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REPORT TO THE UNITED STATES CONGRESS *by* THE AGENCY FOR INTERNATIONAL DEVELOPMENT

INTEGRATED PEST MANAGEMENT and PESTICIDE MANAGEMENT

JULY 1991
WASHINGTON, D.C. USA

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EXECUTIVE SUMMARY

The Agency for International Development (A.I.D.) has taken steps to increase awareness of integrated pest management (IPM) principles and to institutionalize the IPM concept in Agency planning and assistance programs. IPM combines a systematic approach to determining appropriate timing for intervention against pest populations using alternative pest control tactics (ex., cultural, biological, and mechanical control measures) to reduce pesticide application and to ensure safe and environmentally sound selection and use of pesticides where their use is necessary.

This report includes activities undertaken by A.I.D. since the beginning of 1990. The Agency has developed guidance for USAID Missions on pest and pesticide management and on IPM tactics available for incorporation into existing schemes. A.I.D.'s initiatives to research, develop, and implement IPM, are guided by National Research Council (NRC) findings on the constraints to and priorities in implementing IPM and sustainable agriculture (of which IPM is an integral part). NRC deliberations will also provide guidance for planned Collaborative Research Support Programs (CRSPs) on pest management and sustainable agriculture.

Ongoing pest and pesticide management-related activities in the Agency involve all geographic bureaus (ex., Africa, Europe and the Near East, Asia, and Latin America and the Caribbean), the Bureau for Science and Technology (inciuding the Office of the Science Advisor), and the Office of U.S. Foreign Disaster Assistance. These activities include research, training, publication of training materials, eradication of exotic pests using innovative technology, institution building, disposal of unwanted pesticide stocks, and crop loss assessments, all of which are fundamental to improving pest management.

INTRODUCTION

The Agency for International Development (A.I.D.) fully supports the adoption of integrated pest management (IPM) by A.I.D.-assisted developing countries. The Agency has continued its efforts to introduce and implement IPM strategies in host countries by a variety of means. A.I.D.'s policy is delineated in A.I.D.'s 1988 Policy Paper on Environment and Natural Resources, its 1978 Policy on Pesticide Support, and its 1981 Environmental Regulations in the U.S. Code of Federal Regulations, 22 CFR Part 216. A summarized description of A.I.D.'s policy on pest and pesticide management is provided in the appendix of this report, and in *Reports to the United States Congress by the Agency for International Development - I. Integrated Pest Management: A.I.D. Policy and Implementation, II. Pesticide Use and Poisoning: A Global View*, submitted to the Congress in July, 1990. Examples of A.I.D.'s attention to the importance of IPM, from 1990 to mid-1991, follow.

GLOBAL ACTIVITIES

A.I.D.'s Pest Management Guidelines

The Office of Agriculture, in A.I.D.'s Bureau for Science and Technology (S&T/AGR), has compiled a comprehensive document, titled *Pest Management Guidelines of the Agency for International Development*, which is tailored to encourage the design and implementation of environmentally and economically sound pest and pesticide management activities in A.I.D. projects. The guidelines present A.I.D.'s pest and pesticide management policy, strategies for pest management (ex., pest exclusion/quarantine, eradication, biological control, chemical control, cultural control, IPM), regulations for environmental review for A.I.D.-financed procurement or use of pesticides, pest management components in project design, pesticide management, and emergency operations and disaster declarations. Appendixes include 22 CFR Part 216, references and sources of assistance, environmental assessment information, types of chemicals and formulations, and the Food and Agriculture Organization (FAO) of the United Nation's Code of Conduct on the Distribution and Use of Pesticides. The Pest Management Guidelines will be distributed to USAID Missions and other interested parties in July, 1991.

Pest Management Sector Review for A.I.D.

In response to the Congress's request for a comprehensive review of A.I.D.'s pest management activities, the Office of Agriculture contracted the National Research Council (NRC) to convene a panel of experts in November, 1990, to discuss integrated pest management. Experts from the U.S. and developing countries in the fields of entomology, IPM, plant pathology, weed science, vertebrate pest management, agricultural extension, and anthropology/sociology met. The conference charge to the panel, chaired by NRC, was to:

- discuss the importance of pests to crop and livestock production in developing

countries and the particular problems associated with migratory and recently introduced pests,

- discuss the sustainability of various pest management strategies in developing countries with attention to cost, pest resistance to pesticides, and negative impacts to the environment and human health,

- identify and emphasize sustainable pest management approaches,

- identify and prioritize constraints to the development and implementation of pest management strategies (with attention to socio-economic, institutional, technical, and policy issues), and recommend and prioritize ways to overcome the constraints,

- propose alternative actions and consider possible collaboration with other donors, the international agricultural research centers, and the private sector in achieving increased food availability, improved quality, increased consumption,reduced imports, increased exports, increased farmer incomes, enhanced or expanded roles of the private sector, and sustainable use of natural resources,

- identify and prioritize pest management activities for the Science and Technology Bureau and discuss ways to implement the activities, and

- keep all recommendations and prioritizations within the framework of U.S. regulations imposed on A.I.D.

A draft report -- based on the outcome of the conference, additional inputs from conference attenders, and NRC's independent research -- was reviewed by the IPM panel created during the November meeting. Subsequent reviews with NRC and U.S. experts were held in March, April, and May. The sector review is expected to be completed in August.

A.I.D. Pest Management Task Force

Recognizing the need to focus on pest and pesticide management issues, A.I.D.'s Environmental Working Group created a subpanel devoted solely to pest and pesticide management and sustainable agriculture concerns. The IPM subpanel of the Environmental Working Group was formed in early 1991, and is being enlarged to include sustainable agriculture in June. This task force will address pest and pesticide management issues within the context of sustaining and preserving the natural resource base for agriculture. Subpanel members will include IPM, agriculture, agroecology, environment, economics, and anthropology specialists in the Agency.

Pest Management Collaborative Research Support Program

In recognition of the research and training needs inherent in implementing IPM abroad, S&T/AGR is planning a Collaborative Research Support Program (CRSP) for pest management. The National Research Council's pest management sector review was designed to identify and prioritize the constraints to A.I.D.'s pest management efforts. The Joint Committee for Agricultural Research and Development (JCARD) and its parent Board for International Food and Agricultural Development and Economic Cooperation (BIFADEC), as well as A.I.D., have approved the scope of work and the selection of an appropriate A.I.D. Indefinite Quantity Contractor to plan the Pest Management CRSP.

