to A.I.D. requests at a number of locations including some in Africa, be extended through 1992.

Another S&T resource of a different, but potentially valuable nature, is offered by the Agriculture Policy and Planning Project (APAP) which is available for Mission buy-ins to perform studies and analytical services related to policy or regulatory questions and could be used to analyze constraints and needed reforms in the pest-pesticide sector.

[1] Since October 1991, renamed Bureau of Research and Development

Appropriate consideration should also be given to buy-ins to The Communication for Technology Transfer in Agriculture Project.

In addition, the S&T Bureau has been authorized to establish, and is currently guiding the preparation and design of three future CRSPS which could provide important services for pest management approaches. The first of these, being developed under the auspices of the National Academy of Sciences, is in the broad field of sustainable agriculture and natural resources management (SANREM). It will include a "core" research program of some $10 million and an annual series of research grants of up to $100,000 each in many instances to be carried out collaboratively with host country researchers. Integrated pest management is one of the subjects that will receive "special attention."

The second new S&T CRSP initiative is focussed directly on integrated pest management (IPM). It will establish a "CRSP-like" mechanism, meaning that it will not be restricted to research and studies. It will also include training and technical assistance among the services it will provide to LDC institutions. Preliminary plans call for a 15 year project with core funding at $37 million plus $19 million allocated for Mission buy-ins.

A third CRSP will aim at integrating and expanding S&T activities in the post harvest field. Unfortunately the SANREM, IPM and Post Harvest CRSPs are still about a year away from final approval and utilization. Thus, in the near future, the P/PM staff in FARA will face something of a hiatus with respect to the most useful S&T resources in this field.

REFERENCES

Abstracts drawn from the A.I.D. Development Information Services Clearinghouse as follows:

a. AID Crop Improvement Activity in Africa, 128 pages (1980-Present).

b. A.I.D. Pest Projects in Africa, 90 pages (1970-1991)

Adegorye, A.S. et al. (1989). Weeds as a Constraint to Food Production in Africa In: Zethner, O. (ed.) (1989). Pest Management and the African Farmer, Nairobi. ICIPE Science Press. pp. 83-99.

African Emergency Locust/Grasshopper Assistance (AELGA) Mid-term Evaluation (1989), G. Appleby, W. Settle, A. Showler

Akobundu, I.O. (1987). Weed Science in the Tropics: Principles and Practices. New York. Wiley. 522 pp.

Andrews, D.J., Mughogho, L.K. and Ball, S.L. (1984). "Sorghum and Pearl Millet Production in Africa: Problems and Prospects with New Varieties." In: Advancing Agricultural Production in Africa, (Proceedings of CAB's First Scientific Conference, Arusha, Tanzania, 12-18 February 1984), Slough, CAB pp. 85-90: Hawksworth, D.L. (Ed.)

Beedar, P. (1972). The Pegboard - An Aid to Cotton Pest Scouting. PANS 18(1): 43-5.

Bezpaly, I. (1984) "Les Plantes Cultivee in Afrique Occidentale," Mir, Moscow.

CDIE Search for: Pest Management A.I.D. Projects in Africa, 143 pages. (Aug. 1991).

Charudattan, R. and Walker, H.L. (1982). Biological Control of Weeds with Plant Pathogens. New York. Wiley.

Coutu, A. et al. (1989). Communications for Technology Transfer in Agriculture Project (AID/S&T 936-5826): Midterm Evaluation April 1, 1989. Washington Academy for Educational Development. 110 pp.

Cramer, H.H. (1967). Plant Protection and World Crop Production. Pflanzeschutz-nachrichten, Bayer. 20. 524 pg.

Crawford, E.W. (1982). A Simulation Study of Constraints on Traditional Farming Systems in Northern Nigeria. East Lansing, Michigan State University.

Dommen, A.J. (1988). Innovation in African Agriculture. Boulder. Westview Press. 140 pp.

Francis, C.A. and Youngberg, C. (1990). Sustainable Agriculture - An Overview In: Francis, C.A. et al. (1990) Sustainable Agriculture in Temperate Zones. New York, Wiley. pp. 1-16.

Hankins, A. and Jackson, W.B. (1989). Project Evaluation. U.S.USAID Bureau for Science and Technology PASA. Vertebrate Pest Management Systems R&D. (Project Number A36-4173) with Denver Wildlife Research Center USDA/APHIS. Roveo. 23 pp.

