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MID-TERM REVIEW MISSION OF THE GOVERNMENT OF INDONESIA AND FAO IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management in Rice-Based Cropping Systems

MISSION REPORT
July 1991

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GLOSSARY

BALITTAN	-	Balai Penelitian Tanaman Pangan - Research Institute for Food Crops
BAPPENAS	-	National Development Planning Agency
BP-BIMAS	-	Badan Pengadali Bimbingan Massal - Agency for Mass Guidance
BIMAS	-	Rice Intensification Mass Guidance
BLPP	-	Provincical Agricultural Training Center
BPH	-	Brown Planthopper
BPLP	-	Agency for Agricultural Education and Training
BPP	-	Rural Extension Center
BPTP	-	Food Crop Protection Regional
CATEGORY I PESTICIDE	-	Any pesticide classified by the WHO as highly hazardous or extremely hazardous
CGIAR	-	Consultative Group on International Agricultural Research
CIDA	-	Canadian International Development Agency
DINAS PERTANIAN	-	Agriculture Service Agency under Provincial/ Local Government
DITLIN	-	Plant Protection Directorate
FAO	-	Food and Agriculture Organization
FL-I	-	Field Leader I
FL-II	-	Field Leader II
FTF	-	Field Training Facilities
GIS	-	Geographical Information System
GOI	-	Government of Indonesia
GOLKAR	-	Golongan Karya - National Political Organization
GTZ	-	German Crop Protection Program
ICRISAT	-	International Crop Research Institute for the Semi-Arid Tropics
IPM	-	Integrated Pest Management
IRRI	-	International Rice Research Institute
JICA	-	Japan International Cooperation Agency
Kabupaten	-	District
KANWIL	-	Regional Office

Kelompok Tani	-	Farmer's Groups
LITBANG	-	Agency for Agricultural Research and Development
Land Learning Laboratory	-	A field facility where people learn IPM skills by hands-on practice
MOA	-	Ministry of Agriculture
NGO	-	Non-Government Organization
OBOR FOUNDATION	-	Non-Government Organization that produces materials and articles related to environmental issues.
ORSTROM	-	Institut Francais De Recherche Scientifique Pour Le Development en Cooperation
PEMANDU	-	Leader/Facilitator
PHP	-	Pest Disease Observer
PPL	-	Field Extension Workers
PPS	-	Subject Matter Specialists
PPUP	-	Coordinating and Planning Extension Officer
SLPHT	-	Farmers' Field Schools
USAID	-	United States Agency for International Development
WHO	-	World Health Organization

1. GENERAL STATEMENT OF CONCLUSIONS

The mid-term review mission found that the IPM program has succeeded in developing and implementing a training program for integrated pest management (IPM) in rice. The program's focus on experiential learning and farmer participation represents a radical departure from standard agricultural extension methods. This innovative farmer-centered approach has enabled the program to exceed initial training targets and to take decisive steps towards bringing IPM to the mass of Indonesian farmers. This program improves farmers' capacity to manage their own fields. As a result, farmers use less pesticides, obtain higher profits and reduce their exposure to hazardous substances. For the first time in Indonesia — and perhaps in the world — an extension program has put the farmer first in the decision-making process. Farmers sense that they are in control and therefore take the lead in consolidating IPM in their villages and even in neighboring villages. The project also has strengthened the resolve of the Government of Indonesia to maintain a coherent IPM policy which involves continued removal of pesticide subsidies and introduction of restrictions on the use of more dangerous pesticides. Momentum has been generated to support a massive shift in farmer knowledge and practice in Indonesia by way of a multi-faceted program of training, research, education, and encouragement of independent activities by farmer groups.

2. SUMMARY OF RECOMMENDATIONS

Recommendation 1: The project should be continued for an additional five years, actively seek external and national donors, and be designed to: (1) fully implement the ongoing system of field extension training for IPM begun under the current phase — particularly to a broader array of farmers; (2) construct a research and development effort aimed at supporting the development of IPM in crops other than rice; and (3) consolidate IPM as the official crop protection policy in Indonesia for a broad range of crops including horticultural and palawija (secondary field crops in rotation with rice) crops. A fully representative formal program research sub-committee should be formed and used to coordinate and guide the mixture of technical and social research required by the program.

Recommendation 2: BAPPENAS and the FAO managerial staff should develop and obtain Government of Indonesia approval for a plan to match funds for research and farmer training originating from external donors with national funds, aimed at the provision of

matching financial support of Farmers' Field Schools (SLPHT) during the next phase of the project.

Recommendation 3: The Government of Indonesia should consider policy modifications which accomplish the following: (1) allow extension field workers and pest observers to work together in the field; (2) assign extension field workers responsibilities for organizing Farmers' Field Schools (SLPHT) and, with support from Pest Observers (PHPs), training farmers in IPM; (3) change the incentive structure and the credit system now employed for extension field workers to give maximum credit points for field work and resolution of farmers' problems; and (4) identify IPM field schools as THE official vehicle for IPM training.

Recommendation 4: The Program should make a concerted effort to train women, small farmers and other farmers not enrolled in organized farmers' groups (Kelompok Tani).

Recommendation 5: The program should organize multi-disciplinary workshops at the WKBPP (extension subdistrict) and Kabupaten (district) levels designed to bring together extension field workers, pest observers and farmers to discuss pest management and how to make IPM function better at the farm level. Field school design and evaluation, follow-up of previous trainees, and relative roles in delivering IPM would be topics for discussion.

Recommendation 6: The FAO program staff should continue their work on Geographical Information System (GIS) development and elaborate a more detailed strategy for use of cartography based on a detailed needs assessment. Concerted effort should be made to identify the broadest applications of mapping.

Recommendation 7: Before the completion of this phase of the current project, a document should be published which provides the details of how Indonesia transformed from pesticide-dependency to Integrated Pest Management for rice. This document should be replete with color photos, graphs, tables and a novel-like text which can be used as a guide to a world audience.

Recommendation 8: The GOI and FAO should work to organize a Land Learning Laboratory in Indonesia for explicit purposes of educating government officials, policy makers, plant protection specialists, conservationists, and practitioners from other disciplines throughout the world about the history, successes, pitfalls, and current methods of Indonesian rice pest management.

Recommendation 9: The program should make efforts to infuse secondary and university academic and agricultural institutions in Indonesia with the materials, methods and philosophies of IPM.

Recommendation 10: A study should be undertaken to assess the rural health of Indonesians as affected by pesticide use. This could be carried out with the close involvement of the regional IPM project which would have the advantage of drawing on similar experiences from a wide range of country situations.

Recommendation 11: As soon as IPM technology becomes available, expand the current ban to include a prohibition on the use of the 57 pesticides for crops other than rice [Such IPM technology already exists for several major crops]. Continue the policy of no pesticide subsidy. The Government of Indonesia should scrutinize all WHO Category I pesticides and, if found meritorious, consider banning all of them from use in Indonesia.

Recommendation 12: FAO should develop a category for high priority, fast-track projects into which this project should be placed and its needs serviced accordingly. Administrative processing and personnel recruitment should continuingly be handled on a priority basis.

3. INTRODUCTION

3.1 Mission Terms of Reference

The project document calls for the program to be visited by a mid-term review mission. The mission was requested to review the project's objectives, design, implementation and results. On the basis of this review, recommendations were to be made for the future of the project including any further need for external assistance and collaboration from FAO with rationale. The mission terms of reference are attached as Annex 1.

3.2 Dates of Mission & Team Composition

The mission took place from 17 June to 3 July, 1991, in Indonesia. A complete itinerary, a list of officials interviewed, the composition of the review mission, and a map displaying sites visited by each mission sub-team can be found in Annex 2. The review mission was comprised of the following expertise:

1. Plant Protection Specialist/Team Leader with background in IPM and training (Carl S. Barfield - FAO)
2. Evaluation Specialist with background in agricultural economics and organizational/institutional development (John Markle - FAO)
3. Extension/Training Specialist (James Mangan - FAO)
4. IPM Specialist (Soehardjan - GOI)
5. Extension and Training Specialist (Salmon Padmanagara - GOI)
6. Agricultural Policy/Sector Analyst (Roland K. Roberts - USAID)

To optimize review mission time, two teams were formed (A & B). For the first week of the review, the itineraries of mission teams A & B were different (see Annex 2). All six mission members were provided detailed program documentation upon arrival and, during the review, had access to program personnel, farmers, extension workers, pest management specialists, program training methods (in-field and training materials), farmer leaders and a host of government officials. During week two, the mission began to meet as a single team and sort out findings. As questions arose, FAO program staff in Indonesia provided additional documentation and responses.

4. BACKGROUND TO THE PROJECT

President Suharto signed a Presidential Decree in November 1986 to stop one of Asia's most recent environmental crises. Beginning in the late 1970's, Indonesia had subsidized the frequent, prophylactic, often indiscriminate, use of synthetic organic pesticides. Besides environmental and human intoxication, the entire complex of natural enemies which had kept rice pests in check had been decimated. What resulted was a continuously resurgent population of the brown planthopper. More use of indiscriminate insecticides resulted in higher brown planthopper populations. Indonesia's most important crop, rice, was under siege during the very period when Indonesia was seeking to become self-sufficient in rice production.

Decisive research from 1979 to 1986 proved that the rice brown planthopper was a pest induced by pesticide use. Without pesticide bombardment, naturally occurring parasites and predators would keep brown planthopper populations regulated below pest status. The Presidential Decree not only banned a wide array of pesticides and set in motion

the step by step removal (completed in January 1989) of pesticide subsidies, but it also declared integrated pest management (IPM) to be the official pest control policy of Indonesia. Small scale training from 1986 to 1988 showed IPM to be the most cost effective production program for rice in Indonesia. Based on this pilot training, the GOI (1989) initiated the present program, which remains one of the most aggressive IPM training programs ever undertaken.