The goal of the IPM CRSP is to determine appropriate IPM strategies through research and to provide LDC training and technical assistance for missions and the geographic bureaus. While most CRSPs concentrate on research, the nature of IPM requires that the research be tied to a strong training component for successful implementation. The CRSP will be designed to develop findings and IPM methods for global application.

Sustainable Agriculture and Natural Resources Management CRSP

The Sustainable Agriculture and Natural Resources Management (SANREM) CRSP aims to stimulate and support innovative, integrated systems-based research to identify and develop methodologies and technologies for sustainable agricultural production. At A.I.D.'s request, the NRC convened a panel to assist in overall planning and to define research priorities for the CRSP. In February, 1991, the NRC released a prepublication copy of the panel's findings, titled *Toward Sustainability: A Plan for Collaborative Research on Agriculture and Natural Resources Management*, that identified IPM as one of four critical areas for inquiry. The panel recognized the need to integrate IPM with other elements of sustainable agriculture and natural resource management and to pursue additional research on ecological relationships and management techniques involving pests. S&T/AGR is carrying out final planning for the CRSP, which envisions a program that would run for ten years with a budget of about $50 million.

International Pest Resistance Management

Over the past decade, problems of pest resistance to pesticides have surfaced as a major issue in agricultural and public health arenas. A large number of formal and informal groups of academics, government officials, and industry representatives have been working independently to solve problems related to pest resistance to pesticides. International Pest Resistance Management (IPRM) serves as the umbrella organization to which all other groups can affiliate. Participation is multi-sectoral and includes industry, academia, governments, grower groups, and the environmental community on an international level. The goal of IPRM is to provide an international forum for promoting the concepts of pest resistance management in apples and other fruit crops within the context of IPM systems.

A research and education meeting, funded in part by A.I.D., is being convened to bring together representatives from several key groups concerned with management of pesti-

cide resistant pests of tree fruits in Mexico. The initial meeting will include a team of U.S.-based IPRM and Latin American specialists to address: a) codling moth resistance monitoring and management, b) pesticide selectivity evaluation of releases of pesticide-resistant populations of a beneficial wasp, c) resistance monitoring and management to acaricides in spider mites, d) pesticide selectivity and release of insecticide-resistant predatory mites, e) resistance monitoring and management of insecticides in the wooly apple aphid, and f) resistance monitoring to streptomycin and resistance management of fireblight disease. During the meeting, IPRM will name research/education teams, identify sites of work, and design experiments and educational programs to implement programs of resistance management for the pest groups cited above.

A.I.D. Collaboration with the Consortium for International Crop Protection, Denver Wildlife Research Center, and International Agricultural Research Centers

A.I.D. is supporting the Consortium for International Crop Protection (CICP) as a technical resource in IPM until September 30, 1991. In addition to providing training and technical assistance on IPM issues and conducting environmental assessments for A.I.D., CICP has been active with the international agricultural research centers, especially the International Rice Research Institute (IRRI) in the Philippines. CICP has collaborated with IRRI on biocontrol research of insect pests of rice, insect pest variation in relation to plant host resistance, and ecology of brown plant hopper distribution and migration patterns in order to develop IPM strategies for rice.

Similarly, A.I.D. has funded the Denver Wildlife Research Center (DWRC), which is now on a nonfunded extension until September, 1991, to conduct research and training on the control of vertebrate pests (ex., rats, granivorous birds). The Africa Bureau has funded DWRC for a three-year rodent population management project in Chad (to be completed in mid-1992), and various A.I.D. missions, FAO, the United Nations Development Program and other Agencies, have supported a diverse array of vertebrate pest management research and training projects carried out by DWRC. In addition to research conducted on pesticide ecotoxicology and vertebrate control in Africa, DWRC has collaborated with IRRI to develop and evaluate rodent control technology for research plots, rice production extension packages, and training programs. DWRC has also collaborated with CIMMYT on development and use of reflecting tape for bird exclusion from experimental wheat plots. Other international research centers have been supplied information and current methodologies for vertebrate pest management in specific crops.

Our planned integrated pest management CRSP will likely incorporate expertise and technical services similar to those provided by CICP and DWRC.

New World Screwworm Eradication in North Africa

Since the accidental introduction of the New World screwworm fly into Libya in 1988, A.I.D. has actively supported the eradication program being implemented by FAO's Screwworm Eradication Center for North Africa (SECNA). The program uses a biological control technique that involves releasing sterile male screwworm flies into existing fly populations. Because the technique was developed by the U.S., transfer of this innovative and environmentally benign technique required legislative authorization to transfer the eradication technology to FAO for use outside of the Western Hemisphere. H.R. 4010 was signed by President Bush on March 15, 1990, and in July, 1990, A.I.D. pledged $3 million to renovate the sterile male screwworm production facility in Tuxtla Gutierrez, Mexico, and to purchase sterile male flies for FAO use from the U.S./Mexico Screwworm Eradication Committee; A.I.D. has also served as a mediator and information source among U.S. and international organizations and agencies and has conducted environmental assessments for screwworm prevention in Egypt and Tunisia. Other donors have committed $28.6 million toward the screwworm eradication program being implemented by FAO.

FAO's eradication program began on December 18, 1990, and is continuing. The results so far have exceeded expectations: while in May, 1990, 371 cases of screwworm infection were detected in Libya over a 25,000 square kilometer area of infestation, no cases were detected in May, 1991. The eradication program must continue for six months after the last case of screwworm infection has been identified to ensure complete and lasting success.

A.I.D./Office of the Science Advisor Research Support

The Office of the Science Advisor (SCI) supports innovative pest management research as part of its two collaborative grants programs. In both the Program in Science and Technology Cooperation (PSTC, carried out between the U.S. and developing country scientists), and the U.S.-Israel Cooperative Development Research Program (CDRP, carried out between Israel and the developing countries), SCI funds research directed at understanding pests in developing countries and developing innovative means for managing them. SCI programs depend on the active involvement of developing country scientists in "cutting edge" research, using the latest methodologies in biotechnology or biochemistry to enhance biological or cultural control and monitoring of agricultural pests.