Harris, K.M. and Scott, P.R. (eds.) (1989). Crop Protection Information An International Perspective. Wallingford. CAB International. 321 pp.

Integrated Pest Management (IPM) for Food Crops in the Sahel: A.I.D.-tended Accomplishments, Present Status and Proposed Activities (1990). P.C. Matteson, CICP

Kahn, R.P. ed. (1989). Plant Protection and Quarantine, Vols. I, II, III, Boca Raton, CRC Press.

Kiss, A. (1989). The World Bank's Support for IPM in Africa In: Zethner, O. (ed.) (1989). Pest Management and the African Farmer. Nairobi. ICIPE Science Press, pp. 117-9.

Kramer, H.H. (1967) Plant Protection and World Crop Production, Pflanzenshupz-Nachrichten, Bayer 2o, page 524

Lessons learned in A.I.D. 1985-89 Locust Control Program Draft, AELGA Project, A.I.D..

Lindsey, G. and Novak, K. (1989). Developments in Information Dissemination Techniques: Directions for International Agricultural Research Centres. In: Harris, K.M. and Scott, P.R. (eds.) (1989). op. cit.

McCorkle, C. and McClure, G. (1990). Farmer FSR&E and Sustainability: Lessons from CTTA in Niger. In: Designing for Farmer Participation in Technology Transfer: A Roundtable Discussion at the Association for Farming Systems Research-Extension 10th Annual Symposium, Michigan State University, East Lansing, Michigan October 14-17, 1990. Washington Academy for Educational Development. pp. 1-20.

Norman, D.W., Simmons, E.B., and Hays, H.M. (1982). Farming Systems in the Nigerian Savonna. Boulder, Westview Press.

Odhiamho, T.R. ed. (1983). Special Issue: Crop Borers and Emerging Strategies for In: Insect Science and Its Application 4 (1/2): pp. 1-222.

Pest Management Documents, 88 pages. Prepared by A.I.D. Library, Rosslyn. (1991).Their Control.

Review of personal experiences of J. Franklin/Michael Watt relative to A.I.D., FAO and other donor projects. Pimentel, D. ed. (1981). Handbook of Pest Management in Agriculture, Vols. I, II, III, Boca Raton, CRC Press.

Rosenthal, S.S. et al. (1984). Biological Methods of Weed Control Monograph for the California Weed Conference. Fresno. Thomson Publications.

Schulten, G.C.M. (1989). The Role of FAO in IPM in Africa. Insect Science and its Application. 10 (6).

Upton, M. (1987). African Farm Management. Cambridge. Cambridge University Press. 190 pp.

USAID. (1989) Locust/Grasshopper Management: Operations Manual, Washington. United States Agency For International Development.

van Alebeek, F.A.N. (1989). Integrated Pest Management. A Catalogue of Training and Extension Materials. Wageningen. Wageningen University/CTA. 305 pp.

van Epenhuysen, C.W. (1974) "Growing Native Vegetables in Nigeria," Food and Agricultural Organization, United Nations, Rome.

ANNEX 4

SUMMARY OF PEST MANAGEMENT USAID/AFR ACTIVITIES IN AFRICA

Description of A.I.D. Pest Management Activities
in Sub Sahara Africa Since 1970

ANNEXES
1-3
MISSING

SUMMARY OF PEST MANAGEMENT USAID/AFR ACTIVITIES IN AFRICA

Description of A.I.D. Pest Management Activities in Sub Sahara Africa Since 1970

THESE PAGES WERE ABSTRACTED FROM THE FOLLOWING CDIE DOCUMENT SEARCHES
1. A.I.D. Crop Improvement Activities in Africa (1980-Present);
2. A.I.D. Pest Management Projects in Africa (1970-1991)

