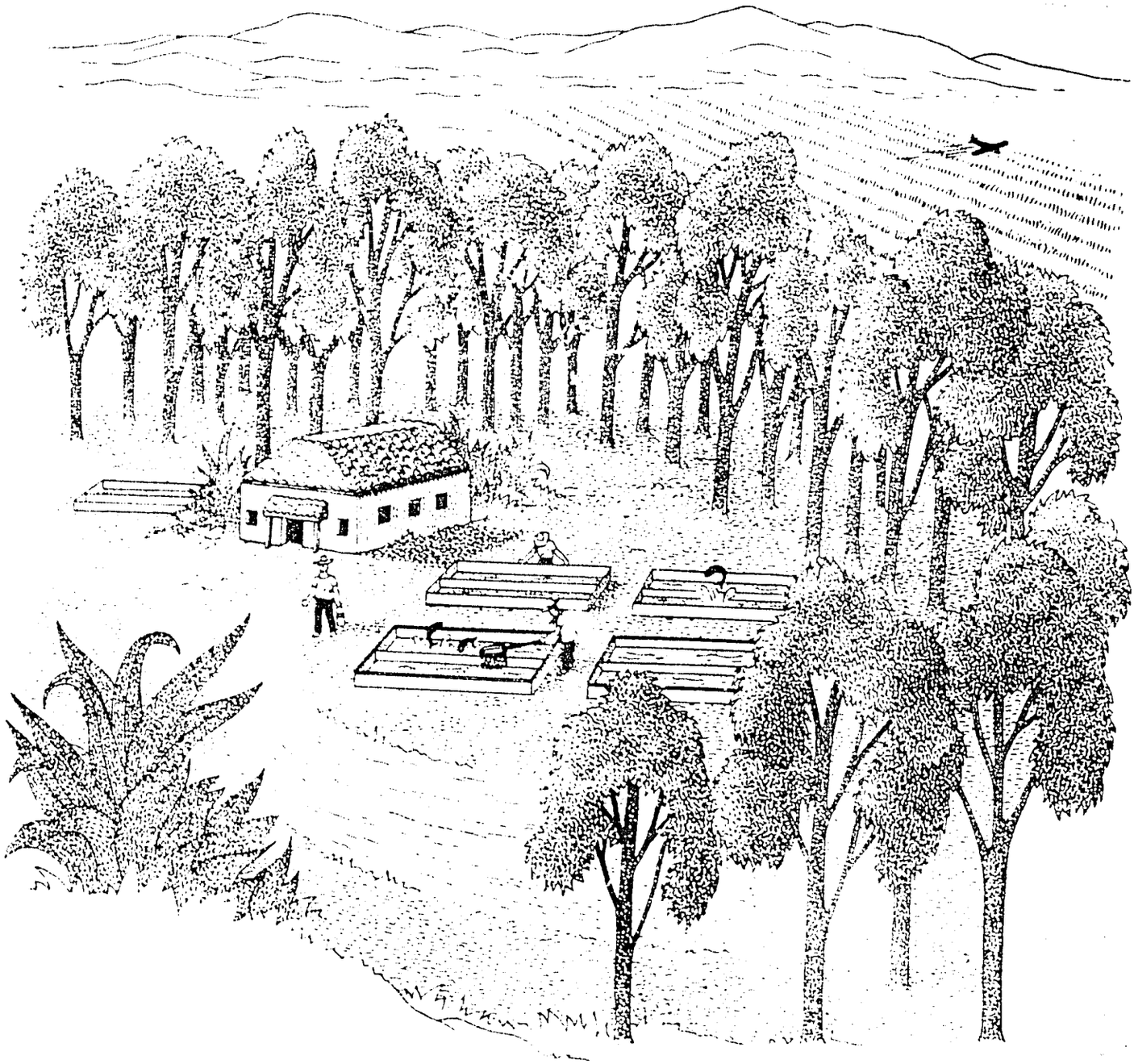
UNIVERSITY OF CALIFORNIA/
AGENCY FOR INTERNATIONAL DEVELOPMENT

Pest Management
and
Related Environmental Protection Project



ANNUAL REPORT
1977

UNIVERSITY OF CALIFORNIA/AGENCY FOR INTERNATIONAL DEVELOPMENT

PEST MANAGEMENT & RELATED ENVIRONMENTAL PROTECTION PROJECT*

1976-77 ANNUAL PROGRESS REPORT

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North Carolina State University
Oregon State University
University of California
University of Florida
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ANNUAL REPORT

The period covered in this annual report reviews the work accomplished from October 1, 1976 to September 30, 1977. Owing to adoption of a new fiscal year reporting period since the last annual report was written, project activity conducted from July 1 to September 30, 1976, will also be discussed.

Introduction

The present contract between The Regents of the University of California and the United States Agency for International Development, AID/ta-C-1195, is a continuation of an on-going project that was initiated in June, 1971. The principal objectives of this project and its general procedures have been presented in two previous annual reports. The current contract terminates December 31, 1977; however, negotiations are in progress for extension of the project for an additional three years.

Briefly, the purpose of the project is to assist AID in the development of a long-term pest management strategy for continued USAID assistance to developing countries which would improve the latter's capability to deal with pest control problems in a manner consistent with the protection and maintenance of environmental quality. Immediate short-term goals of the project were:

1) to provide immediate technical assistance to AID in crop protection and pesticide problems as needed,

2) to study and review AID's pesticide management program and procurement procedures, and

3) to survey and evaluate pest problems and current pest control and pesticide handling practices in developing countries.

Item (1) is a continuing activity of the project while items (2) and (3) were completed during the first contract period, June 1971 - December 1974.

Project activities are conducted by a consortium of universities which include Cornell University, North Carolina State University, Oregon State University, University of Florida, University of Miami (Florida) and the University of California, with the participation also of the U.S. Department of Agriculture.

Although the University of California is responsible for the coordination and general management of the project, the formulation of policy, assignment of priorities and review and assessment of project activities is made by a thirteen member ad hoc Advisory Group, meeting several times a year. This group was formed shortly after the beginning of the project and is composed of the AID Project Manager, the Director and

Associate Director of the project, eight scientists affiliated with the six universities participating in the project and two representatives of the U.S. Department of Agriculture. When a particular activity is being organized and planned that involves the participation and collaboration of other instituions, then individuals from these agencies also attend the Advisory Group meetings, if feasible.

A. MULTIDISCIPLINARY STUDY TEAM REPORTS

Mediterranean Fruit Fly: Team members were Wallace C. Mitchell, entomologist, University of Hawaii; Chris O. Andrew, agricultural economist, University of Florida; Kenneth S. Hagen, biological control specialist, University of California, Berkeley; Richard A. Ha ilton, horticulturist, University of Hawaii; Ernest J. Harris, fruit fly ecologist, U.S. Department of Agriculture, Honolulu, Hawaii; Kenneth L. Maehler, quarantine specialist, Moraga, California and Robert H. Rhode, research entomologist, U.S. Department of Agriculture, Weslaco, Texas.

This UC/AID Multidisciplinary Study Team was organized at the request of USAID's Regional Office for Central American Programs (ROCAP) in Guatemala City for the purpose of conducting an on-site investigation and evaluation of the impact of the Mediterranean Fruit Fly, *Ceratitis capitata* (Wied.), and other fruit flies (*Anastrepha spp.*) on fruit production and the economy of the Central American countries and Panama (CAP).

The objectives of the study were to gather and evaluate data and information and make field observations so that recommendations could be made to CAP policymakers indicating the most appropriate course of action for them to follow in dealing with this pest. The options considered by the team when these recommendations were developed were: (1) no action, (2) suppression, and (3) eradication.

The UC/AID study team visited the CAP region from March 6 - April 3, 1977, and thus was only able to make limited field observations in the time available. However, by means of a review of the literature, a study of the reports of other investigations, and discussions with many knowledgeable people in the region, they were led to the conclusion that the medfly was not presently causing any great amount of economic damage in the CAP countries. On the basis of this conclusion, the team therefore felt that perhaps the most valuable result of their survey would be to place the medfly in its proper perspective in relation to other fruit production problems occurring in the region.