ACTIVITIES IN LATIN AMERICA AND THE CARIBBEAN

Regional Office for Central American Programs

The largest and most comprehensive IPM program financed by A.I.D. in Latin America and the Caribbean is the regional crop protection activity supported by A.I.D.'s Regional Office for Central American Programs (ROCAP), through its Regional Environmental and Natural Resources Management Project (RENARM) for Central America. Since September, 1989, this program has been implemented by the Tropical Agricultural Re-

search and Training Center (CATIE) in Costa Rica, in collaboration with the Panamerican Agricultural School (EAP) in Honduras. The project combines: applied research that targets key pests of food and export crops; short-term, undergraduate, and graduate training in IPM and crop protection disciplines; technical assistance; phytosanitary diagnostic services; and information dissemination in support of pest and pesticide management. The CATIE and EAP IPM programs, which originated in the early 1980s as separate A.I.D. financed projects, continue to play leading roles in generating and disseminating appropriate IPM technology and in training IPM practitioners and decision makers for Central America.

Other Latin America and Caribbean (LAC) Bureau Activities

Numerous other rural development and agricultural projects in LAC countries include IPM and pesticide management activities. They range from short-term training in IPM for technical personnel of project implementing agencies to sizeable investments in research, extension, and training activities that employ full-time IPM technical staff.

Under the Caribbean Basin Initiative (CBI) Act and the Andean Trade Initiative, A.I.D. is helping participating LAC countries diversify their export crops by promoting the growth of nontraditional agricultural export industries. This includes assisting the industries to understand and comply with U.S. pesticide tolerance and quarantine requirements, and supporting export crop-oriented pest and pesticide management and quality assurance programs that often include research, training, and technical assistance activities in IPM.

Quality assurance and/or export crop-oriented pest management activities are included in ongoing or planned bilateral projects in Guatemala, El Salvador, Nicaragua, Honduras, Costa Rica, Belize, Dominican Republic, Jamaica, Ecuador, Peru, and Bolivia. One example: The Agribusiness Development Project in El Salvador, implemented by the Salavadoran Development Foundation/Agricultural Diversification Program (FUSADES-/DIVAGRO) supports a research and development program to seek solutions to pressing pest and pesticide problems on key export crops and a quality assurance program to assist Salvadoran agricultural exports in meeting U.S. Food and Drug Administration (FDA) requirements. The project includes assistance for establishing and operating a laboratory for pesticide residues and diagnosis of phytosanitary problems. Construction of the laboratory facilities is expected to be completed in late 1991.

A second example: During FY 1991, A.I.D. will implement a quality assurance program in Ecuador focused on pesticide residue control, IPM, and environmental monitoring relative to non-traditional agricultural exports (NTAE). The residue control element will include pesticide residue analyses, information management and dissemination, pesticide management and safety training, technical assistance for farmers, strengthening of residue analysis laboratories, and field monitoring of pesticide use. The IPM element will address adaptation, validation, and transfer of pest management practices for major pest problems on priority crops. Under the environmental monitoring element, levels of

pesticide contamination will be monitored in selected project implementation sites, and will include analyses of humans, wildlife, water, soil, and usable crop remains.

ROCAP is also developing a pesticide management program that will involve the U.S. Environmental Protection Agency (EPA) and other U.S. regulatory agencies in strengthening pesticide regulatory agencies in Central America. It will assist the NTAE industry address emerging pesticide problems and needs, and pesticide use and safety concerns through specialized training programs.

ACTIVITIES IN AFRICA

Africa Emergency Locust/Grasshopper Assistance Project
In recent years, A.I.D.'s Bureau for Africa's (AFR) primary vehicle for implementing programs in pest and pesticide management has been the Africa Emergency Locust/Grasshopper Assistance (AELGA) project, which will continue through 1992. In 1990, this project's focus was shifted from short-term emergency responses (ex., to locust and grasshopper outbreaks) to longer range capacity building through research, technical support, and training, with emphasis on preventing pest outbreaks.

Additionally, AFR, through its Strengthening African Agricultural Research and Faculties of Agriculture (SAARFA) project, funds research projects at national and international agricultural research centers which include pest management as one component of a more broadly-conceived agricultural research effort. The thrust of these efforts is the development of crop varieties with resistance or tolerance to major pests. Likewise, many field missions and regional offices in Africa have projects that include pest management. For example, USAID/Chad, in its nongovernmental organization (NGO)-implemented agricultural development project in the Lake Chad Basin area, is promoting the introduction of appropriate IPM technologies among producers of vegetables and grains.

AFR intends to build upon the AELGA project and develop a pest management research and analysis agenda in support of sustainable agriculture in Africa. A study is being initiated to identify an appropriate pest management strategy for the Bureau consistent with its strategic objectives in natural resources management and environment, agriculture technology development and transfer, agribusiness, and food security. A main focus will be to provide analytical support to the Africa Bureau and it[illegible] missions.

Some of the more pertinent pest and pesticide management activities carried out under the AELGA project, include the following:

Research Activities

Research is being conducted on alternative methods of management of pests with cyclical patterns of outbreaks in the Sahel.

Biological Control of Grasshoppers and Locusts: Three separate lines of research into the use of microbial agents to control these pests without chemical pesticides have been supported, through cooperative arrangements with a range of public and private institutions. These research efforts include: a) evaluation of protozoa, fungi, bacteria, and viruses for use against locusts and grasshoppers at the Agronomic Research Center in Cape Verde, which also has a very strong national institution-building and training component; b) a multi-donor project based in Benin (with the International Institute for Tropical Agriculture) and Niger (with the Crop Protection Training Center of the Interstate Committee to Combat Drought in the Sahel - CILSS) which focuses on fungi as possible biological control agents; and c) field trials in Mali, in collaboration with USAID/Mali, the national crop protection services, Agriculture Canada, Ciba-Geigy Corporation, and FAO, which seek to identify promising biological control agents.