Mission	Project No.	LOP	Funding Level	Project Name	Description
Zaire	660-0091 (follow on to 660-0091): 660-0124	1983-89 1990-99	22.0 million 20.0 million	Applied Res. and Ext. Applied Res. and Ext. II	Improve and expand Dept. of Agr. ability to undertake applied Agr. research and transfer agr. tech. to increase village production of food crops. Project supported ongoing research in plant breeding in cassava, maize and grain legumes for resistance to diseases and insects.
Liberia	669-0188 (follow on to 669-0135)	1984-94	24.0 million	Agr. Res. and Ext. II	Develop capacity of central Agr. Res. Institute to identify needs of subsistence farmers ... strengthen crop science (particularly tree crops). Integrated biological and chemical pest control and weed control to be components.
Congo	679-0001	1981-86	3.5 million	Small holder Agr. Res.	Implemented by CARE. Storage facilities built/refurbished with a protection aspect. Also construction of a training ctr. with training in pesticide application for warehouse managers and zone chiefs. Carried out in upper Nieri area of the Congo.
Mauritania	682-0207	1980-85	6.0 million	Dev. of Oases	Dev./extend appropriate technologies to oases cultivation of Agr. crops in southern oases. Included improved varieties, biological and chemical control.

Mission	Project No.	LOP	Funding Level	Project Name	Description
Madagascar	687-0105	1990-94	5.6 million	IRRI Rice Research	Strengthen research and develop appropriate farmer technology to include: improved rice varieties, weed control, inventory rice diseases and pathogenic nematodes and assess economic damage caused by pests.
Swaziland	690-0024				
West Africa (Regional)	698-0429	1981-90	12.0 million	West Africa Rice Development	Grant to WARDA. Included cultural practices concerning farmer methods and constraints to be studied along with methods of weed and pest control.
Africa Regional	698-0435	1990-92	65.0 million	Strengthening African agricultural Res. Programs	1. ICIPE (Nairobi) work on plant resistance to insect attack to target crops (e.g. maize, sorghum, cowpeas) particularly for stem and pod borers. To include training and networking via PESTNET and publication of research results.
	(Note: The abstracts are confusing. So the comments here will reflect activities over a longer period of time. Readers should, as a result, reflect only on the scope of activities and institutions involved.)				2. Commodity networks among national research institutions in East and Southern Africa. Germplasm exchange, improved pest control methodology exchange are components. 3. Grant to IITA to expand to East and Southern Africa. Includes germplasm exchange. Support of national programs for sweet potato and cassava.
Regional (?)	936-4173	1986-91	4.0 million	Vertebrate Pest Management Systems R and D	To help LDCs improve capacities to develop/utilize vertebrate pest management systems to reduce pre/post harvest losses due to pests such as bats, birds and rodents. Components include research, training and information exchange.

Mission	Project No.	LOP	Funding Level	Project Name	Description
Regional (?)	936-4199	1990-94	3.5 million	New World Screwworm Eradication Program for North Africa	This pest of livestock and wildlife had the potential for spread to SSA. Funds from AELGA used to support program and prevent spread to SSA.
Zambia	611-0201	1980-90	12.5 million	Agr. Dev. Research/Ext.	Crops include soybean, sunflower and maize. Breeding and training are project components. Soybean pathology was included.
Zambia	611-0204	1981-86	1.2 million	Chama Rice Production	Program included instruction in weeding practices and use of simple weeding machines. Varietal testing occurred. This probably considered insect/disease production constraints.
Malawi	612-0215 (follow-on to projects 612-0054/0202)	1985-92	15.0 million	Malawi Agr. Research and Extension	Improve min. of Agr. (MOA) capability to increase productivity of traditional crops and to identify most viable crops for diversifying small holder production. Project included a MOA training unit, adaptive research teams and Extension Planning Units. Crops included cereals, grain legumes, forage crops, agro-forestry and horticulture. While not noted, is presumed pest controls were an aspect of the project.
Uganda	617-0106	1985-92	5.8 million	Oil Seed Production	Improve oilseed production and availability of edible oils in 10 Districts in Eastern Uganda. Initial activities to be research oriented (groundnuts, sunflower, sesame, soybean). Ground research to center on developing ground insect/disease resistant hybrids.
Tanzania	621-0160	1980-84	0.80 million	Village Environmental Improvement OPG	Improve standard of living and environment in 6 villages through improved vegetable production, etc. Introduction of improved seeds and new varieties is a component of project. Grant was provided to Lutheran World Relief. It is presumed training on gardening included some aspects of pest management.