Indonesia has participated (since 1980) in the FAO-executed Regional Pest Management program in rice-based cropping systems. Rice culture is the most important agricultural activity in Indonesia where in excess of 10 million hectares of paddy are planted annually. Government intensification efforts in rice production have enabled Indonesia to attain rice self-sufficiency after many years as a net importer. Improved irrigation systems and introduction of intensive input packages such as high yielding varieties, credit, and fertilizers initially contributed significantly to increased rice production. Unfortunately, these packages included prophylactic application of pesticides, which generated a vicious cycle of ever larger pest outbreaks and higher levels of pesticide use. The aforementioned research demonstrated that, in many cases, there was no need to apply pesticides in rice where up to six applications, often with highly toxic and/or unregistered compounds, were used under the subsidized program. What became necessary was training of the agricultural production community in the philosophy and methods of IPM.

A grant from USAID for US$17 million was allocated for IPM implementation. Utilizing a portion of the USAID grant, the Government of Indonesia contracted FAO (Project UTF/INS/067/INS signed on May 12, 1989) to provide technical support for the development of a national IPM program.

The intended beneficiaries of this program must be identified in appropriate historical context. Rice production in Indonesia, up to a few brief years before the initiation of the national IPM program, was inundated with misconception about how to deal with pests. The agricultural support structures had become victims to the rampant idea that synthetic organic pesticides were the only real means of controlling pests. This approach became institutionalized in Indonesia when the Indonesian Government began to provide heavily subsidized "technical packages", including subsidies for pesticides of as much as US$162 million/yr (1990 dollars). Some rice farmers applied pesticides out of fear of crop loss; some out of legal obligations written into loan agreements. The largest instigators of indiscriminate pesticide use in Indonesia, as in other parts of the world, were pesticide companies who were reaping huge profits in the process.

Farmers and their national agricultural support system operated without adequate, often fundamental, knowledge of the rice ecosystem. Such apparently basic ideas as recognizing egg masses as a life stage of an insect whose larval stage would eat rice were not part of the knowledge base of many farmers. Attention had been focused on prophylactic use of pesticides to the exclusion of all else. As will be seen later in this report, training on fundamental aspects of biology and ecology were crucial to success in overhauling the Indonesian approach to pest control.

Some plant protection strategists inside and outside Indonesia had witnessed similar approaches to pest control and understood the problems Indonesia was having as a result of total dependence on pesticides. Rice fields were void of endemic natural enemies. Rice pests resurged to higher and higher levels following ever more frequent and more toxic pesticide applications. Unrefutedly, rice fields in particular and the Indonesian landscape in general were suffering from the effects of pesticide drift and biomagnification. People were no doubt being intoxicated.

Dr. Ida Nyoman Oka (now member of the IPM Steering Committee for the national program) was important in an earlier attempt to get the Government of Indonesia to alter its plant protection practices in 1979. However, only limited pilot training programs occurred prior to 1986, and the government was not yet prepared to embrace fully the IPM approach. The massive problems occurring with brown planthopper provided FAO's regional rice IPM program opportunity to encourage the Government of Indonesia to try the IPM approach rather than invoke a pending massive aerial bombardment with pesticides. The official national policy statement came in 1986. This was quite appropriate; however, since there had been years of neglect of any pest control approach save pesticides, exactly **who** was going to deliver this new approach called IPM? Declaring IPM as national policy and subsequently removing pesticide subsidies was a crucial beginning; however, the IPM approach could not materialize without widespread, practical training for the entire spectrum of the agricultural community in Indonesia. This training would, of necessity, involve training of pest management specialists (pest observers), extension field workers and farmers. Further, the training must be accomplished within a political environment where many key policy makers had to be educated just a step ahead of needed cooperation.

5. PROJECT OBJECTIVES AND THEIR RELEVANCE

As discussed in the initial project document, the project has as its fundamental objective that the Integrated Pest Management approach should become a fundamental and enduring part of Indonesia's approach to development. The first essentials for this were seen as the establishment of a training program for rice farmers to be backed by necessary interactive research and comprehensive data bases to document all aspects of pest problems and interventions. This program was to focus on rice, but with attention also to crops alternating with rice in the rotation (palawija) and to vegetables. The areas for initial concentration were the major rice production provinces (i.e. the whole of Java, North Sumatra and South Sulawesi). In particular, the project was intended to:

- initiate an experience-based training program lasting one year for Pest Observers (PHP), who would support extension and carry out simple studies. The PHPs were to provide on-the-job training for extension workers (PPLs), who would in turn train the mass of farmers;

- mobilize a series of strategic extension campaigns to reach one million rice farmers. The intention of the campaigns was to produce a demand from farmers for more in-depth training in IPM as well as transmit some simple concepts;

- set up a data base to document all aspects of IPM and include a Geographic Information System (GIS). The GIS was regarded as important because there was a lack of maps which brought together topography, agro-ecology, pest incidence and the distribution of major crops and government agricultural services;

- establish a program of field studies principally integrated with training, but also including more fundamental work on the pest habitat in various agro-ecosystems. This was regarded as essential to the design of effective IPM interventions. Durable resistance in rice was also singled out for attention as was more detailed work on pest thresholds for spraying in rice.

It was envisaged originally that research, particularly on crops other than rice, would be contracted separately by the Government; later however, an Addendum for additional research was included under the project.

As is evident from the discussion in the Background section, the mission regards the fundamental objective of this project as essential to Indonesia's development. Indeed, the vicious cycle of pest outbreaks in the nation's basic crop (rice) could only be overcome through a drastic reduction in pesticide use. Further economies in rice and other crops would be achieved through application of a balanced and integrated approach to pests and diseases, and there could be significant improvements in public health and safety. The question was how to achieve this.

The original approach envisaged for the project, in retrospect, over-estimated what could be achieved through extension campaigns (i.e., the transmission of simple messages). Farmer education about the potential of IPM and its application has proven to be a more fundamental process. The approach also gave inadequate attention to how the PPL would carry the training approach on to farmers and the difficulties within the existing extension system. Improving the project's approach has produced an emphasis on other aspects of the project as well as attention to another underlying objective: educating the whole agricultural development system about the importance of IPM.

The attention given to research on IPM on non-rice crops is essential to the development of IPM strategies for those crops for which the information base is weak. In rice, further improvements will require research, but adequate information exists to initiate major changes in farming practice. The emphasis given to durable resistance was probably not essential, as breeding has been a priority both at the international and national levels. Similarly, the overall thrust of the project in recognizing the dynamic nature of the pest complex has overtaken the too simple concept of threshold levels for spraying.

Three fundamental goals have guided planning and implementation of the program:

1. **Provide experiential training crucial to IPM.** Training occurs in the paddy and is hands-on. Training is constantly incorporating critical information and rapidly gets new information to participants.

2. **Provide interpersonal and analytical skills training.** Increased technical knowledge is of little use if those trained do not know how to organize and deliver training to others. Further, some level of data analysis is crucial to expanding overall agriculture capabilities to experiment and interpret beyond the immediate program.

3. **Backstop those trained.** Moral and technical support is provided to insure that trainees do not lose momentum when encountering new and complex situations.

6. PROJECT DESIGN

As discussed below, the project was designed for a duration of two years with an input of US$ 4,177,805. This was later raised to US$ 5,441,272 to permit research on crops other than rice to be taken up more substantively within the project.

The project was designed with a duration of two years. This was clearly insufficient for anything beyond initial training and research. Indeed, an underlying assumption was that the project would be continued beyond its original two year period. Goals were set in the early stages of the project that must have appeared ambitious in the context of a two-year training program. In any event, however, the early gambles have paid off, largely due to the commitment of project staff and the support of the Indonesian Government. Widespread impact now depends on continued access to funding which the mission regards as absolutely essential.

Partly as a result of delays in recruitment, savings have been made and on 27 October 1990, it was decided to extend the project by a further 12 months with no additional funds and to initiate training of PHP in Bali and West Sumatra.

Institutionally, oversight of the project was located with the National Planning Board (BAPPENAS). This was important in view of the multi-disciplinary nature of IPM, the need to ensure priority at provincial as well as national levels and as an indication of the priority the government attached to the program. Project activities required coordination among various directorates and agencies of the Ministry of Agriculture and with the universities. As the project developed, additional linkages to health and irrigation (Public

Works) were expected to grow in importance. An active system of coordination committees also has been established (see below "Project Implementation").

The project document provides a detailed indication of the outputs to be produced, the activities to be undertaken and the inputs to be provided. These were internally consistent as to the work to be done; however, by the standards of most projects of this scope (especially in training), the inputs were inadequate and time-frame too short. The time-frame has proven inadequate with respect to research and the establishment of data bases and a GIS. Initial start-up time was under-estimated for research and, in the case of the GIS, the task may be larger than originally envisaged. In the case of training, although the original goals were highly ambitious, the program actually surpassed these and has moved on to formulate even broader targets for the near future.

The project document was too restrictive in defining the way in which the project should develop, given the calibre of the personnel which has been brought together and the commitment of the Government to the program. This has not proven a barrier, however, as it provided a working guide while the necessary institutional framework was in place to allow justifiable adaption to changing circumstances. The document did define the overall thrust of the project. The basic training philosophy to be employed is a field-based, non-formal education approach aimed at teaching farmers and those who assist them to be better managers of their crops. Emphasis is placed on experiential learning to foster improved decision-making skills. For PPLs (extension workers) and PHPs (pest observers), training was to improve master planning and management, group dynamics, and evaluation. Such skills were deemed crucial to enable these technicians to organize training for farmers.

7. PROJECT IMPLEMENTATION

7.1 Project Start-Up

The project document was signed in May 1989. Project start-up was greatly facilitated by the regional program GCP/RAS/092/AUL, GCP/RAS/101/NET, GCP/RAS/108/AGF. With the decision of the government to introduce IPM as a national policy, resources from the World Bank-supported national agricultural extension project were utilized in 1987 to organize a national campaign. As part of that effort, in cooperation with the regional program, 30 principal trainers who had already been trained from the Plant

Protection Directorate by the regional program trained 200 master trainers also from the Plant Protection Directorate. It was this experience and these trainers which permitted the rapid initiation of training by the current project. The regional project contributed approximately US$ 250,000 for employment before and during formal recruitment of a training specialist/team leader and an IPM specialist from June 1989. The Indonesia project Chief Technical Adviser was also the regional project team leader. This initial input enabled the first season of training for PHPs to begin in September 1989.

