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FINAL REPORT ON THE EVALUATION OF THE INTEGRATED PEST MANAGEMENT (IPM) ACTIVITY AT THE ESCUELA AGRICOLA PANAMERICANA (EAP)

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EVALUATION OF THE INTEGRATED PEST MANAGEMENT (IPM) ACTIVITY

AT THE ESCUELA AGRICOLA PANAMERICANA (EAP)

EXECUTIVE SUMMARY

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I. Development Objectives of the Project

Since 1983, a program in integrated pest management (IPM) has been developing at the Escuela Agricola Panamericana (EAP) located at Zamorano, Honduras. In 1986, USAID/Honduras funded a five-year project in integrated pest management at EAP with the last two year's funding of the project contingent on the results of an evaluation to be held in the third year of the project. The timetable for the evaluation was changed to Year 2 of the project in order to facilitate the funding timetable, and to determine if the IPM project has components that are compatible with a proposed AID Honduras project titled Land Use and Productivity Enhancement (LUPE).

The project at EAP is managed by the Fundacion Hondurena de Investigacion Agricola (FHIA) who also provides administrative support. The technologies developed in the project were projected to increase the annual gross national product by L 40 million/year through increased production of basic grains and cabbage. The technologies developed would now exceed this projection if Honduran extension efforts were in place to "spread the word." Project LUPE should enable dissemination to occur. The project in IPM was to provide an integrated program in plant protection by developing new technologies where current recommendations are deficient, and then test extension procedures and materials for the transfer of validated technologies or programs to trainers and farmers. Emphasis of work is with small farmers in the crops of corn, beans and cabbage. Major programs and resident off-campus staff reside in the regions of El Paraiso, Yoro, Olancho and Siguatepeque.

II. Purpose of the Evaluation

The evaluation was designed aud conducted to review and analyze the effectiveness of the IPM Project at EAP. The effect of the research-extension technologies, methodologies developed for delivery, their impact on farmer acceptance and the ultimate effect on the national economy were evaluated. The role and effectiveness of six centers (Self-help Center, Agroecology Inventory Center, Biological Control Center, Diagnostic Center, Pesticide Use and Efficacy Center and Applied Malacology Center) were to be determined. The contribution of the teaching program and the value and effectiveness of materials prepared by the project were also evaluated.

The compatibility and contributions of the EAP's IPM program with the AID proposed project LUPE were evaluated to determine if the IPM project was appropriate for inclusion for full or partial funding by LUPE. Special attention was given to the role of production enhancement and contributions for maintaining sustainable natural resources by the Integrated Pest Management Project (MIPH) at EAP.

III. Study Methods

After arrival in Honduras, the team leader received a briefing from the Rural Development Office of AID/Honduras where the goals of the evaluation were explained. A thorough briefing was given at EAP regarding the scope of the project, technologies developed, methodology developed and validated, and teaching materials produced. Interviews were held with responsible program leaders of the divisions within the project, EAP administrators, students, and others knowledgeable and familiar with the project. Five days were spent on site with field staff of the project near Siguatepeque, Olancho and El Paraiso. Over 100 farmer cooperators were contacted in the field phase giving the team opportunity to observe and participate in research-extension activities. Personal interviews were conducted with personnel of SRN (extension and other personnel), representatives of private organizations (Los Compañeros de las Americas, Project HOPE, Peace Corps), and others who interact with the project.

Evaluation of scholarly and creative activities and output of teaching and training materials was directed at: (1) the quantity of production, and (2) the quality and appropriateness for audiences to be served. The interaction of Project MIPH with SRN extension personnel and other change agent activities, both public and private, was studied and evaluated. In addition, the appropriateness of the program to goals and objectives of LUPE were considered in all phases of the evaluation.

IV. Findings

The MIPH at EAP has developed an integrated program in plant protection with excellent strengths in IPM, with depth of programs and expertise in research, extension and teaching. The three areas complement each other in meeting overall objectives of the project.

The curriculum in plant protection is well developed and utilizes MIPH-prepared textbooks, laboratory guides, audio-visual teaching modules and many other well-prepared materials. Students receive a good balance of theory and practical training. The research work done both on and off-station is problem-solving work designed to meet production needs of Honduran farmers. Moreover, good research techniques are used and effective collection, processing and dissemination of information takes place.

Research work is integrated into extension programs and detailed research in delivery methods is conducted to find acceptable methods for gaining acceptance by farmers. Anthropologists, both on staff and consulting, are involved in the development of working methods of delivery. Continuous validation of research is conducted so the findings can be integrated into extension methodologies. Farmers

are involved througnout the process of identifying research needs and in developing research and extension methodology to enhance crop productivity and natural resources maintenance. In addition, emphasis is placed on developing methodologies followed by "train-the-trainer" use.

Overall, the program has produced a large variety of teaching materials for extension use. The quality of instructional materials is high and the capability to produce appropriate textual and visuals materials is excellent.

V. Conclusions

The MIPH of EAP is an effective well-managed program and meets its teaching, research and extension mandates. Effective teaching materials have been developed which should serve throughout Central America. Research-extension technologies and methodologies are also effective and serve as a model capable of directing procedures for delivery of other crop production technologies. Students at EAP receive excellent plant protection training by theory and practical application.

Research programs in no-tillage production and in practices of pest control which minimize use of pesticides are compatible with the objectives of project LUPE. The six centers in place at EAP are interrelated and serve the entire program of MIPH. Their value to students, teachers, extension workers and researchers will continue to improve as the centers develop their programs and databases. The centers, especially the Diagnostic Center, Biological Control Center and the Pesticide Use and Efficacy Center, would be of special value to LUPE.

Effective and good relationships exist at EAP, with public and private cooperators and with the farmers reached. Changes in farming practices are being made by farmer cooperators as a result of project MIPH. Moreover, the quality and quantity of teaching and extension materials produced by MIPH/EAP are excellent. In addition to IPM expertise, LUPE should consider EAP for other areas of expertise.

VI. Recommendations

The MIPH should have a funding level of at least $1,000,000 for each of Years 3, 4 and 5 of the project, and beyond. The specialized centers are effective and should be retained and developed. The technology development and transfer methodologies developed should be expanded and include other areas of expertise besides IPM, such as agronomy and rural development.

The work of the MIPH is directly related to project LUPE. If project MIPH becomes part of LUPE, we recommend the USAID/Honduras proposed project LUPE fund EAP/MIPH for at least $1,000,000 per year for inclusion in the project. Funding should include research, extension and teaching, and extension research. Funding for both on and off-station research and extension work should be included as well as support for equipment, infrastructure, the six centers, and support for anthropology and communications activities.

The commitment and responsibility of EAP/MIPH and LUPE/USAID should be by a memorandum of agreement outlining the funding level and obligations of each. Project LUPE should consider EAP for support services to other work of LUPE such as

soil, water, feed and tissue testing, rural development and extension efforts both off-station and through workshops, short courses and internships. Such efforts could be provided by amendments to the initial memorandum of agreement.

MIPH/EAP has developed outstanding teaching materials including 70 teaching modules in integrated plant protection. These materials and teaching techniques have value to other agricultural educators in Honduras and Central America. It is recommended that USAID/Honduras request, through ROCAP or other regional agencies, funding of approximately $400,000 per year for five years for continued development, training and regional distribution of integrated pest management training materials in Central America.

VII. Lessons Learned and Impact on Development

The EAP/MIPH has developed a good program in all phases of IPM. Adoption of methodologies developed could have significant impact on the food availability and gross domestic product of Honduras. Where adopted, the technologies could increase maize production by 8 to 15 percent, bean production by up to 35 percent, and the impact on cabbage production could be even greater.

Plant protection provides easy access to farmers because of solutions which are usually dramatic and positive. The technologies and methodologies developed by EAP/MIPH would be a good farmer-access vehicle for initial activity of LUPE. IPM information could be readily fed to farmer audiences with other programs to follow. IPM activities would serve as the conduit for the flow of other technologies. Other areas of agriculture such as agronomy and farm management need to be included in farmer-received methodology. As other technologies are added to the farmers' programs (examples include soil testing, fertilization, plant population and others), plant protection can serve to protect the farmers' investment in production. Continuing research in IPM is necessary to anticipate and correct early on the problems that arise with technology innovation (i.e., new technology, new problems).

EVALUATION OF THE INTEGRATED PEST MANAGEMENT (IPM) ACTIVITY AT THE EXCUELA AGRICOLA PANAMERICANA (EAP)

I. OBJECTIVE OF THE EVALUATION

In 1986, EAP submitted a proposal to the Honduras USAID Mission requesting funds for a five-year Integrated Pest Management Project. The financing was approved for only three years with additional financing contingent upon the results of an evaluation to be held in Year 3. Because of the closeness of the third year evaluation and the need for more time to correlate with the funding cycle and because of the Honduran USAID Mission development of a project paper for Land Use and Productivity Enhancement (LUPE), the timetable for the evaluation was changed to Year 2 of the project.

The objective of the evaluation is to: (1) review and analyze the effectiveness of the EAP Integrated Pest Management Project (MIPH) research in maize, beans, and cabbage; (2) review and analyze the effectiveness of the extension program in maize and beans; (3) review and analyze the EAP plant protection curriculum development efforts; (4) evaluate EAP specialized plant protection centers which include a Diagnostic Center, Self-help Center, Agro-ecological Inventory Center, Biological Control Center, Pesticide Use and Efficacy Center and Applied Tropical Malacology Center; and (5) determine if the IPM Project is compatible with and should be a part of the proposed LUPE project. The evaluation includes estimates of the effect of the project on Gross Domestic Product (GDP) and its role in conservation efforts for sustained use of non-renewable natural resources.

Since the work of the IPM project has been directed to small farmers, special efforts were made to determine the involvement of small farmers in helping outline their problems, to design and determine their research priorities, and follow up with involvement in on-farm testing with the workers of MIPH. Research is conducted on pest problems which reduce crop yields, and validation of research is carried out prior to carrying out extension techniques on a broad scale with farmer participants. These studies are of special value as they ascertain if the acceptance rate of new technology is appropriate and valuable to the recipient farmers.

II. THE ROLE OF IPM IN HONDURAN AGRICULTURE

Plant protection capabilities in Honduras are less developed than those of neighboring countries. Farmers have rarely received the necessary information and support they need to protect their crops well. In some cases, farmers in a bean/corn intercropping system have had to drop the beans from the rotation because slugs or other limiting pests have reduced the yields of beans to practically nothing. This has created a nutritional as well as an economic problem so the need for IPM information has been of special value in enabling the cropping system to meet nutritional needs of people depending on the land.

Ministry of Natural Resources (SRN) agencies support an extension program but extension workers have little contact with a source of information regarding effective IPM technology. In SRN, for example, research in plant pathology, entomology and weed science has been de-emphasized in favor of agronomic studies; thus, the need of extension workers for an effective source of information as well as an effective technique of information delivery has been severely lacking in the country.

IPM offers a very effective means of reaching farmers and has obtained farmer confidence. Farmers who have a pest problem can get information from a good specialist (if they have confidence in him/her) which will resolve the problem and show results immediately. This development of confidence that helps a farmer solve a problem will also open the door for additional validated research information about production, conservation and related areas.

The IPM program serves as a conduit through which other production techniques and conservation practices can follow. Before the MIPH, little work had been done in the country to develop and validate regionally tailored prototype insect, weed, and mollusk pest management programs. This program, designed to develop and validate the technology, has been transferring the knowledge gained to extension workers (SRN) and interested private sector entities charged with serving farmers. The project has focused on a limited number of pests and only the crops of corn, beans, and cabbage. The responses from farmers, extension workers, and representatives of other organizations who have worked with the MIPH program are very supportive of not only the knowledge transfer but also the methodology that has been developed with the project. The need for IPM in Honduran agriculture is most evident and the need for solutions and education to carry out this work is likewise a missing ingredient that the MIPH has addressed very well.

III. THE EVALUATION TEAM

The evaluation team consisted of Rodney J. Fink, team leader, and Milton Gertsch. Both team members have many years of experience in plant protection and hold PhD degrees in that discipline. They have experience working in private industry, university research, teaching, extension, administration, United Nations agencies, and consulting work. Thus, they combine many years of overseas experience as full-time and short-term consultants including serving as consulting agriculturalists working directly for farmers. Additionally, they are familiar with the political and socioeconomic systems of Central America and have prior experience in Honduras.

IV. METHODS USED IN ACHIEVING OBJECTIVES OF THE EVALUATION

After arrival in Honduras the team leader received a briefing from the USAID Office of Rural Development and was given the attached statement of work (see Appendix 1). After arriving at EAP, a briefing by the Project Director was followed by an in-depth interview with each section's program head, each center's coordinator, and other workers within the MIPH (see Appendix 2). Special attention was given to obtaining interviews from workers in the program who had lived much of their life in Honduras, and especially to those who had grown up in rural areas and were familiar with farm life. After receiving a thorough briefing from representatives of the department and the school, other agencies were contacted. In-depth briefing was provided by the Department of Rural Development and the extension program at EAP. Field trips were conducted to the Danli, Olancho and Siguatepeque regions where extension and research sites were studied. Individual interviews were conducted with collaborating farmers at each area in order to determine their reaction to the research and extension program. Over 100 farmers were present to discuss progress with the team. An expert in information transfer from the University of Florida was a collaborator in the evaluation of teaching and teaching materials. In addition, an extensive tour was taken to the research and extension programs in the region of Olancho. Farmers were interviewed and asked if they accept the research and extension methods used. All evaluations were positive.

Numerous documents were available for study including the thesis of departmental students who completed the four-year program at EAP and thesis work of others from the U.S. who have done their research work at EAP. Publications in professional journals and other media were evaluated for content and quality. The numerous teaching materials were evaluated in detail for content and appropriateness to other institutions both in Honduras and Central America. Also, interviews were conducted with representatives of private voluntary organizations including Companeros de las Americas and Project HOPE as well as interviews with representatives of the Ministry of Natural Resources (Director of Plant Protection in one region and several extension workers). Following the collection of information, the team evaluated the data, analyzed the findings and included a summary of the findings in this report. See schedule of activities and people contacted in Appendices 3 and 4.

V. RESEARCH

The research conducted or controlled by EAP falls into two categories: (1) research conducted on the EAP station, and (2) research done on farmers' fields (off-station research). They differ somewhat, but both are useful in generating and transferring technology. Factors such as credit, land tenure and employment considerations were apparent in the development of solutions by research-extension efforts. Such factors affected the alternatives available to farmers but the MIPH developed a menu of alternatives to allow adjustment for lack of resources or materials.

Credit problems in some cases limited the pest control system used by farmers to those which could utilize manual or low-cost techniques of control. Since labor was readily available, systems using labor or manual controls were emphasized by MIPH. If the labor market would employ more people, transition to non-manual techniques would follow. The amount of land available to each land reform group varied greatly as did management levels. The major land reform problem seemed to be the small size of the holding or quality of land. Total management help needs to be made available to land reform groups.

The farmers, either individual or land reform group, need a united approach to total management including all factors (fertilization, pest control, credit, marketing, and others) to be put in place by LUPE to facilitate the operation. A good technology/methodology development system (such as MIPH) needs to feed and be a part of a good delivery system (LUPE). The pattern developed could work on a major scale to increase agriculture production.

A. On-station Research

On-station research is done on the station. It is limited to the soils, weather patterns, microecological conditions and pest population (pest pressure) prevailing on the station surrounded by well-managed commercial farming. Access to power tillage and cultivation machinery can provide both better soil preparation and more uniform planting leading to a uniform size, evenly spaced, plant population. Also this access to power may be utilized to provide good, timely cultivation (weed control) or uniform application of such items as fertilizer, herbicides or insecticides. In short, on the station there is much better control of the cultural operations but the environment in which they function, especially the insect pest population, is fixed and determined by what is prevailing in the general area of the station situated in a commercial farming area.

B. Off-station Research

Off-station research is usually done on farmers' fields, using farmer practices of soil preparation, seeding, crop variety, and management. Such fields are usually surrounded by "monte" (uncultivated rough land populated with brush and small trees) or farmer's fields where little or no pest control (chemical control of insects or weeds) is done, so pest population pressures are often severe. However, using farmers' fields offers the latitude to vary the environment, especially soils, and to some extent microclimates (arid or humid areas).

While the research done on the station provides for more critical delineation of cause-effect relationships, it is done within an environment of commercial farming operations, an environment that is not typical for the target small farmer group. On the other hand, to function entirely within the context of a farmer's normal practice has shortcomings; such farmers may have the capability and willingness to abruptly change one of the practices such as the crop variety planted, row spacing, plant spacing in the row, or procedure for controlling weeds. Thus, integrated pest management can and probably should be, at least sometimes, expanded into integrated crop management or integrated field management. Conceivably needs for chemicals for insect control and effects of such control may be different if: a) the row/plant spacing is changed, b) herbicides are used to manage weeds, or c) both (a) and (b). So probably some of the pest management research sponsored by EAP should, in addition, be done under normal farmer practice and should be done under conditions of farmer utilization of such other innovations as better soil tillage, more fertilizer, new varieties, and crop management. This is emphasized here because farmers frequently are aware of the damage to crop yields arising from excessive weed competition, devastation by slugs, foliage area loss from plant diseases, and other problems; therefore, the technology transfer mechanism which offers affordable resolution to such problems incurs the confidence of the farmers, and thereby can frequently lead/guide the farmer(s) into such other useful innovations as virus-free seed, optimum fertilization, different plant spacing, contour planting, and improved management practices.

One substantial advantage of on-farm (off-station) research is that it places the researcher-technician in direct contact with the problem as it exists in the field. Also, in addition to the researchers' interpretation of the problem, the researcher learns of the farmer's perception of the problem. This farmer perception will surely influence technology transfer techniques and may influence research strategies and priorities.

C. Evaluation of Research Efforts

1. Breadth and Depth of Research Efforts

The research effort has been methodically tackling needs, beginning with: (a) those causing greatest economic loss, or (b) those lending themselves to quick, easy, simple improvement. It is noted here that several of the off-station, on-farm research projects are studies of the dynamics of pest development and damage under different intercropping systems or different cultural practices (operations). Such research is not expected to generate very much information usable in evolving economic pest management programs. Rather, by being aware of the rate and potential severity of pest population expansion, specific detailed experiments can be designed and implemented. With the current functional research capacity and attitude at EAP, such pest dynamics research will adjust to the realities of identified problems/situations. It is acknowledged that at the outset the EAP integrated pest management program addresses those problems: (1) where the economic impact on yield and farmers' income was highest, and (2) where suitable programs could be developed most rapidly.

2. Quality of Published Papers, Reports, and Other Research Outputs

EAP/MIPH has done a commendable job of reporting and disseminating the output of their research. They quickly and methodically publish/disseminate their research results through various media/mechanisms. The quality of the research and their reporting is sound.

3. Evaluation of Research Activity

While written reports are the main vehicle for disseminating research results/information, other techniques are also used by EAP. Newspapers have been used to publicize the project's information and many audio-visual modules and self-teaching guides have been prepared. Use of radio is also being considered.

Since some of the off-station research is done on farmers' fields, there is farmer demonstration-technology transfer value. This then reaches both the extension apparatus of SRN and those of EAP. Life tables developed for use in extension work were considered especially well done (see Appendix 6) and other methodology work contributes to the project.

The research effort is good but has the weakness (especially the off-station research) of not incorporating other crop production innovations such as planting dates, contour rows, fertilizers, new varieties and other technologies. Incorporation with LUPE would strengthen this aspect of the work.

4. Information Generated by MIPH Which Would Not Otherwise be Available to Honduran Agriculture

The MIPH has made many contributions of importance to Honduran plant protection of basic grains. The following list of contributions are important in that they impact directly on production.

a. Slug taxonomy and ecology. MIPH researchers have identified the species which damages beans, developed a clear idea of its yearly population dynamics, discovered its alternative host plants, and researched its role as host of human parasites.

MIPH was the first to investigate the feeding preferences of slugs and determine that broadleaf weeds are food sources for slugs when beans are not available. This discovery opened the way for the subsequent studies regarding use of herbicides to control broad-leaved weeds as a control procedure for slugs. MIPH researchers were the first (in fact, the only) who have studied population dynamics of slugs.

MIPH was responsible for the creation of an entirely new strategy for slug management, with three new tactics, and for the refinement of several existing recommendations. Based on their discovery of the role of broadleaf weeds and studies of population dynamics of slugs, they developed the early season anticipatory slug management strategy Their slogan that one dead slug in early season results in fifty fewer slugs at bean-growing time has been widely accepted throughout the country by technicians and farmers alike. In order to carry out this strategy,

three distinct technologies are proposed. The simplest is early season baiting using standard poison baits rather than applying the baits as "vengeance" treatment; they suggest the use of baits in June and July. They also designed or developed the use of herbicides to control broadleaf weeds as an alternative to direct control; by removing the food sources for slugs, they are able to reduce their survival rate and reproduction rate and eliminate them. For those farmers who don't have the capital to purchase either baits or herbicides, the use of trash traps in which farmers weed their corn field and rake up the cut weeds into small piles under which the slugs seek refuge at night. Farmers kill the slugs during the day.

b. Slug control. MIPH researchers are responsible for the creation of an entirely new strategy for slug management, for three new tactics and for refinement of several existing recommendations.

c. Grass looper control. MIPH researchers have developed a cost-effective technique for looper control which reduces infestations one thousand-fold.

d. Fall armyworm control. MIPH researchers have conducted considerable research on the ecology and management of this pest. They have documented its natural enemies, its seasonal dynamics, pesticide susceptibility, effective sampling procedures and cost-effective action thresholds.

MIPH has conducted the first long-term (five-year) study of population dynamics of adult fall armyworm using sex attractant-baited sticky traps. They have shown that the number of adult moths trapped during postrera is noticeably lower than the number trapped during primera. During the dry season populations of fall armyworm are extremely low. Their work has elucidated the identity and confirmed the parasitisation rates of various species of parasites which affect fall armyworm. They were the first to document the importance of Hexamermis, a nematode parasite. Their studies led to the conclusion that parasites typically kill between 30 and 60 percent of the fall armyworm larvae; however, the control they exercise is rarely adequate to avoid serious pest damage. On the other hand, predators appear to be important; their work has determined the effectiveness of Polybia spp., Doru spp. and other general predastors in regulating population dynamics of fall armyworm.

e. Leaf hoppers. MIPH researchers have developed several new, improved sampling procedures for these pests, discovered a new parasite and refined chemical control information.

f. Bean pod weevil. MIPH employees have developed a unique sampling procedure utilizing a trap crop and validated improved control techniques.

g. Ear rots. In collaboration with national organizations, MIPH plant pathologists have identified causal agents and developed epidemiological information.

h. Graminaceous stemborers. MIPH, in collaboration with INTSORMIL, has established the first intentionally imported beneficial organism for the biological control of an agricultural pest in Honduras. The parasitic wasp cotesia flavipes is now found in three distinct areas of Honduras and can be expected to control one-third to one-half of the stemborer population present.

i. Other successes with pepper weevil, citrus, and other pests are somewhat outside the scope of this evaluation.

j. The research and services of the Diagnostic, Biological, Pesticide and Inventory Centers all feed directly into Honduran agriculture.

k. Anthropology. The anthropology program has been especially effective in terms of methodological considerations. MIPH can cite as a specific outcome of importance in a research mode the development of the lexicon of rural Honduran Spanish. Work on this dictionary permits insights into farmers' verbal and mental categories; it has resulted in a clear definition of such concepts as "hielo" and other pests as well as other areas of key concern for plant protectionists.

l. It is important to point out that work has been initiated in several additional areas including bean rust, common bean mosaic virus, weed management, tillage programs and white grub, Phyllophaga spp.

m. Methodological considerations. Several methodological issues have been addressed by the MIPH team and deserve to be mentioned as possible contributions to a more effective understanding of how to conduct plant protection work among resource-scarce farmers in the tropical world. Not until the team has had a chance to reflect on the entire MIPH experience will we truly be able to see what are the important methodological issues or breakthroughs which have been obtained.

n. The questioning of methods and media in extension and in pedagogy. The results obtained after three years of research on the effectiveness of different media both in extension programs and in training of university-level students is a methodological breakthrough. The essence of their results will be sustained by future research. Even if they should not be, the research has pointed to the need for concerted efforts by communication scientists to address the key issues regarding the efficacy of materials and alternative methods, rather than conducting naive, trivial trials.

o. Truly interdisciplinary approaches and solutions. The MIPH can pride itself on a true integration of various disciplines, and the production of solutions which have an appropriate level of ecological and conceptual complexity. MIPH has successfully integrated to a significant (although still insufficient) extent social sciences, ecological sciences, technological concerns, public health disciplines and the various plant protection disciplines -- mainly entomology, malacology, plant protection and weed science. Many of their slug, insect and pathology management programs are based on proper weed management. They have also studied the effect of tillage systems on pest management concerns. Their work

combining rats, mollusks, corn, beans and the nematode parasite of rats, slugs and humans serves as a good example for heuristic and conceptual purposes; it is also important in a practical sense.

p. Pesticide Testing and Efficacy Center. The center is expected to: (1) evaluate established pest control materials and to optimize use, schedule and rate, and (2) serve on a contract basis with pesticide suppliers to evaluate new materials.

The center is expected to engage in four major activities:

- On a contract basis evaluate new, not yet commercial pest control products. The results would be provided to the paying client but not published without prior permission of the paying client.
- Evaluate registered products or products ready for registration (and sale), to delineate items such as schedule or rate of use. Some of this activity would be done as a part of normal EAP research and some would be on a fee basis.
- Commercially available products would be tested for economic impact on yield, gross income and net income.
- Serve as a resource to "solve problems," sometimes on a fee basis.