Crop Loss Assessment and Decision Tools for Grasshopper Management in the Sahel: Crop loss assessments and economic thresholds are important concepts in IPM; treatment costs and benefits must be evaluated if rational decisions are to be made. Until recently, little specific information was available regarding the nature and level of crop losses on millet caused by various pests. Determining the economic benefits of treatment is a difficult task, due to the many interactions between the environment, the crop, pests, and control operations. AFR has supported research on economic benefits, and field trials are being carried out in Mali with the collaboration of USAID/Mali and the national agricultural research system. The object is to improve our understanding of the relationship between grasshopper numbers and economic loss, utilizing both field data and simulation model analyses. A preliminary simulation model has been developed based on the population dynamics of the Senegalese grasshopper and is currently being field validated. It was constructed to provide descriptions of grasshopper and crop interactions, and a means of analyzing treatment campaigns. A specific technique for monitoring crop loss in the field has been developed and statistically validated.

Neem and Neem-Related Projects and Activities: AFR recognizes the potential of the neem tree in semi-arid Africa as a source for a natural product to manage insects, and is exploring the potential of neem in specific situations. Projects include: a) a project in Niger assessed the efficacy of neem kernel extract (NKE) against locusts and grasshoppers in cereal crops, and investigated the socio-economic feasibility of NKE production at the village level for local use; b) a brief study was carried out in Mali to determine options for appropriate national-level research on neem in meeting crop protection needs of small-scale farming communities.

Rodent Population Management: In Chad, a three-year research project, being implemented by the Denver Wildlife Research Center in collaboration with USAID/Chad

and the Chadian Ministry of Agriculture, seeks better prediction of when and where rodent outbreaks may occur, and introduction and evaluation of innovative measures to control rodent populations.

Technical Assistance Activities
Major technical assistance was rendered to USAID Missions and national governments through:

Environmental Assessments: AFR has prepared Supplemental Environmental Assessments (SEA) for eight sub-Saharan African countries (Burkina Faso, Cameroon, Chad, Mali, Mauritania, Senegal, Niger, and Sudan) as part of an environmentally sound pest management framework for its future locust and grasshopper control activities following the Agency's major investment in control during the 1986-1989 upsurges. These assessments provide country-specific analyses, recommendations and implementation steps for future A.I.D.-supported programs, and emphasize steps to minimize pesticide use and to mitigate impacts upon humans and the environment. The SEAs have broader significance for pest and pesticide management programs in the affected countries, and have already raised the environmental awareness among other donors. The process has helped promote A.I.D.'s goal of strengthening the capacities of the affected nations to effectively address their pest control problems.

Pesticide Management: Assistance to Sahelian USAID Missions and host country Crop Protection Services in pesticide management includes the coordination of training programs that focus on safe and environmentally sound pesticide storage, handling, use, and disposal practices; working with Sahelian governments on pesticide legislation; and coordination with other donors concerning pesticide donations and related assistance programs. Some specific examples:

-- Pesticide Disposal: AFR organized a West African regional conference on the disposal of unwanted pesticides and pesticide containers in Niamey, Niger in January, 1990. The meeting was attended by representatives of 16 West African Crop Protection Services and Ministries of Agriculture, donor agencies, and pesticide industries. Country delegates prepared draft action plans for dealing with their excess stocks of pesticides. Follow-up initiatives include the Niger Dieldrin Disposal Plan proposed by Shell Chemical Companies. A.I.D., in cooperation with Shell Chemical Companies, and the German Technical Assistance Agency (GTZ) is assisting the government of Niger in removing and disposing of over 50,000 liters of dieldrin, an unwanted and environmentally persistent pesticide. Dieldrin is now being removed from disintegrating barrels in storage sites in northern Niger, placed into large tanks, and transported to the Netherlands for disposal by high-temperature incineration. This operation is unique in that a chemical manufacturer is taking unwanted material back to its place of origin, and disposing of it in a responsible manner.

-- Pesticide Legislation and Regulation: As a result of staff participation in meetings

in West Africa and Southern Africa concerning standardization of regional regulation and distribution of pesticides, AFR is developing options for the Bureau's future involvement in this area of pesticide management. An A.I.D. Administrator's Fellow from a well-regarded state environmental protection agency is assisting the effort.

-- Greenness Maps: Seasonal vegetation index (greenness) maps produced from satellite data continue to be made available to Sahelian crop protection services to support grasshopper and locust surveillance and control, through USAID Missions or through a grant to FAO and OCLALAV (Organization Commune de Lutte Antiacridienne et de Lutte Antiaviaire). These maps allow site-specific dynamic vegetation conditions associated with grasshopper and locust breeding to be monitored. This was one of the first development applications of geographic information systems and remote sensing technologies in Sahelian Africa. Capability to receive, produce, and distribute the maps has been transferred to the Sahelian institution AGHRYMET (Regional Center for the Training and Application of Agrometeorology and Hydrology of the Sahel). A.I.D. hopes to continue to improve this technology and further validate its applications to crop protection.

-- Preventive Control of Desert Locusts: The Africa Bureau has been providing technical advice and donor input to FAO and the International Fund for Agricultural Development (IFAD) regarding development of a plan for a collaborative inter-regional program to prevent desert locust outbreaks. The preventive control concept is integral to all long-term objectives in locust control. Several meetings have been held on this subject and a final FAO proposal is expected to be circulated for consideration in mid-1991.

Training, Workshops, and Conferences

AFR organized or co-sponsored training and meetings on pest management topics in 1990 and 1991. These include:

- IPM on Food Crops in the Sahel (Mali),
- West African Regional Conference on Disposal of Obsolete Pesticides and Pesticide Containers,
- Regional Short-course on Surveillance and Control of Locusts and Grasshoppers (Niger),
- Workshop on Identification of Nymphal Grasshoppers in Mali,
- Interpretation of Vegetation Index (greenness) Maps for Locust and Grasshopper Monitoring and Other Applications (Niger and Burkina Faso),
- Workshop on Grasshopper Egg-pod Survey and its Application to IPM of Immature Grasshoppers (Mali),
- Colloquy on Crop Loss Assessment in Millet in the Sahel: State of the Knowledge (Mali),
- Biological Control of Grasshoppers and Locusts: State of the Knowledge (Benin),
- Exotic Aphid Pests of Conifers in West Africa, with Emphasis on Biological Control (Kenya), and

Regional Short Course on the Ecology and Identification of Grasshoppers in the Sahel, with Emphasis on Intervention Strategies (Niger).