7.2 Supply of Inputs

Annex 3 provides a summary of the inputs provided through the FAO project and separately by the Government of Indonesia. FAO was responsible principally for the recruitment of professional and office support staff, the supply of vehicles and minor equipment (including computers) and the issue of contracts for research. The first two experts to be recruited were in training and in IPM. A cartographer also was contracted along with a senior national IPM specialist. A cautious approach was adopted to further recruitment, as the project placed greater emphasis on finding the right person for the job and allowing flexible development in response to needs than on getting staff into post. In this, as in other respects, although the project had a time horizon of two years, it has been treated by all concerned as the commencement of a long term and enduring program. After testing on an initial consultancy, an extension and training specialist was added in November 1990. A specialist in habitat studies began work in January 1991. Only now, an officer is being recruited to further develop the Geographic Information System.

Careful attention has been paid by the project to bring to this effort only persons who have experience in Indonesia and who understand the nuances of how to effectively develop and deliver IPM programs in Indonesia. Hence, nearly all the existing staff have considerable experience of work in the country, and it is difficult to convey in a report of this type the sense of mission, commitment and *esprit de corps* that they bring to the work. This spirit has infected the whole program in a way that none of the mission had ever before seen outside of NGO activities and never in a program of this size and working within a government structure.

The team was also impressed by the extent to which decision making is already being decentralized and provincial level Plant Protection Heads are making decisions about the future of extension and training in their areas.

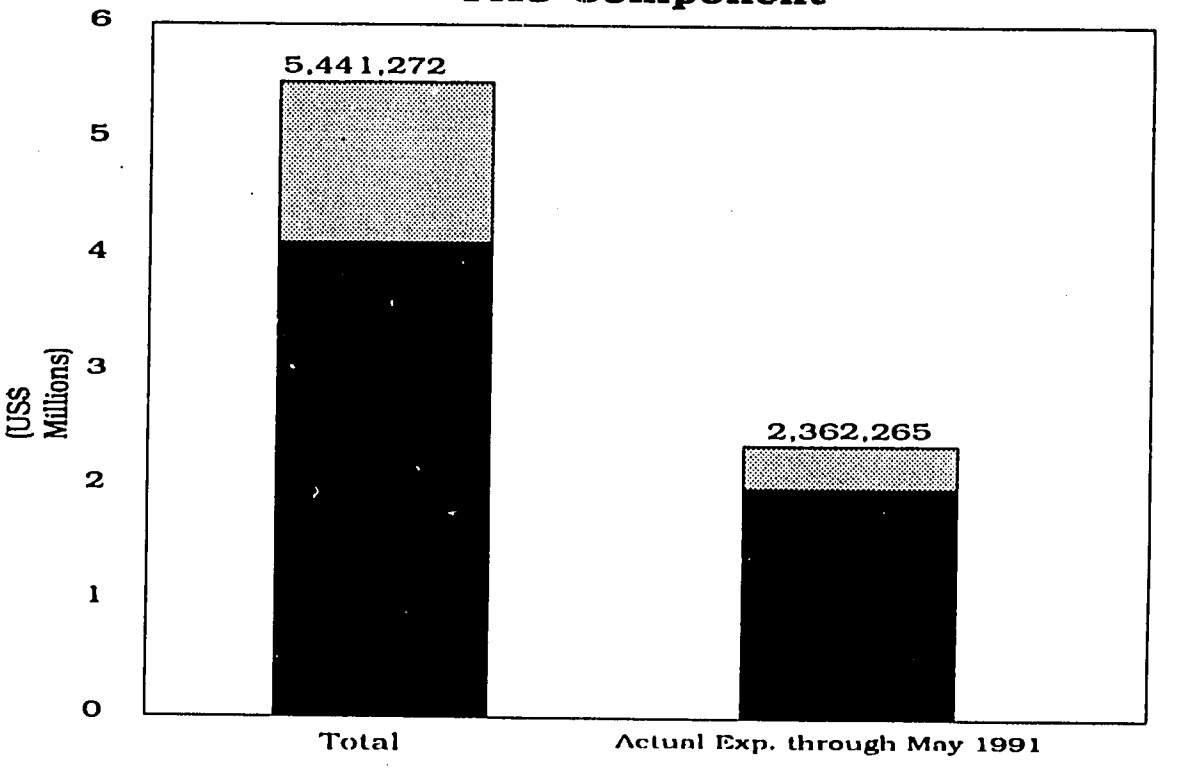
Largely as a result of delays in administrative problems in FAO Headquarters, difficulties were experienced in completing arrangements for a research contract on palawija crops. This has, in the end, facilitated development of more appropriate organizational arrangements for research as discussed below. These draw on and develop national capability, rather than relying heavily on inputs from foreign contractors.

The project has assembled and covers the costs of a comparatively large team of support staff, well equipped with computers, fax machines, etc. The project also has an adequate supply of vehicles. It seems to have demonstrated that the skimping and penny-pinching which often characterize these aspects of projects do not necessarily pay. One result has been that the professional staff have been much freer to concentrate on substantive aspects of the work, rather than administration, and that they have not been hampered in the conduct of activities by continuous battles for the tools to do the job. The budget for equipment, despite its adequacy, is less than 5% of the total budget compared with average of over 20% for the average FAO field project. There will come a time, however, when those aspects of the project which are going to continue on a long term basis (such as continued training of PHPs) will have to be absorbed into and administered through the Government structure.

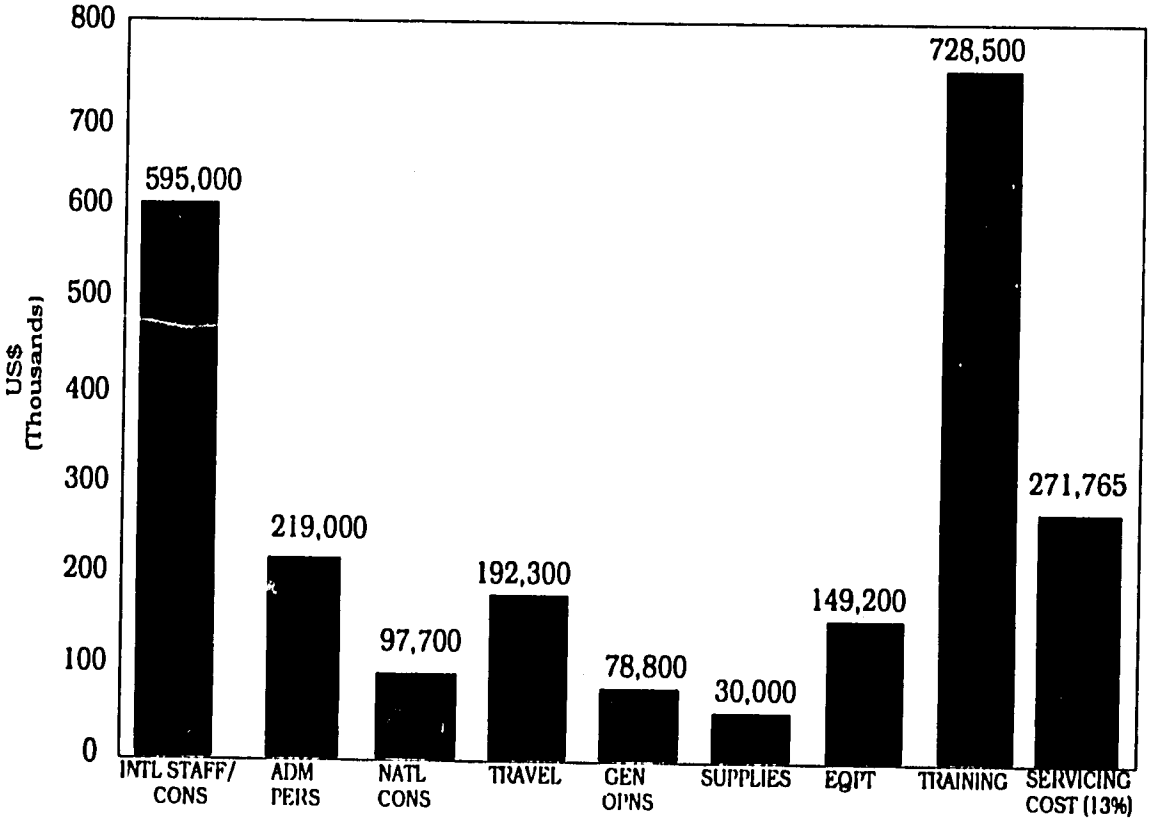
7.3 Budget and Expenditure

The first chart below illustrates expenditures to date compared with those planned. The gray portion of budgeted funds represents the Addendum Budget for Palawija (especially research). The grey portion of the actual expenditures represents FAO Headquarters' project servicing cost of 13%. An estimated US$ 2,362,265 had been expended by May 1991. As can be seen from the second chart, only in the case of training is expenditure in excess of budget to date. Expenditure on national consultants is in line with allocations; whereas, that for international staff is considerably below. New proposals have now been drawn up to extend the life of the project within existing allocations and to increase funds for training.