The activities of the center are now under way and some testing will be accomplished in the next cropping cycle. Contacts with pesticide manufacturers are being made now and the outlook appears promising. The center should be able to receive one-half of its support in an 18-month period and be self-sufficient in three years. If it is not, the value to the pesticide industry is not sufficient for the support.

5. High Priority for Future Research

The research effort, especially the off-station/on-farm activity, is not incorporated with other crop production innovations, such as contour rows, different plant populations, different planting dates, new varieties, and other agronomic practices that farms/farmers are likely to need to adopt within the near future. The association with LUPE could ameliorate this weakness.

VI. EXTENSION

EAP has field tested several strategies of technology transfer-extension methods. These methods have been evaluated and contain input of anthropology experts, both staff and consultants, who are part of the project and are familiar with small farmers of Honduras. The purpose of the MIPH outreach is to improve and stabilize small farmer production. Extension and research are viewed as complementary aspects of a single process. Extension provides the conduit through which results of research reach farmers. They also serve to define agronomic and economic realities, prioritize research options, and determine the efficacy and acceptability of researchers' suggestions. Farmers are actively involved in the research-extension team. Figure 1 shows a transfer of technology scheme followed by MIPH. The capability of MIPH used in this manner to serve SRN extension and other change agents should be utilized by LUPE which would be the bottom block of the figure.

A. Extension Methods and Appropriateness of Methods Used

These techniques have covered a wide range including sophisticated slide presentations to growers, demonstration plots, talks, demonstrations, presentations with flip charts, colorful brochures, simple brochures, and various combinations of techniques. Narrated flip charts were an effective extensionist/change agent. Beyond that no improvements were gained from the use of elaborate visual aids. The visual aids seemed to have some value in supporting the change agent-extensionist, even though it did not improve audience comprehension. Fancy embellishments seemed to have a split effect: (1) distracting and entertaining a fairly large segment of the target audience, and (2) improving the communications of a few of the more sophisticated members of the audience. These studies emphasized that farmers were familiar with and understood direct verbal communication. They also revealed that beyond such direct verbal communication, visual aids, at least not sophisticated, multicolor items, are not cost effective. Simple black and white line drawing flip charts supplemented by simple black and white line drawing highlight reminder sheets do the job well and are inexpensive to reproduce. MIPH uses this approach very effectively.

Innovation adoption rates are difficult to measure. The most useful observation is that where extensionists established rapport with members of land reform cooperatives and discussed innovations, especially slug control in beans, a relatively large number of the members adopted the new practice, and there was a neighbor-to-neighbor multiplying effect.

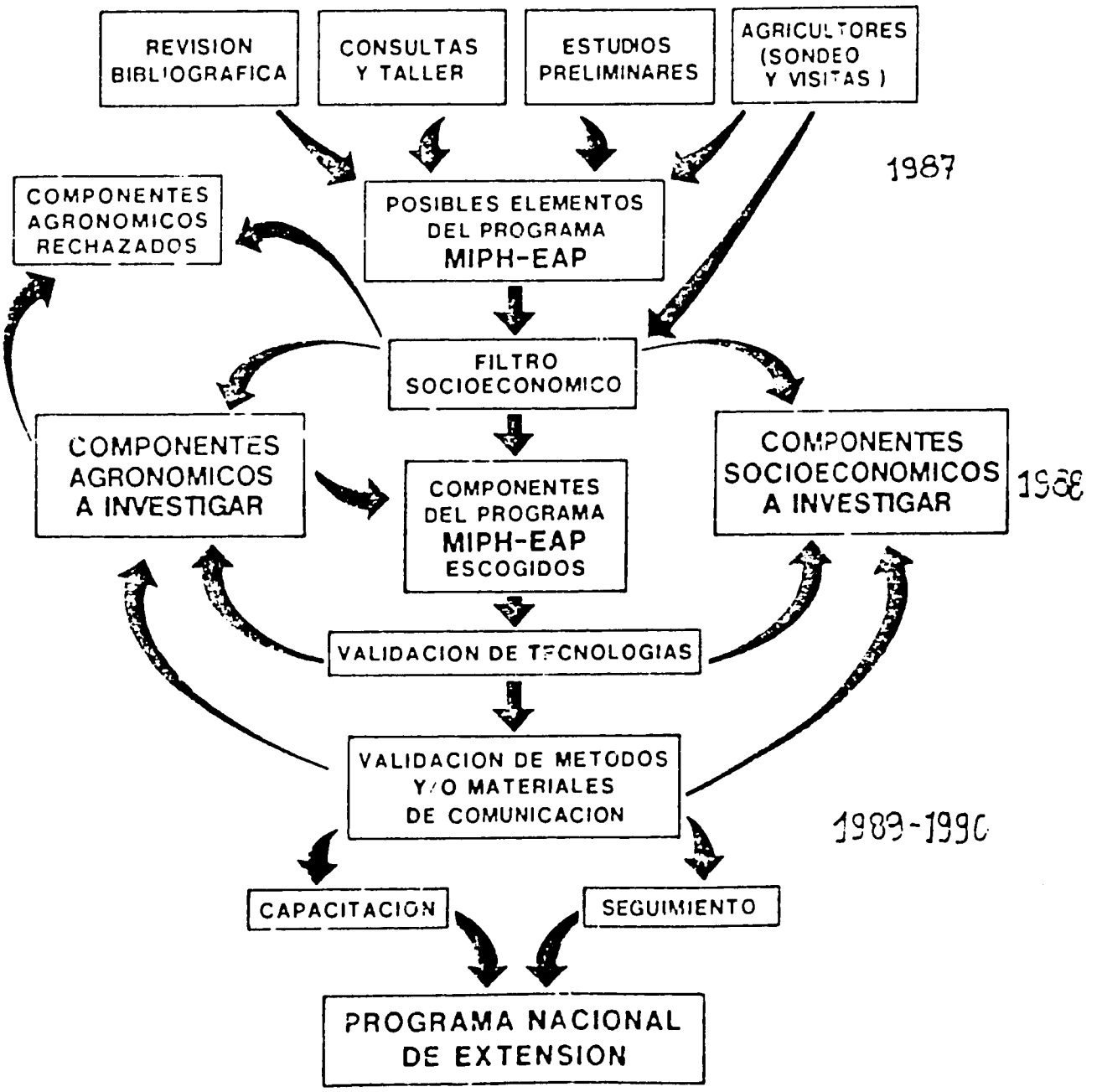
Experience and competence of the change agent and his/her familiarity with the client audience seemed to improve the capacity for the audience to comprehend the message transmitted (farmers taught by Vermont Partners of the Americas and Natural Resources Management Project showed a slightly higher knowledge increase than those taught by the MIPH). The interpretation of this was that greater experience and greater familiarity with the farming community of the Vermont group made communications easier.

There has been some limited opportunity to measure the spread of innovations from sites where there has been successful adoption; but neighbor-to-neighbor spread is expected to occur. Also there has been little attempt to use radio

FIGURE 1

MODELO DE DESARROLLO Y TRANSFERENCIA DE TECNOLOGIAS MIP

Programa de Repollo 1987 - 1990



LUPE

and to measure its impact. It is probably not a suitable strategy for MIPH, but could be useful as a strategy for widespread extension efforts for production and natural resources management which should include IPM.

It should be noted that where there has been effective communications, that is farmer comprehension, the extensionist/change agent was competent, energetic, motivated, with farmer economic interest in mind, and had good trusting rapport with farmer audience. This is not a new observation but needs to be kept in mind as attempts to repeat the IPM program occur. Successful extensionist/change agents that farmers suspect to be lazy, incompetent or concerned with government's interest rather than farmers' economic welfare, may have a friendly but non-trusting relationship with farmer audiences, usually resulting in little useful technology transfer.

B. Research on Development of Extension Methods

MIPH has made outstanding research efforts in the development of extension methodology. Direct involvement of consulting and staff anthropologists have contributed to the validity of their efforts. Their work has evaluated different delivery methods, different types of materials, and the effects of farm size, literacy and other factors on adoption. Disguised evaluators have been employed to determine acceptance of information and disposition of distributed materials. The effects of training aids on retention and studies on the effect of training session length were evaluation items. Excellent methods were developed. The staff anthropologist interacts with employees of the project, farmers' cooperators and cooperating extension/change agents. Their work is continuing and testing of teaching methods and how to reach the target audience is continuously evolving.

C. Linkages of Project With Other Institutions, Media, Cooperatives, Government Agencies and Other Countries

Validated extension technology is shared with extension workers in areas covered by MIPH. Good acceptance of techniques and expertise is obvious with cooperating agencies who interact with MIPH. More discussion on linkages appear in Section XI and a list (nearly complete) appears in Appendix 5.

D. Summary of Efforts on Farmers' Adoption Rate and Number of Farmers Reached Either Directly or Indirectly

Farmer groups being served by MIPH in interviews were pleased with the yield stabilization effects. These farmers also tended to be more eager to try other advanced methods of technology. MIPH has reached many farmers directly as well as through other workers (see Appendix 7).

Specific multiplying effects of MIPH efforts are difficult to measure because of the large number of clients served through other groups. Groups who have used MIPH expertise and methods in reaching others include EAP students, production specialists, outreach specialists and other university students and their instructors (CURLA, ENA and JFK), reformed sector and independent Honduran farmers, Honduran regional extensionists and trainers (SRN, INFOP, Peace Corps, others), and Honduran and regional researchers (those in MNR, CURLA, CATIE, CIAT, FHIA). Thus, immediate effect is apparent.

Since 1984, MIPH has presented short courses to many extension or other advisors to farmers. The number of beneficiaries reached in short course-type programs held by MIPH are as follows:

Year	Number Reached
1985	319
1986	388
1987	600
1988 (through July)	296
Total	1,603

Thus, it is readily apparent that the "train-the-trainer" process of MIPH is doing the job. Personal interviews with participants of workshops confirmed enthusiastically the value of these programs for knowledge necessary to do a good extension job. A good extension worker needs technical backup. MIPH is providing this backup.

Extension workers interviewed gave numerous examples of needs for a better understanding of IPM principles, practices and techniques. Slug problems were mentioned by these workers as an example where IPM had really helped. All extension workers were well aware of the use of poison baits for slug control, the recommended alternative of SRN. The problem they faced, however, was not the practice but the fact that the government didn't make the poison bait available at the time needed (this happened many years). Thus, the extension worker had no alternative for control until MIPH provided them with cultural alternatives of trash traps, better weed (host) control, and direct night-time kills. Unfortunately, pest control has no single alternative that works all the time. Extension workers need to have knowledge to react according to each situation and not simply to have one written recommendation that covers the waterfront.

In addition to the preceding contacts, approximately 700 graduates of EAP have had five courses in plant protection as a part of their course of study.

Estimates of indirect contacts with farmers are difficult to ascertain; however, the number is substantial. Based on information from representatives of the following sources, estimates of contacts through cooperating organizations follow:

Organization	Contacts
MIPH/EAP	1,500
Proyecto MRN	2,000
CEE (European Econ Community)	2,000
INFOP	3,000
Companeros de Los Americas	2,500
Grupo de Paz	800
Other SRN	5,000
Total	16,800

The most effective transmission of information is through satisfied recipients. No estimate of this effect on adoption has been made but the multiplying affect is substantial.

Acceptance studies of farmers has been very good. Follow-up studies at Linaca (El Paraiso) and in Olancho in 1986 found that farmers had no knowledge about control of slugs in beans. Following instruction sessions, over 50 percent of the farmers receiving instruction used one or more of the alternatives given. In Olancho where poison baits were not available, over 50 percent of the farmers reached adopted one or more of the alternatives available (trap trash, herbicide, or direct nightime kill). In Linaca, poison baits were available and over 50 percent of the farmers used poison baits.

One land reform group in Linaca had given up growing beans in 1985. MIPH worked with these people beginning in 1985 and loaned farmers the seed to grow beans with the understanding that farmers would give back the seed used. Beans were successful where MIPH recommendations were followed. In 1986, the acreage increased by over 10 percent and by 1988, yields and acreage of this crop was up to earlier levels (1987 is difficult to measure because of a severe drought). Thus, a solution to an applied problem in hillside agriculture was accepted and has put beans back into the economy and diet of this region.

Further adoption studies in Olancho and El Paraiso have shown that after two years training, over 20 percent of farmers in a region are following recommended sampling procedures for fall armyworm which is a good example of small hillside farmers using action thresholds to determine the need for pesticides (a rather sophisticated approach).

Poison baits are the easiest and best understood method of slug control in beans and farmers adopt poison bait control readily. In regions where the baits were unavailable, 20 to 25 percent accepted either herbicides for grass control or trash traps and some accepted both.

In 1974, 13,000 MZ of beans were grown intertilled in corn. By 1979, this was down to 7,000 Mz because of slug problems. MIPH introduced control measures in 1985 and area in beans was up 30 percent by 1986; bean production in areas reached by MIPH is now up to 1974 area and yield levels.

Control measures developed by MIPH are cost effective and easily adopted. If promoted on a national basis, bean area would increase and yields would reach the same levels as neighboring countries.

In addition to direct and indirect contacts, hundreds of newspaper articles have given free press to MIPH. The technologies are proven and should be implemented. MIPH develops and tries technologies with farmers and then finds a delivery system that works. What is needed is for the national extension program (LUPE) to be trained and supported by MIPH so benefits to crop yield and acreage can be realized over other hillside grain-growing areas.

E. Summary of Outreach Efforts (Teaching Materials, Short Courses, and In-service Training)

The work of MIPH is well accepted because of the competence and enthusiasm of MIPH personnel and because of the help realized with their teaching materials. The validation techniques are useful to outreach workers and in-service training and short-courses have provided valuable technical information and methodology.

VII. PLANT PROTECTION CURRICULUM DEVELOPMENT PROGRAM AT EAP

The Department of Plant Protection, established in 1986, is one of the new programs at EAP. Prior to 1986, it was a section in the Agronomy Department. Activities carried out by the department have been very positive to EAP because the on-farm research and extension activities have enabled teaching to be based on "real world" interaction with small-farmer problems and expectations. Novel teaching materials have developed which are in use at EAP and also at other schools in Honduras and Central America. Documents and training materials can be duplicated in whole or in part (with credit given) which assists in a free flow of information. With subject matter, research, extension and teaching, the department keeps involved with users of new alternatives and maintains the capability to develop new alternatives and not just validate existing IPM related activities. The constant interaction through the research/extension contact provides the classroom setting with a good perspective of small farmer needs and capabilities, an element perceived by some as missing in recent EAP programs.

The academic program in IPM serves EAP students through Years 1-4. As a result, Agronomos and Ingeniero Agronomos are trained with a broad theoretical and practical preparation in plant protection as a component of modern crop production. Those students selected for the fourth year program (initiated in 1987, first graduate in 1988) gain in-depth experience and course work in IPM and prepare a very extensive senior thesis as a part of their graduation requirement. Teaching receives a very high priority at EAP and in the Department of Plant Protection. Good course outlines and lesson plans are also available for every course.

All first year students take a one hour introductory course titled Introduction to Modern Plant Protection. The course provides an interactive approach and general orientation to general principles and parameters of plant protection. Considerable use of audio-tutorial aids accompany course presentations and are available for self-help by students as needed. The course generally follows an introductory course in plant science or plant production.

Students work in modules to gain field experience throughout their training. Modules normally are offered in four-hour blocks, six days per week. Students rotate in three-week modules. During the first year, students receive plant protection experience in entomology, weed science and plant pathology in the work experience. During the second year, three modules (three weeks each) are provided each student in plant protection. The three modules are offered at three intervals (spring, summer and fall) to take advantage of different crop production stages. The first module covers integrated plant protection and the remaining modules are divided between entomology, plant pathology and weed science.

The last module combines skills such as diagnosis, scouting, and planning pest management programs, thus placing the discipline in a "real world" perspective.

Second year students take one course each in weed science, plant pathology and entomology. Each course is three-semester's hour credit and includes a lecture and laboratory. Study and laboratory guides are used for weed science, and audio-visual materials guide students in plant pathology and entomology. Laboratories are well monitored and tend to be true laboratories rather than a time to substitute lectures, audiovisuals and other classroom techniques for field and microscope work.

In the third year, students take a three-semester hour lecture course in Integrated Pest Management. This course has a focus on Latin American IPM programs and enables the student to derive operational principles of IPM. Case studies will help orient the student to what IPM has actually evolved to be. Audio-visual programs, textbooks and self-help resources serve as support materials.

Students electing the fourth year program and specialization in IPM will take additional courses in Biological Control (3), Advanced Plant Protection (4), Use and Handling of Pesticides (3), and a one-hour seminar repeated three times (3). Consideration is being given to adding other courses appropriate for fourth year students.

A. Evaluation of IPM Curriculum for EAP Students

EAP students take a uniform curriculum and thus all students receive a thorough background with practical experience in IPM. The school has and will continue to excel in the preparation of university-level technicians. The three-year Agronomo program provides a generalist with good training in plant protection. The four-year Ingeniero Agronomo has greater depth in IPM training plus research opportunity in a senior thesis. The seminar program in each quarter of the fourth year gives the opportunity for updating students with new technology and scientific findings. The quality of teaching materials for laboratory and lecture is of high quality and useful not only at EAP but at other schools teaching plant protection. All areas have well-developed course outlines, visual aids and related support materials. All areas are handled very well although the IPM courses (first and third year) and the second year entomology course are the most developed. The course in biological control, about to be offered the second time, fills a very important gap in the IPM course offering. The underlying principle of all IPM instruction is to provide basic information, to validate information and techniques, and to develop alternatives of pest management rather than be a strictly pesticide-oriented program.

Few colleges have the depth of plant protection attained by all Agronomos at EAP. Students who specialize in plant protection during the fourth year are well-trained by any standard of comparison at the BS level. Agronomo graduates have obtained good research experience in their second and third year of study which prepares them for good research experience in the fourth year program. Strong research/creative ability and writing skills evolve as a result of the senior thesis.

The instruction in plant protection places emphasis on small farmer agriculture as well as covering all aspects of large scale farming. Few, if any, schools prepare an agronomo or degree student with the level of expertise in plant protection attained by these students.

B. Major Published and Unpublished Texts, Manuals and Other Teaching Materials

Faculty at EAP have been active in scholarly and creative activity. They belong to many related professional organizations where they have held offices, served on committees, led symposia, chaired sections and collaborated on materials preparation. Numerous scientific publications and presentations have added to the general knowledge of plant protection. To date faculty of the center have generated over 14 books, guides and proceedings, over 50 refereed

publications, 28 extension guides, over 57 non-refereed publications, 9 general works, 14 fourth year thesis, 5 MS theses, plus numerous short courses, seminars, professional meetings and related professional activities. Output of the faculty is superior, on average, to most, if not all program staff in plant protection. This is especially significant when one considers the research, teaching and extension validation activities of each staff member.

C. Development of Visual, Audio, Micro-Computer Technology and Other Teaching Materials

The program has developed excellent teaching materials for each class. Audio-tutorial programs are available as well as high-quality lecture and laboratory outlines for IPM, entomology and plant pathology. Teaching materials produced include almost 70 audio-visual programs, 5 laboratory guidebooks, 2 (+1 "in press") textbooks, fact sheets and numerous other high quality materials including numerous overhead transparencies and slides for teaching. Use of computer technology is being developed as an additional teaching reinforcement.

D. Linkages with Honduran and Other Central American Schools for Sharing of Produced Materials and Expertise

Plant protection teaching materials and methods developed and validated by EAP can be and should be shared with all universities teaching plant protection in Central America. Collaboration between national and regional universities would improve the overall level of plant protection instruction and the key leader for undergraduate instruction in the region is EAP. CATIE has a strong research component in IPM but is without experience at the Agronomo or Ingeniero Agronomo level.

EAP has designed and implemented model teaching programs for all phases of plant protection. Materials produced are now used at ENA in Catacamas, UNAH in Tegucigalpa, CURIA and J.F.K. in La Ceiba and by CATIE in Costa Rica. These materials should be shared by an even larger number of teachers and serve as a model for regional improvement of undergraduate instruction in agriculture throughout Central America.

VIII. SPECIALIZED CENTERS AT EAP - THEIR ROLE AND OPERATION

Six specialized centers are in varying degrees of development at EAP and other specialized centers are in the conceptual phase. These centers are being developed to serve informational needs of farmers, research, extension and resident instruction, to generate new information/technologies, and serve as a reservoir of information. For these centers to meet their desired objectives, the development of a major clientele of farmers through direct contact, extension workers, cooperatives and company representatives is necessary. The centers must have contact with users both to serve educational and production needs as well as gain input for the development of an adequate database for the development of new technology.

Computer technology is being used to develop an extensive database for information retrieval. As problems are identified, they are entered into the computer for subsequent computer search and to assist with future problems. The centers interact to maximize both the service functions and information gathering and outreach efforts. In addition, the database will be helpful for validating and updating the life tables developed for corn and beans.

A. Diagnostic Center

The Diagnostic Center has the capacity to diagnose pests affecting major crops of Honduras. Samples are received, processed and prepared for diagnosis by the appropriate EAP expert. Detailed information concerning the pest, the host and the environment is collected from the contributor and the information entered in the database for future retrieval and evaluation.

The Diagnostic Center has four purposes which are to: (1) catalog and know the pest problems of Honduran farmers; (2) diagnose production problems of EAP; (3) diagnose production problems of Honduran farmers; and (4) create a database (both biotic and abiotic) of pest concerns of Honduran crops.

For the center to succeed (both financially and for database generation) a large number of samples will need to be generated. In order to receive samples, good rapport must be developed with extension workers of SRN, farmers, cooperatives and commercial concerns whose clients need such information. In order to develop a good diagnostic skill level and sizable database, many samples from many sources will need to be generated. At this time, there is no charge for services but a charge is anticipated in the future.

B. Self-Help Center

The Self-Help Center is in its formative stage and will serve a support role to: (1) EAP students wishing to gain additional expertise; (2) short and special course participants; and (3) others needing information by a self-help method. The center has four avenues of learning available to users as follows:

(1) The first avenue is access to the database through one of several computer terminals available to users. If information on a specific crop is needed, by entering key information, the computer output can provide answers to many questions.

(2) An audio-tutorial system will be utilized for those who wish to gain additional information about an IPM problem. Study time is variable depending on the needs of the user.

(3) After completing the visual section, a user can obtain a great deal of information from a variety of pamphlets, bulletins, reprints and other information to be made available. If a copy is needed, a copy machine is available to fill that need.

(4) Finally for the person wishing to be able to identify pests, causal agents and damage symptoms, samples of common pests are maintained on file for accessibility of Self-help Center users.

The center will benefit those who wish to learn. The center should be put in place and given a pilot test of 12 to 18 months to determine the utilization rate by EAP students, extension, private voluntary organizations, industry workers and farmers. If it doesn't serve an average of 15-20 (indepth) each week, it should be dropped in favor of other learning approaches.

C. Agro-ecological Inventory Center

This center is rapidly expanding and reportedly has one of the three best collections of insects in Central America. The collection is growing rapidly as additions are made by teams from the centers going out to collect specimens, by specimens brought to the Diagnostic Center, by thesis work of fourth-year students, and by students in classes (both resident and short course) at EAP. The presence of the Diagnostic Center provides a mutually complementary operation to both centers.

The insect inventory is very complementary to the Biological Control Center because of the emphasis in crop fauna. An extremely good collection of parasitic Hymenoptera, a group important in biological control, will be a target for initial work. The inventory contains a large collection of economically and potentially important crop parasites and predators. In addition, data collected at entry and ecological roles (when attacked, where, date, other hosts, etc.) as part of the database will serve other centers. Additional strengths in the inventory include a large mite, scale insect, immature insect, malacology, and plant disease collection. EAP already has the best known herbarium in Central America which contains an estimated 75 percent plus of known flora in Honduras and possibly Central America. The herbarium collection will not be duplicated but strengthened as additional flora are added through the center. The MIPH center keeps a small herbarium of economic weeds.

When samples come to the center for addition to the inventory, a detailed information data form is completed which includes information on time, date, place, host, environment and other appropriate data. This information is entered into the computer database for retrieval in whole or in part as needed. The database serves not only this center but can assist the Diagnostic Center and Self-help Center, and be an invaluable resource to researchers.

The database of the center interacts with the Diagnostic Center, the Self-help Center and Biological Control Center. The database, when properly retrieved, will assist with pest identification and provide outreach support for symptomology, expected dates of infestation as well as serving scientific study.

D. Biological Control Center

The work and planning for the center is underway and will rapidly expand when the new facility is completed in November 1988. Emphasis on use of pesticides only when necessary places a special mandate on this program. Work is underway to identify and catalog natural enemies. The Agro-ecological Center complements this process. The facility will have the capability to maintain and support cultures and safely introduce natural enemies and maximize use of natural enemies. Work of the center has strong linkage with the University of Florida and is giving priority attention to a list of 21 candidate organisms proven useful elsewhere (Appendix 8).

EAP has developed a pattern for selling appropriate technology to users as is the case with improved seeds. The development of natural enemies as biological control agents could be a viable commercial activity of the center. Since a large portion of the Honduran pesticide management and sales force are EAP graduates, development of commercial biological control alternatives could provide revenue to help support the center. The payoff will not be immediate but with use of genetic engineering and competent staffing, long-term payoff potential is good. In addition, if national policy would so determine, action could be undertaken on a national scale to use a biological control alternative in a given region for a specific pest problem. Such a measure could have a significant effect on GDP. Contracting with foreign international agencies to conduct biological control on their behalf also has potential for the future.