Due to the medfly's recent invasion of Guatemala and reported capture of a couple dozen adult flies in baited traps earlier this year in Mexico, the team reported that Guatemala and Mexico have developed a well coordinated cooperative program of medfly prevention and control on a limited scale called MOSCAMED. According to the team, the MOSCAMED operation in Guatemala was the most efficient in the CAP countries; its field operations were well organized and coordinated, work objectives were properly defined, and the overall program was highly functional.

The primary objectives of MOSCAMED are to detect and suppress medfly outbreaks with particular emphasis given to the coffee and citrus area extending along the Pacific littoral to the Mexican - Guatemalan frontier. As suggestions to improve the effectiveness of this program, the team made the following comments:

1) The medfly trap catches should be expressed on a fly/trap/day basis. In this way, the dynamics of medfly populations existing within different ecological situations could be compared directly.

2) The number of traps/unit area (trap density) should be similar in the areas under observation to make the trap catch data more meaningful.

3) Traps placed in a host fruit area should be moved to new locations if they do not register any fly catches within a two-week period. In this way, a larger area could be surveyed more quickly.

4) Suppressive spraying should not be initiated on the basis of only a single fly capture. To determine whether or not a trap capture was the result of an established infestation or of transient fly movement, susceptible fruits found in the vicinity should be collected and the sample held in a protected manner over sand to determine pupal recovery. Additional traps should also be placed around original catch sites to delimit suspected infestations. If one or more of the traps continues to catch flies, an established infestation is indicated and control measures should be initiated.

In El Salvador, the medfly team found that field activities relating to the medfly were principally extension in nature. In response to a Presidential Decree directing growers to carry out control measures against the medfly, trained technicians instruct progressive growers through field demonstrations on prevention, detection and control of fruit flies.

In Honduras, the study team noted that trapping and quarantine activities had been discontinued due to lack of funds. Although the mountainous terrain and relative isolation of many small valleys in Honduras are natural barriers in restricting the voluntary movement of medfly, the team emphasized that a concerted effort involving quarantine post and prevention, detection and control programs would be required to delay the spread of medfly into citrus growing regions on the NW coast. They recommended the systematic collection and burial of fallen fruits by Ministry workers and suggested that this practice should be encouraged among growers also, since this was a relatively inexpensive operation which could greatly inhibit increases in medfly populations, if done consistently. They also recommended the use of a protein bait instead of molasses to bring about a more efficient control of medfly.

The UC/AID study team found that spray applications for the medfly in Panama were initiated when trap catches averaged 1.5 flies/trap/day. In the 350,000 orange tree Cítricos de Chiriquí plantings, the team noted medfly populations could be monitored at weekly intervals throughout the year at relatively low cost. They recommended the use of sticky traps, baited with a 5% w/w mixture of summer grade trimedlure and an adhesive (such as Tack Trap), instead of the Steiner trap for detection purposes.

The team felt that it would be desirable to determine if medfly infestations were present in Panama City, Colón, and their environs. They also recommended that trapping for medfly in the Central Provinces, particularly El Valle and similar areas, should be intensified.

The detection and control program in Nicaragua is a cooperative effort by MAG and OIRSA to suppress medfly populations in coffee-producing areas adjacent to the Honduran border. The team considered the success of this operation as somewhat problematical, particularly since the majority of personnel involved in the project has been reassigned to assist MAG in its control campaign against coffee rust. They also felt that the practice of treating vehicles with DDVP at both the Costa Rica and Honduras border for medfly is not justified since the fly now occurs in both countries.

Field activities associated with fruit fly control, other than the methyl bromide fumigation of fruit entering from Nicaragua, are not being conducted in Costa Rica. At Guadaloupe, a suburb of San José, OIRSA has retained a medfly rearing laboratory which also routinely maintains stock populations of its parasites, some of which also attack Anastrepha spp.

Although the medfly has not yet been found in Belize, the UC/AID team felt that the entomologists of the Ministry of Agriculture and Lands were technically prepared to deal with any outbreaks of this pest based on their experience in carrying out suppressive measures against the Mexican fruit fly, Anastrepha ludens (Loew). They reported that a working agreement with USDA/APHIS was being developed to assist Belize in expanding their capability to detect incipient outbreaks of this pest.

The medfly team found that there was much interest in biological control of the medfly in all CAP countries. Four species of parasites had been released in Costa Rica and Panama, but only two species were released in El Salvador while Nicaragua released just one species of parasite. The ability of the OIRSA insectary to mass culture these parasites clearly indicated to the team that the personnel and facilities were quite capable of providing ample numbers of parasites to all CAP countries if they were to decide that the classical biological control approach was their objective. This approach had been the one originally adopted when the medfly was first discovered in Costa Rica, but as mass culture of the parasite species increased, the biological control strategy apparently shifted to that of making many periodic inundative releases of millions of parasites in several CAP countries. Peak production and release of parasites for this program was achieved in 1975, but production of these species has since declined to maintenance levels.

Presently, only a few countries are actively conducting biological control research because of lack of funds, lack of trained specialists in biological control and systematics, and lack of proper quarantine facilities which precludes handling foreign shipments containing mixed insect material.

The seven-man team noted that records showed that fruit fly larvae in hosts are the most frequent source of introduction of the medfly into the United States. These records also demonstrate that Hawaii has been a greater source of medfly introductions than CAP countries. Although these introductions from Hawaii have been numerous, the team reported that incipient infestations have been very few which they believe indicates that there is considerable environmental resistance in the continental U.S. to the establishment of this species.

The team further believes that while it is possible that the medfly could gradually move northward from CAP countries to Mexico and eventually reach our border, it seemed much more likely to them that some of the hundreds of thousands of tourists visiting Hawaii would introduce medfly larvae in smuggled coffee cherries.

If the medfly does become established in Mexico, the team expected the existing quarantine stations along the U.S.-Mexico border, where vehicles, cargo, and baggage are inspected, to become increasingly more vigilant. They also stated that the quarantine type of barrier that the U.S. employs south of San Diego to discourage the entry of Anastrepha ludens - which involves the release of sterile flies along the barrier whenever Anastrepha ludens activity is detected or suspected - could be modified to also include releases of sterile medflies.

The study team devoted an entire chapter in the report to an extensive economic analysis of the potential impact the medfly would have on the citrus and peach industry if it succeeded in invading the U.S. and becoming established. The area which might be exploited by the medfly in the continental United States was hypothesized by Messenger and Flitters on the basis of laboratory studies they performed during the 1950's. Their studies indicated that the U.S. could be divided into two zones - a "potential" and a "marginal" zone - based on the likelihood that the medfly would be able to survive the prevailing winter conditions characteristic of those zones.

The "potential" zone of medfly establishment is an area where in the average year there is no more than a 60-day period with an average temperature below 14°C. The "marginal" zone for this species is an area that has more than a 60-day period but less than a 90-day period with an average temperature below 14°C. Consequently, the zone appears to be marginally suitable for fruit fly reproduction and development.

Since definite infestation rates from which to project losses were not available, the report assumed loss rates would occur over a range of 10-75 percent in the "potential" zone and that losses would occur in the "marginal" zone at one-half that of the "potential" zone, i.e., over a range of 5-37%.

Once these assumptions had been made, county and statewide production data on citrus and peaches were analyzed to estimate production and value losses that would result from various fruit fly infestation rates. At the lowest infestation rate considered by the team (i.e., 10% and 5%, respectively, for the two zones) for oranges, grapefruit and peaches, a potential retail loss of $174.8 million was estimated (after price adjustments were considered). For higher rates of infestation, proportional increases in retail losses were projected.

The team emphasized that these projections were only, at best, "guesstimates" because of the many variables involved. However, they considered that these were based on the best available information on crop protection, climate limitations of the medfly, and a sliding-scale of percent losses related to host susceptibility.

In appraising the medfly's status as a pest of citrus in the CAP countries, the UC/AID study team concluded - on the basis of their own observations as well as the lack of concern expressed by most of the scientists and producers interviewed - that the medfly was only a minor pest of a minor crop, causing very limited economic damage. Furthermore, it did not appear to be as much of a deterrent to citrus production as insufficient irrigation water, diseases, inferior varieties, harvesting problems, inadequate transportation and marketing facilities, and unstable prices. In estimating and assessing damage of the medfly on coffee, its principal host in Central America, the team noted that it was the predominant attitude and opinion of the producers and scientific workers that it was not causing any loss in production or quality of coffee.