Mission	Project No.	LOP	Funding Level	Project Name	Description
Sahil Regional	625-0957	1984-88	1.1 million	OMVS Agr. Res. II	Senegal, Mali and Mauritania will plan/implement Agr. development activities in the Senegal River Basin. Program included improved crop varieties and technical packages and upgraded research facilities. It is presumed pest management was a component of any crop packages that were developed.
Cameroon	631-0022	1980-85	0.86 million	Small Farmer Fish Production	Increase fish pond production by increasing fingerlings supply. It is presumed fish diseases and predation (e.g. birds) were considerations in production constraints encountered.
Ghana	641-0102	1980-89	21.0 million	Managed Inputs and Delivery of Agricultural Services	1. Build capacity of Ghana Seed Company to operate as an independent, profit-making company. Included improving seed multiplication/production and storage capability. It is presumed pest management issues were addressed as a constraint production and storage. 2. Improve capability of farm/home extension services to demonstrate and convince small farmers in Brong-Ahafo Region to include: 10 acre research station, etc. Ord. Crop Marketing System. It is assumed field and storage pests were considered.
Swaziland	645-0212	1981-91	14.5 million	Cropping Systems Res. and Ext. Training	Improve and expand capacity of Min. of Agr. and Cooperative research/extensions to extend cropping systems recommendation to Swazi Nation Land. This to include: socioeconomic aspects of current cropping systems, research status experiments, on-farm trials, etc. Pest management issues were addressed both in research and as an information services component through training aids, radio messages, etc.

Mission	Project No.	LOP	Funding Level	Project Name	Description
Cape Verde	655-0013	1984-91	5.6 million	Watershed Dev.	To stabilize natural environment and increase agr. production potential in project area in Cape Verde to include linkage of its extension to Food Crop Research Project (655-0011) noted earlier.
Niger	683-0256	1987-93	20.0 million	Applied Agricultural Res.	Increase agricultural production and diversify sources of rural income. Project designed to help National Agronomic Research Institute establish a system of applied agronomic research with strong functional links to extension. Crop improvement, production systems and on-farm research addressed priority constraints on major food crops. It is presumed this included pest caused constraints.
Saotome and Principe	658-0002	1986-92	1.7 million	Trilateral Project for Agriculture	Increase production of cash crops (e.g. COCOA) and peppers. To include a tropical crops/Agr. Ext. specialist who was to develop curricula and materials. It is assumed pest management production constraints were addressed.
Togo	693-0217	1981-84	1.0 million	OICI-Davie Community Farm Phase I	To establish a nonformal Agr. Training Center and demonstration farm to provide training/extension to small farmers on the Plateau and maritime regions. Included was production of various small animals and food crops. It is assumed that strategies to reduce pest constraints were included.
Togo	693-0226	1984-89	3.5 million	Sio River Eco. Development	Stimulate development by increasing productivity and better management of resources. Included encouraging farmers to look at growing/trying crops besides rice. Included management training and introduction of technical packages.

Mission	Project No.	LOP	Funding Level	Project Name	Description
Africa Regional	698-0465	1986-88	1.5 million	Israeli-African Support	To assist government of Israel to carry out training programs in Malawi, Swaziland and Lesotho. Technical assistance included helping form 20 Women's Poultry Cooperatives in Swaziland's rural areas. It is presumed poultry disease management was included.

Mission	Project No.	LOP	Funding Level	Project Name	Description
Bissau					
Kenya	615-0180	1979-87	4.4 million	Dryland Cropping Systems Res.	Project included breeding more disease resistant varieties. Also included identifying major crop diseases in the project area, that may appear with increased production. Crops were maize, other cereals and legumes.
Tanzania	621-0099	1971-80	1.7 million	Agricultural Mkt. Dev.	Pest and rodent control measures instituted to reduce loss in storage.
	621-0163	1981-89	13.4 million	Zanzibar malaria control	Reduction of malaria through pesticides: Larviciding, space spraying and interdomiciliary spraying, chloroquine, educational and community motivation.
	NOTE: There are many other examples in SSA of pest management of vectored human disease control not listed. Only plant and animal health programs are addressed here.				
Sahel Regional	625-0305	1979-82	3.5 million	Sahel Regional Major	Develop, disseminate and multiply high yielding disease resistant, protein rich corn, sorghum and mullet varieties
Sahel Regional	625-0916/ 615-0928	1975-85		Sahel food crop protection/regional food crop protection	Establish eight (8) functioning NPPS (Mali-training only) capable of conducting demonstrations, and combating national pest infestations.
Guinea-Bissau	657-0012	1985-91	2.25 million	Food crop protection	Continue establishment of NPPS started under Regional Food Crop Protection Project 625-0928.