Biological control activities are very positive because once in place, they are very inexpensive and effective. Chances of negative effects are minimal with such activities except for the rare chance that a predator or parasite used for control of an unwanted specie may expand to some desirable species. Thorough research techniques reduce this possibility to the extent that for all practical purposes, other than development cost, there are no negative effects to biological control activities.

E. Pesticide Use and Efficacy Center

MIPH serves Honduran farmers by offering alternatives to pest control rather than a rigid prescriptive control. Also, because of economic reality of small farmers, emphasis on mechanical or manual control is provided. When pesticide use is warranted, reliable data is needed to provide the right pesticide for the problem at a safe and effective rate. As pesticides lose their effectiveness on problem species, new materials must be in developmental stages; thus, the role of this center serves the food production interests of the country by providing unbiased, professional evaluation.

The goals of the center follow:

- To generate reliable efficacy data on a continuous basis to be used for instruction, extension outreach and scientific use. It is very important that recommendations for pesticide use be localized for conditions in Honduras.

- To provide procedures which will optimize chemical control for producers and growers. This will require accurate use of equipment, proper timing and better abilities to target specific pest enemies as contrasted to elimination of a general, non-economic population.

- To contribute to the education of EAP students, producers, extension workers and others who have producer contact. Instruction in pesticide safety, pesticide management and general safety can help develop sound pesticide use by Honduran farmers. The center can interact with other programs such as the corn/bean or cabbage program to help provide a total management package to producers.

The center will serve farmers directly and will be a resource and trainer for extension personnel, specialists of cooperatives and private sector businesses and others needing information. The specific objective of the center is to develop good information on pesticide use and to disseminate this information to users.

The center will serve chemical companies as a source of pesticide testing. Efficacy data will help companies market their products more appropriately and when country data for registration of pesticides is required, the information will serve this need also. The center will assure other scientists of a reliable source of data on which to make recommendations.

In coordination with extension, cooperative and other operations such as Companeros de las Americas, the center will participate in the development of low cost chemical technology for small farmers and hopefully provide information necessary to carry out registration of pesticides.

The Pesticide Use and Efficacy Center not only serves farmers, it can also be of great service for chemical companies needing efficacy data for marketing pesticides in Honduras. The center has the capability to test pesticides at all stages of development and will be able to generate substantial cash flow by charging for this service. By interacting with the Biological Control Center, the marketing of biological control agents also offers a source of potential income. EAP's strong private sector orientation coupled with its technological capability and development orientation makes it the ideal, objective institution for this effort. MIPH personnel are now making industry contacts on behalf of the center. Results will be forthcoming with the next cropping cycle.

F. Applied Malacology Center

This center is currently in its beginning phases of development but because of its importance, future development will be very beneficial. No such center exists in Latin America so this center will serve both Honduras and Central America and hopefully the Islands and Andean countries as well. The center will be a source of information to producers as well as to interested scientists who work on a contract basis with foreign countries and businesses.

G. Relevance and Role of These Centers

Honduran agriculture needs the services these specialized centers can provide. The maintenance of a national database on major crop pests of Honduras will serve all of Central America. The value of these centers will be realized only with high volume use. High volume of materials to the Diagnostic Center will help assure quick turnaround for answers to pressing questions and also help make the Agro-ecology Center and accompanying database develop more rapidly. As the centers develop, efforts can be directed to crops other than maize, beans and cabbage. If knowledge is power, then ignorance is impotence. The proper diagnosis of a problem is the first essential step to its resolution. The economy will react positively by: (1) avoiding unnecessary controls; (2) helping researchers pinpoint key limiting problems to work on; and (3) optimizating protection programs and technification efforts. For volume to the centers to develop, service to extension workers, cooperatives and commercial technicians and audiences of groups such as Companeros de las Americas must occur.

H. Cost Effectiveness and Prospects for Self-sufficiency

Each center plays a unique role and serves IPM in a different way. The Biological Control Center has work underway which could increase crop production. The cost to develop a useful predator or parasite can be considerable; however, application on a regional or national scale could have benefits for the entire nation. One good success in eliminating a pest would require no effort on the part of producers but would add greatly to total production and well-being of the producers and those who utilize the commodity. Good control not only improves quantity but often quality as well. The Diagnostic Center and Pesticide Use Center would serve farmers by developing new technology and by providing solutions to their problems. Similar benefits could evolve from the other centers.

All currently funded MIPH programs including the centers should be funded. The approximate costs of operating the centers follow:

Center	(U.S.$) Cost/Year
Diagnostic Center	$ 36,000
Agro-ecological Inventory Center	18,000
Self-Help Center	18,000
Biological Control Center	18,000
Pesticide Efficacy Center	12,000
Malacology Center	none
Supplies/Equipment for Centers	60,000
Total	$162,000

Within two years, the Pesticide Center should be self-sufficient. The Diagnostic Center would not be expected to reach self-sufficiency but assuming 4,500 samples per year at an average cost of 20L (U.S. $10) per sample, the center would generate 90,000L (U.S. $45,000) of which one-third would apply to supplies and two-third's labor. Such a level of activity is possible within two years which would enable one-half of the laboratory expense to be

underwritten by Year 3 of the project. Use of the diagnostic lab by scientists and students would easily justify the remaining cost. A broad national extension program could increase the number of samples processed to 10,000 per year and provide self-sufficiency.

The Malacology Center is primarily a consulting center that provides consultants on slug control available to other programs in and out of Honduras. There is no cost associated with the center and at times it could generate overhead money.

IX. THE IMPORTANCE OF IPM IN SUSTAINING NON-RENEWABLE NATURAL RESOURCES

Maintaining a sustainable natural resource base is especially important in developing countries. Rapid introduction of technology to impose a rapid production increase may do more harm over time than it does good if the resource base is eroded. Inadvertent use of pesticides may, in addition, eliminate some useful species and create an overabundance of others of little recognized value. The work of the MIPH has many aspects directly related to increasing production while maintaining the natural resource base.

Good crop production practices, including IPM, often allow good land to produce more, leaving marginal land for other uses. Work of the MIPH which enabled farmers to reintroduce beans in a corn-bean intercropping system, involving growing two crops on the same land at the same time, is an example of the use of IPM technologies to enhance production on one parcel of land and thus use other land for forest or pasture.

Stone walls erected on the contour often have a conservation effect. However, the MIPH has found that stone walls provide a habitat for slugs. This counter-effect of a conservation practice illustrates the requirement for an integrated approach for pest management and the need for further research.

No-tillage planting of corn reduces soil loss and allows for greater infiltration of water, resulting in water conservation. In addition to getting a good crop stand, residue management and weed control are tremendous problems associated with no-till systems. In no-till, the pest problems become very persistent and differ from conventional tillage pest problems. The need for additional IPM research in no-tillage work is mandatory if the possible benefits of this technology are to be attained.

In achieving maximum crop production, maintenance of useful species is important and an improper or unnecessary use of pesticides can upset this balance. For example, an inappropriate use of an insecticide may enable crop yield to be increased while eliminating a useful and necessary crop pollinating insect. The MIPH approach, utilizing pesticides as only a part of their control menu, is an important and necessary step in this process. Good IPM procedures contribute to the maintenance of natural resource productivity, increase yields and allow for the possibility of an improved human nutrition level.

A. Land Use and Productivity Enhancement (LUPE) and IPM

The instruction, research and extension work of the MIPH are oriented to stabilizing and increasing crop-yield levels while preserving the soil and other non-renewable natural resources. This is accomplished within a plant protection system designed to provide producers with a menu of alternatives for pest control which prescribe pesticides only when other alternatives have not been effective. Work being done in no-tillage provides a benefit in both soil and water conservation if residue management is carried out properly. The MIPH research and validation is appropriately related to the objectives of LUPE.

The research extension role of the MIPH employees helps farmers to recognize a problem, works with them in research needed for a solution and advises on alternatives for a solution. Plant protection efforts often produce dramatic

results so that confidence develops rapidly between farmer and extension agent; this developed farmer/extension confidence could be invaluable in providing an inroad to farmer acceptance for other programs of LUPE.

The Biological Control Center of EAP and the specialized centers all support the concept of LUPE and could effectively be coordinated or merged. The farmer-research-extension process which includes studies on technology development, delivery techniques and training would serve as an effective model for LUPE extension work. The MIPH currently provides technical assistance to MNR extension workers, specialists of Companeros de las Americas, and other groups with which they cooperate. It would serve well to see MIPH/LUPE sites united and coordinated in carrying out LUPE objectives. In addition to minimizing duplication of efforts, the full services of MIPH (Diagnostic Center, Pesticide Center, Agro-ecology Center) and the EAP could be of assistance to the success of LUPE.

B. The Role of IPM Adoption Research and Support Activities to Meet Extension and Resident Instruction Needs in Resource Management

As a procedure for casting pest management (plant protection) into the context of overall agricultural production, a somewhat theoretical computation is made (see Appendix 9). It follows the crop production cycle of corn beginning with soil preparation and ending when the crop is ready for harvest. At each step, an estimate is made of the loss arising from less than optimum conditions for the crop. In the case of corn, it represents roughly 55,000 plants/ha, uniformly spaced, and all plants producing one reasonably good-sized ear with all rows on the ear reasonably filled; thus, a theoretical yield of 12,000 kg/ha is used (190 bushels of corn/acre or 180 quintals/manzana).

The yield value in the theoretical model (3,450 kg/ha) is substantially above the yields obtained by many of the small farmers, but somewhat below yields obtained by the best farmers. Accordingly it is regarded as useful for: (1) setting research priorities (technology generation); and (2) orienting technology transfer (extension). The major aspects of plant protection are: (1) minimizing weed competition (by cultivation or with herbicides); and (2) keeping foliage and ear-feeder insects at a tolerable level with crop cultivation practices or with chemical insecticide applications. By adding the kg cost within plant protection, the total is 3,039 kg or about the same amount as the harvest. The theoretical loss due to pest problems follows.

Type Damage	Loss (kg/ha)
Early weed competition	1,070
Root damage - insects	303
Pathogens	288
Foliage damage - diseases	310
Foliage damage - insects	780
Ear damage - insects	288
Total	3,039

Good IPM practices protect the investment of other production inputs and enable increased production of a quality product.

X. THE SIGNIFICANCE AND POTENTIAL OF THE PROJECT TO PROVIDE ADDITIONAL INCOME GENERATION AND YIELD STABILIZATION FOR THE HONDURAN ECONOMY WHILE SUSTAINING THE NON-RENEWABLE RESOURCE BASE

Interviews with farmers and published data of the MIPH verified the positive results of effective IPM action on farmer yields and cropping alternatives. In the farmer group of San Juan de Linaca, located near Danli, pest problems (mainly slugs) were so severe for beans that it was no longer practical to grow beans in the bean/corn interrow cropping system. Since small rural families depend on a bean/corn supply for nutritional needs, the absence of beans in the crop had an adverse effect on their diets as well as the economy for this group of 48 farmers. The MIPH worked with the group and provided and verified pest control alternatives that enabled beans to be grown again in the cropping system. The farmers expressed to us their sincere gratitude for the technology support that enabled this turnaround. With a national effort by LUPE, additional groups would benefit from these technologies and methodologies.

A. Corn and Beans

Work with pests of corn has provided baseline data and extension techniques for weeds, seedling weevils, cutworms, ear-feeding pests, stemborers, fall armyworms, and grass looper and work is underway on other pests. Dry beans have received major efforts in controlling slugs, leafhoppers, beanpod weevils, weeds, common bean mosaic virus and several fungal diseases. The research has been verified; delivery techniques have also been researched and verified, and all technology and techniques are now being provided to SRN extension and other farmer support group workers.

Research studies indicate yield increases of 8 to 15 percent for corn and up to 35 percent for beans due to reasonable plant pest control. Obviously, pest control by a significant number of Honduran farmers would have a major effect on the Honduran GDP. With beans, IPM means additional hectares can be placed in production which in turn increases total production. Increased bean production means better nutrition, increased biological nitrogen fixation, and additional employment opportunities.

Tables 1 and 2 show the potential values to the Honduran economy of adoption by farmers of MIPH practices at varying levels. Increases of up to 35 percent for beans and over 10 percent for corn are realistic estimates with good IPM practices.

Without a national extension effort, the full benefit of the MIPH will not be realized. With such a national effort, the effect would be dramatic. With a national extension effort (LUPE), a realistic adoption rate of 25 percent could be achieved with an easy 10 percent increase in corn yields and 20 percent increase in bean yields. This would result in a GDP increase of L 2,500,000 for beans and L 4,375,000 for corn for a total GDP increase of L 6,875,000, not to mention the resulting revenue benefits for cabbage. Thus, new technologies and greater acceptance would add greatly to GDP.

TABLE 1

VALUES TO HONDURAN ECONOMY OF CORN YIELD IMPROVEMENT
WITH ADOPTION OF MIPH TECHNOLOGY
(Lps. x 1000)

Yield increase (%)	With Adoption rates of (%) 10	25	50	75
5%	874	2,170	4,350	6,520
10%	1,750	4,375	8,750	13,120
15%	2,600	6,500	13,000	19,500

Maize annual yield = 470,000 TM (1984)
L 372.00/TM

TABLE 2

VALUES TO HONDURAN ECONOMY OF BEAN YIELD IMPROVEMENT
WITH ADOPTION OF MIPH TECHNOLOGY
(Lps. x 1000)

Yield increase (%)	With Adoption rates of (%) 10	25	50	75
10%	500	1,270	2,550	3,800
20%	1,000	2,500	5,100	7,600
30%	1,500	3,800	7,600	11,400

Beans annual yield = 50,000 TM (1984)
L 1,012.00/TM

An evaluation of available data shows that if MIPH technology were adopted on a national scale (see Appendix 10), substantial improvement would occur. National implementation would have the following effect:

Factor	Beans*	Corn**
Yield increase	17,100 M.T/Yr.	30,000 M.T./Yr.
Increased acreage	15,750 M.T./Yr.	
Increase in GDP	L 28,700,000/Yr.	L 11,000,000/Yr.
Marginal rate of return	2.6	5.2

*Price - L 1,012/M.T.
**Price - L 374/M.T.

Increases in bean production would help meet international demand, provide economic and nutritional needs of farmers and enable bean yields in Honduras to be in line with those of neighboring countries.

The investment required by farmers is modest for the return realized. With maize, the incremental cost is L 16/ha. For bean production, the IPM cost per hectare is about L 8 and rate of return is very high. Marginal rate of return on beans is low; in many cases, farmers had lost money on beans and IPM technology at least put production on a profitable basis (see Appendix 10).

B. Cabbage

Research in cabbage is progressing nicely with initial efforts related to control of the diamondback moth (which is devastating to cabbage) and other insects, and disease control. Since the adaptive technology is only now becoming available, validation and extension methodology is currently being developed. Extension efforts to date in cabbage have been minimal.

The effect of MIPH technology on cabbage yields cannot be ascertained at this time; however, the effects of MIPH technology on cabbage production, because of its more intensive management, will be even more dramatic than the results seen with corn or beans.

C. Other Crops

The MIPH has worked with grain sorghum, because it takes a place in the cropping system similar to that of corn, as well as with citrus, peppers, tomatoes, rice, cucurbits and other local crops. Teaching efforts provide input to other crops by the work of the students on their projects and by the work of fourth year thesis students. Research/extension funding is related to corn, beans and cabbage although some work has been done, and the capability exists to expand the work to other crops of Honduras as priorities and funding allow.

D. Maintenance of Natural Resources

All work, research, instruction and extension emphasize the importance of effective natural resources management. The work also recognizes the abundance of labor available and thus values the importance of manual techniques as well as traditional and necessary chemical methods. The development of the Biological Control Center will help strengthen another useful link in the pest control process.

XI. CURRENT STAFF, INSTITUTIONAL SUPPORT, DUPLICATION OF EFFORTS AND LINKAGES WITH OTHER AGENCIES (BOTH PRIVATE AND PUBLIC)

The current staff is well-qualified and consists of 5 members with PhD degrees, 8 with MS degrees, 17 Ingeniero Agronomos and 14 Agronomos. The staff is appropriately trained for the work assigned and efforts to upgrade degree levels are continuous.

Over 30 percent of the MIPH professionals are from Honduras and the percentage is increasing. Most other employees are from the neighboring countries of El Salvador, Nicaragua and Guatemala or from the U.S. The project is continuously looking for good employees from Honduras. In other words, if two potential employees are equal in qualifications, preference will be given to the person from Honduras. Institutional support for the project is good. The school director is supportive of the project; other areas of school support such as the library and business office are positive and quite adequate.

In looking at possible duplication of effort in the country, no other institution or school appears to achieve the academic success of EAP graduates and only very limited plant protection research for small farmers or validation of extension techniques was apparent. MIPH technology supports the SRN extension efforts and, according to SRN extension and plant protection personnel, such expertise is not available other than through the MIPH.

The MIPH serves as a materials source and trainer of a number of public and private groups who serve farmers. These groups appreciate the validated information and techniques available to them and have encouraged greater involvement and technical assistance. The MIPH collaborates with the Ministry of Natural Resources programs in sorghum, beans, extension, research and vegetable production; the National Institute for Formation of Professionals, los Companeros de las Americas, the European Economic Community program in El Paraiso, the Integrated Development Project in Yoro, INTSORMIL (Texas A&M and Mississippi State have located seven theses and dissertation students here), the Center for Technology Transfer in Agriculture, BANADESA (Development Bank Inc.), National Agricultural School, Peace Corps, World Neighbors, Project HOPE and others.

Technical assistance to support the MIPH comes from CATIE, CIAT, the University of Florida, Mississippi State University, Texas A&M University, Project HOPE, Purdue University, Johns Hopkins University, FHIA, and others.

Included in Appendix 5 is a more complete listing of collaborating agencies and institutions.

Funds from AID to support the MIPH on a contract basis have been channeled through FHIA. In addition, FHIA has conducted laboratory residue analyses on a contract basis and provided other technical support on a fee basis. FHIA has no mandate or interest in basic grains, as they work with export crops. Problems have existed with the administrative flow of funds through FHIA. Dollar payments have been held up three months or more at times which has created serious management problems for the MIPH. Much better use of USAID funds with less overhead and more efficient operation of the MIPH would take place if USAID funds went directly to the MIPH.

XII. CONCLUSIONS OF EVALUATION

The program of integrated pest management at EAP (MIPH) is a well organized, well managed and properly oriented operation. The scope of the program has expanded from an idea in 1983 to an operation which now includes over 60 employees and which has extensive contact with farmers and extension professionals. Effective instruction in plant protection is provided to all students of EAP; adoptive and problem solving research is being conducted, mainly on pests of beans, corn and cabbage; effective methodologies for extension techniques are being developed and tested; and new technology is validated for extension use and the technology is shared and repromulgated by extension agents of the SRN and other organizations, which are both public and private and have responsibilities in teaching, research and extension. High quality technical publications for farmer and student use are produced by the project for distribution to areas of need and use. The work of the project has shown increased production when MIPH technology is adopted by farmers. The techniques of crop protection which emphasize the importance of alternate control measures other than pesticides as well as pest management in conservation tillage practices contribute both to production and to maintaining a sustainable natural resource base.

Specifically the project conclusions are listed below.

(1) The MIPH is carrying out its mandate in teaching, research and extension very effectively.

(2) The MIPH project funding should be retained for the remaining years of the project and beyond (see Appendix 11).

(3) The work of the MIPH contributes to the increased production of maize, beans and cabbage and other crops.

(4) Good quality teaching materials, laboratory guides, teaching guides, instructional modules, extension guides and bulletins and other supportive materials are appropriate for use throughout Honduras and Central America.

(5) The MIPH maintains effective, functional linkages with other agencies and institutions both in and out of Honduras.

(6) Each of the specialized centers serve an important need for plant protection in Honduras. The Pesticide Testing and Efficacy Center, the Diagnostic Center and possibly the Self-Help Center have potential for generating supporting revenue.

(7) The Agro-ecological Inventory Center will be an invaluable source of information to agents serving farmer problems and scientists doing work in Central America.

(8) The development of life tables that identify important pest problems at all stages of a plant's life cycle are scientifically sound and useful to extension workers and farmers.

(9) The extension approach with farmers which involves them in identification of the problem, the solution and methodology development with no incentives except payment for loss of yield due to experimental practices is effective and should be continued.

(10) All students at EAP receive greater depth of quality plant protection instruction than other schools known by this evaluation team. The use of expertise in anthropology (including a full-time anthropologist) and associated research on learning behavior is an effective approach which should be continued. This effort by the project is worthy of significant commendation.

(11) The MIPH has capable communications personnel who are producing attractive and useful teaching materials.

(12) Good relationships exist between some SRN extension and plant protection coordinators, and as a result findings of the project MIPH flow through extension agents to farmers.

(13) The extension, research and teaching components of the MIPH complement and strengthen each other.

(14) Interaction between the MIPH and the Department of Rural Development of EAP will help strengthen the transfer of small farmer technology to students of EAP.

(15) The productivity and skills of EAP agronomos is verified by the effective work accomplished by the graduates employed by the project.

(16) The MIPH is consistent with and should contribute to LUPE objectives. MIPH expertise will contribute to the success of LUPE.

(17) The MIPH could be incorporated into the proposed LUPE project. The MIPH develops the technologies and methodologies which should be carried out as an integral component of LUPE.

(18) The collaboration, technical, and personal relations with FHIA have been good. The transfer of funds, especially the changing of Lempiras to U.S. dollars, has not taken place in a timely manner.

(19) MIPH extension techniques and plant protection expertise could open channels to farmers for other priorities of LUPE.

(20) Extension/research validation techniques and delivery systems are appropriate for LUPE. MIPH staff is young and growth of the project has been very rapid. Administrative modifications may be necessary as the program matures.

(21) The work of the MIPH is compatible with and parallels objectives of LUPE because of the MIPH's productivity enhancement and concern for non-renewable natural resources.

(22) Regional sources of revenue should be considered for funding and expanding the biological control effort on behalf of all of Central America.

XIII. RECOMMENDATIONS RESULTING FROM THE EVALUATION

The MIPH at Zamorano is an effective program in teaching, research, extension and train-the-trainer phases of integrated pest management. The coordinated project should be maintained and funded for the remaining life of contract and beyond. The technologies of the project should be developed and expanded throughout Honduras. Specific recommendations follow.

(1) Recommend USAID/Honduras continue support of the EAP/MIPH at US$ 1,000,000 per year. Funding through project LUPE is a viable alternative (see Appendix 12).

(2) If the EAP/MIPH is funded through USAID/LUPE, the mechanism should be a memorandum of agreement between USAID/LUPE and EAP outlining obligations of both parties. Funding should support the following:

a) Research both on and off-station;
b) Extension development and validation activity;
c) Teaching development and teaching research;
d) Extension materials and methodology;
e) Vehicles, teaching and research equipment, supplies and other needed materials;
f) The six specialized centers; and
g) Teaching development and teaching research.

(3) The AID commitment to EAP should be continued throughout the 5-year period and beyond.

(4) There should be close functional linkages between LUPE and EAP/MIPH in order to facilitate:

a) Pest management practices evolved by the MIPH which are usable within the LUPE production and conservation enhancement effort;

b) LUPE's utilization of the extension/research methodology developed by the MIPH; and

c) The possible use by LUPE of EAP capability on a negotiable fee basis for specialized activities such as soil testing, tissue testing, feed analysis, seed processing, anthropological and other surveys.

(5) AID/LUPE should fund the six specialized centers fully for two years followed by reduced funding as the Diagnostic Center and Pesticide Use and Efficacy Center generate replenishment revenue.

(6) Life tables research should be sustained, expanded and improved as other research extension avenues evolve.

(7) If fund reduction is necessary, support to centers should be reduced. The plant protection base of the MIPH should take the lead in information transfer and be the conduit for initial farmer contact and confidence building to be followed by other technologies appropriate to LUPE.

(8) EAP/MIPH should become the Center for plant protection and teaching improvement in Central America. USAID/Honduras should support and encourage ROCAP support to establish EAP/MIPH as a center of teaching improvement for development, training and regional distribution of IPM instructional materials (see pre-proposal Appendix 13).

(9) Regional agencies (ROCAP) should be contacted for support of a regional effort in biological control through the Biological Control Center (Appendix 14).

(10) EAP should be established as a single site not only for diagnostic services related to plant protection but also for soil testing, tissue testing, water testing and other services on a fee basis.

(11) Anthropology work with EAP/MIPH and the Rural Development Department of EAP should be considered for services (by memorandum of agreement) to support LUPE.

(12) Other funding considerations for MIPH/EAP (by USAID/Honduras or LUPE) are programs of training consulting agriculturalists, employment of 5 agronomos who would concurrently complete the EAP fourth year program, and thesis research of Central American students studying related work in the U.S. (See Appendix 15.)

(13) USAID/LUPE should contract with EAP as a resource institution capable of evolving crop production/farm production programs, including soil conservation, preparation, management, water management, post harvest problems and other areas of expertise.

(14) The MIPH should be a part of LUPE. If not, the current funding relationship with FHIA should be discontinued and EAP/MIPH should be funded directly by USAID/Honduras.

(15) In the event full funding is impractical, alternatives for reduction (in priority order) are the six centers, near deletion of one resident site and the cabbage program, and phase down of central support because of less off-station work (see Appendix 16).