The UC/AID team considered that placing the medfly in its proper economic perspective and determining realistic estimates of damage provided a sound biological and economic basis for the development of recommendations for appropriate control programs. In considering alternative types of action, the team concluded that the low economic losses attributed to medfly and related species did not justify the high cost of an attempted eradication program. In addition, sufficient trained personnel and an adequate data base for planning and developing an eradication program were not available. Due to the difficult terrain, inaccessible areas and lack of precise information on the extent of medfly infestation, there was no assurance that such a program would be successful. The team pointed out that even if the medfly were to be eradicated, there would still be a problem with fruit flies of the genus Anastrepha. They, therefore, did not recommend an eradication program.

Neither did they recommend that nothing be done to control this pest since they believed that changes in agricultural policies and production of host fruit for export within the CAP countries could result in increasingly serious problems if this policy were to be adopted. They estimated that the medfly could migrate into the U.S. within ten years if no action was taken by Mexico or CAP countries to deter or slow its rate of migration.

After considering and rejecting the two options just cited, the UC/AID team recommended to the CAP countries the adoption and implementation of

an integrated pest management program which would strengthen the present relatively low levels of medfly detection and control efforts. They felt that this program would be a more realistic and logical approach commensurate with the importance of the medfly as a pest in the CAP region. The study team stated that considerable basic biological, ecological and economic information would be needed to develop, plan and coordinate a successful fruit fly suppression program and therefore the following measures should be included in an integrated pest management program:

1) Training program for CAP technical personnel.
2) Standardization of trap data.
3) Chemical control with malathion - protein hydrolyzate bait spray.
4) Improvement of cultural practices.
5) Biological control effort.
6) Strengthening of quarantine program.
7) Establishment of a biological control quarantine facility.
8) Develop economic analysis on impact of fruit flies in CAP countries.

B. PESTICIDE MANAGEMENT

The problems associated with the distribution, handling and use of pesticides in developing countries have been a major concern of the UC/AID Pest Management Project since its inception. Consequently, the project inaugurated a series of seminar/workshops in December 1973 to be presented in developing countries throughout the world and intended to encourage and assist the mobilization of national or regional efforts to develop sound, functional programs of pesticide management. The purpose of these seminar/workshops is to acquaint participants with the requisite technology essential for the safe, efficient, and economic handling and use of pesticides and to develop with them a knowledge and understanding of the interrelationship of health, agriculture and the environment to the economy and welfare of their home country.

Thus far, the UC/AID/PM project has presented seminar/workshops in four countries - El Salvador, Indonesia, Philippines and Guatemala. The latter seminar was terminated by a major earthquake, but preliminary contacts for its rescheduling have been made. Discussions regarding the desirability of presenting a fifth seminar/workshop in Egypt were held in October 1975 between Project Director, Ray F. Smith, and Egyptian officials. Agreement was reached to hold this event at the University of Alexandria during February 1977.

Arab Republic of Egypt: A visit to Egypt was made in September 1976 by R. F. Smith and J. B. Mann to meet with members of the Egyptian Steering Committee and hold discussions concerning various aspects of the proposed seminar/workshop.

Preliminary Trip (September 8-22, 1976 - J. B. Mann and September 18-20, 1976 - R. F. Smith) - The UC/AID Director of Quality Control, J. Bruce Mann, travelled to Egypt to visit several pesticide residue laboratories in Cairo and Alexandria and familiarize himself with the

personnel, equipment, capability, etc., of each laboratory. He was to rendezvous with the Project Director on September 18 and together, they were to meet with officials of the Ministry of Health and the Ministry of Agriculture to make arrangements for the seminar/workshop.

During his stay in Egypt, Mr. Mann visited the following laboratories.

1) Chemical Laboratory, Plant Protection Department, University of Alexandria.

2) Central Agricultural Pesticide Laboratory (CAPL), Plant Protection Institute, Ministry of Agriculture, Cairo.

3) Regional Radioisotope Center Laboratory, Dokki, Cairo.

4) Chemical Laboratory, Plant Protection Department, Ain Shams University, Cairo.

5) Central Laboratory, Ministry of Health, Cairo.

6) National Organization for Drug Control Laboratory, Ministry of Health, Cairo.

Based on his observations and discussions with the personnel of the laboratories, Mr. Mann concluded that, in general, they were not funded adequately enough to procure the supplies necessary for their smooth functioning. Solvents, gases and other chemicals especially were not readily available due to lack of funds. He stated that the laboratories have the personnel with the necessary credentials to potentially fulfill the "ongoing" research objectives, but that to insure the completion of future objectives training in analytical techniques would be necessary. He noted that there was a general lack of training and experience in new methodology and instrumental operation among the personnel in the laboratories visited.

Mr. Mann suggested that a training program for 4-5 technicians from the Ministries of Health and Agriculture could be provided by the UC/AID Pest Management Project at the University of Miami (Florida) in 1977. This training would be for a period of 5-6 weeks and would include: (1) sample extraction and clean-up, (2) thin layer chromatography, (3) gas chromatography, and (4) confirmation techniques. Assistance with particular problems in any of the individual laboratories would be accomplished in follow-up trips at scheduled intervals by the Director of the Quality Control Program.

Mann also cited a need for these laboratories to focus on future objectives. In order for these objectives to be properly outlined, he explained that it would first be necessary to delineate the responsibilities of each Ministry with regard to agricultural chemicals. He recommended that officials of the Ministry of Health and the Ministry of Agriculture should ascribe responsibilities to each unit within the Ministry in order to: (1) prevent duplication of effort, (2) utilize present resources to the fullest, and (3) insure fulfillment of all obligations and responsibilities.

After the Project Director joined Mann on September 18, the two men spent the following two days meeting with Egyptian health and agricultural officials to discuss organizational aspects of the seminar/workshop. They also met with Ralph J. Edwards, USAID Rural Development Officer, at the American Embassy to talk about the project's plans for providing additional training to analytical chemists after the seminar/workshop. In their informal discussions with local officials, a later meeting between the members of the Egyptian Steering Committee and Dr. Smith -to coincide with his return from Senegal-was scheduled for October 3rd.

Second Trip (October 2-5, 1976) - The UC/AID/PM Project Director returned to Egypt on October 2 in order to participate in the Third Pest Control Conference being held at the Ain Shams University in Cairo. On the evening of October 3, he met with members of the Steering Committee to discuss plans for the Seminar/Workshop on Pesticide Management to be held the following year. Present at the meeting were representatives from the Ministry of Agriculture, Assiut University, Ain Shams University, the University of Alexandria, and the local pesticide industry.

During the discussion, it was agreed that the main objective of the seminar/workshop would be to prepare a draft of a policy for pesticide management in Egypt. The Steering Committee was to devise a plan to assure the attendance of between 100 and 150 participants with representation and proper balance among the areas of agriculture, health and industry. They were also to arrange to have invitations sent to neighboring countries who might be interested in having observers from their Ministries of Health and Agriculture participate in the seminar/workshop. The Steering Committee was also to send invitations to WHO, FAO, ILO, IAEA and, in the United States, to EPA and the Food and Drug Administration.

Another topic discussed at the meeting was the importance of having a reasonable balance between Egyptian and expatriate speakers distributed through the program. By shortening the length of the talks originally proposed in the draft program, it was possible to accommodate several more speakers. Thus, it was agreed that the Steering Committee would select additional Egyptian speakers on topics related to: (a) pesticide legislation, (b) public health viewpoint on pesticides, (c) viewpoint of the pesticide industry, (d) pesticide applications, and (e) possibly additional subjects.

The various types of associated training activities that were to be presented after the seminar/workshop were also reviewed. It was decided that as far as the intensive training in advanced residue analysis was concerned, this would best be developed in 1977 at the University of Miami (Florida). It was felt that the necessary support for the travel and per diem for the trainees might be obtained through USAID/Cairo. Plans to followup this chemistry training activity with additional training in Egypt in 1978 were also briefly explored. At the conclusion of the meeting, it was agreed that a revised program for the seminar/workshop would be developed by the Steering Committee and sent to Smith for comments by him and the other American participants.