Mission	Project No.	LOP	Funding Level	Project Name	Description
Zaire	660-0077	1978-85	4.5 million	Manioc Outreach	Develop capability of National Cassava Program (Program) to develop cassava varieties resistant to various diseases/insects while having farmer and consumer acceptance. Insect/disease cultural control was to be included into production technologies.
Seychelles	662-0002	1979-84	1.5 million	Food crop research	Testing of high-yielding, disease and pest-resistant food crop varieties tested and introduced to small farmers through extension services. To include setting up a joint plant path-soils analysis lab. Plant protection methods developed to include foliar protection and reflective polyethylene strips.
Sahel Regional				Integrated Pest Management	Develop research facilities and staff capable of pest management related research. Crops were mostly millet and sorghum. Grasshoppers/locust were excluded as was most pesticide related work.
Botswana	633-0244	1986-92	0.1 million	Emergency Crop Protection Center	Grant to GOB for construction and partial equipping of an Emergency Command Center.
Sudan	650-0018	1978-86	12.0 million	Blue Nile Agr. Dev.	Develop effective system approach to small farm and livestock development, including livestock health and improved sesame and sorghum.
Cape Verde	655-0011	1982-90	8.0 million	Food crop research	Adaptive research on food crops to include breeding and pest management of associated with pests of field and vegetable crops.
Guinea-Bissau	657-0002	1976-85	2.4 million	Agricultural development	Provide assistance for seed improvement, identification and control of plant diseases.

The Africa Mission responses to the AFR/TR request for information concerning A.I.D. financed pest management activities indicate that pest management is a component of several A.I.D. projects in the Africa Region, but is not generally the main focus. In projects with pest management activities, ecologically rational tactics predominate (e.g. host plant resistance). Only one project, Integrated Pest Management Research Project for Cotton Production in Sudan, was designed with IMP as the major focus. However, this project has not yet begun.

All cable responses are attached along with a project-by-project summary. A review of the responses indicated that A.I.D. involvement in pest management can generally be grouped into the following categories.

1. **Agriculture Research and Extension Projects**

The majority of A.I.D. Mission involvement in pest management activities in conducted as one component of broader scale agricultural research and extension projects. In some of these projects A.I.D. is the major donor, while in others A.I.D. is one of several cooperating institutions. The major thrust of pest management research/extension in these projects is typically focused on the development of crop varieties with resistance or tolerance to major insect and disease pests. This tactic is considered to be highly appropriate because of the ease of adoption (assuming agronomic characteristics are acceptable) and lack of inputs needed once improved seed is distributed. Problems associated with this pest management strategy include the length of time for development of resistant varieties (often 10 years or longer), breakdown of resistance after time (particularly when based on one or a few major genes), and the fact that this tactic has not been successful with every crop/pest complex (e.g. grasshoppers/millet).

2. **Short-term Training**

Several Missions have sponsored the participation of host country participants in training courses or workshops on pesticide safety and pest management. Some of these workshops have been organized on a regional basis through centrally-funded projects, such as the Africa Bureau's AELGA project (e.g. the Training Materials Workshop held in Niamey in May 1989, and the Mali Pesticides and Health Conference held in Bamako in June, 1989).

3. **Agricultural Production Support Projects**

Two Missions (Dakar and Maputo) have, or plan to begin, activities designed to stimulate private sector involvement in the supply of agricultural inputs. The Maputo Mission requested a Regulation 16 waiver to allow the inclusion of pesticides in the commodity support program, but the waiver was not granted. Dakar has plans to include EPA approved pesticides in their program contingent on A.I.D./W approval.

4. **Policy Reform**

The Yaounde Mission is considering a request from the GOC to become involved in pesticide policy reform. There would be modelled after a previously successful Mission effort aimed at fertilizer policy reform. Areas to be addressed would include subsidies, distribution, and quality of application.

5. **CILSS IPM and Regional Food Crop Protection Projects**

In responding to the AFR/TR request for pest management information, two Missions (Dakar and Bamako) related accomplishments of past A.I.D. efforts in pest management, notably the IPM and RFCP projects. Both Missions indicated that these projects continue to have an impact on pest management, particularly through the activities of host country participants trained under the two projects.