Publications

AFR has produced and is distributing the following publications in connection with the AELGA project:

Pesticide User's Guide: A Handbook for African Extension Workers (in English, French, Portuguese, and Arabic);

Nymphs of the Sahelian Grasshoppers: An Illustrated Guide (in English and French);

Clip Art Book: Crop Protection. Volume 1. The Sahel (in English and French);

Report on the West African Conference on the Disposal of Obsolete Pesticides and Pesticide Containers (in English and French);

Report on the Colloquy on Crop Loss Assessment in Millet in the Sahel: State of the Knowledge (in French).

Research by Historically Black Colleges and Universities (HBCUs)

Two recent research projects undertaken by HBCUs that have dealt with pest management are:

-- The Insect Resistance and Alternatives to Insecticides, being conducted in Rwanda by Selma University, is surveying the resistance among three stored grain insects to two insecticides commonly used in Rwanda, and to test the use of non-toxic plant extracts as possible alternatives to insecticides.

-- Systematics/Aquatic Weevils to Enhance Biological Control, being conducted in North America and Africa by Florida A&M University, aims to identify weevils that can be used for biological control of aquatic weeds.

ACTIVITIES IN EUROPE AND ASIA

Europe and Near East Bureau Activities

The National Agricultural Research Project (NARP), supported by USAID/Cairo, includes pest management components, such as control of blossom blight of pears using plant growth regulators. NARP also sponsors collaborative research such as the Citrus IPM project, which is developing facilities and technologies for the field collection and mass rearing of natural enemies of citrus pests in Egypt. The Cotton IPM Project seeks to determine methods for control of the pink bollworm (ex., exotic parasitoids, Bacillus spp., and pheromones), while reducing pesticide applications. NARP is strengthening Egypt's capacity to prevent introduction of the New World screwworm fly from Libya by providing vehicles for surveillance, microscopes for diagnoses, and vats for drenching sheep and goats with a diluted pesticide (registered in the U.S. for the same use) to deter screwworm infection.

Other NARP activities include crop loss assessments in wheat and maize, IPM for tomatoes, integrated pest-nematode management in Egyptian and U.S. cropping systems, toxicology of pesticides, and development and implementation of natural pesticide technology in high-cash vegetables and fruit production.

Asia and Private Enterprise Bureau Activities

The Asia and Private Enterprise Bureau (APRE) is holding a joint agriculture/environmental conference in Sri Lanka in September, 1991. USAID Missions in Asia will have a chance to share their experiences in sustainable agriculture and environmental programs and to determine where A.I.D.'s linkages between agriculture and the environment need to be strengthened. The conference will include a presentation on Indonesian IPM activities.

The Indonesian IPM program began in earnest when the Government of Indonesia banned the importation of many of the active ingredients to pesticides. IPM advisors initiated a very successful training and practical IPM program which concentrates on minimal pesticide use combined with intensive management and preservation of natural predators and parasites of pests. A.I.D. has been a contributor to the Indonesian IPM program by supporting its training components. Indonesia has maintained production gains despite reduced pesticide applications, and the rate of environmental damage has decreased. The program will likely serve as an IPM model for other Asian countries.

The USAID/Pakistan Mission has conducted a series of sessions to bring together farmers, Government of Pakistan agricultural staff, private sector personnel, and other interested parties to discuss and suggest solutions to environmental problems. Much of the discussion involves the development and implementation of alternative (nonchemical) pest control measures, and the sessions have become the basis for future IPM programs in Pakistan.

The A.I.D. representative for Afghanistan has conducted a one-year locust and senn pest (a plant-sucking insect that infests grain crops) control program which draws heavily on IPM methods and limited pesticide applications.

Destruction of Obsolete Pesticides by Cement Kiln Incineration

There is a widespread problem of stockpiles of banned, obsolete, and degrading pesticides in developing countries. After the last locust plague ended in Africa, it was discovered that large stocks of undesirable organochlorinated insecticides (ex., dieldrin and benzene hexachloride), none of which were supplied or encouraged for use by A.I.D., were being stored under less than optimal conditions for long periods of time. Deterioration of the containers will inevitably result in leaks and spills that will endanger humans and the environment. A number of governments and USAID Missions in those countries where accumulation of large pesticide stocks has occurred have expressed concern and actions are being taken to address the problem.

In November, 1989, a pilot pesticide burn was conducted at the D.G. Khan Cement Company in Punjab, Pakistan, under the sponsorship of A.I.D.'s Office of U.S. Foreign Disaster Assistance (OFDA). About 17,000 liters of organophosphate and organochlorine pesticides were incinerated at high temperatures in the rotary cement kiln. Emissions from the burn met current Punjab Environmental Protection Agency standards and closely approached U.S. Environmental Protection Agency standards. No pesticides were detectible in process samples (feed, clinker, and electrostatic precipitator dust).

The procedure provides an avenue for national self-reliance in eliminating obsolete or undesirable pesticides in an economically and environmentally acceptable fashion, and has considerable potential for technology transfer among developing countries. This approach contrasts with the episodic nature of "return to donor (or manufacturer)" pesticide disposal proposals, and avoids the problems associated with transport of hazardous materials across national borders. Also, because much of the pesticide stocks consist of oil-based formulations, there may even be considerable fuel value to cement kiln operation as the compounds are being destroyed. The methodology and results of this pilot pesticide incineration are described in "Pesticide Disposal in a Cement Kiln in Pakistan Report of a Pilot Project and a Report on Test Results from a Pilot Burn of Overaged Pesticides" available from OFDA.

SUMMARY

A.I.D. has taken steps to build an institutional capacity for effective integrated pest management and to apply IPM tools and tactics in agricultural development activities particularly where pests and use of pesticides are a problem. The details are spelled out above; the major steps are:

-- A.I.D. has developed and will issue in July, 1991, pest management guidelines that include policy, strategies, and regulations as well as sources of assistance and references for A.I.D. mission use.

-- A Pest Management Task Force was created as a sub-panel of the Environmental Working Group and will be expanded to include related natural resource management issues.

-- The Agency, with assistance from the National Academy of Science's National Research Council and other U.S. experts, is completing a pest management sector review.