Pesticide Management Seminar/Workshop (March 5-10, 1977) - The seminar was inaugurated by the President of Alexandria University and the Chairman of the Plant Protection Department who presented welcoming speeches to the nearly 150 delegates from the agriculture and health sectors and the pesticide industry. Representatives of FAO, WHO, USAID and ALESCO (Arab League Educational, Scientific and Cultural Organization) were also in attendance. During the opening ceremonies, speeches were also given by the Governor of Alexandria, the Minister of Agriculture, and a representative of ALESCO.

The seminar/workshop was divided into morning sessions in which technical talks on such subjects as the agromedical approach to pesticides management, principles of integrated pest control, chemodynamics of pesticides, ecological aspects of pesticide use, legislation on the regulation of pesticides, etc., were presented, and afternoon workshop sessions in which the delegates separated into five groups to hold discussions on specific problems and develop recommendations for improving pesticide management practices in their country. The five workshop groups considered the following areas of pesticide management in their discussions:

1) new approaches in pest control in relation to pest management,

2) legislation for importation and registration of new pesticides,

3) formation of agromedical teams and responsibilities,

4) pesticide residue analysis and monitoring in food, humans and environment, and

5) extension, education and training in relation to pesticide management.

This seminar/workshop was planned as a study/work session for government, industry and private groups involved in pesticide management which would encourage the coordination of national objectives regarding health and agricultural aspects of pesticide use. That the dialogue between these groups was successful is indicated by the detailed resolutions adopted by the plenary session of the workshop which proposed development of an effective pesticide management program for Egypt. Some of the recommendations which were adopted at this workshop were: (1) that integrated control systems be implemented on Egyptian cotton as soon as research demonstrated their feasibility, (2) that improved safety procedures be initiated for protecting workers from pesticides, and (3) that a comprehensive agromedical program for pesticide management be developed.

Colombia: Project Director, Ray F. Smith, and Donald J. Calvert visited Bogotá in June to discuss plans for the presentation of a seminar/workshop in Colombia with USAID and local officials.

First Trip (June 26-30, 1977) - Following their arrival in Bogotá, the two project representatives met with local AID personnel to review

the purpose of the seminar/workshop and discuss the logistical and financial details involved with its presentation. The AID officials expressed great interest in this activity and promised their full co-operation and support. The possibility of obtaining financial assistance from USAID/Bogotá to support specialized training in the U.S. for several Colombians employed by the Instituto Colombiano Agropecuario (ICA) was discussed. The AID officials stated that some of the funds in a special block grant allocated for training purposes might be available for this purpose and explained the procedure used for applying for these funds. In particular, a three-week study tour for the head of ICA's Agricultural Inputs Division to enable him to become more familiar with pesticide regulatory practices in the U.S. was discussed.

On June 28, the two men attended a meeting of the Organizing Committee at ICA during which the format and structure of the seminar/workshop were discussed. As a result of this discussion, the Committee agreed to have a series of background papers of thirty minutes duration presented at the opening day session. The subjects chosen for these talks were: the agromedical approach to pesticide management, chemodynamics of pesticides, nutrition and pesticide management, toxicology of pesticides, integrated pest control, and pesticide regulation. These presentations would be followed on the next two days by a series of six panel sessions on the same or similar topics. These panel sessions would consist of 4-5 persons speaking for 15 minutes on the same theme after which there would be a 45-minute question and answer period. The last two days would be devoted to meetings of the workshop groups. The Committee agreed that the seminar/workshop should be held at the Club de Empleados Oficiales, a government owned facility operated for the recreation and social activities of government employees. It has a large auditorium, several meeting rooms, a restaurant, and also provides hotel accommodations for a small number of guests. The latter rooms were to be made available for the U.S. and other foreign participants.

During their stay in Colombia, the two men also visited the pesticide residue analytical laboratories of the Instituto Nacional de Salud (INS) in Bogota and of ICA in Tibaitata. In discussions with the personnel of these laboratories, it was suggested that the Director of the UC/AID Quality Control Program should visit Colombia in November in order to conduct an informal colloquium during which the problems and difficulties these laboratories were experiencing could be discussed. The possibility of presenting a short training course on analytical techniques at the INS laboratory the week following the seminar/workshop was also discussed.

C. PROJECT REPRESENTATION AT INTERNATIONAL MEETINGS AND CONFERENCES

IV International Symposium on Tropical Root Crops, Cali, Colombia (August 1-7, 1976) - The UC/AID/PM project sponsored H. David Thurston, plant pathologist, Cornell University to attend this conference. The symposium was held at the headquarters of the International Center for Tropical Agriculture (CIAT) under the sponsorship of the International Society for Tropical Root Crops. Financial support was provided by USAID, CIAT and the International Development Research Centre (IDRC) of

Canada. This support enabled many scientists from developing countries in the Americas, Africa and Asia to attend the meeting. Including scientists from Europe and North America, a total of 172 persons participated in the symposium.

The meeting was organized into several discussion groups which considered the following topics:

1) Origin, evolution and dispersal of root crops.
2) Productivity of root crops.
3) Pre- and post harvest losses.
4) Utilization of the potato in the Tropics.

In addition, there were individual sessions where technical papers on breeding, agronomic practices, production systems, crop protection, food value, economics, medical problems associated with tropical root crops, etc. were presented. Crops included in the purview of this symposium were cassava, sweet potatoes, yams, arracacha, aroid crop plants, potatoes and minor root crops of tropical origin.

As evidenced by the papers presented, there has been a considerable growth in research and increasing specialization among root crop workers within the last decade. Through presentation of these symposia, the Society plays a very important role in focusing attention on this important group of food crops.

WHO Regional Seminar on the Safe Use of Pesticides, Manila, Philippines, (August 30- September 3, 1976) - This meeting was attended by John E. Davies, medical toxicologist, University of Miami (Florida), Virgil H. Freed, pesticide chemist, Oregon State University, and Edward H. Glass, entomologist, Cornell University as representatives of the UC/AID/PM project. This seminar was presented by the World Health Organization at the WHO Conference Hall in Manila for member countries of the Western Pacific Region. Representatives of the health and agriculture administrations from fifteen countries in this geographical area attended the five day event. The three UC/AID delegates served as consultants and speakers for the seminar.

The purpose of the seminar was to:

1) Discuss the toxicity and health hazards of pesticides.

2) Consider appropriate safety precautions in their ap-application, handling, storage and disposal.

3) Study procedures for diagnosis and treatment of pesticide poisoning.

4) Encourage national and international coordination on on health and agricultural aspects of pesticide use.

These objectives were accomplished by means of lectures, discussions and presentations of country reports. The need for coordination between

health and agricultural authorities in all aspects of pesticide use was cited several times during the seminar and led to the adoption by the participants of a conclusion that this coordination be strengthened at the national, state, district and local levels. Among other conclusions was one which recommended that the feasibility of establishing a central consultative service on pesticides for the Pacific Islands should be explored by WHO and FAO. The responsibilities of this service would be to standardize pesticide registration procedures in the region, standardize legislation on importation, sale, transport and storage of pesticides, and assist with training in pesticide management.

EPPO/IOBC Conference on Systems Modelling in Modern Crop Protection, Paris, France (October 12-14, 1976) - The subject of this three-day conference was the application and use of systems analysis in modern crop protection programs. The majority of the 108 participants were representatives of the plant protection services from the different EPPO member states, but several delegates from the United States, FAO and other agencies also attended. The UC/AID/PM project sponsored the attendance at this meeting of Andrew P. Gutierrez, entomologist, University of California, Davis.

Some of the topics considered during the conference included a discussion on the selection and use of the appropriate mathematical techniques in systems modelling, a survey of the present possibilities of disease simulation models and their use in the exploitation of horizontal and vertical resistance in plants, and an appraisal of the use of the computer in crop production and protection management.