XIV. SUPPORTING DOCUMENTATION

A. Guide to Specific Tasks of MIPH/EAP Evaluation

Specific Task Number	Section of Report Where Addressed
1.	V.A-B, VI.D
2.	VI.A-B, VI.D, VII.C
3.	VII.A-D
4.	VIII.A-H
5.	IX.A-B
5.1	V, VI
5.2	V.A-C, X.A-C
5.3	VI.D-E
5.4	V
5.5	V.A-C
5.6	V.A-C
5.7	V.C.1-5
5.9	XII, XIII
5.10	IX.B, XII
5.11	XI
5.12	XI
5.13	XII
5.14	XI
5.15	XI, XII
5.16	XI, XII
5.17	V.C.3
5.18	Appendix 7 and V.C.3-4
5.19	VI.A-E
5.20	VII.A-D
5.21	VIII.A-H
5.22	IX, XI, XII, XIII
5.23	XI
5.24	XI
5.25	V.B.1-3
5.26	VII.C-D, VIII, XII
5.27	V.C
5.28	VI

B. Summary Answers to Specific Tasks from Plan of Work

1. Review and analyze the effectiveness of EAP's integrated pest management research to date in maize, beans and cabbage.

   The work is very effective; progress is covered in the text of the report.

   a) Quality and quantity of on-farm and on-station research is high. Work of outstanding quality is being done with quality people, and the number of experiments is in line with the number of people who carry out the experiments.

b) Papers published are excellent; they have been published in a wide variety of journals and popular sources and serve not only Honduras but also Central America and other Carribean countries.

c) Many scientific symposia were sponsored by EAP and the program indicators showed that attendance and performance were excellent. Faculty members are involved in a number of national symposia.

2. Review and analyze the effectiveness of EAP's IPM extension program in maize and beans.

The extension program has been very effective. It is limited to validating the research that has been done and will not serve the entire needs of the country but would serve as a model to be passed on to the country's extension service (LUPE).

a) Methods used are excellent, they validate information, having anthropologists involved to give good input into the process.

b) Numbers of farmers reached directly and through cooperating institutions are tabulated in the report and the numbers are high. They could be higher if the national extension service (LUPE) were involved as a trainee for the work being done. Media use is currently limited to newspaper, much of which is free and hard to evaluate.

c) The number of international technicians trained is somewhat difficult to ascertain but the report summarizes the numbers of national and international technicians trained over the last few years.

d) Adoption rates range from 20 percent to 50 percent, which is quite good.

e) Extension materials and methodologies are very appropriate to Honduras as well as to other LDCs, especially Central America. An outstanding array of extension materials has been prepared, tested, and distributed. They should be distributed to other extension workers throughout Honduras and parts of Central America.

3. Review and analyze the effectiveness of EAP's plant protection curriculum development efforts to date.

The plant protection curriculum is excellent.

a) Excellent laboratory guides and textbooks have been produced.

b) Audio-visual programs are excellent; 70 modules are on the market and should be distributed throughout Central America.

c) The present curriculum is outstanding; all students at EAP take five courses in plant protection. The overall MIPH has facilitated development of a strong plant protection curriculum.

d) The methods and materials and development lesson materials should be available to all schools in Honduras.

4. Evaluate the EAP specialized Plant Protection Center's orientation and projected effectiveness in dealing with Honduras plant pest problems.

   Specialized plant protection centers are in their infancy and should be expanded to serve the extension work to be done in Honduras and in some cases (Malacolgy Center and Biological Control Center) should serve Central America.

   a) Relevance and importance are discussed in the report. The centers are good and the dignostic and pesticide use in efficacy centers could become self-sustaining. Other centers serve research/production needs of Honduras and Central America.

   b) Cost effectiveness is indicated in the report. The Diagnostic Center and the Pesticide Testing and Efficacy Center could obtain near self-sufficiency in two years.

5. Evaluate the feasibility of incorporating the IPM project into the proposed LUPE project.

   The project should be incorporated into LUPE. LUPE apparently will have the extension arm to reach 50,000 of the 200,000 farmers in the country and the new technology should be channeled through the LUPE extension personnel to enable the realization of the potential of the MIPH. The MIPH extension program is not capable of reaching all the farmers nor was it designed to do so. The research/extension component is considered as one activity to develop the workability and techniques for serving the farmers and pass these on to the national extension service and to other operations such as private volunteer organizations. This should be done.

   1) Was the research focused on small farmers? If not, was the project designed to assist small farmers?

      The research is focused on small farms and was designed to assist the small hillside farmers. Small farmers benefit from the technology if they are involved and the technology spreads to other large farmers where appropriate. The only factor that prevents small farmers from benefitting was that many small farmers were not contacted or close to the work. Large farmers capitalized because they were more in line with what research was going on at the EAP Research Station which enabled them to capitalize on the technology.

   2) Did the research concentrate on crops produced by small farmers, on crops important to resource-poor regions of the country, or on foods important to the diets of the rural poor?

      The research concentrated on corn, beans, and cabbage although a number of other crops are encountered in the research (especially sorghum). The research focused on these crops as cash crops in some cases, as food crops in others, and in some cases as both. Cabbage is primarily a cash crop. The MIPH should include other crops.

3) Did the research conducted take into account the constraints under which the farmer operates?

The research certainly took into account the constraints of water, credit, marketing system weaknesses and producer prices, and worked with many people on land reform farms. The program develops a menu of alternatives that work under maximum or minimum credit, under high or low prices, and also took into consideration the fact that manpower was available and should be used wherever possible as the cheapest source of labor or energy to carry out the cropping practices. The anthropologists were involved in the project both as consulting and full-time anthropologists to work with the people to help the learning process take place and to fit in the sociocultural limitations of the technology.

4) Was there an attempt by the researchers to analyze the effect of the project and its new technology on the beneficiaries during project implementation?

The researchers analyzed the effects of the project throughout its implementation. They monitored the effects with anthropologists, with the studies from live-in anthropologists/agronomists, and fed the information back into the design of the process. As a result, the procedures changed, the process changed, and the methodology was developed with these factors in mind.

5) Was realistic on-farm testing carried out in order to adapt the technology to local conditions?

The on-farm testing has evolved with the cooperation and coordination of the farmers and the methodology was developed to provide input at all levels. It was very adaptive and useful as a learning tool while the research was taking place. Many side effects occurred, including the spinoff of a farmer learning about areas peripheral to research while the research was being carried on. Farmers participated and in some cases there was an incentive if the farmer could not grow beans; he was given bean seeds with the understanding that the bean seeds would have to be returned when the crop was harvested. Other incentives were not given because they were not needed. The farmers benefit from the technology and increased yield (or the ability to grow beans).

6) Were farmers involved in carrying out the research?

Farmers were directly involved in carrying out the research. They were involved in the planning and the problem identification, and worked in the testing, and technology evaluation. Their continuous involvement helped them to learn. Many of the groups were land reform groups so all farmers were involved in the project. In some cases there was limited involvement but overall the information was passed on to others who were not directly involved.

7) Did the research make use of inter-disciplinary expertise, or was it conducted along narrow, disciplinary lines?

One limitation of the research was that it was tied to pest control. The narrow approach of pest control did not adversely affect the results

because it did solve the pest problem. By being involved in LUPE, the research and extension work would be broader and would help farmers in other areas of implementation. One side effect was that production expertise (other than the direct pest control) was transmitted through an overall extension program. The design and implementation of the program was excellent. The problems were identified, objectives were set, experiments were conducted to find the answers, and delivery systems were developed.

8) Is the project scope large enough to achieve the results expected?

The project was large enough to see the results and validate the work. The only delays that caused problems were the delays of ZHIA in getting the funding (especially funding in dollars) through on time.

9) Were the institutional structures for research and extension adequate to facilitate the research effort?

Good institutional linkages were established for research and extension. These were summarized in the report and one linkage that needs to be continued is the ability to carry out this work through the national extension service. LUPE offers this alternative. The overall system as it was designed utilized available manpower and equipment very well. There was not excessive fragmentation of the work within the unit and there were good relations with other agencies with which it worked. There was no other research on basic grain crops or cabbage so there was no duplication of effort.

10) Was the priority accorded to the project by the host country government sufficient to ensure the success and sustainability of the research effort?

Priority was appropriate by the host country and the resources provided by Zamorano were good. Price incentives were not needed to encourage farmers to participate; they adopted the technology as it helped them to make more money and produce more crops. The auxiliary government services created problems; credit could have been used in some cases and certainly marketing assistance needs to be developed for all. One constraint was a lack of poison baits being available for slug control. A coordinated effort is needed and LUPE could coordinate this effort utilizing the expertise and the input of the MIPH, hopefully making the MIPH part of the overall project.

11) Were the staff assigned adequately trained?

Staff assigned for the project were adequately trained. Most were Zamorano graduates who had good basic expertise, and a strong work ethic, and who performed very well.

12) Were host country personnel adequately integrated into the research programs?

Host country personnel were integrated into the program; 30 percent of the workers are Honduran and that percentage is increasing.

13) Was the training program successfully implemented?

The training program was successfully implemented.

14) Were there problems with procuring equipment and materials necessary for project implementation?

The only delays were in equipment and construction; delays in receiving funding from FHIA (especially U.S. dollars) has been a continuous problem.

15) Was the performance of long-term technical staff adequate?

Long-term technical staff performed adequately. There were no delays necessarily in field staffing, although turnover of staffing has created some problems. All people were adequately qualified in Spanish and most have a good capability in English.

16) Was the short-term technical assistance used during the project employed effectively?

Short-term technical assistance was used. For example, consulting anthropologists and pest control people from a number of institutions have been utilized very effectively with skills which have enchanced project operation. Short-term technical assistance was provided regularly and seemed to meet the needs of the project.

17) What research papers were published?

Many research papers were published for general audiences, for scientific audiences, and for farmers. They were widely disseminated through short courses and other media. They are summarized in the report.

18) What scientific symposia were sponsored and attended?

A number of scientific symposia were sponsored and attended. The purpose was to expand pest control knowledge to others, and they were a useful means of transmitting and collecting information for the project. It was a good use of project funds in that it multiplied the expertise developed by the project.

19) What extension methods were used?

Everything in extension methods was used from flip-charts to slide projector and expensive other media. The most effective methods were the flip-chart and presentations by the experts. Materials and audiences were tested in cooperation with anthropologists and are appropriate not only for Honduras but also for Central America. The numbers of people contacted are summarized in the report.

20) What kind of teaching materials were produced by the project?

Excellent teaching materials have been prepared by the project. The presence of the project helped the development of good teaching materials

and 70 modules of instruction and plant protection are available for distribution. These should be distributed throughout Honduras and Central America for use in enhancing instruction in plant protection throughout the area.

21) Is the Plant Protection Center useful to Honduras?

The Plant Protection Centers are useful to Honduras. The Pesticide Efficacy Centers could become self-sufficient as could the Dignostic Center. The others will serve the needs of the country and more than offset their cost by value returned to the country.

22) Is the IPM project well situated within FHIA?

The MIPH should not be situated under FHIA. It should be either funded through LUPE or under direct funding from USAID/Honduras. LUPE should pay for the entire project and incorporate the entire project into the overal LUPE project. EAP is a good home for the MIPH.

23) Does the project have linkages with research institutions or government agencies in the developing countries?

The project has linkages which are summarized in the appendix. These linkages are formed as needed at the administrative level and serve throughout the project.

24) Have professionals from the developing country participated in the research?

Professionals from the developing country have participated in the research as have host country personnel. Thirty percent of the project personnel are host country and the other personnel are primarily from surrounding Central American countries with some from the United States.

25) Was the quality of the research conducted adequate?

The quality of the research was good. Experiments were well designed, effectively carried out, and analyzed properly, and the information was disseminated appropriately.

26) What unexpected side effects have occurred as a result of the research?

As a result of the research, farmers are trying to do better and be more innovative in carrying out practices that will make them more money. The research needs to be spread to more farmers so more use can be made of it. LUPE should expand the use.

27) Has the research program objective to increase the scientific knowledge base, or create or improve a given technology?

The research has not only increased the scientific knowledge base it has also helped create a better application of existing technology. In addition, the menu of technologies has benefitted; for example, on slug control, having a bait alternative, a bait trap alternative, or good weed control are different types of technology that can be applied according to need and appropriateness.

28) Have the research findings been adequately disseminated?

Research findings have been disseminated throughout the scientific community and throughout the communities in which the MIPH is working. They should be directed through the extension service and through project LUPE as a means of dissemination to the farmers so the good information can be spread. They should also be distributed to other areas with similar problems in Central America. The purpose of the project was to develop the technology and the methodology in cooperation with farmers and put it together so that it would work as an extension outreach. This has been done and the main constraint to the use of these findings is having a vehicle where they can be distributed to more farmers. This should be the national extension service project under LUPE.

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C. Evaluación de la Actividad del Manejo Integrado de Plagas de Honduras (MIPH) en la Escuela Agrícola Panamericana (EAP)

RESUMEN EJECUTIVO

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I. Objetivos Desarrollados del Proyecto

Desde 1983 se ha venido desarrollando un programa de manejo integrado de plagas en la Escuela Agrícola Panamerica (EAP). En 1986, AID en Honduras se comprometió con la EAP para financiar un proyecto de cinco años en Manejo Integrado de Plagas con los dos últimos años de financiamiento contingente en los resultados de una evaluación a llevarse a cabo durante el tercer año del proyecto. La fecha de la evaluación fue cambiada del año 3 al año 2 del proyecto con el propósito de facilitar la programación de financiamiento, y para determinar si el proyecto MIPH tiene elementos que sean compatibles con el Proyecto titulado Uso de la Tierra e Intensificación de la Productividad (LUPE) propuesto por AID/Honduras.

El manejo del proyecto en la EAP ha sido a través de la Fundación Hondureña de Investigación Agrícola (FHIA), la cual ha proveído apoyo técnico y administrativo. La proyección de las tecnologías desarrolladas por el proyecto se puede ver en el incremento de L 40 millones/año en la producción nacional anual bruta. El papel del proyecto de manejo integrado de plagas consistió en proveer un programa integrado en protección vegetal por medio del desarrollo de nuevas tecnologías donde las recomendaciones ya existentes son deficientes y luego probar los procedimientos y materiales de extensión para la transferencia de tecnologías validadas a los capacitadores y campesinos. El énfasis del trabajo es con pequenos agricultores en los cultivos de maíz, frijol y repollo. Empleados del programa residen en las regiones de El Paraiso, Yoro, Olancho y Siguatepeque.

II. Propósitos de la Evaluación

La evaluación fue diseñada y conducida para revisar y analizar la efectividad del proyecto MIPH en la EAP. Se evaluaron el efecto de las tecnologías en investigación extensión, metodologías para transferencia, su impacto en la aceptación por el agricultor y el efecto final en la economía nacional.

Se ha evaluado el papel y la efectividad de seis centros (Centro de Autocapacitación, Centro de Diagnóstico, Centro de Inventario Agroecológico, Centro de Eficacia y Manejo de Plaguicidas y Centro de Malacología Aplicada). La contribución del programa de enseñanza y el valor y efectividad de los materiales preparados por el proyecto fueron evaluados.

La compatibilidad y contribuciones del programa de MIP de la EAP con el proyecto propuesto por AID (LUPE) fueron evaluados para determinar si el proyecto MIPH es apropiado para ser financiado total o parcialmente por LUPE. Se le dió especial atención al papel del incremento en la producción y las contribuciones por el mantenimiento de recursos naturales sustentables por el proyecto MIPH en la EAP.

III. Método de Estudio

Después de la llegada a Honduras, el lider del equipo recibio una explicación en la oficina de Desarrollo Rural de AID en Honduras donde los objetivos de la evaluación fueron promulgados. En la EAP se les proporcionó una descripción completa sobre el alcance del proyecto, las tecnologías desarrolladas, metodologías desarrolladas y validadas, materiales de enseñanza producidos y entrevistas a profundidad con los coordinadores de los programas de las divisiones dentro del proyecto, administradores de la EAP, estudiantes y otros familiarizados con el proyecto. Se gastaron cinco dias con el personal de campo del proyecto en los lugares de Siguatepeque (repollo), Olancho y El Paraíso. Alrededor de 100 campesinos cooperadores fueron contactados en la fase del campo. Además se tuvo la oportunidad de observar y participar en las actividades de investigación extensión. Entrevistas personales fueron conducidas con el personal del SRN (extensión y otro personal), representantes de organizaciones privadas (Los Compañeros de la Americas, Proyecto HOPE, Cuerpo de Paz) y otros que interactuan con el proyecto.

Evaluación de actividades creativas y académicas y los resultados de los materiales para enseñanza y entrenamiento fueron dirigidos a la cantidad de producción, calidad y conveniencia para la audiencia a ser servida. La interacción del proyecto MIPH con el personal de extensión del SRN y otras actividades de los agentes de cambio, ambos públicos y privados, fueron estudiadas y evaluadas. La conveniencia del programa a las metas y objetivos de LUPE fueron consideradas en todas las fases de la evaluación.

IV. Descubrimientos

El proyecto MIPH de la EAP ha desarrollado un programa integrado de protección vegetal con excelente capacidad en MIP con programas profundos y experiencia en investigación, extensión y enseñanza. Las tres áreas se complementan una con otra en alcanzar los objetivos globales del proyecto.

El programa en protección vegetal esta muy bien desarrollado y utiliza materiales preparados en MIPH como ser libros de texto, guías de laboratorio, módulos de enseñanza audiovisual y muchos otros materiales bien preparados. Los estudiantes reciben un entrenamiento teórico/práctico bien balanceado.

La investigación dentro y fuera es trabajo encaminado a resolver los problemas de producción que enfrentan los campesinos de Honduras. Las técnicas de investigación usadas son buenas y utilizan métodos adecuados para la recolección, procesamiento y difusión de datos. El trabajo de investigación esta integrado dentro de programas de extensión y se conduce una investigación detallada sobre transferencia de métodos a fin de encontrar métodos aceptables por los campesinos. Los antropólogos, tanto empleados y consultores, estan involucrados en el desarrollo de métodos de transferencia aceptables. Se realiza una continua validación de investigación de modo que los descubrimientos puedan ser integrados dentro de la metodología de extensión. Los agricultores son involucrados en todo el proceso de identificación de necesidades de investigación y en el desarrollo de metodología de investigación y extensión, y metodología para incrementar la productividad del cultivo y el mantenimiento de los recursos naturales. Se ha puesto énfasis en desarrollar metodologías seguidas por la capacitación del capacitador.

El programa ha producido una gran variedad de materiales de enseñanza para ser usados en extensión. La calidad de los materiales de instrucción es buena y la capacidad de producir material textual y visual apropiado es excelente.

V. Conclusiones

El proyecto MIPH de la EAP es un programa efectivo y bien conducido que cumple con sus mandatos de enseñanza, investigación y extensión. Se han desarrollado materiales de enseñanza efectivos, los cuales deberían ser utilizados por todo Centro America. Las tecnologías y metodologías de investigación/extensión son efectivas y sirven como modelo capaz de dirigir los procedimientos de transferencia de otras tecnologías de producción de cultivos. Los estudiantes en la EAP reciben un excelente entrenamiento en protección vegetal por medio de teoría y aplicación práctica.

Los programas de investigación en producción usando cero labranza y prácticas de control de plagas, el cual no enfátiza un máximo uso de plaguicidas, son compatibles con los objetivos del proyecto LUPE. Los 6 centros especializados estan interrelacionados y sirven a todo el programa de MIPH. Su valor para los estudiantes, maestros, extensionistas e investigadores continuaran mejorando a medida que los centros desarrollen sus programas y base de datos. Los centros, especialmente el Centro de Diagnóstico, el Centro de Control Biológico y el Centro de Eficacia y Manejo de Plaguicidas serían de valor especial para LUPE.

En la EAP existe una relación buena y efectiva con los colaboradores públicos y privados y con los agricultores alcanzados. Los agricultores estan cambiando sus prácticas agrícolas, como resultado del proyecto MIPH. La calidad y cantidad de materiales de investigación y extensión producidos por MIPH/EAP son excelentes. Además de MIPH, la EAP tiene la capacidad de servir como impulsador y suplidor de recursos y tecnologías para LUPE, inicialmente en los departamentos de Agronomía y Desarrollo Rural y en recursos de Antropología y Comunicaciones ahora en la EAP.

VI. Recomendaciones

El proyecto MIPH debería tener un nivel de financiamiento de por lo menos US$ 1.0 millón de dólares por cada uno de los años 3, 4 y 5 del proyecto y más aún. Los

centros especializados son efectivos y deben ser mantenidos y desarrollados. La metodologías para el desarrollo y transferencia de tecnología desarrollada deben ser expandidas e incluir otras áreas de especilización como ser agronomía y desarrollo rural.

El trabajo del proyecto MIPH esta directamente relacionado con el proyecto LUPE. Si el proyecto MIPH llega a ser parte de LUPE, recomendamos a USAID/Honduras que el proyecto LUPE financie EAP/MIPH por lo menos con US$ 1.0 millón de dólares por año para inclusión en el proyecto. El financiamiento debe ser incluído para investigación, enseñanza, extensión e investigación en enseñanza. Se debe incluir financiamiento para investigación dentro y fuera de la escuela y para trabajo de extensión asi como apoyo para equipo, infraestructura, los 6 centros y apoyo para actividades de antropología y comunicación.

El compromiso y responsabilidad de EAP/MIPH y LUPE/USAID debe ser por un memorandum de entendimiento describiendo el nivel de financiamiento y las obligaciones de cada uno. El proyecto LUPE debe considerar a la EAP como fuente de apoyo de servicios para otro trabajo de LUPE como ser análisis de suelo, agua, alimento y tejido, y además desarrollo rural y esfuerzos en extensión, tanto fuera de la escuela como por medio de talleres de trabajo, cursos cortos e internados. Tales esfuerzos podrian ser provistos mediante modificaciones al memorandum de entendimiento.

MIPH/EAP ha desarrollado materiales de enseñanza relevantes, incluyendo 70 módulos de enseñanza en protección vegetal integrada. Estos materiales y técnicas de enseñanza tienen valor para otros educadores agrícolas en Honduras y Centro America. Se recomienda que AID/Honduras solicite por medio de ROCAP u otra agencia regional, financiamiento de aproximadamente US$ 400,000 por año durante 5 años para un mayor desarrollo, capacitación y la distribución regional de los materiales de capacitación en manejo integrado de plagas en Centro America.

VII. Lecciones Aprendidas y su Impacto en el Desarrollo

El proyecto MIPH/EAP ha desarrollado un buen programa en todas las fases de MIP. La adopción de metodologías desarrolladas puede tener un impacto significativo en la disponibilidad de alimento y en el producto bruto doméstico de Honduras. Las tecnologías donde se las adopten pueden tener impacto en la producción de maíz en más de 30% y en frijol en 40% y aún un mayor impacto en la producción de repollo.

Protección vegetal provee un fácil acceso a los agricultores por las soluciones provistas, las cuales son generalmente dramáticas y positivas. Las tecnologías y metodologías desarrolladas por MIPH/EAP serian un buen vehículo de acceso al agricultor para la actividad inicial de LUPE. La información de MIP podría alimentar rápidamente a la audiencia campesina y luego seguir con otros programas. Las actividades de MIP servirian como conducto de donde fluyan otras tecnologías. Otras áreas de agricultura como agronomía y manejo de finca necesitan ser incluidos en la metodología recibida por el agricultor a fin de maximizar el rendimiento y retorno económico. Así como otras tecnologías se han agregado a los programas para agricultores (ejemplos, ensayos de suelo, fertilización, población de plantas y otros), protección vegetal puede servir para proteger la inversión del agricultor en producción.

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STATEMENT OF WORK

A. Title

Evaluation of the Integrated Pest Management (IPM) Activity at the Escuela Agrícola Panamericana (EAP).

B. Objective

The purpose of this evaluation is to determine progress made to date with respect to the development and success of research pertaining to integrated pest management: the identification and development of viable technologies to deal with pest management; the dissemination of those technologies and the development of appropriate training materials.

C. Background

The purpose of the IPM activity is to improve pest management capabilities in Honduras by implementing outreach-oriented research and training programs focused on the use of safe, efficacious and socio-economically acceptable control practices of important pests affecting Honduras' small-scale basic grain and vegetable farmers.

Under a three-year Integrated Pest Management local currency Operational Program Grant (OPG) with the EAP, their Department of Plant Protection was provided approximately L1.5 million to develop integrated control measures for major bean and corn pests in Honduras. Funds were provided for the research and development of training materials and their extension as well as for the development of viable technologies for dealing with these pests. The first phase project was completed in September 1986.

Prior to the original expiration date of the Grant in May 1986, EAP submitted a proposal to the Mission requesting funds to help them continue basic integrated pest management research during a second phase effort for five years (1986-1991). Based on the Project's strong record of innovation and productivity and, in an effort to take advantage of EAP's existing institutional capability, the Mission approved financing for three years of the five year second phase effort. Financing for years four and five was made contingent upon the results of an evaluation to be held in year three, hence the rationale for this evaluation.

Given the need to approve financing for the activity in year four in early 1989 and the timing of the crop cycle, it was felt best to hold the evaluation in the summer of 1988 rather than 1989. In addition the Honduran AID Mission is presently developing the Project Paper Document for LUPE an extension-oriented program designed to increase production especially of basic grains at the same time the natural resource base of producers is preserved. The IPM Project is operationally and philosophically compatible with this major effort and the Mission is interested in evaluating the feasibility of including IPM within LUPE.

Also, in an effort to develop closer operational ties between existing private sector entities, the IPM activity was formally incorporated under the Agricultural Research Foundation Project (522-0249) with the Honduran Agricultural Research Foundation (FHIA). Although linkages between the institutions are longstanding, formal incorporation was just recently completed with the signing of a tripartite Memorandum of Understanding.

Under the second phase, the basic Project modus operandi is unchanged. Maize and beans continue to be the major concern, but cabbage and other vegetable crops receive increasing emphasis. More emphasis is placed on plant pathology and weed science. The Project validates existing procedures and generates new technologies where extant recommendations are deficient. Subsequently, the Project develops and validates extension procedures and materials for the transfer of the validated programs.