6. Pesticide Management/Disposal

The issues of pesticide management and disposal of unwanted pesticide stocks were mentioned by REDSO/ESA and Khartoum. REDSO/ESA has give advice on multiple occasions to Missions and host country governments on pesticide management questions. Additionally, REDSO/ESA produces "Pest Management Guidelines" for several East African countries which provide information on appropriate pesticides for major pest problems. The Mission in Sudan had planned a project entitled Medium-Term Locust Control which would have dealt with the disposal of out-dated pesticides. The Niamy Mission is currently implementing a centralization and containment plan for obsolete pesticide stocks in Niger.

7. Livestock Projects

One project in Mali and one in Kenya are involved in the control of livestock pests. The project in Mali includes a component for integrated control of tsetse flies, and the Kenya project is targeted towards the development of cattle resistance to ticks.

8. Human Health Projects

The A.I.D. Mission in Khartoum is involved in a Schistosomiasis control project which involves the use of molluscicides to suppress the snail vector.

AFRICA
SUMMARY OF MISSION RESPONSES TO PEST MANAGEMENT INQUIRY

Mission	Cable No.	Project No.	LOP	Funding Level	Project Name	Description
Yaounde	07001	631-0052	1980-95	47 million	National Cereal Research and Extension Project	Institution building support for the Institute of Agronomic Research. Project focuses on screening and breeding varieties of sorghum, millet, corn and rice for agronomic and pest resistance characteristics.
		631-0058	1986-91	5.7 million	Tropical Roots and Tubers Project	Screening and breeding root crops for desirable agronomic characteristics and resistance to major pests. No varieties that require pest management over and above the inherent resistance will be released.
		Non-Project			Pesticide Reform	The mission may get involved in pesticide reform considering questions concerning subsidies, distribution, and quality of applications.
Khartoum	09529	650-0082			Medium-term Locust Project	Project was designed to assist Sudan government with locust control activities but due to constraints imposed by Brooke's amendment the project has not begun. One component of the project involved assistance for disposal/management of surplus pesticide and empty pesticide containers.
					Blue Nile Health Research Program	A.I.D. has assisted this project which includes an activity for control of snail vectors of schistosomiasis using molluscicides.
					Integrated Pest Management Project for Cotton Production	Project developed by the Sudanese Agricultural Research Council, Plant Protection Division, and University of Agriculture Faculty for which A.I.D. funding has been requested. Project would be focused on decreasing pesticide use in cotton through adoption of an IPM strategy.
					Western Sudan Agricultural Research Project	A.I.D. funded a portion of the initial phase of this project which focused on rainfed sorghum and millet. Sorghum bugs and millet headworms are major constraints to production and will be a focus of future research efforts. A.I.D. had planned to continue involvement in this project but was unable to do so because of sanctions imposed by Brooke's amendment.
Maseru	02471	632-0221	1989-91	26.1 million	Lesotho Agricultural Production and Institutional Support Project	This project has made limited use of pesticides on horticultural crops.
Maseru (Cont.)						Mission may be sponsoring short-term training in safe pesticide use in the future.

Mission	Cable No.	Project No.	LOP	Funding Level	Project Name	Description
Bamako	05573	688-0226	1981-90	7.5 million	Semi-Arid Research Project	This project provides technical and administrative support to ICRISAT and the Malian Institute of Rural Economy for research on improving varieties of millet and sorghum. Screening/breeding programs include plant resistance to major insect and disease pests.
					Mali AGRHYMET Pilot Project	This is a multi-disciplinary project which includes integrated pest management of sorghum and millet pests.
					International Sorghum and Millet Collaborative Research Project	This project includes breeding millet and sorghum varieties for pest resistance.
Bamako		688-0232	1985-94	19.5 million	Farming Systems Research/Extension Project	This project collaborates with the IPM unit in the Agricultural Research Institute regarding pest management.
		688-0218	1982-91	$22,000 for IPM Activities	Livestock Sector Project	This project has an IPM component which is focused on control of trypanosomiasis vectors.
					Agricultural Research Support Project	This project, which is in the planning stage, will provide commodity support (equipment and vehicles) to IPM scientists in the Ministry of Agriculture.
		688-0233	1988-93	$7,500 for Training	Development of the Haute Vallee	This project will provide short-term training in crop protection to project extension agents. Additionally, the project will hire a crop protection specialist for the extension division.
Maputo	0355		1984-		Commodity Support Program	This program is designed to encourage private sector involvement in providing agricultural inputs. The mission requested a waiver of Reg. 16 to include pesticides among the input commodities but the waiver was not granted. Plans were to include a pesticide training component if the waiver had been given.
						Mission sponsored the participation of 2 persons from the National Institute for Agronomic Investigations in a regional pesticide management workshop held in Nairobi in 1985.
REDSO/ESA Burundi Burundi Kenya Lesotho	24604	695-0101 695-0106 615-0190 615-0221			Basic Food Crops Farming Systems Research On-farm grain Storage II Ag. Production and Institutional Support Cropping Systems Research and Extension Manpower of AF. Dev.	The REDSO/ESA regional pest management advisor evaluated and gave advice on several A.I.D. bilateral projects to A.I.D. missions, contractors, and Ministries of Agriculture. As part of this activity, REDSO/ESA has prepared pesticide guidelines which list EPA registered pesticides for different crop/pest complexes.