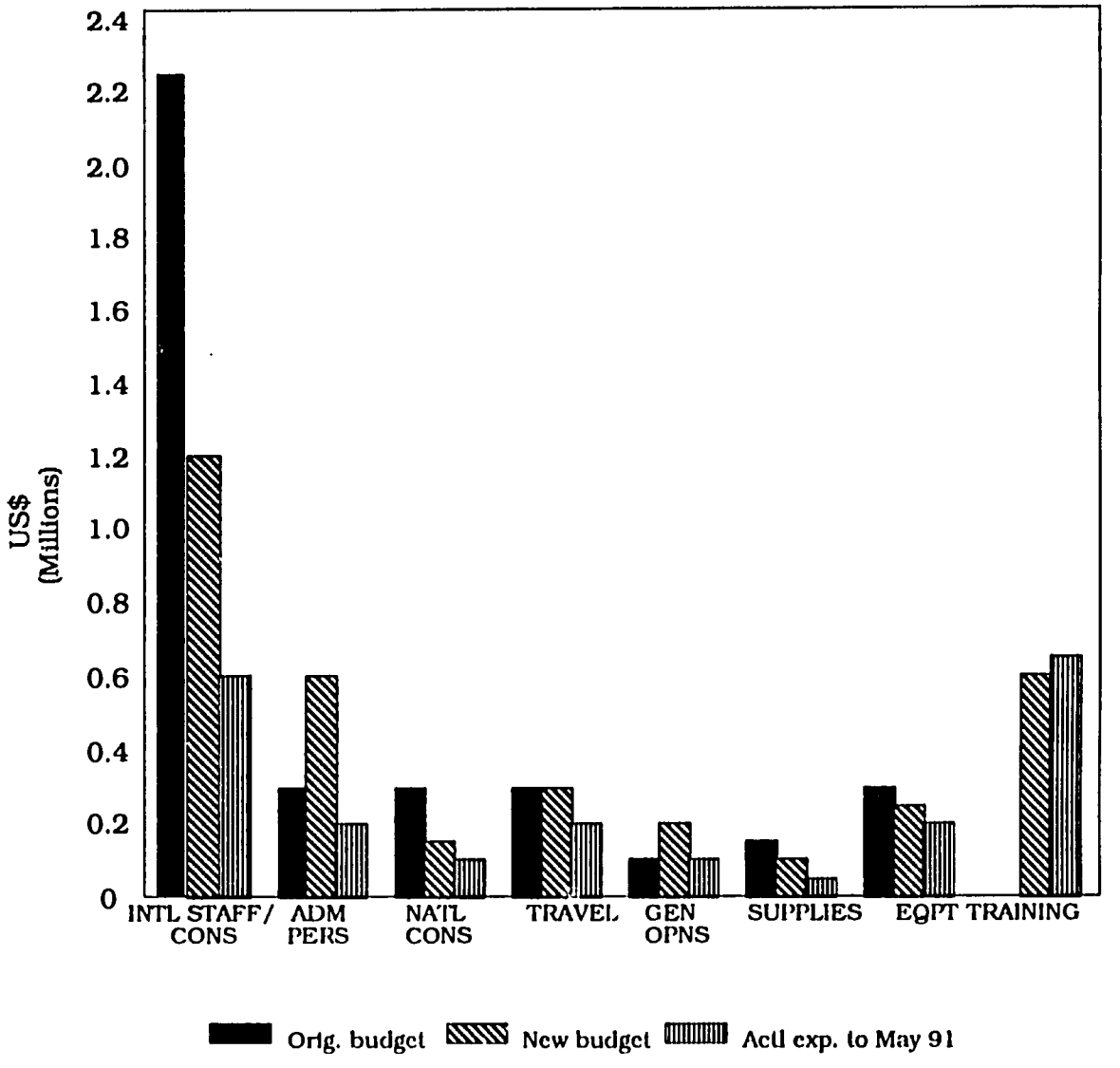
Comparison of Total Fund Allocation and Total Expenditure through May 1991 FAO Component



Actual Expenditure up to May 1991 FAO Component



Comparison of Original and New Fund Allocations with Actual Expenditure up to May 91 FAO Component



7.4 Management

The project is managed and coordinated by the National Development Planning Agency (BAPPENAS). Implementation occurs primarily through the Plant Protection Directorate (DITLIN) of the Directorate General of Food Crops, Ministry of Agriculture. The Ministry of Agriculture's Agency for Agricultural Education and Training (BPLPP) facilitates PHP training, and universities take overall responsibility for this program which culminates

in a diploma (D1) for pest observers. To ensure adequate coordination, a Steering Committee has been established including senior government figures as well as representatives of the main agencies. This group has met approximately twice a year, but is supported by an active working group. The working group identified in Annex 4 consists of representatives from Crop Protection, Education and Training, Rice Intensification Mass Guidance (BIMAS), the Agency for Agricultural Research and Development (LITBANG), BAPPENAS and FAO staff in Indonesia. It meets regularly and has recently established a sub-group on research. The mission review team understands that several months were needed to resolve differences among this diverse group. The productive fashion in which the program now functions is testament to the resolve of all parties to implement IPM in Indonesia. The working group functions adequately as a program directing and implementing structure.

In order to understand the institutional framework in which the project operates, Annex 5 summarises the structure and workings of the extension service, the Plant Protection Directorate and the agricultural education system.

The mission team has been impressed with the degree of adaptability demonstrated by program staff and programs. This program began as a massive training exercise. As questions arose (e.g., how to resolve a new pest problem) for which no answers existed, the program has demonstrated a remarkable ability to regiment forces, establish practical field experiments, find usable solutions and then incorporate those solutions and experiences immediately into training. The result is a solution to immediate problems and direct feedback to trainees and farmers. The program has been exceptionally responsive to the needs of Indonesian farmers and the national agricultural system which supports farmers. The overall quality of training improved with each new piece of information resulting from a set of field experiments aimed at solving particular pest management problems.

7.5 FAO and GOI Support

Difficulties relating to the contract for research were commented on above. Early on, FAO/Headquarters was not adequately servicing the program and responding to communications and program needs in timely fashion. By the time of this mission, however, the situation seems to have improved significantly and there is evidence of adequate support from Rome.

Technical support for the national project has been provided largely by the regional project. One visit was made by an officer from FAO Headquarters to discuss extension aspects, particularly computer applications. In certain specific areas which do not lie within the mainstream of project expertise (such as GIS development and the relationship between pesticides and food standards), technical support from FAO Headquarters might be helpful. In general, however, a closer technical relationship between the project and Headquarters could provide useful lessons for Headquarters to transfer elsewhere, particularly with respect to agricultural training and extension approaches.

The extent of commitment by the Government of Indonesia to the program has been extremely impressive. In particular, staff have been mobilized and committed from the Directorate of Crop Protection in very large numbers. A similar commitment is now growing in the provinces and needs to be transferred to the extension services.

8. PROJECT ACTIVITIES, OUTPUTS, AND EFFECTS

Annex 6 summarizes the production of outputs *vis-a-vis* the original project document targets. In the section below, the mission has attempted to provide a rather more substantive and qualitative discussion of these.

8.1 National Policy and Planning

The current project grew out of a bold policy initiative; and as it progresses the program continues to generate results that support and strengthen national IPM policy. On the planning side, the concrete results obtained in the field have become a focal point for gathering officials from relevant agencies at all levels.

The National IPM Program's central policy and management structures were established by decree No. 075/KET/9/1989 from the State Minister for Development Planning. Subsequently the daily operational mechanisms allowing fast and flexible action at the field level were established by Ministerial Decree No. 136/KET/12/1989. These decrees, plus the official assignment of 110 full-time trainers and 1000 trainees to the program by the Director General of Food Crop Production, gave the project a solid policy base for operations.

The project has taken a pro-active stance in promoting IPM policy evolution. Some of the activities undertaken to further entrench IPM include:

- Coordination and Planning Workshops at Province and District levels. For example, a provincial workshop on IPM in Central Java was hosted by the Governor and chaired by the Minister of Agriculture. Workshops in West Java have brought together District Agriculture officials, representatives of IPM farmers groups, and area extension workers. Meetings at the District level in East Java have been used to generate local budgetary funding for IPM farmer training programs.

- At the international level, Indonesian IPM is being promoted as an "export commodity". The policy initiatives and operational results of the IPM program have been showcased at the national level to groups from Vietnam, the Philippines, Bangladesh, and Thailand. The South-South Commission led by the Honorable Julius Nyerere visited only two projects in Indonesia: IPM and Family Planning.

- The Jalur Pantura (Northeast Coastal Plain of West Java Province) White Rice Stemborer Mass Action Program, a program which in its initial stage alone provided training for 75,000 farmers, village officials, and extension workers, attracted visitors from cabinet ministers to the chairman of the GOLKAR political group. Such broad exposure of 'IPM in Action' provided feedback to a wide range of local and national officials concerning the efficacy of the IPM approach, and the strength of the IPM operational network, for tackling immediate and pressing problems in the field. The immediate response capability shown by the IPM system prevented a large scale release of pesticides that would have caused further damage to agricultural production as well as to IPM policy.

- In the area of public health, the IPM Program through the auspices of BAPPENAS has begun the implementation of a collaborative set of activities with the Department of Health. Besides immediately strengthening the health-aspects technical backstopping for IPM field activities, this collaborative effort will move into an examination of the health impacts of IPM in an effort to broaden the policy support base for IPM.

- Successes in IPM for rice has led to proposals for developing IPM programs for other cropping systems including horticulture and estate crops.

Top level Ministry of Agriculture meetings have presented the IPM fieldbased training approach as the model for extension and training activities across all agricultural content areas.

- Press Orientation programs have been held to promote IPM through national media. With consistent reporting on IPM field programs now appearing in newspapers plus national and local television broadcasts, national and local officials as well as the general populace are becoming aware of the ecological principles underpinning IPM.

- Publications of IPM literature have been produced and sold by local printing houses, including an Indonesian translation of Rachel Carson's *Silent Spring* distributed by the OBOR Foundation.

8.2 Training Activities and Outputs (see also Annex 6)

Perhaps the most distinct feature of the Indonesian National IPM Program is the training method. It is characterized by very carefully thought-out field exercises at all levels, which are designed to engender skills of observation and judgement.

This is a response to a conviction of the IPM Team that farmers are quite capable of becoming their own best decision-makers. But this is also a response to past failures of more "message oriented" training approaches involving simple formulas and threshold levels of pests, which did not work—in part due to the complexity of an ecological system, which is not reducible to such simple rules of thumb, and part due to the method of training which did not sufficiently emphasize the role of his or her own judgement. The Indonesian IPM Program has thus learned valuable lessons from previous training models and seems to have struck upon an approach to training which increases understanding of agro-ecosystems and ability to make judgments, instead of just following instructions.