In addition to the on-farm technology generation, validation and transfer work, substantial emphasis is being placed on the development of new institutional capabilities which can enhance the EAP's ability to deal simultaneously with the region's plant protection problems and contribute to a permanent self-sustaining program. Key elements of this effort include the development of the Tropical Agricultural Malacology Center, the Diagnostic Center, the Self-help Center, the Agroecological Inventory Center and the Pesticide Efficacy and Safety Center. Interinstitutional linkages are being created and strengthened.

Scope of Work

The contractor, in close coordination with the Mission offices of Agriculture and Project Development will evaluate MIPHs contributions and progress, focussing on measurable parameters included in the "Proposal for a Second Phase of the Project Integrated Pest Management in Honduras" presented to USAID/Honduras on April 21, 1986.

Specific tasks include:

1. Review and analyze the effectiveness of EAP's integrated pest management research in maize, beans and cabbage to date. The evaluation should focus on (but not be limited to) the following areas :

    (a) On-farm and on-station research carried out.

    (b) Specific papers published.

    (c) Scientific symposia sponsored and attended.

2. Review and analyze the effectiveness of EAP's IPM extension program in maize and beans. The evaluation should focus on, but not be limited to, the following areas:

    (a) Extension methods used.

    (b) Number of farmers reached directly, via cooperating institutions and through use of the media.

(c) Number of national and international technicians trained via short courses, in-service-training and the teaching materials produced.

(d) Adoption rates observed among participating farmers.

(e) Research on extension materials and methodology, applicable to Honduras and other LDCs.

3. Review and analyze the effectiveness of EAP's plant protection curriculum development efforts to date. The evaluation should focus on, but not be limited to, the following areas:

(a) Laboratory guides, texts and other major work published.

(b) Audiovisual programs produced.

(c) EAP's present IPM curriculum.

(d) Value of EAP's methods and materials for Honduran and Central American agricultural schools and universities.

4. Evaluate the EAP specialized plant protection Center's orientation and projected effectiveness in dealing with Honduras plant pest problems.

Parameters to be evaluated include:

(a) Relevance and importance to Honduran agriculture of the Diagnostic, Self-help, Biological Control, Agroecological Inventory and Pesticide Use and Efficacy Centers.

(b) Cost-effectiveness of the centers and perspective for their self-sustainability.

5. Evaluate the feasibility of incorporating the IPM project into the proposed LUPE project. The following list of evaluation study questions will be answered. These questions will help focus the evaluation.

1. Was the research focused on small farmers? If not, was the project designed to assist small farmers?
   - Did factors prevent the smaller farmers from benefiting from the new technology?
   -What factors prevented smaller farmers from benefiting from the project or were responsible for farmers outside the target group (such as larger farmers) capturing the benefits?

2. Did the research concentrate on crops produced by small farmers, on crops important to resource poor regions of the country, or on foods important to the diets of the rural poor? Did the research focus on a cash crops, food crops, or both?

3. Did the research conducted take into account the constraints under which the farmer operates?
   - Availability of required inputs (seed, fertilizer, water, pesticides):
   - Availability of credit;
   - Weaknesses in the marketing system;
   - Producer prices;
   - Land tenure;
   - Employment considerations (manpower availability and seasonality, alternative sources of income, and so forth); and
   - Socio-cultural limitations of the technology.

4. Was there an attempt by the researchers to analyze the effect of the project and its new technology on the beneficiaries during project implementation?
   - How were these results monitored (surveys, frequent contact with beneficiaries, evaluations, and so forth)?

   - Was this information fed back into the design and implementation process?
   - What unexpected side effects occurred as a result of the research?

5. Was realistic on-farm testing carried out in order to adapt the technology to local conditions?
   - What problems were encountered in implementing the on-farm research?
   - Who conducted the field testing?
   - Was the methodology used sufficient to permit lower-level researchers to do scientifically valid research under the less controlled? conditions associated with on-farm adaptive research

   - Were there logistical problems associated with conducting on-farm research?
   - What type of research was carried out on-farm?
   - What type was carried out on station?
   - How many farmers participated in the on-farm research program?
   - Did the program develop and disseminate technologies which benefited farmers economically?
   - What incentives or mechanisms were used to encourage researchers to do on-farm research aimed at the problems or small farmers?

6. Were farmers involved in carrying out the research?
   - What role did the farmers play in the technology generation process (such as constraint identification, testing, technology evaluation, and so forth)?
   - What incentives were used to encourage their participation?
   - What measures were used to ensure that the farmers involved were representative of all farmers as a group?

7. Did the research make use of inter-disciplinary expertise, or was it conducted along narrow, disciplinary lines?
   - Did the use of a narrow, disciplinary approach adversely affect the project's success?
   - What factors contributed to or hindered the implementation of an inter-disciplinary approach?

Were the design and implementation of the research program itself adequate? Were the problems correctly specified, realistic objectives set, the experiments professionally conducted, and so on?

8. Is the project scope large enough to achieve the results expected? Is the project life span long enough to permit the project to mature and producer results? Did delays in construction or inadequate facilities adversely affect the research program of the project?

9. Were the institutional structures for research and extension adequate to facilitate the research effort?
   - Was the linkage between the research center and extension service adequate to meet the needs of technology dissemination?
   - Was the overall research and extension system adequate in terms of availability of manpower, equipment, financial resources, and so forth?
   - Was there an excessive fragmentation of research and extension among agencies?
   - Did the research conducted duplicate research efforts undertaken elsewhere in the country?

10. Was the priority accorded to the project by the host country government sufficient to ensure the success and sustainability of the research effort?
    - Were required resources (personnel, budgetary support, equipment, fuel, and so forth) supplied by the government/Zamorano to the project at the required level?
    - Were there adequate price incentives to encourage the farmers to adopt the technology being developed by the research effort?
    - Was the absence of auxiliary government services (credit, provision of inputs, marketing assistance, and so forth) a constraint to project success?

11. Were the staff assigned adequately trained?

12. Were host country personnel adequately integrated into the research programs?

13. Was the training program successfully implemented?

14. Were there problems with procuring equipment and materials necessary for project implementation?

15. Was the performance of long-term technical staff adequate?
   - Were there delays in fielding staff?
   - Were the qualifications and experience of the long-term staff adequate? Was language ability a problem?

16. Was the short-term technical assistance used during the project employed effectively?
   - Did the consultants' skills match project needs?
   - Was the short-term technical assistance provided in a timely manner?
   - Were the recommendations made by the short-term technical assistance consultants adopted by the long-term staff? If not, why?

17. What research papers were published?
   - What was the target audience of these papers?
   - Were they widely disseminated?

18. What scientific symposia were sponsored and attended?
   - What was the purpose of these symposia?
   - Were they an effective means of transmitting and/or collecting information useful to the project?
   - Was this a good use of project funds?

19. What extension methods were used?
   - Were they cost effective?
   - How many farmers were directly contacted by project extension agents?
   - How many farmers reached by means other than direct contact with extension agents?
   - How many of the farmers contacted adopted project technologies?
   - How were extension materials and methods tested?
   - Were they appropriate for Honduras and Central America conditions?

20. What kind of teaching materials were produced by the project?
   - Were they employed in teaching students and training farmers?
   - Did the project contributes to EAP's IPM curriculum?
     - If so, what courses and or materials did t contribute.
     - Did MPH help improve the EAP IMP curriculum?
     - Are the courses and/or materials developed useful to other Central America countries agricultural schools or universities?

21. Is the plant protection center useful to Honduras?
   - Who uses the Center?
   - Is it cost effective?
   - Can it become economically self sufficient?

22. Is the IPM project well situated within FHIA?
   - What can FHIA contribute to the IPM Project?
   - What can the IPM project contribute to FHIA?

Would the IPM Project be better situated in the LUPE Project?
Should IPM be incorporated into LUPE?
   - Should LUPE pay for the entire project?
   - Should LUPE incorporate only specific aspects of the IPM project?

23. Does the project have linkages with research institutions or government agencies in the developing countries? Were these linkages formed in a timely manner? At what administrative level?

24. Have professionals from the developing country participated in the research? Were host country personnel trained through the project? What problems were encountered in conducting research in the developing country using local institutions and researchers?

25. Was the quality of the research conducted adequate? Were the experiments adequately designed and carried out?

26. What unexpected side effects have occurred as a result of the research? Has this information been fed back into the research program?

27. Has the research program objective to increase the scientific knowledge base, or create or improve a given technology?

28. Have the research findings been adequately disseminated? What mechanisms have been used for this dissemination? To whom have the findings been directed? What have been the constraints to the use of these findings?

In order to accomplish the above detailed tasks, the Contractor will provide the Services of three individuals for a total of 40 work days with the following qualifications:

1. IPM research specialist (18 working days). Good working knowledge of English and Spanish, a PhD in agricultural or related field is desirable, at least 3 years experience in applied IPM research in developing countries.

2. Extension specialist (12 working days). Good working knowledge of English and Spanish with at least 5 years experience in outreach efforts oriented to mainly illiterate, resource scarce farmers. Should be knowledgeable of IPM practices and participative extension methodologies. MS in extension or related agricultural field is desirable.

3. Teaching specialist (6 work days). Good working knowledge of English and Spanish with at least 3 years experience in teaching and training programs in developing countries. IMP experience desirable.

E. Time Frame

The contractor will provide these individuals for a period of 3 weeks. The consultants will arrive in Honduras beginning mid July 1988. A six day work is authorized.

F. Relationships and Responsibility

The contractor will present five copies of a draft (in English) for discussion with USAID 3 days prior to departure from Honduras. This report shall include:

- Executive Summary: Containing development objectives of the project or program to be evaluated, purpose of the evaluation, study method, findings, conclusions, recommendations, lessons learned, and comments on development impact. The Executive Summary must be a self-contained document;

- Project Identification Data;

- Table of Contents;

- Body of the report (approximately 30-40 pages) must include the purpose of the study questions of the evaluation; the economic, political, and social context of the project or program; team composition, field of expertise and role it played in the evaluation, and study methods (one page maximum); findings of the study concerning the evaluat on questions (any deviation from the scope of work must be explained); conclusions; recommendations, in a separate section of the report; lessons learned and comments on development impact; and,

- Appendixes: Which should contain the scope of work and lists of individuals and agencies contacted, and documents consulted.

A separate version of the executive summary should also be prepared in Spanish (3 copies).

Following receipt of written Mission comments the contractor will incorporate the proposed revisions and complete the report within 3 weeks after receipt of Mission comments. The final report and five copies will be forwarded to the Mission.

G. Miscellaneous

The Mission is presently developing a new project, Land Use Productivity Enhancement (LUPE), which focuses on dissemination of appropriate technologies to small and medium size basic grain producers. Given the recent changes to the FHIA mandate, the IPM activity seems more consistent with LUPE goals. LUPE project design documentation to date suggests that close collaboration with IPM or incorporation of the IPM activity in LUPE is desirable. Therefore, the earliest possible evaluation of the IPM activity will provide useful information for the LUPE Project Paper which is planned for FY88 approval.

SECCIONES Y ENCARGADOS DE SECCIONES DENTRO DEL DEPARTAMENTO DE PROTECCION VEGETAL

AGOSTO, 1988

Sección o Actividad	Personal	Responsabilidad
Enseñanza	Dr. Jacobo Cáceres	Coordinador
	Secret. Iris Juarez	Secretaria
Comunicación-Enseñanza	Com. Juan M. García	Comunicador
	MAP. Darlan Matute	Dibujante
	MAP. Samuel Trigueros	Dibujante
	Br. Oscar Ortiz	Dibujante técnico
	P.M. Ricardo Ortiz	Fotógrafo
	Secret. Sara de Velásquez	Secretaria
Antropología	Dr. Jeffery Bentley	Coordinador
	Agr. Werner Melara 1	Ayudante de Inves.
Entomología	Dr. Ronald Cave	Coordinador
	Agr. Gerardo Márquez 1	Ayudante de Enseñanza-Inves.
	Ing. Luis Vásquez	Ayudante de Investigación
	Sr. Juan Angel Sánchez	Ayudante en el campo
	Srta. Julia Ortega	Ayudante de Laboratorio
	P.M. Diana Rubio	Ayudante de Laboratorio
Fitopatología	Dr. Jacobo Cáceres	Coordinador
	Agr. Pedro Calderón	Ayudante de Enseñanza-Inves.
	Sra. Wolvia Ramos	Ayudante de Laboratorio
Malezas	Dr. Abelino Pitty	Coordinador
	Ing. Roni Muñoz	Ayudante de Inves.-Enseñanza
	Agr. Jaime Vega 1	Ayudante de Inves.-Enseñanza
Malacología	Dr. Keith Andrews	Coordinador
	Ing. Rafael Caballero	Ayudante de Inves.-Enseñanza
	Agr. Juan Ordóñez 3	Ayudante Investigación
	Lic. Marlene Medina 5	Microbióloga
Plaguicidas	Ing. Kimberly Taylor	Coordinador
	Sr. Jorge Araque	Ayudante de Campo
Control Biológico	Dr. Ronald Cave	Coordinador
Centro de Autocapacitación	Ing. Hernando Dominguez	Coordinador
	Ing. Penny Jennings 4	Colaborador
Producción	Ing. Rogelio Trabanino 2	Coordinador
	Agr. Juan Marenco	Ayudante de Inves.-Enseñanza

Centro de Inventario Agroecológico	Dr. Ronald Cave	Coordinador
	Br. Rosa Ortega	Montaje, procesamiento
Sistemas de Labranza	Dr. Abelino Pitty	Coordinador
	Ing. Alí Valdivia	Investigador
Centro de Diagnóstico	Ing. Javier Gutiérrez	Coordinador
	Lic. Marlene Medina 5	Microbióloga
	Agr. Héctor Hernández 1	Procesamiento inicial
Enlace ENA	_____ (Vacante)	
Repollo	Ing. Carlos Herrera	Coordinador
	Ing. Reynaldo Sánchez	Ayudante de Inv-Ext
	Agr. Victor Rivas	Ayudante de Inv-Ext
	Lic. Mario Ardón	Animador social
	Agr. Marvin Mora 1	Ayudante de Inv-Ext
	Secret. Yadira Barahona 2	Secretaria
Maíz-Frijol	Dr. Keith Andrews	Coordinador
Olancho	Ing. Luis del Río	Supervisor Regional
	Agr. Pedro Quiel	Ayudante de Inv-Ext
	Agr. Iván Navarrete	Ayudante de Inv-Ext
	Agr. Juan Bautista Rubio	Ayudante de Inv-Ext
	_____ (Vacante)	Agrónomo-antropólogo
El Paraíso	Ing. Orlando Cáceres	Supervisor Regional
	Agr. Guillermo Cerritos	Ayudante de Inv-Ext
	Agr. César Moscoso	Ayudante de Inv-Ext
	Ing. Ramón Fuentes	Ayudante de Inv-Ext
	Ing. Ramón Escobar	Ayudante de Inv-Ext
Enlace Interinstitucional	Ing. Juan Herrera	Coordinador
Comunicación	Lic. Bernardo Martínez	Comunicador
	Secret. Lourdes de Jiménez	Secretaria
Administración	Dr. Keith Andrews	Jefe
	Lic. Rafael Turcios	Administrador
	P.M. Mario Torres 6	Contador
	Secret. Aleida Cruz	Secretaria Ejecutiva
	Secret. Carmen de Herrera	Secretaria
	Sra. Isbela Avila 6	Conserje
	Sr. Domingo Avila	Conserje
	Sr. Pablo Polio	Jardinero
	Lic. Suyapa Meyer	Coordinadora Computo
	Ing. Edmundo Porras	Comunicador (un tercio)

Estudiantes Posgraduados en El Zamorano

Ing. Julio López	MSU INTSORMIL-Sur,EAP, M.S.
Ing. Héctor Portillo	MSU INTSORMIL-Sur, M.S.
Ing. Mike Martin	UFLA-Estudios Socioeconómicos, Ph.D
Ing. David Riley	UFLA-Picudo del Chile, Ph. D
Ing. Andy Cherry	Imperial College-Control Biológico de PDD, Ph.D
Ing. Lorena Lastres	TAMU INTSORMIL-EAP, M.S.

Estudiantes Postgraduados Fuera de El Zamorano

Ing. Isabel Montenegro 7	UFLA, Taxonomía veronicéllidos, Ph.D
Ing. Alfredo Rueda	UFLA, Control Biológico de Veronicéllidos, M.S.
Ing. Nora Jiménez 8	UFLA, Etología de veronicéllidos, M.S.

1 Trabajo-Estudio 4to Año.

2 Trabaja en el Depto. de Agronomía y DPV

3 Empleado Proyecto Hope

4 Voluntario Cuerpo de Paz

5 Medio tiempo microbiología - Angiostrongylus

6 Paga la EAP

7 Paga Universidad de Florida

8 Paga Colombia

APPENDIX 3

CALENDARIO DE ACTIVIDADES DE LOS SRES. R. FINK Y M. GERTSCH MIEMBROS DE LA COMISION EVALUADORA DEL PROYECTO EAP/MIPH

Julio 24, 1988 - Agosto 11, 1988

JULIO

Lunes 25

12:20 pm	Llegada al aeropuerto del Dr. R. Fink
12:30 pm - 2:00 pm	Almuerzo con Keith Andrews
2:00 pm - 4:00 pm	Visita a USAID
	Entrevistas con B. Cooper, C. Zambrana y D. Sherer

Martes 26

6:30 am - 8:00 am	Planificación general
8:00 am - 8:30 am	H. Portillo
9:00 am - 9:30 am	Centro de Plaguicidas - K. Taylor
9:30 am - 10:00 am	Centro de Inventario Agro-ecológico - R. Cave
10:00 am - 10:30 am	Centro de Diagnóstico - J. Gutierrez

Enseñanza

1:00 pm - 1:30 pm	K. L. Andrews
1:30 pm - 2:00 pm	R. Cave
2:00 pm - 2:30 pm	A. Pitty, R. Muñoz
3:30 pm - 4:30 pm	K. L. Andrews

Miercoles 27

	J. Cáceres
	Reunión con J. B. Mendoza - Compañeros de las Américas
1:00 pm	R. Puerta
5:00 pm	Llegada del Dr. M. Gertsch

Jueves 28

8:00 am	Llegada a Danli
8:00 am - 8:30 am	Sede regional
	Bienvenida
	Presentación de los técnicos del equipo regional

	Caracterización y antecedentes de la región Expositor: Ing. Orlando Cáceres
8:30 am - 9:00 am	Sede regional Informe de extensión Expositor: Agr. Guillermo Cerritos
9:00 am - 9:25 am	Viaje al Valle de Jamastran
9:25 am - 9:40 am	Visita a Las Acacias Control Mágico de Mocis latipes Expositor: Agr. Guillermo Cerritos
9:40 am - 10:10 am	Lote Demostrativo para el Control de Mocis latipes Expositor: Agr. Cesar Moscoso
10:10 am - 10:25 am	Viaje al grupo Campesino 19 de Abril
10:25 am - 11:00 am	Interacción con los miembros del grupo interacción informal. Temas a voluntad
11:00 am - 11:15 am	Viaje al grupo Los Peregrinos
11:15 am - 11:45 am	Visita a un lote individual del Sr. Fermin R. Moderador: Agr. Cesar Moscoso
11:45 am - 11:55 am	Traslado a un ensayo
11:55 am - 12:20 pm	Herbicidas Postemergentes en Maíz o Cultivos de Cobertura para Control de Malezas. Expositor: Agr. Cesar Moscoso
12:20 pm - 12:45 pm	Traslado a la sede
12:45 pm - 1:45 pm	Almuerzo en la sede
1:45 pm - 2:15 pm	Presentación del estudio de Adopción Expositor: Agr. Cesar Moscoso
2:20 pm - 2:40 pm	Presentación del estudio ¿Qué es hielo? Expositor: Agr. Guillermo Cerritos
2:45pm-3:05 pm	Presentación sobre "Lexico Rural Hondureño", "Científico Natural" Expositor: Lic. Bernardo Martinez
3:05 pm - 3:25 pm	Viaje a San Matias
3:25 pm - 3:55 pm	Diferentes Niveles Críticos de Empoasca sp. Basado en Porcentaje de Hojas Infestadas. Expositor: Ing. Ramón Escobar

3:55 pm - 4:05 pm	Viaje a San Jeronimo
4:05pm - 4:35 pm	Tablas de Vida para Evaluar Perdidasenel Cultivo de Frijol. Expositor: Ing. Orlando Cáceres
4:35 pm - 5:00 pm	Viaje a Danli
5:00 pm - 6:00 pm	Descanso
6:00 pm - 7:00 pm	Cena
7:30 pm - 9:00 pm	Sede Discusión general. Temas varios. Interacción con otras instituciones.

Viernes 29

7:30 am - 7:50 am	Viaje a Cuyali
7:50am-8:15am	Efecto de las Malezas sobre la Dinámica Poblacional de Plagas. Expositor: Ing. Ramón Escobar
8:15 am - 8:35 am	Residualidad de Atrazina Expositor: Agr. Guillermo Cerritos
8:35 am - 8:55 am	Viaje a Linaca
8:55am- 9:20am	Tablas de vida para Evaluar Perdidas en el Cultivo de Maíz. Expositor: Ing. Orlando Cáceres
9:20 am - 9:50 am	Antecedentes de Linaca Expositores: Dr. Keith L. Andrews Ing. Orlando Cáceres
9:50 am - 10:20 am	Interacción con Agricultores del Grupo Campesino Interacción Informal. Temas a Voluntad.
10:20 am - 10:40 am	Viaje a Danli
11:00 am	Regreso a la EAP
1:00 pm - 2:00 pm	Reunión Departamental
2:00 pm - 4:00 pm	Reunión de Supervisores

Sabado 30

7:00 am - 10:00 pm	Visita a ensayos en la EAP Escribir

Domingo 31

Libre

AGOSTO

Lunes 1

8:00 am - 10:00 am	Reunión con representantes de LUPE
1:00 pm - 3:00 pm	

Martes 2

7:30 am - 9:00 am	Revisar los ejemplares de los materiales producidos en Florida con su respectiva evaluación tanto en Ecuador como en Honduras.
9:00 am - 10:30 am	Revisar y dar información sobre ciertos trabajos que se han producido aqui; y las evaluaciones que se han obtenido sobre los mismos.
12:30 pm - 1:30 pm	Hablar sobre la forma que funciona el Fondo Rotatorio en la venta de materiales. Dr. George Pilz
1:30 pm - 2:30 pm	Revisar los materiales escritos
2:30 pm - 3:30 pm	Hablar sobre los resultados obtenidos por el Dr. Rodney Fink eu sus diferentes viajes por otras instituciones.
3:30 pm - 5:00 pm	Revisar el documento escrito por el Dr. Rodney Fink.