The purpose of the conference was to evaluate the progress which had been made in systems modelling, to exchange experiences and to propose further developments. It brought together scientists from many different disciplines who were interested in the use of systems analysis for improving crop protection. Some of the recommendations which were approved by the participants at this meeting were: (1) that efforts in model development be continued and intensified with a view to practical applications, (2) that these efforts should be interdisciplinary, (3) that systems analysis should aim at solving immediate practical problems and at developing entire crop optimization systems, and (4) that a working group should be established under the aegis of EPPO and IOBC with the task of studying the possibilities of implementing models in plant protection.

FAO Government Consultation on Crop and Post Harvest Protection Needs in the Sahel, Rome, Italy (December 13-17, 1976) - This meeting was attended by Harold T. Reynolds, entomologist, University of California, Riverside, as a representative of the UC/AID/PM project. The consultation was called in an effort to provide a more permanent solution to the pest problems which adversely affect the economic development and welfare of the countries in the Sahel region of Africa. Delegates, representatives and observers from 10 African nations, 8 donor countries, and several interested international organizations attended the meeting in Rome.

The purpose of the meeting was to examine in more detail the immediate and long-range needs for crop and post-harvest protection in these countries. This aim was accomplished through the presentation of individual country reports which assessed the present status and development needs of national and regional plant protection services, and also by a review of ongoing and planned bilateral and multilateral assistance programs.

The delegates at the Consultation noted that the ultimate goals of the internationally sponsored plant protection program were to:

1) establish a national capability to implement pest management programs for protection of food crops in field and storage in the countries concerned,

2) promote expansion of extension service capability and activity to an effective level,

3) encourage and promote appropriate regional collaboration in plant protection, and

4) promote regional and national training programs in plant protection.

An important outcome of the consultation was the decision to organize a regional program design team which would formulate a detailed plan for implementation of the long-range program. This team was to consist of plant protection experts, agricultural economists, integrated pest control specialists, sociologists or anthropologists, an agricultural information officer, and a program design officer. The team was to be divided into sub-teams of 3-4 members to evaluate and design a comprehensive program, using the documents compiled by the FAO Consultation as a base from which to work.

13th General Conference of the Interafrican Phytosanitary Council, Accra, Ghana (January 10-14, 1977) - The UC/AID/PM project was represented at this meeting by Durward F. Bateman, plant pathologist, Cornell University. This conference was held at the Kwame Nkrumah Conference Center in Accra and was attended by 46 representatives from 20 of the Council's 46 member states. Among the many issues considered at this meeting were the cooperative efforts undertaken between member states regarding crop protection problems, the adoption of appropriate phytosanitary legislation, the hiring and training of appropriate personnel, and the establishment of plant quarantine facilities in the various member countries.

The IAPSC has devoted considerable effort, since its organization in 1963, to the establishment of quarantine stations at key locations on the continent to prevent introduction of new pests into Africa. However, most member states have not been able to establish and carry out effective plant quarantine programs because of a lack of trained personnel and financial resources. The IAPSC presently has two training centers in

Africa for upgrading the level of expertise of personnel in the area of crop protection and plant quarantine - one is in Cairo, Egypt, and the other is in Ibadan, Nigeria. After considerable discussion, the Council decided that the center in Cairo would be used to train phytosanitary inspectors at the lower to intermediate levels while the Ibadan center would be used for training at the senior level. The Council also proposed that both centers be made bilingual and serve to train both English and French-speaking participants. However, final action on this issue was not taken.

Reports were also given at this meeting by each country on the occurrence of new disease and pest problems within its borders since the last meeting of the Council in 1973. The three most important introduced diseases and pests appeared to be (1) bacterial wilt of cassava caused by Xanthomonas manihotis, (2) ground nut rust caused by Puccinia arachnidis, and (3) the cassava green mite, Mononychellus tanajoa.

Some of the recommendations approved at this meeting concerned the creation of additional training centers, establishment of seed certification centers, revision of the coordinated Interafrican Phytosanitary Regulations, and the organization of symposia over the next two years on the subject of rodents, grain-eating birds, pesticides, and locusts.

In his report of the meeting, Dr. Bateman stated that the Interafrican Phytosanitary Council was a well organized and functional organization, but that most of its attention had been paid to plant quarantine matters as opposed to disease and pest control in the field. He considered that the major problems of the IAPSC were those of insufficient trained personnel and financial resources to implement effective programs of quarantine and/or control of pests in a great many of the member countries. Dr. Bateman felt there was a tendency for each country to want its own quarantine station or stations, but considered that regional stations would be more economical, perhaps more effective, and should be encouraged. He believed that the Council should be encouraged to place more emphasis on pest and disease control work which extended beyond quarantine considerations.

BIOTROP Southeast Asian Workshop on Pesticide Management, Bangkok, Thailand (March 14-16, 1977) - Following the conclusion of the Alexandria Pesticide Management Seminar/Workshop, Project Director Ray F. Smith travelled to Bangkok at the invitation of BIOTROP to take part in this workshop which was being presented for countries of the Southeast Asian region. The UC/AID Pest Management project also sponsored the participation of David Pimentel, entomologist, Cornell University, and Ian J. Tinsley, analytical chemist, Oregon State University, at this meeting.

The workshop was held at the New Amarin Hotel in Bangkok and was attended by nearly 100 delegates from the Philippines, Indonesia, Malaysia, Sri Lanka, and Thailand, with token representation from Taiwan, Yemen, the Netherlands, England, France, West Germany, and the United States. It was organized into eight sessions, five of which were devoted to the presentation of 20-30 minute talks on such topics as the strategies and techniques of pesticide use, environmental aspects of

pesticide use, research and training in pesticide management, and pesticide regulations; in two other sessions, status reports of pesticide use in four of the countries in the region and research reports on pesticide residues and on the effects of insecticides on soil and water communities were given; whereas the last session was scheduled for a general discussion of the subjects presented.

Participants at the meeting were organized into five work groups which met on the afternoon of the second day to discuss the socio-economical and ecological aspects of the application of pesticides in the Southeast Asian region and to develop recommendations for the formulation of a long term pesticide management policy for the countries involved. A few of the recommendations proposed by the working groups were:

a) that governmental educational agencies should give urgent attention to promoting a wider understanding of the hazards offered by pesticides,

b) that programs of research and training on pest and pesticide use under tropical and subtropical conditions be expanded,

c) that the fundamental tactics of integrated pest management, i.e., utilization of indigenous natural control, cultural control, inherent plant tolerance and chemical control should be considered for integration into a flexible control program, and

d) that research and training on the development of strategies and techniques for the control of pests affecting public health be emphasized.

Joint Meeting of the Southwestern and Pacific Branches of the Entomological Society of America and the Sociedad Mexicana de Entomología, Guadalajara, Mexico (April 18-21, 1977) - The UC/AID/PM project sponsored the attendance of Donald J. Calvert, crop protection specialist for the project, at this meeting which marked the celebration of the 25th anniversary of the founding of the Sociedad Mexicana de Entomología. It was also the occasion of the 25th annual meeting of the Southwestern Branch of the ESA. Several speakers during the opening ceremonies commented on the desirability and importance of establishing and maintaining professional contacts between entomologists of the two countries. The value in these relationships was especially emphasized by the recipient of the Woodworth Award in his talk on international cooperation in biological control.

The meeting was well attended by both U.S. and Mexican entomologists with over 800 delegates registered at the four day event. There were over 250 submitted papers presented during the paper reading sessions in the three organized sections of the meeting, i.e., (1) economic entomology, (2) biology, ecology and behavior, and (3) systematics and morphology. In addition, there were symposia on the cotton boll weevil, fruit flies, host-plant relationships and the loss of vigor in laboratory reared cultures.

The symposium on the fruit flies was particularly appropriate as the Mediterranean fruit fly had only recently invaded Mexico (early February). The Mexican Ministry of Agriculture was particularly worried about the threat this pest posed for its citrus and vegetable production and export markets and officials presented a recently prepared film showing the trap survey, host fruit destruction and surveillance activities of the MOSCAMED Commission. The film also depicted scenes of the quarantine interception and fumigation of potential host material at customs check points on the Mexico-Guatemala border. Up to the time of the meeting in Guadalajara, only 25 flies had been found in baited traps. Approximately three-quarters of these were females, which is highly unusual since the traps normally attract male flies primarily. The Mexican government has plans to build a rearing facility at Tapachula, Chiapas where they will mass rear the Mediterranean fruit fly, sterilize the males and then release them along the border with Guatemala.