-- A.I.D.'s Bureau for Africa (AFR) has prepared Supplemental Environmental Assessments for eight sub-Saharan African countries as part of its effort to develop an environmentally sound pest management framework for its future locust and grasshopper control activities following the Agency's major investment in pest control during the 1986-1989 upsurges.

Ongoing and planned research and technical assistance, as well as efforts to safely destroy stockpiles of banned, obsolete and degrading pesticides in both Africa and Asia, are evidence of A.I.D.'s commitment to environmentally sound pest and pesticide management in developing countries.

Appendix

A.I.D. Policy Related to Integrated Pest Management

A.I.D. POLICY AS IT RELATES TO INTEGRATED PEST MANAGEMENT

Basic Policy: Official A.I.D.-wide policy for integrated pest management (IPM) exists within three documents:

- A.I.D. Policy Paper: Environmental and Natural Resources, 1988,
- 1978 Policy Paper on Pesticide Support, and
- A.I.D.'s Environmental Regulations in 22 CFR Part 216 (1976, revised in 1980). The tenets of A.I.D.'s policy as it relates to pest and pesticide management are being consolidated in A.I.D.'s Pest Management Guidelines from which much of this document is derived.

The nucleus of A.I.D.'s environmental and natural resources policy resides in the concept of attaining sustainable economic and social progress by environmental and natural resources conservation, protection, and management. The main goal of this policy is to "help developing countries to conserve and protect their environment and natural resources, and to promote long-term economic growth by managing exploited resources for sustainable yields" (A.I.D. Policy Paper: Environment and Natural Resources, 1988).

Sole reliance on pesticides to reduce pest-induced crop injury and improper pesticide selection and application procedures can result in undesirable conditions that include soil and water contamination, human health risks, pest resistance, destruction of nontarget organisms, secondary pest problems, unacceptable toxic residues on agricultural products, and unnecessary financial burdens. In striving to "support activities specifically designed to achieve sustained natural resource productivity and management while protecting or enhancing the environment" (A.I.D. Policy Paper: Environment and Natural Resources, 1988), a more systematic approach to pest control is fundamental to sustainable development. Integrated pest management (IPM) offers strategies for effective long-term pest control while mitigating hazards to humans and the environment. IPM, however, does not preclude the use of pesticides, which are in many cases an integral component of IPM approaches.

Since the early 1950s, A.I.D. and its predecessor agencies have provided pest management assistance to developing countries to protect:

- human health, mainly by controlling disease vectors,
- food crops at pre- and post-harvest stages, and
- livestock from direct pest injury and from transmission of diseases (A.I.D. Policy Paper on Pesticide Support, 1978).

In 1971, the Agency began to direct pest management activities toward IPM. In 1976, A.I.D. adopted its first environmental procedures, 22 CFR Part 216 (also known as Regulation 16), revised in 1980, to require a careful integration of environmental consequences into one decision-making process for A.I.D. projects, programs, and activities. This allows mitigative measures, such as IPM strategies, to be incorporated in project design prior to project authorization and implementation.

Because environmentally sound and sustainable agriculture requires the proper selection, application, storage, and disposal of agricultural chemicals, A.I.D. policy is to implement IPM tactics wherever appropriate. This policy includes:

- minimal pesticide use,
- judicious pesticide selection,
- discouraging general requests for pesticides,
- emphasis on nonchemical pest management tactics,
- infrastructure development for proper pest and pesticide management, including regulation of pesticide manufacturing, labeling, distribution, worker and public exposure levels, application, storage, and disposal,
- communication of U.S. policy and experience to other nations and international organizations,
- promotion of supplements or alternatives to vector control that do not involve toxic chemical use, and
- encouraging host country efforts to research improved pest management methods (A.I.D. Policy Paper: Environmental and Natural Resources, 1988). All of the above items are implicit to IPM.

A.I.D. has discontinued procurement of pesticides on a nonproject basis under the commodity import program, except in emergencies and cases of compelling circumstances. Pesticides have been eliminated from the list of commodities automatically eligible for A.I.D. financing. Requests for the use of pesticides as part of projects are reviewed on a case-by-case basis (A.I.D. Policy Paper on Pesticide Support, 1978). Exceptions to this requirement may be granted for research projects, emergencies, and projects in which A.I.D. is considered to be a minor donor.

Host Country Legislation: It is A.I.D. policy to support the creation and implementation of laws and regulations which will maximize benefits derived from pesticide use while minimizing potential adverse environmental impacts in developing countries (A.I.D. Policy Paper on Pesticide Support, 1978). Legislation should cover all aspects of pesticide involvement, such as control of imports, registration, sale, distribution, use, marketing, training, licensing, certification, storage, disposal, tolerance levels on agricultural commodities, and enforcement. A.I.D. complements pest management programs with appropriate efforts to strengthen institutional capabilities and scientific expertise. A.I.D. has traditionally stipulated that U.S. technical assistance and donated equipment be used only in conjunction with the application of pesticides approved by A.I.D. (22 CFR Part 216). For example, in the recent locust and grasshopper plague, A.I.D. prevented the continued use of pesticides such as dieldrin and benzene hexachloride because of their environmental persistence.

Training: A.I.D. policy is to assist developing countries in the establishment and implementation of regulations that will reduce pesticide-related risks to the environment and humans (A.I.D Policy Paper on Pesticide Support, 1978). Attaining the goals of this policy involves training to increase host country capabilities in IPM tactics, and pesticide

selection, formulation, labeling, storage, application, and disposal. This includes assistance to host country governments for enhancing institutional capacity to maintain control over pesticide availability, production, and use through training. Training should be aimed at all levels of pest and pesticide management, from government decision makers to pesticide applicators and farmers.

Pesticide Selection: A.I.D. pesticide purchases are limited primarily to chemicals registered in the U.S. Assistance for the procurement or use of pesticides may be approved after a thorough environmental examination, which includes how the chemical can be used in an IPM strategy, as stipulated in 22 CFR Part 216. In general, the pesticide that is least hazardous to humans and the environment, and has U.S. Environmental Protection Agency registration for same or similar use, is preferred. In some cases, pesticides are not registered in the U.S. (ex., those used against tropical pests not found in the U.S.) because there is little or no use for them, not because they are particularly hazardous to the environment and humans.