8.2.1 Site Selection

The determination of geographic regions for program activities was made on the basis of a rigorous and systematic study of suitable sites in Indonesia. Selection of target sites was the result of careful agro-ecosystem analysis with focus on intensively cropped, irrigated, multiple cropped rice lands. Selected sites, six of which were visited by the mission team (see Annex 2), were chosen as program sites because they met criteria for

maximal impact on the most intensive rice cropping areas in Indonesia. These 10 areas represent 75% of total rice production in Indonesia. As can be seen in the following table, the 10 study sites represent areas which encompass a large share of the nation's cropped area in rice and total rice farmers.

Selection of target sites is a crucial, yet sometimes chaotic, process in development programs. After viewing on-going activities at the various sites, the mission team feels that program staff used a rational agroecological approach to site selection that succeeded in maximizing program impact.

NO	FTF	Province	AREA* (Ha)	PHP**	PPL***	FARM**** Families
1	Tanjung Morawa	Sorth Sumatera	541,832	167	1,137	889,279
2	Serang	West Java	1,194,507	494	2,334	3,178,713
3	Jatisari					
4	Cihea					
5	Tegal	Central Java	1,010,506	334	2,866	3,177,006
6	Scropadan					
7	Wonocatur	Yogyakarta	62,552	45	367	402,476
8	Kepanjen	East Java	1,171,316	546	2,184	3,443,581
9	Banyuwangi					
10	Batangkaluku	South Sulawesi	589,283	169	1,586	699,167

PHP: Pest and Disease Observers
PPL: Extension Workers

* based on Central Bureau of Statistics, 1989
** based on estimation of Directorate of Crop Protection Data, 1991
*** based on Directorate of Food Crops Extension Data, 1990
**** based on Agricultural Census Data, 1983

8.2.2 Training of Pest Observers

The bulk of training resources in the project have thus far been devoted to the training of Pest Observers (PHP) — plant protection agents who are under the Plant Protection Laboratories within the Department of Agriculture. These Pest Observers (PHP) are the trainers of both Field Extension Agents (PPL) (who learn how to conduct a field school) and

farmers (learners in the field school). So far, more than 1000 Pest Observers (PHP) have been trained in a program approximately one year long.

Briefly, the one year training program contains the following exercises:

1. Planning a rice crop; carrying out on field experiments with the rice crop to determine results based on first hand observation; keeping and observing an "insect zoo" in which ratios of pests to natural predators are observed over time; harvesting the rice crop and weighing it, to find out the consequences of the trials as far as yield is concerned. (Approximately 3 1/2 months.)

2. Carrying out an extension season in which they teach Field Extension Agents (PPL) and farmers how to identify pests and predators based on a questioning approach designed to get farmers to draw their own conclusions; has to grow a healthy crop; how to carry out field inspection; how to monitor ratios of pests and predators; how to keep an insect collection as a record of what insects inhabit one's field; how to decide on whether or not the field needs spraying. (Approximately 10 weeks.)

3. Planting a secondary (palawija) crop, usually soybeans; carrying out field experiments; based on first hand experience, drawing conclusions about the consequences of various practices on the harvest (Approximately 4 months.)

4. Enrollment in a University (the five affiliated with the National IPM Program are Institut Pertanian Bogor in West Java, Universitas Hasanuddin in South Sulawesi, Universitas Gadjah Mada in Yogyakarta, Universitas Brawijaya in East Java and Universitas Sumatera Utara in North Sumatra) where they attend lectures in order to obtain their D1 degree (Diploma 1, a one year higher education certificate program). (Approximately 3 1/2 months.)

To date, 500 Pest Observers (PHP) have already been trained (Cycle I) and another 500 (Cycle II) are in the process of being trained in the program, in 10 different Field Training Facilities (FTFs).

8.2.3 Training of Field Extension Workers

To date, 1000 Field Extension Agents (PPLs) have been trained in Cycle I of the program, and 2216 in Cycle II with the Pemasyarakatan ("popularization") and Extension Center (BPP) training. This training of Field Extension Agents (PPL) is done by Pest Observers (PHP), and is characterized by the following features:

1. Of those 10 to 16 Farmers' Groups for which the Field Extension Agent is responsible, motivating two (2) to take part in the Extension Season IPM training.

2. Facilitating Group meetings about IPM in which farmers carry out the following activities:

   - Keep an insect zoo in which they observe for themselves that many species of insects in their fields are beneficial pest controllers;

   - Carry out weekly observation of the insects in Field School (SLPHT) fields, noting tiller development, rat damage, diseased leaves, and counting pests and predator insects;

   - Draw a picture, with crayons on newsprint, which shows crop requirements such as water; takes note of weather conditions; and which shows insects and spiders that they see during each field inspection on a piece of newsprint, noting where it was observed on the rice plant;

   - Count the number of tillers on the rice plant and note carefully other signs of health;

   - Draw conclusions after each field observation about field management needed, including whether spraying is or is not needed; whether weeding or more irrigation is needed, etc.

   - Learn how to keep an insect collection as a record of the types of pests and predators found in their field.

As has been mentioned, the most important feature of Field Extension Workers (PPL) training as promoters of IPM is that they must organize two Farmer Field Schools (SLPHT)

based on their Farmers Group (Kelompok Tani), and assist the Pest Observer in training these participants. This "learning by doing" approach has resulted in a good, workable training model as well as in the most direct and effective opportunity for the Field Extension Workers (PPL) to learn how to train.

The program has trained a growing cadre of extension workers and pest observers. These individuals, in turn, have trained others. More importantly, they have new and improved communications with farmers as a result of this training. The national IPM program has taken care to train pest observers and extension workers not only in details of IPM but also in details of group dynamics, interpersonal skills, appropriate training methods and evaluation techniques—including data analysis and interpretation. Virtually every other IPM program worldwide would envy the success with which this program has so appropriately trained a wide array of agricultural support personnel. The mission team witnessed a deep sense of pride and dedication among trainees and a sincere commitment to IPM which should serve Indonesian agriculture for a long time.

8.2.4 Five Training Program Models

There have been five models (see page 23), so far, of training design for a Farmer Field School (SLPHT) where farmers learn concepts and practices of IPM. These models are as much a consequence of responding to local opportunities and adapting to local conditions as they are a product of advance planning. This should be taken not as a criticism, but as an indicator of the striking adaptability and versatility of the National IPM Program to take advantage of the many types of opportunities which present themselves in different provinces, and as a result of client demand.

As the IPM Program expands and begins to reach larger and larger numbers of farmers, the number of models also can be expected to increase.

CHARACTERISTIC / MODEL	PARTICIPANTS	TRAINING SITE	TRAINERS	BUDGET SOURCE
1. Extension Season Model	Farmers (usually from a farmers' group or Kelompok Tani)	The farmer's land in the village.	Pest Observers (PHP) with Field Extension Workers (PPL) support	
2. Pemasyarakatan ("popularization") Model	Farmers (usually from a farmers' group or Kelompok Tani); Agriculture and other officers	The Extension Center (BPP) and the farmer's land in the village	Pest Observers (PHP) at the Extension Center, supported by the Field Extension Workers (PPL) in the farmers' fields	National IPM Program (BAPPENAS); FAO
3. IPM at the BPP (Extension Training Center)	Field Extension Workers (PPL) and others	Extension Center (BPP)	Pest Observers (PHP)	FAO
4. Self-supporting Model	Farmers (usually from a farmers' group or Kelompok Tani)	The farmer's land in the village	Pest Observers (PHP) or Field Extension Workers (PPL)	Local (non-project) revenues, including village District (Kabupaten) or other. In some cases, farmers' contributions
5. Farmer to Farmer Model	Farmers	The farmer's land in the village	Farmers, sometimes supported by Pest Observers (PHP)	Farmers themselves

DRAFT NOT FOR QUOTATION

It should be pointed out that the last model, farmer to farmer, includes training of trainers for the farmers who do the training. The IPM Team does not believe that IPM can yet be spread informally; training of trainers is still needed to insure quality of the training.

8.2.5 Materials that Support Experiential Training

A major aspect of training in this program, which is consistent from site to site, is this experiential approach. Training is performed in the rice paddy. Other than that, trainers have demonstrated adaptability in picking and choosing appropriate materials, subjects and techniques tailored to particular trainee clientele. This approach is elegantly practical and efficient, as it gets the most appropriate message(s) to each client rather than forcing all trainees to perform as if homogeneous.

The training approach utilized is materials intensive but not materials driven. A unique aspect of the national program is that it maintains a balance between the development and use of training materials and the need for in-field, hands-on training. Many other IPM training efforts dilute experiential aspects in favor of printed training materials and conceptual models. The mission has no doubt, development of appropriate experiental approaches to training which avoid undue reliance on training materials has contributed significantly to the current productivity of this program.

Annex 7 contains a complete list of all materials (brochures, videos, training materials, etc.) developed by the program to date. Professional-quality materials in support of project goals have been produced rapidly and inexpensively. Project staff have developed and refined skills such as research, writing clear and readable prose, desk-top publishing, design, photography and distribution. As a result, the quality and variety of materials available for the training and education is remarkable in view of the resources actually allocated for this purpose.

8.3 Effects of Training

Indonesian farmers are the immediate beneficiaries of this program. The mission team found overwhelming evidence that farmers have changed their pest control practices immensely. Field monitoring occurs where none did before. Farmers talk to each other in groups and small meetings about natural enemies and how best to conserve them. Farmers who have gone through the training show such confidence in their knowledge that they are willing to correct the misconceptions of agriculture officials about pest-predator ecology. On one occasion, a farmer corrected the Minister of Agriculture himself. Farmers who have not yet been a part of any project training desire to become a part because they witness trained neighbors spraying less and yet yielding more. Farmers have begun to train other farmers. Trained farmers have devised basic field experiments and build on what they were taught by the project by coming up with creative ways to deal with pests. These are genuine indications that farmers have been the true beneficiaries of the program.

Indonesian citizens will benefit from this program in two obvious ways. First, the level of toxic pesticides released into the Indonesian environment is being reduced as more and more farmers are trained. This will reduce the incidence of a number of acute and chronic health problems. Second, along with fewer pesticides, there has been an increase in yield (ca. 10%) in the single most important grain crop grown in Indonesia.