The symposium on the cotton boll weevil was well attended and provided an excellent opportunity for Central American workers to present the results of their research on this pest conducted over the past four to five years. The subjects covered in the symposium were the integrated pest management program in Nicaragua, the role of recently discovered alternate host plants in Mexico and the needs and prospects for future research on the boll weevil.

Seventh Session of the FAO Panel of Experts on Integrated Pest Control, Rome, Italy (April 21-28, 1977) - This meeting was attended by Perry L. Adkisson, entomologist, Texas A&M University; J. Lawrence Apple, plant pathologist, North Carolina State University; Louis A. Falcon, insect pathologist, University of California, Berkeley; and Harold T. Reynolds, entomologist, University of California, Riverside, under sponsorship of the UC/AID/PM project. Project Director, Ray F. Smith, as chairman of the Panel, was also in attendance.

This Seventh Session of the FAO Panel initiated its deliberations with a review of progress in the implementation of the FAO/UNEP Cooperative Global Programme for the Development and Application of Integrated Pest Control in Agriculture. This program, for which the Panel serves as the main advisory body, provides for a mechanism to increase capability in participating countries for developing and applying integrated pest control with emphasis on the following areas:

1) transfer of existing knowledge through demonstration and training,

2) implementation at the farmer level through assistance to extension services, and

3) improvement of local knowledge by adaptive research.

The activities of this programme are focussed on the establishment of inter-country programmes on specific crops, such as cotton, rice, sorghum/millet and associated crops. The basic structure of the programme

consists of groups of national projects whose activities are to complement each other. The most advanced of these programmes, in terms of planning, organization and funding, were the three regional project proposals for cotton. The latter had been fully endorsed by the Panel at its Sixth Session held in Karachi, Pakistan, in October 1975.

During the current meeting of the Panel, the Coordinator of this Global Programme presented a report on the current status of these three projects, summarizing the availability of funding and problems in the identification of qualified experts for key positions in the programme. The Coordinator had visited most of the countries expected to participate in the programme and all had expressed strong interest. A second trip to Latin America was planned for later in the year to discuss the proposals and their financing with government officials and to study various aspects of the programme's implementation.

The Global Programme Coordinator also reported on initial contacts for the development of a similar programme on rice for the Southeast Asia region. A five-month consultant mission to the major rice-producing countries of Southeast Asia was planned for the near future during which the consultant was to develop a draft proposal for a comprehensive programme. This proposal would then be submitted to a meeting of technicians from the countries concerned for review.

The Coordinator also discussed a recent proposal to develop an integrated pest control project for countries of the Sahel zone in Africa. The proposal plans a multidisciplinary approach with outreach activities to be developed at an early stage. These outreach activities will be complemented by research on major pests and diseases, and particularly on major factors responsible for population changes or alternative methods of pest control, biological control possibilities, etc. The proposal outlines the first five-year phase of a long-term programme which will probably require fifteen years.

In other matters, the Panel reviewed the first edition of the FAO Cotton Guidelines and agreed that a revision of the text was essential. It decided that the text needed to be expanded to include examples of integrated pest control programs in African and Asian countries, to detail techniques applicable to the small individual farmer, and to revise recommendations on pesticide use to include more selective and less hazardous chemicals. The preparation of proposed guidelines on selection and use of chemical pesticides and microbial agents in integrated pest control was also discussed. The emphasis of the proposed guidelines would be towards the developing countries and aimed at research workers in pest control, senior extension staff, and staff and students in relevant university departments.

The Panel also discussed in some detail the preparation of several training manuals in integrated pest control. Funds for a consultant to assist in the preparation of these manuals were to be provided by UNEP. The principal purpose of the manuals is to provide basic instructions for organizing, implementing, and conducting training in integrated pest

control at all levels. The manuals will serve to orient in-country teaching staff as well as technical assistance personnel. The separate manuals were to provide the basic information and course material needed for the execution of long-term training courses at the following educational levels:

1) college or university graduate with degree in agriculture or related sciences,

2) students in agriculture or related sciences working towards a degree, and

3) technical or high school level students.

The status and progress in the preparation of a series of integrated pest control guidelines for several major crops (i.e., in rice, maize, sorghum and grain legumes) was also reviewed by the Panel. Depending on the stage of preparation of each guideline, the Panel made appropriate suggestions and recommendations meant to expedi the completion of these publications.

Other matters taken up by the Panel were the role of pesticides in integrated pest control, continued use of certain pesticides in developing countries, and international activities related to integrated pest control, such as the OECD Report on Small Farmer Pest Control and activities of the Commonwealth Institute of Biological Control.

V Reunión Nacional de Control Biológico y Sector Agropecuario Organizado, Ciudad Victoria, Mexico (April 27-29, 1977) - At the conclusion of the FSA meeting, Dr. Calvert travelled to Ciudad Victoria to attend the annual meeting of biological control workers in Mexico. This event was similar to the one held in 1976 in Tapachula, with respect to the amount of emphasis given to reports presented by the heads of Centros de Reproducción de Insectos Benéficos (CRIB) on the rearing and use of *Trichogramma* sp. for the control of various lepidopterous pests. However, the urgency of the medfly situation was evident at this meeting also, as Ministry of Agriculture officials made a special presentation of the same film that had been shown at the meeting in Guadalajara.

A special effort was made to integrate foreigners into the meeting this year as several Americans and a Frenchman were named to preside at some of the paper-reading sessions. All delegates to the meeting were given a copy of the proceedings at the time of registration. This publication contained nearly all of the talks that were to be presented during the meeting, including those of the foreign guests whose talks had been translated into Spanish. This document has been placed on file in the project's International Plant Protection Library in Berkeley.

D. PROJECT SPECIAL REPORTS

Analysis and Review of Philippine/USAID Pest Control Project (August 31 - September 27, 1976) - At the request of AID's Technical

Assistance Bureau, Washington, D.C., UC/AID/PM Project consultants Edward H. Glass, entomologist, and Otto E. Schultz, plant pathologist, both of Cornell University, travelled to the Philippines to assist in the preparation of a Project Review Paper (PRP) for that country's proposed pest control project. This project was being initiated for the purpose of developing a National Crop Protection Center (NCPC) and seven Regional Crop Protection Centers (RCPC), which would conduct research and training in crop protection and pesticide management and provide scientific advice to the Philippine government for formulation of policies and regulatory programs.

After their arrival in Manila, the two men contacted members of the AID Mission staff whereupon they were given a brief background history on the establishment of the NCPC and the seven regional centers by Presidential decree in May 1976. Mission personnel also provided them with an overview of AID's involvement in the recently established program of the Philippine Council for Agriculture and Resources Research (PCARR). AID officials presented Drs. Schultz and Glass with documents pertaining to the method of preparation of the Project Review Paper and discussed with them the areas in which their help was especially needed. Such areas included formulation of administrative mechanisms to allow cooperation and interaction among existing crop protection agencies and the new centers, and establishment of the respective roles of the national and regional centers.

Subsequently, the two consultants interviewed staff of the University of the Philippines at several administrative levels to determine their reaction to the establishment of the NCPC and to assist in developing compatible relationships between the College of Agriculture of the University and the National Center. Staff members disclosed to the two men that considerable planning for college involvement in the NCPC had already been undertaken by a college-wide pest control committee. It was envisioned that full-time staff of NCPC would have adjunct status in the departments of UPLB while commodity oriented teams of existing university faculty would be appointed as part-time NCPC staff. It was pointed out in these discussions that top priorities for success of the National Center would be the provision of fellowships for staff development and the construction of building facilities.

The UC/AID team also held talks with officials of the Bureau of Plant Industry (BPI). During these discussions, considerable time was spent outlining the nature and administration of extension services in the Philippines, the training programs devoted to extension personnel, and the current status of applied research within BPI. Consultants Schultz and Glass were told that one regional crop protection center at Maligaya in Central Luzon was presently being constructed with funds provided by West Germany (and matched by the Philippine government), with the possibility of German support for centers in two other regions of the country.