Local Currency for Pesticide Procurement: Since the mid-1950's, PL-480 and related food-aid programs have supported natural resources conservation in developing countries. It is A.I.D. policy to use PL-480 resources for *inter alia* reforestation, agroforestry, watershed management, soil conservation, and habitat protection. Although A.I.D.'s formal environmental procedures (22 CFR Part 216) do not apply to activities funded with host country-owned local currency, A.I.D. is committed to ensuring that projects funded by local currency are environmentally sound. Because IPM strategies are aimed at mitigating environmental damage, IPM would be a viable alternative to sole reliance on chemical control of pests. IPM, however, does not preclude the use of pesticides, which are in many cases an integral component of IPM systems. A.I.D. may approve a country's use of PL-480 generated local currency to finance procurement or use of pesticides applied as part of an IPM program or not, but they should be reviewed in the same manner as A.I.D. financed pesticides.

Donor Coordination: It is a critical element of A.I.D.'s pesticide and pest management policy that pest management activities be coordinated with other donors, international organizations, and U.S. agencies (A.I.D. Policy Paper on Pesticide Support, 1978). A.I.D. works closely with other bilateral donor agencies through the Development Assistance Committee of the Organization for Economic Cooperation and Development, multilateral development banks, and international organizations such as the Food and Agriculture Organization of the United Nations. Donor coordination is especially important at local levels to reduce overstocking pesticides, duplicating efforts, providing an unwieldy variety of products, and avoiding shortages of needed materials.

Storage, Handling, Application, Transport and Disposal of Pesticides, and Monitoring Human Health: A.I.D. policy is to promote safe and effective pesticide operations to protect human life and the environment. Policy is not specific with regard to particular protocols for pesticide storage, handling, application, labeling, transport and disposal, and

monitoring human health. Although A.I.D. is studying improved methods to accomplish these tasks, specific "best" methods have not been identified or incorporated into formal policy. At this time, recommendations to refine pesticide storage, handling, application, labeling, transport, disposal and safety practices (may include recommendations on residue tolerance levels for agricultural commodities) are included in Initial Environmental Examinations (IEE) and Environmental Assessments (EA) conducted by A.I.D.

Specific IPM Strategies: Because each **IPM** system should be specifically designed for particular geographic locations, crops, pest complexes, and resource availabilities, it would be unrealistic for A.I.D. to create policies on which specific IPM tactics must be incorporated into every site-specific IPM strategy. In this context, appropriate research is a fundamental component of IPM and is encouraged, and funded where appropriate, by A.I.D.

A.I.D. is, however, focussing its attention on the concept of sustainability in the agricultural context. A.I.D.'s Pest Management Sector Review, being prepared by the National Research Council, includes an examination of constraints to the implementation of IPM strategies in developing countries. The National Research Council has been charged with recommending ways in which to instigate the development and use of IPM strategies consistent with the objectives of sustainability.

The principal goal of the sustainable agriculture initiative is to enhance the ability of developing countries to improve the welfare of their growing populations by sustaining both agricultural production capabilities and environmental quality, both of which are primary tenets of IPM. The sustainable agriculture initiative will strive to accomplish sustainable objectives by applying a holistic approach to selected research, technology transfer, training, and public education activities. This integrated approach will also be applied to the development of host-country policies, laws, and regulations, and will include, but not be limited to, the disciplines of agronomy, soil science, animal science, economics, agricultural engineering, entomology, genetics, geography, sociology, anthropology, political science, and ecology. External insights will be combined with farmers' traditional knowledge to develop managerial and technological options tailored to environmental conditions and to farmers' goals, capabilities, and resources.

Regulations for Environmental Review for A.I.D. Procurement or Use of Pesticides: It is A.I.D. policy to ensure that the potential environmental consequences of A.I.D.-financed activities are identified and considered by A.I.D. and the host country prior to the final decision to proceed with an activity. The procedures that guide this policy are set forth in 22 CFR Part 216. Section 117(c) of the Foreign Assistance Act and Section 533(g) of the 1991 Appropriation Act require that A.I.D. review its projects, programs, and activities in accordance with the requirements of 22 CFR Part 216.

22 CFR Part 216 includes specific instructions for examining A.I.D. projects which include funding for pesticide use (includes procurement or use of equipment and technical

assistance in connection with pesticide use, storage, transport, and disposal), or procurement of pesticides. For such projects, Project Identification Documents (PIDs) or Project Papers (PPs) include a preliminary review of the proposed action for pest control as it relates to the environment. Generally, the first step in this review is called the Initial Environmental Examination (IEE) which provides the basis for a "Threshold Decision" as to whether an Environmental Assessment (EA) is required prior to project implementation or whether no further review is necessary. (For certain actions that affect the environment of the United States, the global commons, or areas outside the jurisdiction of any nation, an Environmental Impact Statement may be required in accordance with the National Environmental Policy Referendum; since virtually no A.I.D. actions are in this category, it will not be discussed further). Depending on the U.S. Environmental Protection Agency (USEPA) registration status of the proposed pesticide(s), an EA may be mandatory. In cases where an EA is mandatory, the IEE may be omitted from the review process. Precise definitions for the IEE and the EA are provided in 22 CFR Part 216. **Project Officers must always consult and comply with the requirements of 22 CFR Part 216 during the design and implementation of activities involving the use or procurement of pesticides.**

The rationale for treating USEPA registered pesticides differently from those which do not have USEPA registration is that these chemicals have been found to be acceptable in the U.S. after undergoing a thorough risk evaluation. USEPA registered pesticides must be evaluated first in an IEE to determine whether or not they will cause significant harm to the environment. If not, no further review is required. If the proposed pesticide may have adverse environmental impacts, then an EA is required. Pesticides that are not registered for same or similar use in the U.S. and pesticides that are for "restricted use" must automatically be examined by an EA. The issues to be addressed in IEEs and EAs are presented in two documents that were developed for A.I.D. and satisfy the requirements set forth in 22 CFR Part 216:

Manual for Preparation of Initial Environmental Evaluations (IEE) and Environmental Assessments (EA) of U.S.A.I.D. Projects for the Control of Vector-Borne Diseases. 1990. Vector Biology and Control Project, Arlington, VA, and

How to Prepare Environmental Assessments of Pesticide Use in A.I.D. Agricultural Projects. 1991. Consortium for International Crop Protection, College Park, MD.