The program has so far reached over 50,000 farmers with at least 50 hours of intensive season long field training. Another 50,000 will have been trained in IPM by the end of 1991. This is more than any other IPM project in world. The mission review team personally interviewed large numbers of farmers who had received the benefits of direct training or benefits of improved advice from extension workers or pest observers who had been trained. The Recommendations section of this report will address concerns about wide expansion of direct farmer training.

The program undertook a broad-based study of the impact of training on farmers' behavior from April to June of this year. The study was conducted in a very professional and valid manner. It surveyed more than 2,000 farmers from all ten IPM locations to compare pesticide use before and after IPM training. Among the study's key findings was that the number of pesticide applications per farmer fell by more than 50 percent after training. This is a remarkable result in view of the fact that pesticide use had already declined prior to training as a result of higher prices associated with the removal of pesticide subsidies. As a result of using less pesticide, farmers saved more than 50 percent on their

pest control costs, savings which translate directly into higher economic returns for IPM rice farmers. It is estimated that farmers obtain benefits greater or equal to the cost of training in less than three planting seasons on average.

The study also found that use of the most dangerous pesticides (those actually banned for use on rice by the Indonesian government) fell more than 80 percent after training. This finding alone constitutes dramatic evidence of the public health and environmental gains made under the program.

Evidence from the study also reveals a direct link between training and farmers' knowledge and attitudes about pesticide use. Before training, farmers for the most part applied pesticides as a preventive measure or against insects that they could not identify. After training, however, 80 percent of farmers still using pesticides did so based on observations of pest populations in their fields.

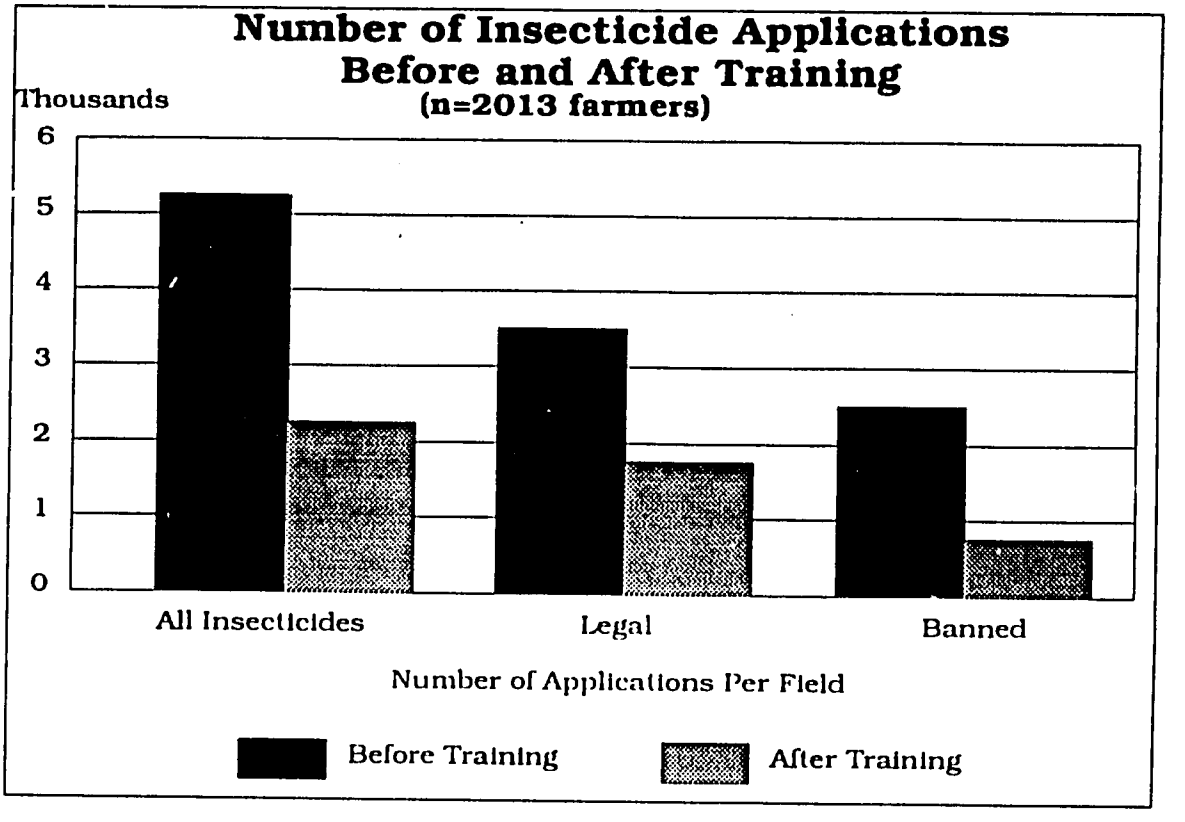
The impact study presented to this team constitutes clear and convincing evidence of real benefits from IPM training. A preliminary report of findings from the impact study is presented in Annex 8.

8.4 Economic and Social Analysis of IPM

A comprehensive benefit-cost analysis of IPM is in progress. When completed, this study will provide valuable information for additional evaluation and program planning. In the meantime, the team has compiled a brief list of social and economic benefits which will form part of the benefit-cost study.

8.4.1 Reduced Risk of Pest Outbreaks in Key Rice-Growing Areas

The resurgence of brown planthopper (BPH) outbreaks in the mid-1980s brought with it fears that Indonesia would again suffer an ecological and economic disaster on the scale of the BPH explosions of the 1970s. Rice is not only Indonesia's staple food, but also the foundation of the rural economy in Java and other densely populated rice-growing regions. Economic and political stability depend crucially on the production and supply of rice. Thus, when three million hectares were threatened by BPH in 1986 the government (facing elections in 1987) knew that decisive steps would have to be taken to protect rice farmers and consumers.



BANNED INSECTICIDE APPLICATIONS BY TYPE

	All Province	North Sumatra	West Java	Central Java	South Sulawesi	East Java
Before Training						
Organophosphates	1552	389	333	313	295	222
Organochlorines	406	64	92	84	97	69
Pyrethroids	13	5	2	2	4	0
Carbamates	129	30	19	16	3	61
Other	61	17	14	12	13	5
After Training						
Organophosphates	341	70	51	102	109	9
Organochlorines	41	6	5	11	17	2
Pyrethroids	18	1	0	4	13	0
Carbamates	21	3	2	2	3	11
Other	41	1	17	14	8	1

Indonesia's strategy of pest control at the time relied heavily on the development and diffusion of new pest-resistant varieties. However, the brown planthopper overcame resistance in a new strains faster than the breeders could produce them. Presidential Instruction 3 (banning 57 varieties of insecticide on rice) and the phasing out of the pesticide subsidy set the stage for a new approach to the prevention of major outbreaks. These decisions signalled the government's desire to break the vicious cycle of massive pesticide use and recurrent pest outbreaks.

Yet, these steps by themselves were not enough to protect the rice economy. Even at higher prices, farmers who lacked knowledge about the causes of pest outbreaks still applied large and frequent doses of pesticides when faced with an actual or potential outbreak. Moreover, many of the most toxic chemical banned on rice were still available in kiosks for use on non-rice crops, and so still accessible to rice farmers. The political sensitivity of rice also translates into constant pressure on Indonesian policymakers to reinstate pesticide subsidies and to adopt high profile but self-defeating measures such as aerial spraying and free distribution of pesticides.

IPM is the key element in Indonesia's new strategy to protect the rice sector. The strategy is based on knowledge and rapid communications at all levels of the rice production system, from farmers to government ministers.

Knowledge of IPM enables farmers to reduce pesticide use and therefore decreases the risk of pest outbreaks. Knowledge of IPM on the part of policy makers and government officials at all levels helps the government respond in an appropriate manner to pest outbreaks and prevents the sort of panic which produced the brown planthopper explosions of the 1970s.

Rapid communication is equally important for the prevention of outbreaks. IPM farmer groups identify pests and monitor their own fields. Trainers skilled in IPM methods, and in contact with farmer groups, channel news about conditions in the field to the rest of the pest control network. The emphasis in IPM training on constant monitoring of fields can reduce the response time to a pest problem by as much as one year, enough time to save millions of hectares from crop damage.

The present IPM program is the first phase of a much larger five- to seven-year effort to train 2.5 million Indonesian rice farmers. These IPM farmers, their trainers and GOI officials behind the IPM program will form the first rational, farmer-based system of pest

control in Asia (indeed, the world). While obtaining direct economic benefits for themselves in the form of reduced expenditures on pesticides and lower risk of crop loss, IPM farmers also serve the nation through the constant supervision of their fields and communication with other farmers and GOI through IPM farmer groups.

The reduction of risk of major outbreaks represents potential benefits to the Indonesian economy totaling hundreds of millions of dollars. Rice production lost to large-scale infestations must be replaced by rice imports. Indonesia, as one of the world's largest rice-consuming nations, is a pricemaker on the world market in situations of serious production shortfalls. Due to the unpredictability of the world market for rice, each ton imported by Indonesia could mean higher rice prices. Large pest outbreaks may therefore result in substantial outflows of scarce foreign exchange at a time when the national economy already faces a sizeable deficit on its current account. Another effect of harvest failures on the national economy relates to aggregate demand. Rice production still represents an important share of total GDP. Loss of farm income following pest outbreaks reduces total demand for goods and services from other sectors of the economy, which can affect output and employment in industry, services and the non-rice agricultural sector.

The prevention of outbreaks also yields distributional benefits. In Indonesia's major rice-growing areas, rice production is the backbone of the economy. Rice farmers, farm laborers, rice mills and traders all depend for their livelihood on successful harvests. Moreover, harvest failures are hardest on the bottom rung of the income distribution ladder. Small farmers can often survive one lost harvest by borrowing from landlords and moneylenders, albeit at high rates of interest. After two harvest failures, however, small farmers are often forced to sell land, contributing to concentration of assets in the hands of wealthier households. Farm laborers receive the bulk of the season's wages at harvest time when landowners pay out a share of the crop to harvesters (the share of the harvest in a laborer's total wage receipts can be as high as 60 percent in Java). Therefore, with the loss of just one harvest, farm laborers are often forced to migrate in search of successful harvests or to the cities for work in construction or the informal sector. This obviously places strains on the urban economy and infrastructure.