Miercoles 3

6:30 am - 4:00 pm	Dr. Fink: Enseñanza con C. Barfield Dr. Gertsch: Programa Repollo

Jueves 4

6:30 am	Llegada a la oficina del DPV
7:00 am	Salida
7:10 am - 7:30 am	Visita a la Florencia-EAP Ensayo: Evaluación de dos tipos de labranza en el sistema maíz y frijol en relevo. Resultados, 1987 Resultados parciales, 1988 Expositores: Ing. Ali Valdivia Agr. Juan Marenco

7:35 am - 7:50 am	Ensayo: Manejo de malezas en maíz con cultivos de cobertura y su efecto en la dinámica poblacional de plagas. Expositor: Ing. Ali Valdivia
8:05 am - 8:15 am	Visita a Terrazas de Agronomía
	Ensayo: Efectos de dos tipos de labranza en el sistema maíz y frijol en relevo en plagas invertebradas, malezas y dos manejos de un nivel de nitrogeno. Expositor: Agr. Jaime Vega
8:20 am - 8:35 am	Ensayo: Evaluación de herbicidas preemergentes de maíz bajo labranza reducida. Expositor: M.S. Roni Muñoz
8:40 am - 9:00 am	Visita a Terraza 13
	Ensayo: Efecto de aditivos en atrazina post-emergente. Expositor: Dr. Abelino Pitty
	Ensayo: Efecto de aditivos en basagram post-emergente. Expositor: Dr. Abelino Pitty
9:05 am - 9:20 am	Ensayo: El papel de la tijerilla (Dorutaeniatum y la hormiga brava Solenopsis sp.) en el control biológico del gusano cogollero (Spodoptera frugiperda). Expositor: Ing. Lorena Lastres
9:25am -9:40 am	Ensayo: Cuatro estudios sobre la antibiosis de los maicillos criollos al cogollero en Honduras. Expositor: Ing. Julio Lopez
9:45 am - 10:05 am	Reporte de Producción en la EAP Expositor: M.S. Rogelio Trabanino
10:10 am - 11:00 am	Ensayo: Estudio de la relación entre malezas, babosas, roedores, daño al maíz y frijol, e incidencia de Angiostrogylus costaricensis. Expositores: Ing. Rafael Caballero Agr. Juan Ordoñez Lic. Marlen Medina
11:10 am	Almuerzo

Viernes 5

7:00 am	Desayuno
7:40 am	Bienvenida y presentación del equipo regional

7:45 am	Características geográficas y agrosocio-económicas del Valle del Guayape.
8:10 am	Antecedentes del Proyecto MIPH en Olancho y Plan de Trabajo para 1988.
8:35 am	Salida del equipo de extensión
8:40 am	Exposición sobre maíz muerto
9:05 am	Salida del equipo de investigación
	EXTENSION
9:55 am	Visita comunidad de El Terrero Parcela de Práctica y distribuidor de insumos características de la nueva zona de trabajo y descripción del estudio de extensión (40 min.)
11:05 am	Visita comunidad de El Bebedero Parcela de práctica
11:40 am	Almuerzo
12:10 pm	Visita ensayos Tabla de Vida (maíz y cobertura vegetal) en San Antonio.
1:10 pm	Visita comunidad de Guacoca Parcela de Israel Mencias
	INVESTIGACION
9:30 am	Visita comunidad de La Puzunca Ensayo de densidad poblacional (maíz muerto)
10:10am	Visita comunidad de Jutiquile Ensayo de Residualidad de Atrazina
10:30 am	Ensayo Tabla de Vida (maíz)
10:50 am	Ensayo evaluación de variedades criollas (maíz muerto)
11:10 am	Ensayo de fertilización potsica (maíz muerto)
11:50am	Visita cooperativa Guaymuras
12:10 pm	Almuerzo
1:15 pm	Visita parcela de José Albino Ayala
1:30 pm	Visita al grupo Santa Cruz # 1

2:20 pm	Visita comunidad de Guacoca
2:50 pm	Regreso a Juticalpa
3:20 pm	Refrigerio
3:35pm	Reunión para comentarios y recomendaciones del equipo evaluador y jefe del proyecto.
4:00 pm	Regreso al Zamorano

Sabado 6

Visita a ensayos en la EAP, Escribir

Domingo 7

Libre, Escribir

Lunes 8

Presentacion a AID
Entregar borrador a AID

Martes 9

Revisar los materiales escrito
Salida del Dr. Gertsch

Miercoles 10

Reunión en AID

Jueves 11

Salida del Dr. Fink

APPENDIX 4

OTHER INTERVIEWS

San Juan de Linaca, El Paraíso
Presidente: Sr. Santos Roman

Virgilio Salgado
Aldea San Juan del Rancho
Municipio Distrito Central

Bertran Benitriz
Aldea El Zapote, Siguatepeque

Bertil Mayo
Aldea El Zapote, Sigatepeque

Marko Ehrlich, PhD
LUPE-Project Paper Team

George E. Pilz
EAP Biblioteca

José Raúl Espinal, MS
Field Supervisor, Project Kellog
Rural Development Center
EAP

Ricardo A. Puerta, PhD
Coordinator, Rural Development Program
EAP

Jose Alberto Benitez
Tecnico Agrícola
Recursos Naturales
Yoro, Yoro

Pedro Paz, Input dealer, El Terrero

Esteban Castellanos, Farmer
San Antonio Mante

Antonio Velex, Farmer
Tierra Blanca

APPENDIX 5

EAP/MIPH LINKAGES

* Desarrollo Rural Integrado (DRI-Yoro)
* Programa de Recursos Naturales (RR.NN)
* Banco Nacional de Desarrollo Agrícola (BANADESA)
* Cooperativa 20 de marzo
* Federacion de Cooperativas de Ahorro y Crédito de Honduras (FACACH)
* Ministry of Natural Resources (SRN)
* Programa Cooperativo de las Tribus Indigenas de Yoro (PROCOINY)
* Acción Cultural Popular Hondureña (ACPH)
* Compañeros de las Américas
* Proyecto Manejo de la Cuenca del Rio Choluteca (MRN)
* Centro Agronómico de Investigación y Enseñanza (CATIE)
* Instituto Nacional de Formación Profesional (INFOP)
* Comisión Económica Europea (CEE)
* Departamento de Comunicacion Agrícola y Comunicación de Transferencia de Tecnología Agrícola (DCA-CTTA-RR.NN.)
* Instituto Nacional Agrario (INA)
* Centro de Desarrollo Industrial (CDI)
* Escuela Nacional de Agricultura (ENA)
* Fundación Hondureña de Investigación Agrícola (FHIA)
* Centro Universitario Regional del Litoral Atlántico (CURLA)
* Centro Internacional de Cultivos de Cobertura (CIDICO)
* Secretaria de Planificación (SECPLAN)
* Universidad Nacional Autónoma de Honduras (UNAH)
* Vecinos Mundiales
* Agencia Internacional para el Desarrollo (AID)
* University of Florida
* Johns Hopkins University
* Universidad de Guayaquil, Guayaquil, Ecuador
* Universidad Nacional Agraria
* La Molina, Perú
* Texas A & M
* Iowa State University, Ames, Iowa
* Purdue University
* Mississippi State University
* Proyecto HOPE
* The Asian Vegetable Research and Development Center (AVRDC Cabbage)

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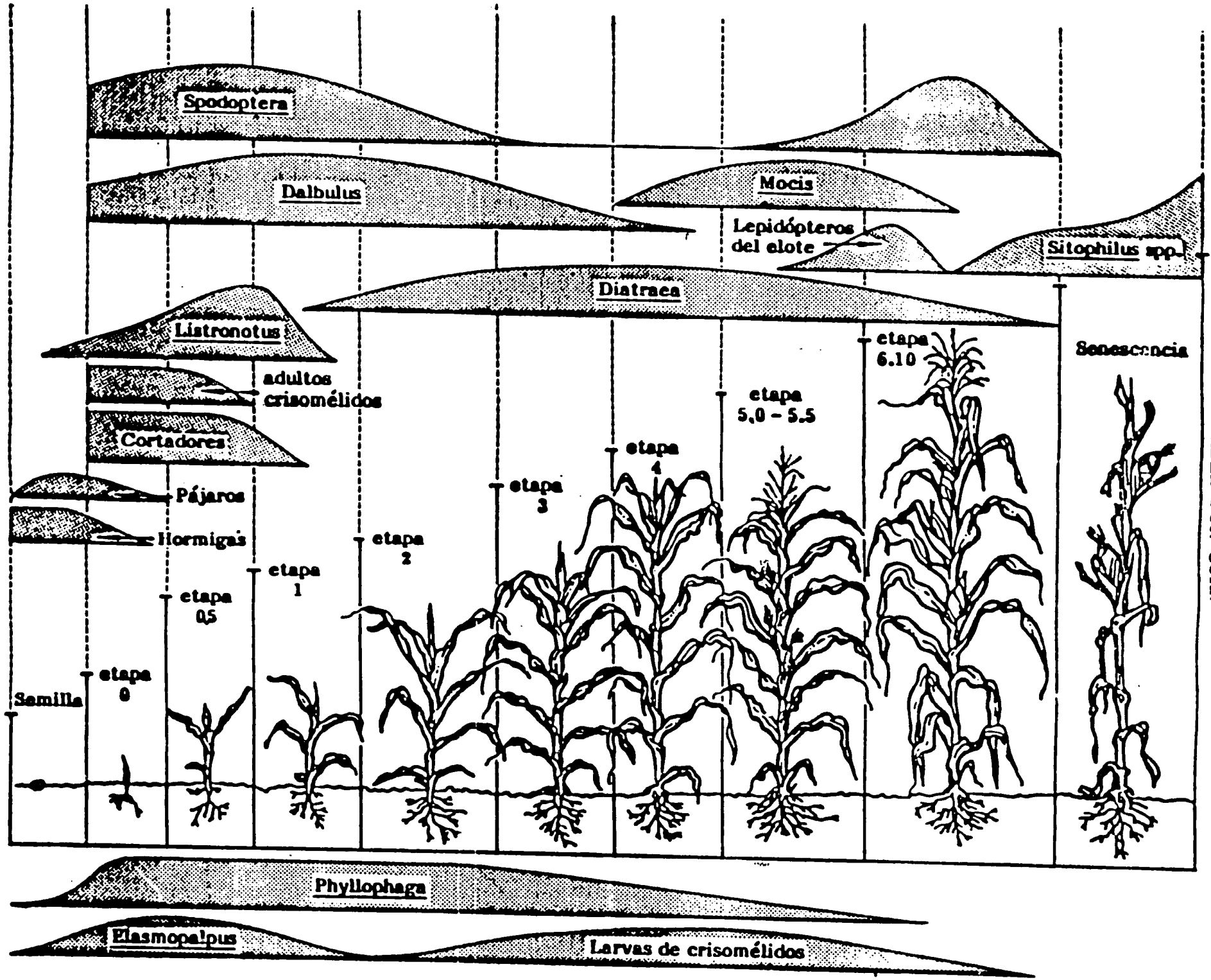


RESUMEN DE BENEFICIARIOS MEDIANTE LA PARTICIPACION EN CURSOS CORTOS, SEMINARIOS, CONFERENCIAS Y GIRAS DE CAMPO, IMPARTIDOS POR PERSONAL DEL PROYECTO MIPH/USAID

AÑO 1984

2	Cursos cortos sobre manejo integrado de plagas	40	Técnicos y especialistas

AÑO 1985

4	Presentaciones cienticas	120	Especialistas
2	Seminarios y Simposios	40	Entomólogos e investigadores
6	Cursos cortos sobre MIP y extensión	99	Investigadores y extensionistas de Recursos Naturales y EAP
2	Reuniones/mesa redonda sobre MIP en el Programa de Maiz y Frijol	30	Investigadores y técnicos
1	Día de campo	30	Funcionarios y técnicos
	T o t a l Participantes	319	

AÑO 1986

9	Cursos cortos sobre manejo integrado de plagas en maiz, frijol, chile y repollo	368	Investigadores y extensionistas de varias Instituciones
1	Curso sobre metodología de extensión	20	Técnicos y extensionistas
2	Campañas sobre protección del bosque del Uyuca		
	T o t a l Participantes	388	Técnicos beneficiarios

AÑO 1987

13	Presentaciones cientifcas sobre MIP en maiz y frijol	358	Técnicos, extensionistas y especialistas
1	Seminario sobre investigación	30	Profesores multidisciplinarios, varias instituciones
1	Curso de extensión	18	Agrónomos
8	Cursos sobre MIP, Entomología y Ciencia de Malezas	179	Investigadores, extensionistas y docentes
2	Reuniones anuales del frijol	15	Extensionistas e investigadores MIPH
	T o t a l Participantes	600	Técnicos

AÑO 1988

1	Coloqui Internacional	30	Docentes
1	Taller de Investigación	50	Investigadores y agricultores
1	Curso sobre fitoprotección de cultivos	23	Estudiantes Centroamericanos CAPS
18	Charlas sobre MIP en cultivos de maíz y frijol	95	Técnicos
1	Reunión promocional	10	Técnicos promotores
3	Giras de campo a las regiones agrícolas de El Paraíso, Olancho, EAP	88	Técnicos del Programa de Maíz-Frijol y Repollo
	T o t a l Participantes	296	Técnicos

Total de técnicos beneficiados durante los cuatro años. 1,603

Más cinco cursos sobre fitoprotección a estudiantes CAPS con un promedio de 25 participantes, durante los años 1985-88

Personal capacitado por el Proyecto en el exterior 47

RESUMEN DE AGRICULTORES BENEFICIADOS

Agricultores beneficiarios directos del programa de extensión en 1985	302
Agricultores beneficiarios directos del programa de extensión en 1986	490
Agricultores beneficiarios directos del programa de extensión en 1987	359
Agricultores beneficiarios directos del programa de extensión en 1988 (Capesinos independientes)	200
Total de beneficiarios - 72 grupos (Capesinos del sector reformado y productores	1,351

PERSONAL MIPH QUE SE CAPACITO DURANTE EL PERIODO 85-87
EN EL EXTERIOR CON FONDOS DEL PROYECTO Y CONTRIBUCIONES
DE UNIVERSIDADES

25 Profesionales obtuvieron títulos avanzados en las áreas de fitoprotección.

20 Personas cursan estudios universitarios, motivados por las acciones al Proyecto serán claves para el futuro del Proyecto.

Un Representante de MIPH participó en el curso de evaluación de programas de extensión en Florida.

Un Representante del Proyecto MIPH recibió adiestramiento en CATIE, Turrialba,sobre documentación y manejo de información técnica para la organización del Centro de Documentación del DPV. (87)

Total: 47 Técnicos capacitados

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Cursos, Seminarios Durante el Periodo Mayo - Noviembre de 1984

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
1	Curso sobre manejo integrado de plagas en cultivos de maíz y frijol	1 semana de mayo, 1984	E.A.P.	15	Voluntarios del Cuerpo de Paz y Compañeros de las Américas
2	Curso sobre manejo integrado de plagas en cultivos de maíz y frijol	Agosto, 1984		25	Extensionistas y Especialistas de Recursos Naturales
	T O T A L			40	Técnicos

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Capacitación en MIP para Agricultores, año 1985

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
1	Charlas según el Programa de Extensión	Mayo - Nov.	Danlí, El Paraíso	129	Agricultores de cinco grupos campesinos del sector reformado
2	Charlas según el Programa de Extensión	Mayo - Nov.	Yeguare Fco. Morazán	75	Agricultores de cinco grupos del sector reformado
3	Charlas según el Programa de Extensión	Mayo - Nov.	Valle de Guayape, Depto. Olancho	98	Agricultores de cinco grupos del sector reformado

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Capacitación en MIP para Agricultores, año 1986

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
1	Charlas sobre manejo integrado de plagas en los cultivos de maíz y frijol, según el programa de extensión	Mayo - Nov.	Valle de Jamastrán, Danlí	159	Agricultores de diez grupos del sector reformado
2	Charlas sobre MIP en los cultivos de maíz y frijol, según el programa de extensión.	Mayo - Nov.	Valle de Guayape, Olancho	146	Agricultores de diez grupos del sector reformado
3	Charla sobre manejo integrado de plagas en los cultivos de maíz, según el programa de extensión	Mayo - Nov.	Sabana Grande, Fco. Morazán	90	Agricultores de seis grupos de sector reformado
4	Charla sobre manejo integrado de plagas en los cultivos de maíz, según el programa de extensión	Mayo - Nov.	Choluteca	95	Agricultores de seis grupos de sector reformado

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Capacitación en MIP para Agricultores, año 1987

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
1	Charlas sobre MIP en los cultivos de maiz - frijol, según programa de extensión en el 2do. año	Mayo - Nov.	Valle de Jamatrán, Valle del Guayape	253	Agricultores de veinte grupos del sector reformado
2	Curso sobre manejo integrado de plagas, pesticidas y calibración de equipo		EAP	25	Agricultores
3	II Encuentro campesino	Marzo 5 - 8	Talanga	51	Agricultores de cooprativas de Olancho, El Paraíso, Choluteca
4	Dos conferencias en el seminario "Avances Tecnológicos en la Producción de Maiz"		EAP	30	Productores Agricultores

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Cursos, Seminarios y Días de Campo realizados por el Personal MIPH - 1985

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
1	Cuatro presentaciones científicas sobre avances en la investigación en plagas de maíz y frijol.	16-19/4/	S.P.S.	120	PCCMCA - Especialistas, Técnicos de Instituciones Agropecuarias de Centro América.
2	II Seminario C.A. sobre la babosa del frijol.	22-25/4/	E.A.P.	30	Entomólogos de C. A.
3	Reunión Anual Programa de maíz y frijol	6-7/6/	Comayagua	20	Investigadores de PDR, MIPH, RR.NN., CIAT.
4	Cursos cortos de extensión en MIP maíz-frijol	30/7/	E.A.P.	19	Extensionistas de RR.NN.
5	Cursos cortos en extensión en plagas de frijol	30/8/	Danlí	20	Extensionistas de RR.NN.
6	Curso corto sobre plagas del frijol	14/10/	Juticalpa, Olancho	15	Extensionistas promotores de RR.NN. y C.D.I.
7	Curso corto sobre MIP	13/11/	Comayagua	30	Investigadores y extensionistas de RR. NN.
8	Mesa Redonda	15/9/	Danlí	10	Investigadores RR.NN.
9	Día de campo por la cooperativa San Juan de Linaca y La Libertad.	2/11/	Danlí	30	Funcionarios y técnicos de AID, RR.NN. y EAP.
10	Simposio "Green Revolution Revisited"	9/12/	Hollywood,CA	10	Entomological Society of America National Meetings Hollywood, Florida.
11	Curso corto sobre extensión agrícola	28-29/1/	EAP	15	Agrónomos Proyecto MIPH, Puerto Rico y Depto. de Agronomía/EAP.
	T O T A L			319	Técnicos

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Cursos, Seminarios, Encuentros del Período Junio - Diciembre de 1986

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
1	Curso sobre manejo integrado de plagas en maíz y frijol	Junio	Sta. Rosa, Copán	20	Técnicos de INFOP
2	Curso sobre manejo integrado de plagas de maíz y frijol	Agosto	Choluteca	50	Técnicos de Recursos Naturales y Compañeros de las Américas
3	Curso sobre manejo integrado de plagas		EAP	15	Técnicos de RR.NN. Yoro, Comayagua, Santa Bárbara
4	Curso sobre manejo integrado de plagas		Catacamas	43	Técnicos RR.NN., CDI, y Banchasa
5	Curso sobre manejo integrado de plagas		Comayagua	100	Profesores de Escuelas Vocacionales de Centro América
6	Curso sobre manejo integrado de plagas		Tegucigalpa	30	Extensionistas de UNICOOP
7	Niveles críticos y muestreo		La Paz	15	Extensionistas de INFOP
8	Plagas y enfermedades del chile y repollo		Comayagua	25	Extensionistas de RR.NN patrocinado por MIP/CATIE
9	Metodología de extensión		EAP	20	Técnicos: MIPH, RR.NN. y Compañeros de las Américas
10	Una campaña contra la deforestación del Uyuca	Oct-Dic	EAP		Proyecto MIPH
11	Una campaña para la prevención de incendios en el bosque	Oct-Dic	EAP		Proyecto MIPH
12	Cursos Cortos sobre MIP y Entomología	Oct-Dic	EAP	50	Técnicos Agrícolas del Cuerpo de Paz y el Instituto del Café (IHCAFE)
	T O T A L			388	Técnicos

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Cursos Cortos, Seminarios, Charlas del 1 de mayo al 30 de septiembre de 1987

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
1	Curso/Taller "Colección y Manejo de Muestras de Plagas"	12-15/5/87	EAP	15	Investigadores y técnicos de sanidad vegetal de RR.NN., Docentes CURLA, MIP/CATIE, ENA, y J.F. Kennedy
2	Manejo integrado de plagas de maíz-frijol y calibración de equipo	11-13/5/87	Talanga, Fco. Morzán	14	Extensionistas de RR.NN.
3	Charla sobre el Proyecto MIPH "avances y resultados"				Universidad de Florida
4	8 presentaciones científicas sobre MIP en Honduras	Marzo/87	Guatemala 33 Reunión Anual del PCCMCA	300	Ténicos y especialistas de varias instituciones en Centroamérica
5	Entomología	Feb. 9 y 7	EAP	25	Agrónomos EAP
6	Fitopatología	Feb.16 y 17	EAP	25	Agrónomos EAP
7	Diseño Experimental	Feb. 24	EAP	25	Agrónomos EAP
8	Muestreo	Feb. 23	EAP	25	Agrónomos EAP
9	Extensión	Marzo 2 y 3	EAP	18	Agrónomos EAP
10	MIP maíz, frijol en Danlí	Marzo 18-20	EAP	25	Extensionistas de Recursos Naturales Región Danlí, El Paraíso
11	Malezas	Abril 6 y 7	EAP	25	Agrónomos EAP
12	Seminario de Investigación participativa	Agosto	EAP	30	Antropólogos, T.S., Comunicadores, Agrónomos, Extensionistas, Entomólogos

ESCUELA AGRICOLA PANAMERICANA
Departamento de Protección Vegetal
Cursos Cortos, Seminarios, Charlas del 1 de mayo al 30 de septiembre de 1987

No.	Nombre del Evento	Fecha	Lugar	No. de Participantes	Instituciones
13	Dos conferencias sobre plagas de repollo en Honduras			23	Patrocinada por MIP/CATIE para extensionista e investigación
14	Conferencias sobre "Un Métotodo de Muestreo del Picudo de la Vaina del Frijol y Labranza Mínima"		CURLA, UNAH	35	UNAH, III Semana Científica
15	Se participó en La Reunión Anual del Programa Nacional del Frijol y Reunión Nacional sobre Maíz Muerto			15	CIMMYT, MIP/CATIE Y MIPH/EAP
	T O T A L			600	Técnicos y especialistas

POTENTIAL BIOCONTROL CANDIDATES AND THEIR NATURAL ENEMIES

PEST	NATURAL ENEMY
1. rufous scale	Aphytis roseni
2. snow scale	Aphytis lingnanensis
3. " "	Telsemia sp.
4. purple scale	Aphytis lepidosaphes
5. Florida red scale	Aphytis holoxanthus
6. diamond-back moth	Cotesia plutellae
7. " "	Diadegma encerophaga
8. " "	others
9. fall armyworm	Telenomus remus
10. water hyacinth	Neochetina bruchi
	Neochetina eichnarniae
11. coffee bean borer	Prorops nasuta
12. " "	Heterospilus coffeicola
13. " "	Ceraphron sp.
14. " "	Cephalonomia stephanoderes
15. coconut scale	Cryptognatha nodiceps
16. Empoasca spp.	Gonatocerus spp.
17. mexian bean beetle	Pediobius foreolatus
18. Graminaceous stem borers	Lixophaga diatraeae
19. cotton leaf perforator	Sympiesis spp.
20. fruit flies	Biosteres spp.

Source: Biological Control Center

THEORETICAL MODEL FOR CROP PRODUCTION

As a procedure for casting pest management (plant protection) into a context frame of overall agricultural production, a somewhat theoretical computation is made. It follows the crop production cycle of maize, beginning with soil preparation and ending when the crop is ready for harvest. At each step, an estimate is made of the loss arising from less than optimum conditions for the crop. In the case of corn, it assumes roughly 55,000 plants/ha, uniformly spaced, and all plants producing one reasonably good sized ear with all rows on the ear reasonably filled, so for this, a theoretical yield of 12,000 kg/ha is used (190 bushels of corn/acre or 180 quintals/manzana).

Research results usually show that marginal improvements can be made at many steps in the production cycle. In this theoretical computation, the yield erosion resulting from suboptimum conditions is estimated to range from 5 to 15 percent. For example, soil preparation may be judged to be 90 percent of perfect, leaving a 10 percent loss aspect. So at each step, the computation gives available yield based on the potential yield. It is conceded here that at no point are the yield loss points precisely accurate. However, for corn, with the prevailing sunlight, moisture and temperatures, a potential yield of 12,000 kg/ha is appropriate. While some technicians may argue that the percent loss of their expertise is too low, by following through the computation as outlined, the saleable available consumable yield is shown as 3,450 kg per hectare (55 bushels/acre or 52 quintals/manzana). These yields are considered fairly good within the Honduran context; many are much lower.

Accordingly, the computation is regarded as a useful technique for: 1) showing that to obtain the benefit from technology generation and transfer, all aspects of the crop (or field or farm) should be considered; 2) making decisions regarding whether: (a) the technology is available but innovation is simply not adopted, or (b) the basic technology is missing; 3) enabling focus on research priorities: (a) items where greatest improvement is possible, or (b) items where improvement can be made quickly and inexpensively; and 4) having the technology transfer mechanism (extension) to strengthen those components.

Theoretical Computation Showing Yield Reduction Impact of Several Factors in the Crop Growth Cycle on the Potential Yield of 12,000 kg of Maize Grain per Hectare Obtainable within the Environment (sunlight, moisture, and temperature).

	% a Loss	% b Available	kg c Available	kg Cost
Potential set by optimum crop under optimum conditions in environment	—	--	12,000	
Inadequate, improper soil preparation	10	90	10,800	1,200
Planting date slightly off	7	93	10,044	756
Poor seed/soil moisture contact	8	92	9,240	804
Inadequate improper phosphorus	5	95	8,778	462
Inadequate plant population	8	92	8,076	702
Suboptimum plant spacing	5	95	7,672	404
Insufficient nitrogen fertilizer	1	93	7,135	537
Early weed competition	15	85	6,065	1,070
Root damage by insects	5	95	5,762	303
Root damage by pathogens	5	95	5,474	288
Nitrogen fertilizer too late	5	95	5,200	274
Foliage damage by insects	15	85	4,420	780
Foliage damage by diseases	7	93	4,110	310
Ear damage by insects	7	93	3,822	288
Post maturity disease damage	5	95	3,631	191
Post maturity insect damage	5	95	3,450	181
Saleable-consumable yield			3,450	8,550

a Percent loss/yield improvement potential for the factor involved

b Percent available = 100% minus % loss; e.g. 100 minus 10 = 90

c Kg available x % available = new kg available, i.e. 12,000 kg x 0.90 = 10,800 kg; 10,000 kg x 0.93 = 10,044 kg; etc.

The yield value in the theoretical model shown here (3,450 kg/ha) is substantially above the yields obtained by many of the small farmers, but somewhat below yields obtained by the best farmers. Accordingly it is regarded as useful for: 1) setting research priorities (technology generation), or 2) orienting technology transfer (extension).

With the model, corn production constraints can be consolidated into four groups, namely:

(1) Establishing the crop stand. This involves soil preparation, seedbed preparation and drilling/planting at a suitable date.

(2) Nutrient-water adequacy. This usually involves the application of fertilizer, especially nitrogen, and such cultural operations as terracing or contour rows to retain both moisture and soil.

(3) Plant protection. The major aspects of plant protection are: a) minimizing weed competition (by cultivation or with herbicides), and b) keeping foliage and ear feeder insects at a tolerable level with crop cultivation practices or with chemical insecticide applications. By adding the kg cost within plant protection, the total is 3,039 kg or about the same amount as the harvest.