A.I.D. is exempted from fulfilling the requirements of 22 CFR Part 216 in certain limited situations. These include emergencies, as determined by the A.I.D. Administrator, projects where A.I.D. is a minor donor in a multi-donor project, projects using pesticides for research purposes, and, under very restricted conditions, non-project assistance. Exemptions are granted very infrequently and, even under emergency conditions, efforts to fulfill the spirit of 22 CFR Part 216 are undertaken.

In addition to A.I.D.'s policy relevant to the environment and natural resources conserva-

tion, the Agency has a cadre of environmental officers that ensure compliance with the policies and regulations at the USAID Mission and the Regional Bureau levels under an overall Agency Environmental Coordinator.

Pest Management in Project Design: Both in goal and by mandate, A.I.D. programs are designed to consistently promote sustainable productivity and to maintain or enhance the natural resource base in recipient countries. Actions which address these issues are built into all A.I.D. projects. A.I.D. subscribes to the multifaceted approach to pest management that brings several non-pesticidal, sometimes traditional, control tactics to bear in place of or in addition to pesticides. An integrated approach to pest management often involves research, training and evaluation which must each be planned and budgeted. Project planning is developed and described in a variety of documents that are generated prior to or during project implementation. The following documents involved in project development reflect A.I.D. policy on how pesticide-related activities are planned and implemented.

• Country Development Strategy Statement (CDSS): CDSSs are multi year strategy documents that summarize the country's social and economic development status, the country's development plans and resources, and A.I.D.'s assistance strategy within the country. The CDSS provides the rationale and setting for current projects and often prompts ideas for new projects. Agency central Bureaus develop a comparable document, the Central Program Strategy Statement (CPSS), which outlines long-term Bureau goals in the context of A.I.D.'s policy. These documents usually do not describe specific actions but instead discuss in broad terms the strategies used in A.I.D.'s health, agriculture, environment and other developmental programs in countries or A.I.D. Bureaus. Pest management, although not usually discussed in detail, is often mentioned. The CDSS should include, either in the sectoral sections of the document, or in a separate "pest management" section, the Agency's and Mission's commitment to safe and sustainable pest management through an integrated approach. For example, efforts to bolster the agricultural capabilities of the country should include training and research in the safe use of pesticides, and in the development and use of alternatives such as pest resistant plants or biological control. Discussions on pest management in these documents will set the stage for all projects to follow.

• Action Plan (AP): With a CDSS in place, Missions prepare APs every year to specifically focus on how current programs and projects contribute to objectives outlined in the CDSS, and on how new initiatives will help address issues raised in the CDSS. The AP links the long range objectives in the CDSS to more detailed plans for activities. A.I.D./-Washington Bureaus may also develop an AP (usually every 3 - 5 years) to assess the progress of current projects and to identify new projects. Plans for research, training, and evaluation may appear in the body or annexes of the AP. Project officers involved in overseeing pest management activities should contribute descriptions of activities and objectives to the AP. If pesticide procurement, use, storage, transport, and/or disposal is contemplated, then accompanying safety training is described. Budget line items for specialists in pest management training, and for pesticide monitoring should be included. If alterna-

tive pest management methods are to be used, then the political/social acceptability of those methods may need to be evaluated. If so, plans for this (or other assessments) should be mentioned and budgeted.

• Project Identification Document (PID)- This document reflects In greater detail specific projects being planned and how inherent activities will be implemented. All budget line items for pest management in the project should be indicated, including the costs for conducting an EA, other assessments, training, research, social studies, equipment, and technical assistance. The PID includes the IEE (if an IEE is needed), which should be relevant to the project, not separate from it; that is, the way the project is planned and conducted should influence the contents and outcome of the IEE. **By consulting 22 CFR Part 216 early in project design, the project can be planned so that many of the concerns are addressed at the PID stage, not after the project is underway.** By provisioning for a need for pesticide training at the PID stage, for example, the project officer will be prepared for the IEE.

• Project Paper (PP): The Project Paper includes all information needed to justify, explain and implement the project. The Logical Framework included in the PP provides the goals and objectives against which project progress will be measured. Pest management plans should be included in the PP, along with the objectives of the planned activities with objectively verifiable indicators (ex., crop damage level assessments, or numbers of persons trained) clearly indicated so that progress can be measured. The budget should identify by line items those funds that are earmarked for pest management. The PP also includes preparations for an EA. As part of project design, pest management recommendations from the EA should be addressed in the PP. Ideally, if pest management has been considered throughout project design, recommendations will be few and will be easily incorporated into the project.

• Project Agreement (PROAG): Based upon the approved PP, the PROAG describes how A.I.D. and the host country government will collaborate on the project. Generally, a description of the project is followed by discussion of financial arrangements. A.I.D. makes every effort to ensure that the recipient country's government is aware of proposed pesticide usage in assistance programs and consents to the use. The PROAG is the appropriate document to describe any proposed use, and to describe how, based upon the IEE and EA, mitigative and alternative tactics will be used. Early involvement of recipient country representatives on pest management issues in the project will minimize difficulties at this late stage. Once the PROAG is signed by all parties, the project is ready for implementation.

Pest management concerns are also addressed in "umbrella projects" and non-project assistance.

• Umbrella Projects: Many A.I.D. projects are structured so that subprojects such as grants or cooperative agreements will be supported under the project. The nature of the

subprojects is not always clear when the overall umbrella project is being designed. As each subproject is proposed, it should be reviewed as per 22 CRF Part 216 for pest management components, and plans for such a review should be described in the umbrella project's IEE and/or EA. Project amendments and extensions are also subject to the requirements of 22 CFR Part 216.

• Non-project Assistance: When A.I.D. provides funds, credit, or commodities outside of the context of projects, measures should be taken by A.I.D. to assure that assistance for pest management activities is used responsibly and in accordance with A.I.D.'s environmental and pesticide regulations. A.I.D. has discontinued procurement of pesticides on a non-project basis under the commodity import program, except when the approval of the Administrator is obtained in cases of emergency and other compelling circumstances. Pesticides have been eliminated from the list of commodities automatically eligible for A.I.D. financing. Requests for the use of pesticides as part of projects are reviewed on a case-by-case basis bearing in mind the regulations in 22 CFR Part 216.