In addition, the success of the rice crop has secondary effects on retailers, construction, services, small traders and even small industries in rural areas. Consumption in rural areas is often postponed until harvest time, when producers and retailers who rely on farmers' spending earn the bulk of their annual income. A small or failed harvest can be

the ruin of small rural businesses, which return results in job losses for workers in these industries (many of whom are farmers themselves).

8.4.2 Health Benefits Associated with IPM Training

IPM training is directly linked to a dramatic reduction in the use of the most dangerous pesticides, particularly organophosphates. These chemicals are responsible for many cases of pesticide poisoning in Indonesia each year. The benefit-cost analysis currently in progress will draw on ongoing studies of the health impact of pesticide use in Java. Although this information is not yet available, we can estimate the dimensions of the cost to the Indonesian economy of pesticide poisoning by doing some rough calculations. According to WHO estimates, the worldwide total for occupational pesticide poisonings totals 25 million per year. WHO estimates that Indonesia accounts for 300,000 of these cases. If each of these farmers lost one week of work, the total loss of farm household income would be about $5 million. Other health related costs associated with the use of pesticides include the cost of health care to treat poison victims and indirect cases of poisoning (drinking and bathing water, laborers working in treated rice fields, consumers eating poisoned vegetables, etc.). Clearly, a reduction in pesticide poisoning carries with it substantial economic benefits.

8.4.3 Benefits of Environmental Protection

Indonesian farmers release thousands of tons of highly toxic chemicals into the environment every year. The acute and chronic consequences of these emissions to the air, land and water upon overcrowded and fragile environments such as the island of Java, which is an area roughly the size of New York State that must support over 110 million, persons cannot be predicted with certainty at the present time. Already, the accumulated toxicity of agrichemical run-off is presenting problems of water quality for cities, rural communities, and local fresh water fishing ventures.

8.4.4 Farmer Control Over Decision Making and Participation in the National Strategy to Prevent Pest Outbreaks

The impact study described in the previous section of this report showed that IPM farmers changed their pesticide habits based on a better understanding of the effects of insecticide application. There was a dramatic fall in the incidence of harmful prophylactic spraying after IPM training, and farmers who did spray had specific targets in mind. The

element of farmer control in IPM means that the training will provide sustainable benefits for many years after the completion of the initial training. The network of trained extension workers and farmers being developed by IPM creates the possibilities for further policy optimizations including areas such as nitrogen fertilizer use and water resource utilization. Only approaches such as IPM which strengthen farmer decision making capability and pluralistic rural people's organizations at the community level and improve the ability of extension services to adapt new technologies to local needs will allow for this type of progress without causing economic loss to rural populations.

8.4.5 Savings to Farmers Resulting from Reduced Pesticide Use

Savings directly obtained by farmers as a result of reduced pesticide use are the most readily measured benefit of IPM training. As the above discussion illustrates, farmer savings was by no means the original impetus for the project nor its most important goal. It cannot be emphasized strongly enough that the benefits associated with reduced risks of major outbreaks through constant observation, knowledge of the rice ecosystem and rapid communications are many times greater than the benefits obtained by individual farmers in the form of savings on pesticide expenditures. Nevertheless, the IPM impact study included with this report indicates that savings by farmers are substantial and provide a real incentive for farmers to continue practicing IPM in the future.

The cash flow statement (see below) gauges the magnitude of farmers' savings by comparing costs of training with savings obtained by farmers. The most important lesson from this exercise is that even when the issues of reduced risk of outbreaks, health environment and farmer autonomy are completely ignored, **IPM training still yields benefits far in excess of the costs of training**. The rate of return of nearly 70 percent shows that IPM training provides benefits for farmers many times the size of the initial investment in training.

CASH FLOW FOR BENEFIT COST ANALYSIS OF IPM TRAINING
(Rupiah, Thousands)

	1990	1991	1992	1993-2000	2001
I. COSTS					
A. Training Phase I	1,825,849				
1. Salaries/Honoraria	222,650				
2. Materials	289,905				
3. Transportation	216,136				
4. Other	1,097,159				
B. Pantura Crash Program		180,000			
C. Outreach (Pemasyarakatan)		219,738			
1. Salaries/Honoraria		43,080			
2. Materials		59,973			
3. Transportation		41,366			
4. Other		75,320			
D. Farmer to Farmer		14,480			
E. Training Phase II		2,191,019			
1. Salaries/Honoraria		267,179			
2. Materials		347,886			
3. Transportation		259,363			
4. Other		1,316,590			
F. TOTAL COSTS	1,825,849	2,605,237	0	0	0
II. BENEFITS					
A. Training Phase I		1,054,200	1,054,200	1,054,200	
B. Pantura Crash Program		383,915			
C. Outreach (Pemasyarakatan)		349,230	349,230	349,230	
D. Farmer to Farmer		39,113	39,113	39,113	
E. Training Phase II		1,264,200	1,264,200	1,264,200	
F. TOTAL BENEFITS OF TRAINING		1,826,458	2,706,743	2,706,743	1,264,200
II. CASH FLOW	(1,825,849)	(778,779)	2,706,743	2,706,743	1,264,200
IV. IRR (Internal Rate of Return)	**69.4%**				
V. NPV (Net Present Value)	**5,656,365**				

Assumptions of Cash Flow Statement

1. Farmer Savings: Based on Impact Study of IPM covering more than 2000 farming household, and using the average savings on pesticide use per household (Rp. 10,500 per season). This figure has been multiplied by two since IPM areas are all double-cropped in rice (i.e. two rice crops per year). It must be emphasized that this is an extremely conservative estimate of savings per farmer, as more extensive village-level work in IPM suggests savings several times greater than Rp. 10,500 per season.

2. Farmer Savings, Jalur Pantura Crash Program: The Jalur Pantura crash program brought IPM 75,000 farmers over a period of several weeks. There are no data on which to base an estimate of savings per farmer. Field observations at the time provide anecdotal evidence of changes in farmer behavior during the training season. In the absence of more concrete information, used an extremely conservative estimate of Rp. 2,500 per season over one year was used. In other words, the assumption is that the impact of the crash program did not extend beyond 1991.

3. Farmer Savings, Farmer-to-Farmer Training: Although there are no data on the impact of farmer-to-farmer training, this estimate assumed that farmers' savings will not be as great as those obtained after training by IPM trainers and extension workers. Ssavings are presumed about half those of other forms of training (Rp. 5,250 per season).

4. Farmer to Farmer Doesn't Expand: The estimate assumes that there will be no expansion in farmer-to-farmer training after 1991. Although farmer-to-farmer training will in fact continue, it is difficult to predict how many new farmers will be trained since this method depends exclusively on the initiative of the farmers themselves.

5. Pemasyarakatan Not Repeated: This estimate assumes that this form of training will not be extended after 1991.

6. Time Frame: The benefits of training are assumed to extend for ten years.

7. Discount Rate for NPV: A discount rate of 20 percent is used to calculate the net present value of future benefits. This rate is roughly equal to current Indonesian interest rates.

8.5 Strategic Extension Campaigns and Public Information

In Jalur Pantura, parasites were noticed attacking egg masses of rice stemborers. Attempts to educate farmers to the fact that they should conserve parasitic natural enemies were stalled by a total lack of knowledge about egg masses, their function and the implications of their presence. It was obvious that training in basic biological life cycles of rice pests had to be incorporated into the field training schools. This was achieved in a very short period of time. Further, project staff had to know at what stage in the rice crop's phenology the stem borer was optimally controlled. Simple experimental plots indicated that adult stem borers preferred to oviposit on rice seedlings before transplant, and project field staff originated the idea of removing egg masses from seedling rice (by hand) so that transplanted rice free of stem borer egg could be used. Demonstrations of removal of stem borer egg masses on a small scale were so impressive to farmers that both farmer groups and provincial officials (on their own initiative) organized community wide egg collection campaigns. Rice farmers, boy scouts, and school children (after school) were participants in dedicated stem borer egg collections.

During review mission Team A's visit to one site, local officials described the process in which over 7 million egg masses were collected and how a potential outbreak was avoided. Project field staff responded by providing convenient, practical containers for egg collection and return to rearing sites where parasites could emerge and be returned for release in rice, thus providing additional stem borer biological control. As mission review Team A moved to other sites in the area, it was clear that successes at this one village had spread and that extension workers, pest observers and farmers themselves were educating other farmers to the egg collection and parasite release techniques. The Jalur Pantura campaign illustrates the adaptability of the national IPM program, its responsiveness to farmer needs, its practicality, its research-driven training approach and its impact. Similar stories occurred at virtually every site visited by the review mission.

"Puskat", an NGO located in Yogyakarta, was contracted to facilitate and produce community theater presentations about IPM in order to promote general awareness in areas where Farmers' Field Schools (SLPHT) have been carried out. Presentations are prepared after community discussion of local problems, and include community member as performers. To date 100 villages in Java and Sumatra have been visited by this community theater in an effort to raise community awareness.

8.6 Databases, Mapping and GIS

The project has developed a set of maps covering the most important rice growing areas. These cover topography and the incidence of wetland and dryland rice as well as administrative boundaries, the number of cultivations per year and major irrigation canals, roads, government offices etc. (scale 1:100,000). The difficulty of obtaining accurate maps in Indonesia, and the necessity of viewing the spatial relationships between pests and rice in the context of growing seasons and cropping areas, made this an important prerequisite for both the planning of training and outreach in IPM and the possible organization of preventive measures in the event of epidemic outbreaks of pests. It is viewed also as an important training tool for both PHPs and more senior government officers who are not always accustomed to viewing problems within spatial relationships. In this regard, the maps can be an important tool to prevent panic when it is seen that outbreaks are unlikely to lead to widescale problems.