Mission	Cable No.	Project No.	LOP	Funding Level	Project Name	Description
Swaziland Uganda		645-0212 617-0103			Training Activities	REDSO/ESA has started collaboration with GIFAP (International Group of Agrochemical Producers) for the organization of train-the-trainer courses in safe pesticide use and management. One such course is scheduled to be held in Uganda in November 1989 (mission funding).
Dakar	10170			20 million	Agricultural Production Support Project	This project is designed to foster evaluation of a private sector input supply industry. Although not yet functional, a $9 million credit component is planned to finance private sector input sales including EPA registered pesticides.
					Agricultural Research Project	This project, which is presently being designed, is expected to include pest management as one of its components. Strategies will be developed based on initial work conducted under the CILSS Integrated Pest Project.
						Short-term training: The mission has funded the participation of crop protection service personnel in several short-term pest/pesticide workshops.
Harare	04683				Zimbabwe Agricultural Sector Assistance Program	This project has supported training on safe pesticide labeling and handling. No funds from this project or other mission supported activities have been used for the purchase of pesticides.
Regional Projects		698-0425.02	1984-92	4.8 million	Bases of Plant Resistance to Insect Attack	This project supports activities of ICIPE (International Center of Insect Physiology and Ecology) which in turn collaborates with National Agricultural Research Services. This project is designed to develop strategies for using plant resistance to insects as a component of IPM. Results are passed to breeders at national institutions through PESNET (Pest network). A.I.D. project funds have been used to train several entomologists at ICIPE.
Regional projects (Cont.)		698-4083	?-1989	1.67 million	Host Resistance Integrated Tick Control	This project works with ICIPE and other research organizations (ILRAD, ILCA, KARI) to develop acquired resistance of cattle to ticks. ICIPE has submitted a proposal to A.I.D. for funding a second phase.
		698-6435.01	?-1991	2.5 million (A.I.D.) 2.5 million (CANADA)	CIAT Bean Research in East Africa	Designed with the objective of reducing crop losses due to pests through the development and dissemination of resistance plants. Varieties with beanfly resistance have been identified and work is continuing on resistance to leafhoppers.
		698-0435.04	?-1991	1.6 million	CIP/PRACPAC Potato Research Network	Designed with the objective of identifying major potato pests and developing varieties resistant to these pests.
					Disposal of unwanted pesticides and empty pesticide container management	REDSO/ESA has assisted missions and host country governments with pesticide storage and disposal issues for more than 10 years. Examples include the Sudan medium-term locust project which includes a component for pesticide disposal and the Zanzibar mosquito control project for which REDSO/ESA provided advice on the disposal of 50 tons of outdated pesticide.

Mission	Cable No.	Project No.	LOP	Funding Level	Project Name	Description
Centrally Funded		698-0517	1987-90	30.5 million	African Emergency Locust and Grasshopper Assistance Project (AELGA)	This project was designed as a medium-term response to the recent locust and grasshopper outbreaks in Africa and has supported control operations, training, and research activities. Training programs funded under this project include ULV pesticide application and safety, training materials, human health aspects of pesticide disposal conference, and an IPM research conference. Research activities have focused on biological control of grasshoppers and locusts.