Later, they had a very brief meeting with the Director General of PCARR in order to determine the channels through which research funds

for the NCPC and regional centers would be directed. By Presidential decree, PCARR is charged with establishing research priorities and allocating all government revenue earmarked for agricultural research. The two men were assured that no significant problems were envisioned in having the crop protection centers administered in this fashion.

In order to provide a meaningful background for the determination of physical and human resource needs for the centers, Drs. Schultz and Glass visited several existing research facilities. These sites included the Rodent Research Center and Biological Sciences Building at Los Banos, the BPI Citrus Experiment Station at Lipa City, the Maligaya Rice Research and Training Center at Munoz and the BPI Pesticide Residue Laboratory in Manila. Their general impressions of the Biological Science's facility were that it was grossly inadequate to house the additional manpower and equipment needed for the National Center. They felt that expansion of the Rodent Research Center to house the NCPC would be more feasible in terms of location and availability of adjacent land for field experimentation. At all of the sites visited, a common shortcoming was the lack of efficient communication equipment and a dearth of maintenance facilities. The two men also inspected laboratory and greenhouse facilities at the Cyanamid Agricultural Research Foundation in Calamba, Laguna,which gave them a meaningful appraisal of equipment needs for the centers while at the same time emphasizing the limitations typical of rural areas, i.e., electrical power interruptions, losses due to pilferage, communication difficulties, etc.

Since a portion of the Project Review Paper had already been written by the time the two men arrived in the Philippines, their assigned task consisted largely of reviewing and modifying previously prepared material, fortifying certain aspects,and drafting some sections of the document. The completed PRP was submitted to the AID Mission in Manila prior to their return to the United States.

As a result of their experience and after a careful review of the concepts and proposed programs of the national and regional centers, Drs. Schultz and Glass came to the following conclusions:

a) the Centers are well conceived and the proposed interdisciplinary research and training programs are practical in terms of the country's crop protection needs,

b) the potential benefits far outweigh the initial establishment and future operational costs,

c) the projected operational support by the Philippine government is thought to be adequate for the proposed four-year duration of this project,

d) the overall concept is excellent although some real or potential problems must be resolved to make the program effective, and

e) the Philippine crop protection centers should serve as a nucleus for the development of an inter-country crop protection research and training network for the Southeast Asian region.

E. SPECIAL PROJECT ACTIVITIES

Periodical Newsletter, PEST MANAGEMENT NEWS - Publication of this newsletter continued to be on a quarterly basis with the printing of four numbers of Volume 2 during the report period. The five-part series providing a history and background information on the project concluded with the lead article in the first issue of Volume 2. This series of articles was intended to acquaint the audience of plant protection professionals and technicians with the goals and objectives of the project and to bring them up-to-date on project activities. Additional articles have provided summary reports of major activities sponsored or participated in by the project.

The last page of the newsletter features a Calendar of Events which is a partial listing of the many projected worldwide meetings, conferences, symposia, etc., dealing with some aspect of plant protection and directed toward a large regional or international audience. A number of these conferences are attended by representatives of the UC/AID/PM project and accounts of these meetings also appear in the newsletter.

Quality Control Program for Pesticide Analytical Laboratories - In 1975, a Quality Control Program for pesticide analytical laboratories in developing countries was intitated under the direction of UC/AID/PM project staff at the University of Miami, Florida. The purpose of this program is to measure the overall performance of each participating laboratory with respect to each other,and to determine any specific training needs that would be required to upgrade and standardize their performance.

To evaluate the precision and accuracy of the analytical procedures used by the laboratories in the program, samples of a hexane solution, or beef fat, containing several known pesticides are sent to each laboratory for analysis. These laboratories are then requested to analyze the sample using their normal procedures. They are asked not only to identify what pesticides are in the sample, but also to determine the concentration of each pesticide present. The results obtained by the laboratories performing the analysis are summarized by the University of Miami in a report sent to each participating laboratory. This report presents the data in coded form so that while individual laboratories are not able to identify each other, they can still compare their performance with the others.

Up to the present time, four samples have been mailed to participating laboratories in 18 countries. The number of laboratories participating in the program has increased from the initial 15 to the current 45; however, only 50-60% of the labs send in results for any

particular sample. Analysis of the first three samples required only the identification and quantitation of the unknown chemicals since the pesticides were mixed in a hexane solution; in contrast, the fourth sample required the performance of extraction and clean-up procedures of the pesticide residues before the chemical could be identified as the pesticides had been "spiked" into a piece of beef fat.

Laboratories that experienced difficulties in accomplishing the analysis were given suggestions on how to improve their performances. Results of the sample analyses furnished by these laboratories indicated the need for training in operation of instruments and new methodology. Such training was provided in the past year to seven individuals from two countries at the University of Miami.

International Workshop on Ecology and Control of Bacterial Wilt Diseases, Raleigh, North Carolina (July 19-25, 1976) - This international planning conference and workshop on the ecology and control of bacterial wilt diseases caused by the species, *Pseudomonas solanacearum*, was presented by the Department of Plant Pathology, North Carolina State University, with financial assistance from the U.S. Agency for International Development and the UC/AID/PM project, for the purpose of coordinating worldwide efforts to obtain effective control of this very important pathogen. The conference was attended by over 50 scientists from 23 countries.

At the beginning of the conference/workshop, the participants were organized into three task force committees and asked to consider the current status and need for research in strain identification and variability of the organism, soil ecology, genetics of disease resistance in various hosts, and improved methods for development of resistant varieties. Meeting several times during the course of the week-long conference, the committees assessed the current resources, personnel and facilities available in the world to work on these problems, and also evaluated specific needs for funding ongoing research programs and new projects. Based on this assessment and evaluation, the committees developed specific research proposals of programs that would be needed to facilitate the development of more effective control measures for this disease. Three subcommittees were appointed at the end of the conference whose function was to seek the support of international agencies and local governments for implementation of the recommendations of the task forces.

A few months following the conclusion of this conference, the UC/AID/PM project published a compilation of the papers presented at this meeting. In addition to the texts of invitational papers, this publication contained several research proposals and numerous country reports presenting the current status of bacterial wilt research in the participant's respective countries of origin.

Special Training Workshop for Entomologists from Developing Countries (July 19 - August 28, 1976) - Under the guidance and direction of personnel from Cornell University and North Carolina State University (NCSU),

the UC/AID Pest Management Project presented an intensive five-week training workshop in agricultural pest management for 25 entomologists from 15 countries in Asia, Africa, and Central and South America. The principal objectives of the workshop were to:

1) provide participants with a working philosophy and concept of pest management,

2) provide information on the latest developments in pest control technologies and an assessment of their potential for arthropod pest control,

3) provide participants with new ideas and approaches to the practical solutions of the entomological problems they face in their home countries,

4) develop a dialogue between the workshop participants and contributing staff for the purpose of seeking solutions to mutual problems, and

5) provide an opportunity for participants to establish contacts and friendship with other entomologists, which would likely lead to continuing communication among them to their mutual benefit.

The approach used to achieve these objectives was to provide trainees with instruction in the latest developments in crop protection entomology with emphasis on applied aspects of pest management that would be applicable to pest control situations in the trainee's home country, and afford them the opportunity to observe operational pest management projects and field research programs in crop protection. The intent throughout the workshop was to provide for an interchange between the participants and the contributing staff.

The organization and format of the workshop basically consisted of the following:

1) review of pest management philosophy, principles, history, new technologies, strategies, and observations of ongoing projects in New York,

2) supplemental discussions and detailed reviews of North Carolina pest management projects,

3) travel through agricultural areas of New York, Pennsylvania, Virginia, North Carolina, and Maryland to observe crop protection problems and visit with research and extension entomologists working towards solutions to these problems, and

4) attendance at the XV International Congress of Entomology in Washington, D.C.