(4) Post maturity damage-loss. Post maturity is when physiological maturity has occurred (photosynthesis accumulation has ceased) but the grain is not dry enough to harvest and store. After maturity, the corn ears remain on the stalk in the field and there is substantial rot loss; also, some insect infestation occurs. Both of these aspects cause deterioration of grain quality after the crop has been harvested. IPM technology by itself will not provide the means to produce a crop but if other ingredients are present, good crop protection will allow maximum benefit from other production inputs. This is consistent with the intent of LUPE.

AN ECONOMIC ANALYSIS OF PROJECT IPMH'S PEST MANAGEMENT VALIDATION TRIALS IN HONDURAN MAIZE AND BEANS DURING 1985

(DRAFT FOR DISCUSSION)

Prior to the initiation in 1983 of the Escuela Agrícola Panamericana's Integrated Pest Management Project (known best by its Spanish acronym MIPH), no systematic efforts had never been made in Honduras to validate management or control techniques for pests of the maize-bean polyculture system under the the socio-economic and agronomic reality of small and medium scale producers. At that time, virtually all conclusions regarding the efficacy and economic value of pest management technologies were based on statistical analysis of data derived from studies carried out on experiment stations. We hypothesized that the dismal track record of plant protection outreach programs in Honduras was largely attributable to a lack of socio-economic or agronomic relevancy of recommended practices.

The Project IPMH was designed to correct this serious deficiency. After eliminating many common but flawed pest control recommendations using a "socio-economic filter", plausible technologies were validated at three sites in 1983 and 1984. Most IPMH technologies demand greater labor than capital inputs. In 1985, validation work was dramatically expanded to include commercial scale plots managed by farmer cooperators in 19 sites in Olancho, El Paraíso and Francisco Morazán. Side-by-side comparisons of farmers' conventional technologies and the IPMH procedures were made on plots measuring at least 0.5 ha each. Records were kept for both statistical and economic analysis of results of these pilot studies.

RESULTS

Results of the extensive 1985 trials are presented in the accompanying figures and tables.

MAIZE

Despíte the government's "guaranteed price" of L 17/qq, all calculations are based on true market prices for maize of L 12 to 16/qq; these values bracket the amount paid to farmers by intermediaries who buy "at the farm gate".

MIPH yields compared to farmers' yields averaged 7.2 and 8.3% higher in Olancho and the East Central Region, respectively (fig. 1). As shown in tables 1 and 2, net benefits experienced by farmers were L 75-123/ha depending on zone and prices. The low incremental capital outlay ($\bar{x}$ = L 16/ha) makes these technologies attractive. The marginal rates of return are 4.8 - 7.6.

BEANS

Microeconomic analyses conducted assumed a value of L 40/qq and opportunity costs for labor of L 5/day. The former assumption seems valid (guaranteed price = L 46) but the latter is highly questionable because farmers lack reliable alternative employment opportunities during months when the MIPH technologies must be applied; therefore, the opportunity cost perceived by the farmer who applies these technologies must be substantially lower than the minimum wage.

The data presented in figure 2 and table 3 confirm that the traditional technologies used by the farmers are clearly deficient. In Olancho, the traditional farmer enjoys a return to investment of only 11% while his counterpart in the East Central zone lost income when he planted beans. Nationally farmers did not quite break even.

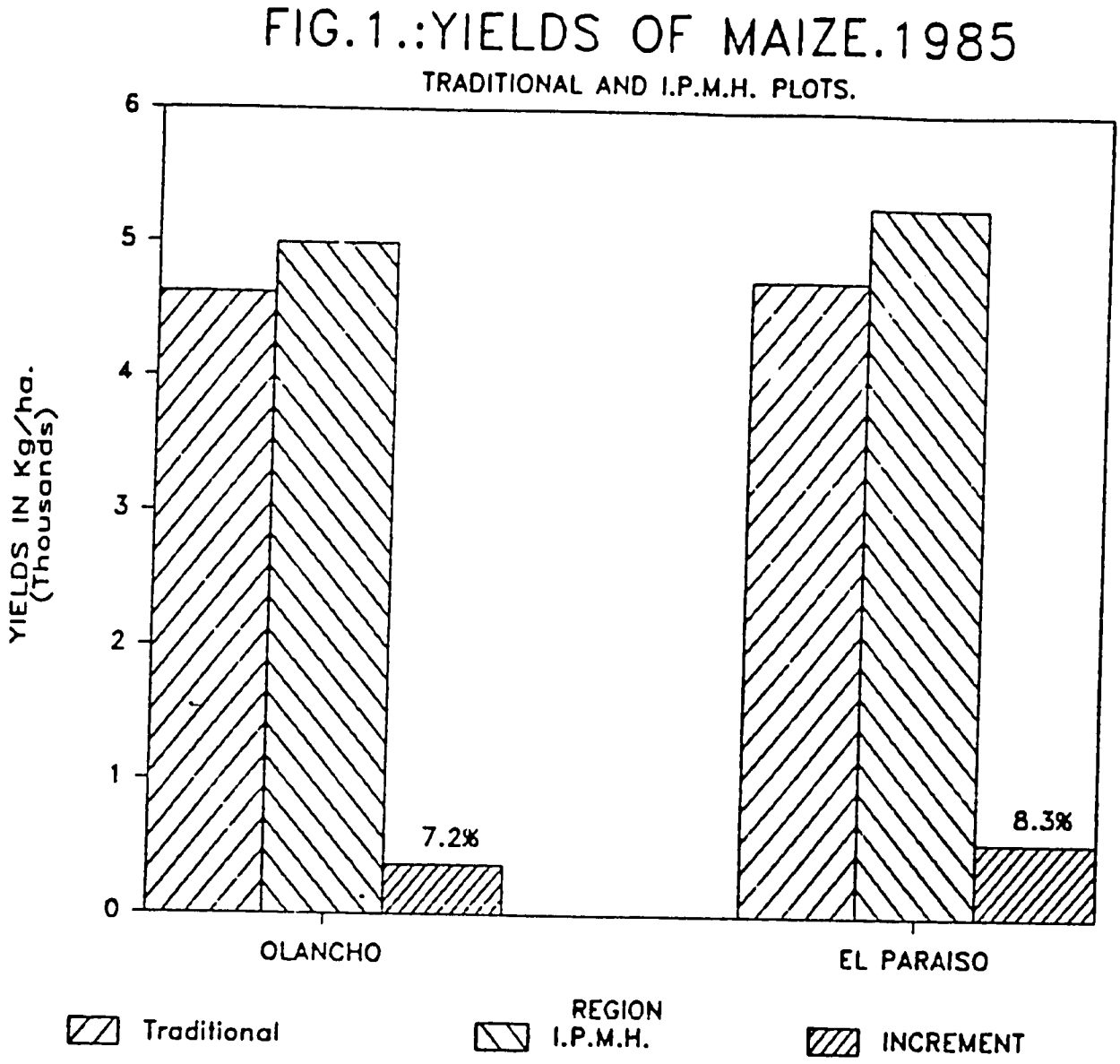


Figure 1. Yields of maize in traditional and IPMH plots in Olancho and El Paraíso in 1985. IPMH technologies outyielded traditional practices in both regions.

TABLE 2.

ECONOMIC COMPARISONS FOR CORN PRODUCTION IN HONDURAS IN 1985. IPMH TECHNOLOGY WAS SUPERIOR TO TRADITIONAL PRACTICES; CALCULATIONS ARE BASED ON A SALE PRICE OF L 16 PER 100 LBS.

REGION	TOTAL COST (L./hectare)		GROSS INCOME (L./hectare)		NET INCOME (L./hectare)		MARGINAL RATE OF RETURN FROM MIPH TECHNOLOGY
	TRADITIONAL	IPMH	TRADITIONAL	IPMH	TRADITIONAL	IPMH	
OLANCHO	505	523	1,698	1,840	1,193	1,316	6.7
EAST CENTRAL	566	580	1,647	1,765	1,081	1,186	7.6
NATIONAL*	546	561	1,664	1,790	1,118	1,229	7.3

Note:

* - National averages are adjusted to account for region-specific differences in area under cultivation.

TABLE 3.

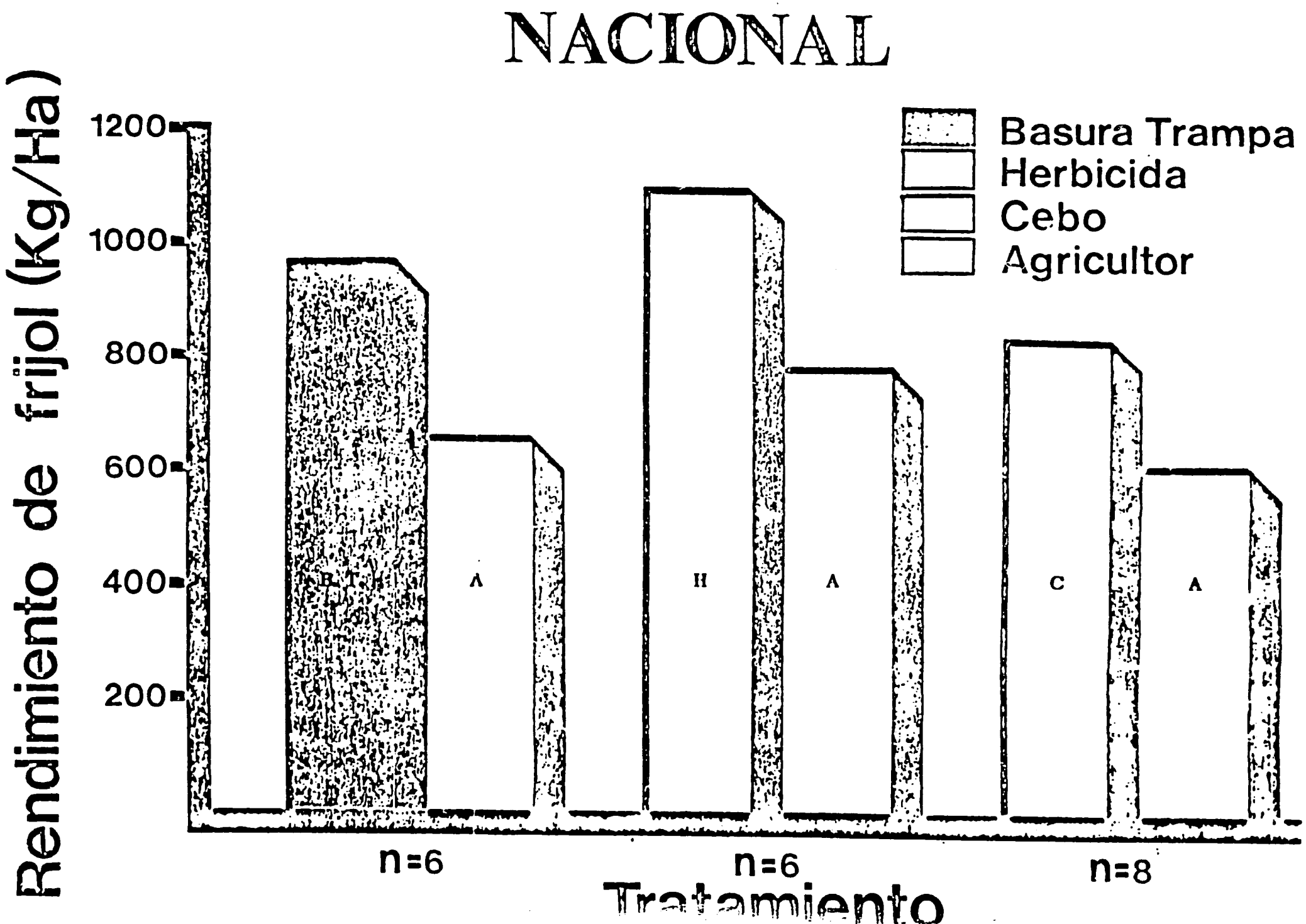
ECONOMIC COMPARISONS FOR BEAN PRODUCTION IN HONDURAS IN 1985. IPMH TECHNOLOGY WAS SUPERIOR TO TRADITIONAL PRACTICES; CALCULATIONS ARE BASED ON A SALE PRICE OF L 40 PER 100 LBS.

REGION	TOTAL COST (L./hectare)		GROSS INCOME (L./hectare)		NET INCOME (L./hectare)		MARGINAL RATE OF RETURN FROM IPMH TECHNOLOGY
	TRADITIONAL	IPMH	TRADITIONAL	IPMH	TRADITIONAL	IPMH	
OLANCHO	570	650	631	1,005	61	355	3.1
EAST CENTRAL	634	723	598	893	-36	169	2.3
NATIONAL*	613	699	609	930	-4	231	2.6

Note:

* - National averages are adjusted to account for region-specific differences in area under cultivation.

Figure 2. Bean yields during 1985 for 3 principal IPMII slug control procedures. n = number of comparisons. All 3 of the IPMII technologies gave returns significantly greater than traditional practices.



Only by using the IPMH technologies did farmers in the two areas enjoy a satisfactory net return to investment (x MRR = 2.6) and acceptable net income of L 231/ha.

The level of farmer enthusiasm for the bean pest management technologies was unexpectedly high (figure 3). Studies conducted in Olancho (La Concepción # 1) and El Paraíso (San Juan de Linaca) showed that farmers did not take a "wait-and-see" attitude toward the new technologies. Instead, three of the five novel techniques for slug control were adopted by over 50% of the farmers during the first year of demonstration work - even before the final results of the test plots could be seen. Farmers were clearly excited by and felt comfortable with the technologies offered.

This high level of enthusiasm was not limited to applying the new technologies to regular hectarages. Total area planted as individual plots increased 31-42% in asentamientos where farmers learned new tools to deal with the threat of pests (table 4). Surveys conducted among farmers in assisted areas indicated that the increase was due to increased farmer confidence and the feeling that they were no longer passive victims of uncontrollable pests.

The accompanying figure 4 demonstrates that the MIPH technologies generally outperformed the traditional program. At 2 sites, yields in MIPH plots were lower because one slug control technology was improperly applied. In 11 comparisons, no economically important difference in yields was observed. In 17 of 30 comparisons, IPMH plots outproduced the farmers by 11% or more. In 5 of 30 comparisons the difference was greater than 100%.

CONCLUSIONS

1. The IPMH technologies increase yields and are cost effective in both crops but the impact is much greater in beans than in maize.

TABLE 4. BEAN HECTARAGE INCREASED IN THOSE FARMERS' COOPERATIVES WHERE PROJECT IPMH CARRIED OUT EXTENSION ACTIVITIES IN 1985

	Ha in cooperatives sampled		
REGION	1984	1985	% INCREASE
EL PARAISO	74	104	42
OLANCHO	38	50	31

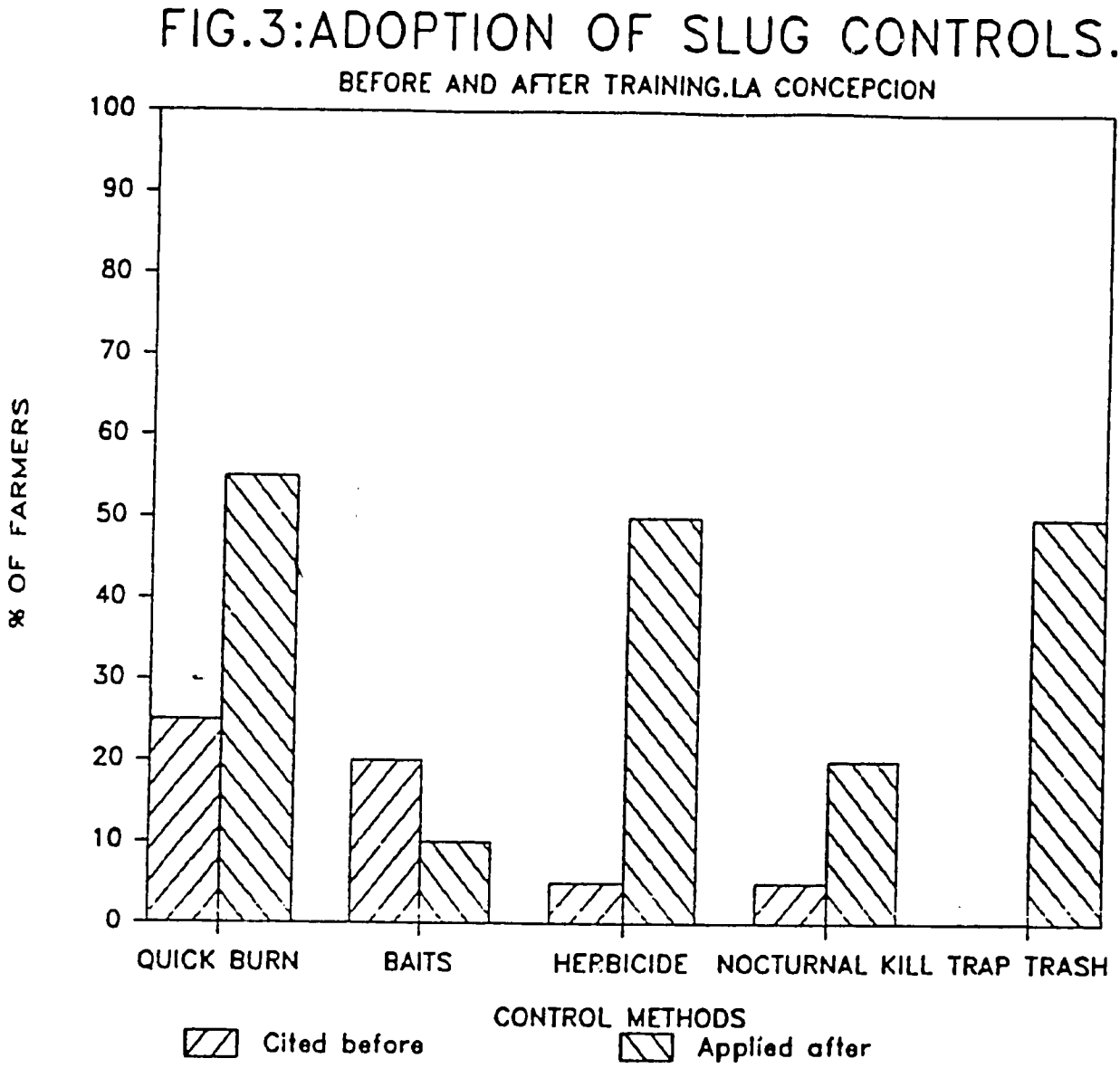
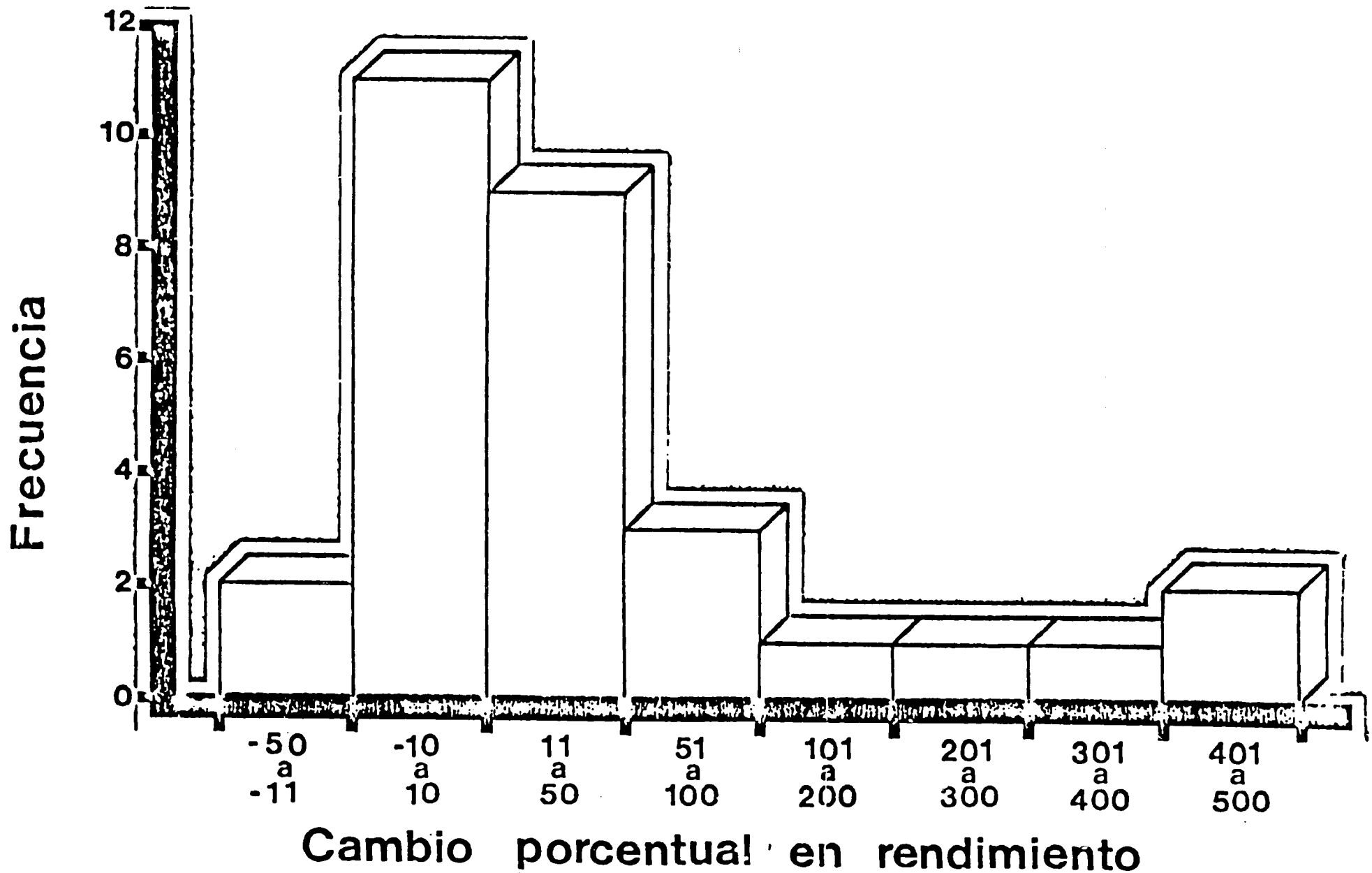


Figure 3. Adoption rates of Project IPMH technologies for control of bean slugs. Despite low initial levels of awareness, a high proportion of farmers applied several IPMH techniques post training.

Figure 4. Frequency of outcome comparing bean yields in IPMH plots to traditional technology plots. National trials 1985.

In a majority of comparisons, IPMH technologies outperformed traditional practices. In 5 cases, IPMH technologies gave returns that were from 100 to 500% higher than traditional practices.



2. The maize pest management technologies are cost effective at the farm level. The average rate of return was 6, which is very high. The incremental cost of only L 16/ha means that the technologies are economically accessible to virtually all farmers, but the marginal net income of slightly over L 90/ha may not be of a significant magnitude to motivate widespread adoption.

3. The maize pest management technologies, if implemented on a national scale,would increase annual production by approximately 7.5% or 30,000 m.t./yr. At a retail value of L 374/m.t., this is equivalent to L11,000,000 /year.

4. The bean pest management technologies are very cost effective for the farmer. The high marginal rates of return (2.3 and 3.1 in El Paraíso and Olancho, respectively) on an incremental investment of 14% of the fixed cost of production are highly attractive to farmers in all areas tested.

5. The IPMH technologies are even more cost effective than herein indicated if labor-associated opportunity costs are less than L 5/day during the months of July and August when most of these technologies must be implemented.

6. On average, the IPMH technologies increased bean yields by 38%. Estimating a current average national yield of 550 kg/ha, a national production of 45,000 m.t./year, and a "farm-gate" price of L 46/qq (L1,012/m.t.), the increase translates to:

   - average yields of 760 kg/ha
   - total national production of 62,100 m.t./year
   - increased crop value of L 17,270,000/year

7. Increases of the magnitude cited in (6) would mean that:

   - bean yields per hectare in Honduras would at last be in line with those of neighboring countries.
   - bean production would meet internal demands.
   - considerable economic benefits would accrue to farmers who produce beans.

8. Farmers in asentamientos in Olancho and El Paraíso who have received one year of training in slug control procedures increased the size of their bean plantings by 31 and 42%,respectively.This was accomplished without direct technical assistance (extensionists intervened only in the communal demonstration plots), without need for additional credit (the techniques require little cash outlay) and without reducing area planted to other crops (previously no second crop was relay planted after the maize senesced). Farmers report that they increased the size of their plantings simply because they felt confident of their ability to control the bean slug.

9. Recalling that sizeable areas of highly productive land have been abandoned due to chronic problems with slugs, it is reasonable to assume that the new technologies will have the same effect on a large scale that they did in the pilot studies. Assuming only a 25% increase in area planted would mean that production would be increased:

   - in Olancho by 1,500 m.t./year = L 1,500,000/year *
   - in El Paraíso by 3,000 m.t./year = L 3,000,000/year **
   - nationally by 11,250 m.t./year = L 11,400,000/year ***

10. The bean pest management technologies do not increase risk to the farmer but rather, consistently stabilize yields over a wide range of sites and agronomic conditions.

11. The principal macro benefits to be obtained from the nationwide implementation of the bean pest management technologies are summarized in the following equation:

TOTAL YEARLY BENEFITS = VALUE OF PRODUCTION ON LAND PREVIOUSLY LEFT FALLOW DURING BEAN SEASON (from 9)

+

VALUE OF INCREASED YIELD ON LAND WHICH PRESENTLY PRODUCES BEANS (from 6)

= L 11,400,000 + L 17,300,000

= L 28,700,000

This equation does not include extra labor opportunities, increased nutritional status, decreased pesticide costs nor other spinoff effects.