The first week of the workshop was held on the campus of Cornell University in Ithaca, New York, and was devoted to classroom instruction in the following subjects: pest management principles and philosophy, pest identification, new developments in insect monitoring, sampling and survey, ecology of pest management, biological control, pesticides, host plant resistance, cultural practices, systems approach to pest management, quarantine, and economic thresholds. The workshop participants were then taken to an agricultural experiment station at Geneva, New York, to observe research programs in vegetable and tree fruit pest management.

Subsequently, the trainees were able to tour a pesticide research facility and manufacturing plant in Middleport, New York, a grape research station in Fredonia, New York, and a field experiment station in Biglerville, Pennsylvania, while en route to North Carolina State University (NCSU) in Raleigh, North Carolina. The staff at NCSU welcomed the participants to the university and provided them with a review of the status of agriculture in North Carolina and of the university research programs in crop science, horticultural science, plant pathology, and entomology. While at NCSU, field tours were made to several experimental research stations to observe insect pest problems and management in peppers, sweet potatoes, vegetables, and tobacco. Visits to fields and experimental plots illustrating integrated pest management programs in cotton, corn, soybeans, and peanuts were also made.

The workshop trainees were then taken to tour the truck and field crop station in Virginia and later shown the soybean and vegetable pest management programs in Maryland. The final stop on their itinerary was the U.S. Department of Agriculture's research center in Beltsville, Maryland, after which they were transported to Washington, D.C., to attend the XV International Congress of Entomology.

The trainees were asked at the termination of the workshop to evaluate the training program and to make suggestions for its improvement. The majority of the participants expressed great satisfaction with the program, but indicated they would have preferred more time for group discussions and the pursuit of individual interests, such as meeting with special professors, visiting labs that were not included on the program, etc. Among other criticisms mentioned by participants was their suggestion that more effort should have been paid to relating the workshop to conditions in the trainees' own country.

Appendix 1

Financial Summary

Expenditures for the period July 1, 1976 to September 30, 1977, on Project AID/ta-C-1195, Pest Management and Related Environmental Protection, appear on the following table:

Salaries and Wages	$ 93,492
Consultants	26,090
Employee Benefits	18,928
Overhead	73,775
Travel, Transportation and Allowances	94,694
Publications	10,706
Newsletter	1,826
Mailing Costs	9,934
Other Direct Costs	46,686
Subcontracts University of Miami	61,513
	$437,644

Financial Summary
for the
Medfly Study in Central America

Expenditures for the period February 12, 1977 to July 15, 1977, on Project AID/ta-C-1380, Mediterranean Fruit Fly Study in Central America are as follows:

Salaries	$ 3,057.46
Fringe Benefits	693.48
Consultants	33,895.00
Transportation & per diem	19,219.91
Other direct costs	2,360.60
Overhead	14,688.16
	$ 73,914.61

Appendix 2

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8. Dr. Durward F. Bateman - January 10-14, 1977, to represent the UC/AID project at the 13th Meeting of the Interafrican Phytosanitary Council held in Accra, Ghana.

9. Dr. Teddy T. Hebert - February 14 - March 16, 1977, to Nigeria, Chad, Cameroon and Senegal to examine the immediate and long-range needs of each country as a member of Sub-Team II of the Sahel Design Team.

10. Drs. Ray F. Smith, Virgil H. Freed, John E. Davies, Wesley E. Yates, Perry L. Adkisson, Frederick W. Whittemore and Mr. J. Bruce Mann - March 5-10, 1977, to Alexandria, Egypt to attend and participate in the UC/AID Pesticide Management Seminar/Workshop.

11. Drs. Harold T. Reynolds, Perry L. Adkisson and Teddy T. Hebert March 8-16, 1977, to Dakar, Senegal to assist the Sahel Design Team in the preparation of an Overall Action Proposal for the Sahel Crop Protection Project.

12. Drs. Ray F. Smith, David Pimentel and Ian Tinsley - March 14-18, 1977, to Bangkok, Thailand to participate in the BIOTROP Southeast Asian Workshop on Pesticide Management.

13. Drs. Wallace C. Mitchell, Chris O. Andrew, Kenneth S. Hagen, Richard A. Hamilton, Ernest J. Harris and Messrs. Kenneth L. Maehler and Robert H. Rhode - March 6 - April 3, 1977, to Central America and Panama for an on-site investigation of the economic impact of the Mediterranean fruit fly on fruit production and the economy of these countries.

Appendix 3

Summary of Overseas Activities of Consultants and Project Personnel of the University of California/USAID Pest Management and Related Environmental Protection Project

July 1, 1976 - September 30, 1977

1. Dr. David Thurston - July 31 - August 8, 1976, to Cali, Colombia to attend and participate in the IV International Symposium on Tropical Root Crops.
2. Drs. Otto E. Schultz and Edward H. Glass - August 31 - September 27, 1976, The Philippines to review suggested Regional Crop Protection Project.
3. Drs. Virgil H. Freed and John E. Davies - August 30 - September 4, 1976, to Manila, Philippines to participate in WHO Regional Seminar on the Safe Use of Pesticides.
4. Mr. J. Bruce Mann and Dr. Ray F. Smith - September 8-22, 1976, to Cairo, Egypt to make final preparations for the Pesticide Management Seminar/Workshop to be held in Alexandria, A.R.E. March 5-10, 1977.
5. Dr. Ray F. Smith - October 2-5, 1976, to Egypt to attend the Third Pest Control Conference at the University of Ain Shams.
6. Dr. Andrew P. Gutierrez - October 12-14, 1976, to Paris, France to attend the EPPO/IOBC Conference on Systems Modelling in Modern Crop Protection.
7. Dr. Harold T. Reynolds - December 13-18, 1976, to Rome, Italy to represent the UC/AID project at the FAO Consultation on Plant Protection in the Sahel.

14. Drs. Kenneth S. Hagen and Donald J. Calvert - April 17-30, 1977, to Mexico to attend the Joint Meeting of the Southwestern and Pacific Branches of the Entomological Society of America and the Sociedad Mexicana de Entomología in Guadalajara (Hagen and Calvert) and the 5th annual meeting of Biological Control Workers of Mexico in Ciudad Victoria(Calvert).

15. Drs. Perry L. Adkisson, J. Lawrence Apple, Louis A. Falcon, and Harold T. Reynolds - April 21-28, 1977, to represent UC/AID project at the Meeting of FAO Panel of Experts on Integrated Pest Control in Rome, Italy.

16. Drs. Ray F. Smith and Donald J. Calvert - June 20-24, 1977, to Bogotá, Colombia to meet with the Colombian Steering Committee concerning development of a program for a Pesticide Management Seminar/Workshop to be held in Bogotá February 13-17, 1978.

17. Dr. Ray F. Smith - July 17-24, 1977, to Lima, Peru to hold discussions with government officials concerning training programs and other plant protection matters.

18. Drs. Ray F. Smith and Frederick W. Whittemore - August 8-12, 1977, to Guatemala to discuss with ROCAP officials results of Mediterranean fruit fly study and other plant protection matters.

Appendix 4

UC/AID Pest Management and Related Environmental Protection Project Publications

Annual Report, 1976. University of California/Agency for International Development Pest Management and Related Environmental Protection Project Contract No. AID/ta-C-1195. 1975-76 Annual Progess Report.

Anonymous, 1977. A report on a Seminar/Workshop in Pesticide Management. Proceedings of these activities held at the University of Alexandria, Alexandria, Arab Republic of Egypt, March 5-10, 1977. Sponsored jointly by UC/AID/PM, University of Alexandria, Ministry of Agriculture, Egypt and USAID/Cairo.

Mitchell, Wallace C., et al., 1977. The Mediterranean Fruit Fly and its Economic Impact on Central American Countries and Panama. UC/AID/PM Multidisciplinary Study Team Report.

International Conference Related to Pest Management. Meeting list compiled and issued periodically by the UC/AID Pest Management and Related Environmental Protection Project. (Issued September 1976, January 199 and June 1977.)

Pest Management News. Newsletter edited and issued periodically by the UC/AID Pest Management and Related Environmental Protection Project. (Publication schedule for Volume 2, Nos. 1-4 appears below.)

September 1976	-	Volume 2, No. 1
December 1976	-	Volume 2, No. 2
March 1977	-	Volume 2, No. 3
September 1977	-	Volume 2, No. 4