Estimates of current average yearly production:

* 6,000 m.t./year

** 12,000 m.t./year

*** 45,000 m.t./year

FUNDING RATIONAL FOR CONTINUATION BEYOND YEAR FIVE OF PROJECT

Funding beyond the current five-year commitment would be a very cost effective effort because only the tip of the rainbow has been reached even with corn and beans. Development work needs to be expanded to other pests of corn, beans, and cabbage and other crops such as sorghum, millet and rice.

As no-tillage practices are more widely accepted, several years' work will be needed to provide yield stability to the practices. When the current five-year program ends, the following annual appropriation seems appropriate for a second three- to five-year period (in order of priority).

(1) Core support U.S. $500,000 per year.

(2) Funding for support of two new major crops (or problems) as pest problems U.S. $200,000.

(3) EAP should prioritize major pest problems and aggressively seek funding from other sources both in and out of Honduras.

(4) Hopefully SRN would provide support for some of this work.

(5) EAP should aggressively seek external support for the Pesticide Use and Efficacy Centers and the Biological Control Center.

Pest control problems will continue and research/methodology development needs to continue in place. There is always a tendency to keep projects going well beyond their useful life. Pest problems cannot be properly covered in a short cycle (for example, five years) as weather/insect/disease cycles and weed ecology need a minimum of seven to ten years to develop a stability of expectations. In Honduras, the plant pest problems are severe and the means of control are very limited. The only question is who will fund the work. The GOH should take up part of the cost, as the benefit to nutrition and GDP is substantial. Specific problems need to be funded by other agencies/sources (Foundations, IICA, ROCAP, CRSPs, and others).

If widespread dissemination of the methodologies aren't achieved, the useful life of the project will be much shorter. The work must be integrated into an overall outreach system that gets the word, the system, the technology, and other inputs to farmers. If LUPE achieves this, the returns from the MIPH investment will be dramatic.

BUDGET RATIONALE

LUPE should extend budget activities to include EAP/MIPH. The MIPH budget was U.S. $1.25 million in FY88. Of this amount, EAP provides $250,000 in direct support (see Table I). An estimated breakdown of budget efforts shows that research extension and teaching receive the greatest amount of the budget (see Table I).

TABLE I
(in U.S. $)

Provided by EAP	$ .25 million
Provided by USAID-Honduras	$ 1.0 million
Total Budget	$ 1.25 million

TABLE II
(in U.S. $)

Breakdown of Budget According to Support of Efforts

Effort	Amount
1. Teaching/teaching development and teaching research	$ 250,000
2. Research/extension	687,500
3. Infrastructure support	187,500
4. Equipment (vehicles, teaching/research equipment, office support	125,000
Total	$1,250,000

TABLE III
(in U.S. $)

Breakdown of Extension-Research Budget

1. Development research	$ 80,000
2. Applied research	150,000
3. Validation technology	70,000
4. Training of trainers (short-courses, seminars, self-help center)	86,250
5. Training technology development	76,250
6. Operations	70,000
7. Biological Control Center	70,000
8. Diagnostic Center	50,000
9. Problem identification and direction	35,000
Total	$687,500

In order to maintain the program, LUPE should fund $1.0 million of MIPH through a memorandum of agreement with EAP. Resources and programs of MIPH would support and be a coordinated part of the overall effort and goals of LUPE. As other segments of EAP become involved with LUPE, modifications of the MOA would be necessary for effectuating the additional activity.

The extension research breakdown provides overall effort cost and includes some funding of students who work full-time on the project while completing fourth year studies. Also included is funding for the Biocontrol Center,the Diagnostic Center, and the other 4 centers which link with goals of LUPE.

Additional funding to expand MIPH outreach and to meet objectives of LUPE include the following recommendations for additional support.

PRE-PROPOSAL FOR CONTINUED DEVELOPMENT, TRAINING AND REGIONAL DISTRIBUTION OF PEST MANAGEMENT INSTRUCTIONAL MATERIALS

Rationale

Since 1983 and via USAID/Honduras funding, the project "Manejo Integrado de Plagas en Honduras (MIPH) has maintained a cooperative relationship with the Department of Entomology & Nematology (University of Florida). The major focus of this cooperation has been the development and testing of pest management and agricultural ecology teaching materials. To date, >70 modules have been developed (see Table 1). Each consists of a text, a professionally prepared set of full color slides, and both instructor & student copies of a tailored study guide.

To date, sets of our modules have been tested twice: (1) 1985-86, Pan American School of Agriculture (PAS, Honduras), 3rd year, Agronomo level students; and (2) 1987-88, University of Guayaquil (Ecuador), 5th year, Ingenero Agronomo level students. Two additional tests (PAS, 1988-89 and the National Agricultural University, Peru, M.S.-level students, 1988) are planned. Tests have been designed to place relevant modules WITHIN the context of an existing course. As the lecture topic involving one of our modules is ready to be taught, students are divided into 3 treatment groups (depending upon the mode of instruction to be used). Treatments have involved conventional lectures (unassisted, professor-given lectures), slide backdrop methods (where professor gives normal lecture, but uses our module slides as backdrop), and autotutorial (no lecture, students study ONLY our module). Pre- and post-instructional exams and statistical analyses on percentage increases between

them, for each presentation mode and module subject, have begun to give us insight into how students learn, which modules may best be taught by what presentation method, and the role of autotutorial instruction in Latin American institutions. An example of some of our results can be seen in Table 2.

From 1983 - present, we have gained much insight into the current state of instructional capabilites in Latin America, particularly relative to pest management and agricultural ecology. We have learned how to optimally prepare, edit, test and display relevant instructional modules in these subject areas and have assembled a staff experienced in such endeavors. Two regional colloquia (1988, PAS and 1988, Quito, Ecuador) have allowed us to expose Latin American professors to our cadre of materials, our philosophies about instruction in the region, and our techniques for building and testing such instructional materials. In both cases, we received overwhelming support for our efforts and were led to believe that there was strong need for inter-regional programs to (1) distribute the materials we had already developed and (2) establish a network of Latin American instructors who could collaborate towards improving the status of teaching materials and towards improving overall pedagogical skills. Both comments were made repeatedly at both colloquia. Thus, the time appears ripe for regional efforts to distribute what already exists, to establish area-wide networks and "training for trainers" workshops, and to use our experiences for improving pest management and agricultural ecology teaching in Latin America, with initial focus on Central America.

Proposed Objectives TO:

1. utilize the PAS (and its University of Florida linkages) as a Central American "Center of Excellence" for pest mangement and agricultural ecology teaching
2. obtain ROCAP funding to underwrite the purchase of existing teaching materials by Centrl American institutions and to develop additional teaching materials in pest management and agricultural ecology
3. obtain ROCAP funding to hold 10 "training for trainers" workshops (over a 5 year period)
4. allow in-service training for Central American educators by underwriting their studies at the PAS and, in some cases, at the University of Florida
5. enhance to materials-development and pedagogical skills of Central American eductors, especially in improved teaching methodologies

Proposed Methods

We propose to stablish the PAS as a Central American focal point for the improvement of pest management and agricultural ecology teaching skills in the entire region. Its physical location, experience and demonstrable skills in this subject make it an ideal choice. Further, its strong likages and past cooperative efforts with the University of Forida give it access to materials, methods and subject matters not typically present in the region. The PAS, if funded by ROCAP, could be productive from day one. A cadre of >70 teaching modules already exist, regional colloquia have already helped to identiy the PAS as a leader in development of teaching materials, and investigation into pedagogical skills improvement has already begun. There will be absolutely no "start up" or lag time for the PAS, if funded.

We propose a 5 year grant, with the principal contract let to the PAS in Honduras. They could then sub-contract the University of Florida for collaborative materials and methods development, much like has occurred over the past 5 years. The major foci of this effort would be to:

1. hold 10 "training for trainers" workshops where detailed discussions of teaching methods and materials development could occur and through which a strong, regional network of Central American educators could be established. We propose 2 workshops/year, with 1/yr held at the PAS and 1/yr held elsewhere in the region (e.g., El Salvador, Costa Rica, Guatemala). The PAS would be the lead institution and organizer of these workshops.
2. copy and distribute the 70+ pest management and agricultural ecology modules already in existence, with ROCAP underwriting of the purchase and distribution costs. We propose that institutions which send representatives to the "training for trainers" workshops be allowed to obtain subsidies for purchasing these materials.
3. allow in-service training for Central American educators who can come to the PAS for up to 1 month and learn improved teaching methods, improve their skills at development of teaching materials and learn both the theoretical & practical pedagogical skills which will improve their teaching capacities at their home institutions.
4. recruit two Ph.D.-level students who will pursue that degree at the University of Florida but will focus their research on the pedagogy of pest management and/or agricultural ecology in Central America. Optimally, these would be Central American students who would return to the region after degree completion.

5. continue to develop additional teaching modules -- some independently and some through the regional network of educators. This will involve modules on social science, pedagogy itself, population and community ecology, natural resources conservation, and various as yet undeveloped topics in pest management. Working through the established Central American network will allow all educators (and us) to tailor existing and future teaching materials to each country's particular needs. This effort will also entail the additional development of field exercises, pedagogical techniques, laboratory exercises and testing procedures unique to each institution's needs.

We feel the proposed effort will bear the obvious fruit of greatly improved teaching skills in Central America. Further, it can firmly establish a network of concerned educators that, heretofore, have been disaggregated in their teaching efforts. The teaching materials themselves, the improved pedagogical techniques, the network linkages and the interpersonal development skills which can be developed via this effort should last far beyond the mere 5 year project. Lastly, to insure some level of persistence, we propose to "test" workshop participants in Years 1, 3 and 5 to gain some measure of the degree to which they have improved pedagogical skills, materials development skills and commitments to regional cooperative efforts.

This pre-proposal captures the essential elements of what we propose. If ROCAP desires, a full proposal (complete with manuscript citations and more detailed methods) can be filed in rapid order. A tentative budget is attached and is subject to modification, depending upon ROCAP's needs.

BUDGET (US$)

PRINCIPAL CONTRACT	1988-89	89-90	90-91	91-92	92-93
Personal[a]					
2 artists	18,600	19,530	20.507	21,532	22,609
1 communicator	16,900	17,745	18,633	19,564	20,543
0.5 photographer	4,700	4,935	5,182	5,441	5,713
1 training coordinator	16,900	19,530	20,507	21,532	22,609
Supplies[b]	80,000	80,000	70,000	70,000	50,000
Travel & Per Diem[c]	10,000	10,000	10,000	10,000	8,000
Faculty Subsidies[d]	10,000	10,000	10,000	5,000	5,000
Internships[e]	9,000	9,000	9,000	7,000	4,000
Workshops[f]	20,000	20,000	20,000	20,000	20,000
Purchase Subsidies[g]	50,000	55,000	60,000	65,000	60,000
FLORIDA SUB-CONTRACT					
Personal[a]					
1 artist	25,000	26,250	27,563	28,941	30,388
1 secretary III	18,000	18,900	19,845	20,838	21,880
Travel & Per Diem[c]	10,000	10,000	10,000	10,000	7,000
Supplies[b]	6,000	6,000	5,000	5 000	4,000
Ph.D. Ass'tships[h]	10,000	10,000	20,000	1,000	10,000
SUB-TOTAL:	305,100	316,890	326,237	329,848	291,742
25% Indirect Cost	76,275	79,223	81,560	82,462	72,936
TOTAL PROPOSED BUDGET:	381,375	396,113	407,797	413,310	364,678

[a]5% salary increase allocated per year; budget item includes all fringe benefits

[b]includes duplication of modules (texts and slides) and mailing costs; graphics artists, typists, photographer, etc. for development of new modules

[c]travel and per diem for PI's, or their designees, to attend all "training for trainers" workshops and national, regional or international meetings to report results and/or facilitate networking; some travel for Ph.D. students included

[d]to contract specialists for drafting original, technically competent texts on specialized subjects within pest management and agricultural ecology

[e]to allow Central American educators to study at the PAS and, in special cases, the University of Florida to improve their teaching skills by in-service training; room and per diem included (not transportation costs)

[f]2 per year (1 at the PAS and 1 elsewhere in the region); based on 20 participants per workshop

[g]to underwrite costs of module purchase by those Central American institutions sending faculty to the "training for trainers" workshop

[h]0.5 FTE; dissertation topics to focus on pedagogy of pest management and/or agricultural ecology in Central America; degrees at University of Florida; one student years 1-3; one student years 3-5

Table 1. Teaching modules in pest management and agricultural ecology developed to date in joint effort between Pan American School of Agriculture and University of Florida. (Taken from Barfield et al., 1988, manuscript submitted to Tropical Pest Management).

TITLE	ADAPTATION**	LANGUAGE
WORLD MODEL SIMULATOR	CAI on IBM/PC	English
ON-LINE INFORMATION DELIVERY SYSTEMS FOR IPM	CAI on IPM/PC	English
EONOMICS FOR AGRICULTURE	CAI on IBM/PC	English
SAMPLING*	CAI on IBM/PC slide/text	English English & Spanish
TEMPERATURE-DEPENDENT DEVELOPMENT* OF POIKILOTHERMS	CAI on IBM/PC slide/text	English Spanish
ECONOMIC THRESHOLDS IN PRINCIPLE* AND PRACTICE	slide/text	English & Spanish
A GUIDED TOUR OF FLORIDA AGRICULTURE	CAI on PLATO	English
PESTICIDES	CAI on IBM/PC	English
Use		
Terminology		
Formulations+,++,*		
Calibration		
Application Equipment++,*		
Sprayer Mehanics		
Toxicities+++		
Labels		
Laws		
SIMULATION OF PEANUT PRODUCTION	CAI on IBM/PC	English
ORDERS OF INSECTS	CAI on IBM/PC	English, French & Spanish
PESTS OF MAIZ*	slide/text	Spanish

Table 1, continued.

PESTS OF BEANS*	slide/text	Spanish
NEMATODE BIOLOGY*	slide/text	Spanish
INTRODUCTION TO IPM IN CITRUS	slide/text	Spanish
PRINCIPLES OF CALIBRATION OF SPRAY EQUIPMENT	slide/text	Spanish
MANIPULATION OF NEMATODES	slide/text	Spanish
BASIC PRINCIPLES OF ENTOMOLOGY	slide/text	English, French & Spanish
Introduction		
The Exoskeleton		
Structures of the Exoskeleton		
Mouth Parts of Insects		
Internal Systems I & II		
Insect Development		
Orders of Insects I & II		
Evolution, Specialization & Coevoluton		
Insect Ecology		
Insect Behavior		
Insect Control I & II		
USE OF ENTOMOPATHOGENS IN CONTROL* OF INSECT PESTS	slide/text	Spanish
NATURAL ENEMIES OF AGRICULTURAL* PESTS: PARTS I & II	slide/text	Spanish
SPECIALITY LESSONS	slide/text	Spanish
pests & diseases of cabbage		
pests & diseases of pepper		
diseases of corn		
soil pests of corn		
pests of corn		
the fall armyworm		
the slug in beans		
pests of curcurbits		
white grubs		
soil pests of beans		
MANAGEMENT OF WEEDS I & II	slide/text	Spanish

Table 1, continued.

INTRODUCTION TO PLANT PATHOLOGY	slide/text	Spanish
Introduction to Phytopathology I & II		
Introduction to Phytopathogenic Fungi		
Introduction to Phytopathegenic Bacteria		
Introduction to Viruses		
Introduction to Phytopathegenic Nematodes		
INTRODUCTION TO PLANT PROTECTION	slide/text	Spanish
Basic Concepts of Ecology I & II		
Stress		
Consequences of the Use of Pesticides		
Safe Use of Pesticides I & II		
Introduction to Integrated Pest Management*		
Management of Weeds I & II	slide/text	Spanish

*detailed information on authors & content in Barfield et al. (1987)

**CAI = Computer Aided Instruction

+exists also as CAI in Spanish

++exists also as slide/text in Spanish

+++currently being developed

*there is a detailed study guide for this module

Table 2. Mean percentage increase of post-instruction (over pre-instruction) test scores for students in 3 treatment groups each exposed to 6 teaching modules, Pan American School of Agriculture, 1985-86. Taken from Brfield et al., 1988, manuscript submitted to Tropical Pest Management.

Subject*	Treatment Group**	Mean*	PR > F[b]
EQUIPMEN	CONVENTIONAL	39.31 A	.0733
	SLIDE BACKDROP	31.68 AB	
	AUTOTUTORIAL	10.01 B	
FORMULAT	SLIDE BACKDROP	50.20 A	.5710
	CONVENTIONAL	47.78 A	
	AUTOTUTORIAL	25.03 A	
INTROIPM	SLIDE BACKDROP	57.42 A	.8920
	AUTOTUTORIAL	55.37 A	
	CONVENTIONAL	50.90 A	
SAMPLING	CONVENTIONAL	64.67 A	.5751
	AUTOTUTORIAL	45.43 A	
	SLIDE BACKDROP	44.51 A	
POIKILOT	CONVENTIONAL	162.67 A	.0110
	SLIDE BACKDROP	71.60 B	
	AUTOTUTORIAL	57.90 B	
ECONTHRE	SLIDE BACKDROP	43.44 A	.1449
	CONVENTIONAL	16.17 A	
	AUTOTUTORIAL	12.85 A	

*acronym of module used (Pesticide Application Equipment, Formulations of Pesticides, Introd. to IPM, Sampling, Poikilotherm Development and Economic Thresholds, respectively).

**Conventional = normal, unaided professor-delivered lecture; Slide Backdrop = professor-delivered leture & slides from modules used as backdrop; Autotutorial = only module studied; no lecture

*means followed by same letter not significantly different according to LSD Test, a = 0.05

[b]"protected" multiple range test; level where significant shown per group

A PRE-PROPOSAL FOR THE STUDY OF THE BIODIVERSITY OF PARASITIC HYMENOPTERA IN HONDURAS

Principal investigator: Ronald D. Cave
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Co-Investigator: _____
_____
_____
_____

The parasitic Hymenoptera constitute the most important group of insects used in biological control programs for suppressing pest insect populations. However, the parasitic Hymenoptera of Honduras and the rest of Central America are poorly known taxonomically and ecologically. Keys and identification guides for nearly all taxa are lacking for the Neotropical region. Host associations and geographic distributions are unknown for the majority of species. Even for the parasitic Hymenoptera attacking the major crop pests, alternate hosts, seasonality and distribution have not been adequately studied. Studies investigating the taxonomy and ecology of parasitic Hymenoptera in Honduras will provide useful information for applied biological control programs which ultimately benefit Central American farmers. The information gathered in this study would be useful for the Biological Control Center of EAP by way of providing data on parasitic Hymenoptera guilds of crop pests and directing research on those pests which lack natural enemies or are not adequately controlled by the indigenous parasitoid fauna. Moreover, the information from these studies will be helpful to diagnostic personnel and biological control workers throughout Central America, United States and in other parts of the world.

The Plant Protection Center of the Department of Plant Protection (DPV) has the necessary infrastructure to conduct studies on the parasitic Hymenoptera of Honduras. New facilities which have ample space for housing and caring for collections of parasitic wasps and their hosts were recently completed. Adequate insect collection cabinets are available. A new

microscope and new stereoscope are located in the collection room for use by DPV personnel, visiting scientists and graduate students. Adequate space, equipment and personnel are available for rearing, mounting, and labelling specimens. Computer facilities are available for cataloging all data and identifications. The principal investigator has extensive experience working with parasitic Hymenoptera taxonomy and ecology and has been studying these insects for the past year. Technicians in the DPV are experienced and capable of identifying certain groups of hosts. Cooperative agreements are being strengthened with taxonomic specialists and institutions (such as the Systematic Entomology and Beneficial Insects Laboratory Plant Sciences Institute, Beltsville) to have the material examined, identified, and studied.

In order to take full advantage of the new facilities and personnel, we seek support for a major project to study the parasitic Hymenoptera of Honduras.

SUMMARY OF PROJECT OBJECTIVES:

1.- Collect, identify, and catalog parasitic Hymenoptera as a complement to faunal and floral inventories of agroecosystems in Honduras.
2.- Investigate host associations, specificity, and distribution of parasitic Hymenoptera.
3.- Gather knowledge of presence of parasitic Hymenoptera of potential value to biological control programs in foreign countries as well as establish need for introduction of exotic species in Central America.
4.- Collate and publish gathered information for use by biocontrol workers in Central America and other regions.
5.- Enhance collections of parasitic Hymenoptera in U.S. and Canadian museums and institutions where material is needed for systematic research.

METHODS:

1.- Collect and rear parasitic Hymenoptera throughout Honduras; material collected principally in agroecosystems, with additional collecting in non-agricultural areas whenever possible.

2.- Record and computerize pertinent data, such as locality, date of collection, host plant, parasitized host, abundance.

3.- Identify material via qualified personnel at DPV, PSI, Canadian National Collection and other institutions (universities, museums).

4.- Produce computer-generated catalogs and identification guides.

MATERIAL TO BE PRODUCED:

1.- Catalogs of Honduran parasitic Hymenoptera listing species, their hosts and distribution.

2.- Identification keys and guides for diagnostic personnel and biocontrol workers in Central America, United States, and other countries.

3.- Well-organized collection of parasitic Hymonoptera for reference and systematic studies.

PERSONNEL AND EQUIPMENT NEEDED:

- 1 full-time technician with Ingeniero Agronomo or B.Sc. degrees (including graduate students conducting theses; a U.S. university will cover assistantship during time student is studying)	$ 15,000.00
- 1 post-doctorate	24,000.00
- 10% salary of project supervisor	3,000.00
- Supplies and equipment	6,000.00
- Operational expense	3,000.00

ADDITIONAL FUNDING RECOMMENDATION-AID/LUPE

A. Consulting Agriculturalist

Pest management is a critical component in the overall production of a crop (maize in this example). Accordingly it is advocated here that LUPE Daunch a training program to train and create a base of consulting agriculturalists. In this case it is envisaged that they would be smart energetic high school students, each of whom:

1) Would be trained in integrated agriculture/integrated pest management, possibly at EAP;

2) Would be subsidized for about 1.5 years until they became sufficiently effective to earn their livelihood; and

3) Would charge the farmer a fee for his services, expected to be 10% of yield increase, estimated here to be 20 qq maize at L 35.00 mza for maize. It is estimated that at the outset each will serve, and be paid for, 150 mza maize per season or L 5250. Assuming he will also serve other crops, especially high value cash horticultural crops, with an additional 50% of maize earning, his minimum base initial income is envisaged to be L 7,875 or about L 650 per month. By the 2nd or 3rd year, he will probably double this earning.

A social fringe benefit is that he will coalesce farmers into groups of 10 or 15 (for the convenience of his work) who will then qualify for input credit and who then can organize output processing or marketing.

It is estimated here that for a class of 30 students (10 candidates from each of 3 communities) the cost for the first two years will be as shown below. The consulting agriculturalists should generate adequate support to be self-sufficient after two years, and will not be further subsidized.

Year One

Per diem and travel: 30 days @ L100/day x 30 consultants	L 90,000
Salary subsidy: 52 weeks @ L100/week x 30 consultants	156,000
Backup support (3 supervisors)	50,000
Program Manager	25,000
Supplies, travel, and support	30,000
Year One Total	L 351,000

Year Two

Backup support/supervision	L 50,000
Salary subsidy (1/2 of Year One)	78,000
Supplies	20,000
Year Two Total	L 148,000

B. Employment of Additional Agronomos

Included in the Extension/Research budget are 5 full-time researchers and fourth year thesis students. These full-time agronomos complete their school in 2 years, provide full-time service to the school and, in addition produce, a useful and contributive research project. The staff could supervise an additional 5 to 8 agronomo/4th year students. The cost per student follows:

Research expenses	L 5,000
Tuition	3,600
Housing	2,400
Food	3,100
Salary	2,900
Total	L 17,000

For this modest investment the project receives 2 years of full-time service and the country receives a B.S. degree trained Plant Protection Specialist (Ingeniero Agronomo).

C. Thesis Study of Central American Students Attending U.S. or Other Universities

The value of supervised M.S. degree thesis student research from U.S. universities by Honduran or other Central American students has been well documented at EAP. Not only does the thesis research project provide information of value to Honduran small farmers, the consultant visits of the major professors contribute to the knowledge base of EAP. The cost of such a program per student has been calculated as follows.

Student expense for 2 six-month periods	$ 9,000
Incidental expenses	2,000
Total	$11,000

The M.S. student is expected to spend one year in the states in coursework and about one year working full-time on the project with a portion of the work to apply to the thesis requirements of the student's home university. The U.S. major professor is obligated to provide thesis supervision plus consultant support which aids the overall program. This approach provides for a high level thesis research project, one year of support to the project and the training of a student for possible future contributions to Central American agriculture. Funds for 5 students per year are recommended for consideration.

5 thesis students at $11,000/student = $55,000/yr.

APPENDIX 16

RATIONALE FOR REDUCED FUNDING

In the event that full funding is not possible, the best alternatives for funding reductions would be the six centers, one site of work (probably Olancho because of the distance) and the cabbage work at Siguateguape, in the order stated. The important element to keep in place is the team approach being developed which identifies problems, conducts research for a solution, develops the delivery system and trains the trainer who multiplies the outreach.

The following are cost estimates which could provide guidance for reduction:

OPERATION	COST SAVING (U.S.$)
Phase out of centers	$162,000
Near deletion of one resident site	100,000
Near deletion of cabbage program	60,000
Phase back EAP personnel by 10 percent (estimate)	70,000
Operational savings from reduced operations of above sites	40,000
TOTAL ESTIMATED SAVINGS	$432,000

If a phase back of funding is necessary (and even if not), additional efforts by EAP/MIPH should be directed towards obtaining outside support for funding of valid research proposals generated within the program.

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