The project was fortunate in being able to utilize several skilled cartographers from another recently completed project. The maps were prepared by hand. The versatility of the system is now being enhanced by the addition of a computerised GIS facility. An expert has been recruited for this and purchase of additional equipment is envisaged. Among the early outputs have been maps to assist the planning of the next season of farmer training. In this regard, it should be noted that the system is not regarded as a substitute for local planning, but as a valuable addition at the apex of the system which will permit local information to be placed in context. It is foreseen that rough drawings on standard maps of pest and disease incidence at the local level can be entered into the system and that PHP training will include instruction in several key aspects of mapping. Overall direction of GIS development has been in the hands of a senior advisor to the National Development Planning Agency (BAPPENAS).

Various GIS systems are currently under development in Indonesia, including one for agro-ecological zoning, particularly in support of agricultural research planning. The tendency for compartmentalization, even within the Ministry of Agriculture, makes it both extremely slow and organizationally difficult to develop systems or central facilities and data bases which could simultaneously serve the needs of a very wide circle of users. Agreement on common data bases and formats alone could take several years. At the same time, the rapid decline in costs of equipment and software has made central mainframe installations less relevant. The project's system is thus at present PC based.

8.7 Research in the National IPM Program

The IPM Program focuses on training for rice and non-rice crops grown after rice. The Program attempts to guide both contents and location of research activities closer towards the field level.

Research in the national IPM Program uses both traditional and non-traditional forms. Traditional research inputs for this training originate in the national Food Crop Research Institutes (Balittan) in Bogor, Sukamandi, Malang and Maros, from Horticultural Research Institute in Lembang, from national and foreign universities, other bilaterally assisted groups in the country (JICA, ORSTROM, Dutch missions), IRRI, ICRISAT, the Asian Grain Legume Network, non-government organizations and crop protection agencies in the region. Contact between the Program and these agencies is intensive, frequent, and concentrates on field problems rather than formal arrangements.

Many senior researchers from all institutions listed above have either contributed to training materials, edited materials, or provided training directly in the training program. This *network of researchers* allows for more direct interaction and introduction of materials than the usual structural path which limits transfer of knowledge by reducing direct contact between researchers and trainers. ***Researchers become trainers.***

Non-traditional research forms begin with training activities. These include studies to provide illustrations of basic IPM processes. These studies focus on ecosystem response to levels of fertilizers, varietal performance, yield loss simulation, sampling, and natural enemy population dynamics. These studies are introduced as training activities but are also research: they provide confirmation and testing of hypothesized relationships in the field. This is true both at the FTF and in the Farmer Field Schools. ***Trainees becomes researchers and research exists at field level at many locations.***

During the design of curriculum and training activities, major "black-holes" in knowledge become evident. In this case, the development of training is similar to the role of modelling in terms of defining research problems or specifying the lack of research results on particular topics. Topics such as survival of white stem borer eggs and larvae, the impact of rice seed bug (*Leptocorisa* sp.) feeding, and the comparative application of IPM across different rice habitats are identified during training. Research is not driving the IPM technology, but rather assisting in training. These activities are ***training driven*** supporting studies.

Supporting studies are carried out at Observation and Forecasting Laboratories that are the structural units assigned to backstop PHPs. Results are in the direct conduit for implementation by Pest Observers (PHP) in the field and for technical transfer. Pest Observers are the source of much technical knowledge at the Rural Extension Centers (BPP) during regular meetings.

The Farmer Field Schools are also field research units. They are testing and comparing two types of rice production systems; IPM recommendations and the official rice intensification package. It is hoped that the skills learned in the comparison study will be put to work on other topics to improve local recommendations. ***Farmers as IPM experts are able to improve their systems for local conditions.***

On IPM-related health issues, research is being carried out by a team of national and international experts working with the Ministry of Health and NGOs.

BAPPENAS has recently set up a research commission to target specific topics for financial support. The results are direct inputs to training and dissemination to farmers through the Farmer Field Schools.

The latest major research initiative of the Program studies the problem of habitats and IPM identified by contrasting experiences in different training locations. This initiative takes an ecological rather than a purely agricultural approach, because the 3000 year history of Javanese rice cultivation is long enough (over 30,000 generations of major species) for significant coevolution of communities of indigenous populations.

The habitat studies will characterize how different rice-based ecosystems respond to stresses from pesticides and pest immigration pulses. This can be thought of as the "resilience" of a particular system — its capacity to absorb stresses. Field surveys, experiments, and statistical models will explore community dynamics in agro-ecosystems and to develop management and risk profiles for them. Independent variables include structural, temporal, and biochemical aspects of habitats, abundance and diversity of animal populations, and agricultural practices. The dependent (or predicted) variables include stage-specific mortality estimates for key populations (such as potential pests) and parameter estimates for simple models of the overall potential for "outbreak" in a specified system.

A particular rice ecosystem comprises a mosaic of local habitats within which insects may move freely and continuously. For instance, during the "dry" season rice fields

in both the upland and lowland areas spend much of their time without free-standing water. During this time ants from surrounding paddy dikes invade the fields and carry off a wide range of insects including stem borer larvae and aquatic predators "beached" by the receding water level.

Studies will evaluate the relative importance of local habitats as refugia and buffers for natural enemies. These habitats include:

- rice fields (canopy, aquatic, mudflats);
- paddy dike vegetation;
- adjacent, often larger, areas of non-rice vegetation (such as stream sides, irrigation canals, and forest canopies);
- adjacent rice fields under different planting schedules (asynchronous plantings); and
- adjacent non-rice crops (soybean, tobacco,vegetables).

Expanding the scale of study from within field neighborhood habitats to among regional habitats allows us to ask how a village's decision to adopt IPM and reduce pesticide load will be affected by the surrounding sub-district or larger area. What are the relative importances of local and long distance movements of plant-feeding and predacious insects?

The first season shall explore relatively healthy fields in a lower elevation synchronized planting area and in a higher elevation, mountain-spring fed, asynchronous area. Future seasons will add areas with supposedly chronic pest outbreaks and those with heavy insecticide loads.

Observational and correlational studies will lead to experiments. Densities of natural enemy guilds will be manipulated to compare their impact on stage-specific mortality of bait pest densities. The most common experiment carried out by farmers is to treat fields with insecticides. The purpose (besides the sobering experience of rapid defaunation) is to examine the rate at which the natural enemy community reconstitutes itself by re-invasion of a treated field. As the range of experiments designed to investigate characteristics of specific sites expands, ecological experiments will be steadily brought into the training contents of PHP, PPL, and farmers.

The village research station in Panyingkiran, Jalur Pantura was visited by the review mission (see Section 8.6). As well as the pioneering approach to research involving farmers, undergraduates, and graduate students, the specific results of that station are exciting for any field ecological study. These include stage-specific mortalities for the key pest, white stemborer, single and multi-stage sampling designs for this species, estimates of the impact of natural enemies, rice stage, and rice variety on population dynamics, and the impact — or paradoxical impact — of insecticides on basic demographic parameters.

9. SUSTAINABILITY OF PROJECT RESULTS

The review mission has seen evidence that provincial government officials now seek out program personnel to share IPM innovations and ideas and eagerly interact in a positive fashion. This aspect of the program has improved markedly since project initiation and is indication that program successes and training can be sustained in the long term.

The ability of this program to perform at the provincial and local level depends heavily on the attitude of provincial government officials who control the time and direction of extension experts and pest observers. In North Sumatra, mission Team A saw convincing evidence that provincial government has embraced the program and has allocated major amounts of funding and personnel to insure program success. In South Sulawesi, mission team B saw similar impressive evidence. The IPM program is successful and provincial officials can take a large share of the credit. This gives preliminary indication that financial sustainability of farmer training is possible.

The mobilization of entire communities (as mentioned earlier in the case of Jalur Pantura) is indication that the agricultural community is embracing IPM in a way which **guarantees sustainability**. Actions, eagerness to seek training and the most recent information, and allocation of significant funds from community treasuries in some locales are testament to the enthusiasm for IPM that exists at the local level, and these reflect positively on the prospects for the future development of IPM at governmental levels closest to the target community of farmers.

10. SOME GENERAL LESSONS

In terms of materials developed, creativity, practicality and adaptability, **it would not be an exaggeration to say that this program is the most impressive pest management program in the world.** Some of the reasons which lie behind the program's success include the following:

1. The Indonesian Government made IPM a national policy and worked with FAO's regional program to vest IPM in a national policy initiating institution (BAPPENAS) which also acts as the chief inter-departmental coordinator. This allowed the national program, once checked for consistency with national policy, to work together with a broad range of national, provincial, district, and extension institutions, as well as directly with farmers.

2. Indonesians themselves are responsible for program development and priorities, with technical assistance from qualified staff who have prior experience in Indonesia and who could therefore contribute immediately to the program.

3. The training approach utilizes practical experiential learning to address issues of concern to Indonesian farmers, while simultaneously providing instruction in the fundamental techniques of IPM

4. Training is not forced to fit into any preconceived model, but is adaptable and capable of focusing on any of a wide array of pertinent issues (from how to deal with specific pest problems to general agronomic skills which make Indonesian farmers better caretakers of their land) relevant to installing a balanced, ecologically-based approach to agriculture as the norm in Indonesia.

5. Management of the farm as an integrated unit can only be undertaken by the farmer. Supporting integrated management requires a fundamental departure from traditional extension methodology with its top-down transmission of messages to an approach where farmers are assisted to discover for themselves the critical issues and potential solutions to their problems.

6. Applicable research cannot take place divorced from intimate contact with on-farm problems, and extension can only make limited progress in the absence of closely associated research.

7. That training of rural communities in discovery-based, participatory approaches, as distinct from the application of simple messages, requires a substantial investment in comprehensive training of the agricultural support and extension system at all levels BEFORE commencing widespread farmer training.

Before explicitly recounting specific examples of program results, it is quite important to again place what is happening in Indonesia in its appropriate historical context. Since the emergence of the term "integrated control" in the early 1950's, there has been constant debate on exactly what is meant by integrated control or its offspring "integrated pest management" (or IPM).

One must remember that the emergence of the term IPM was in response to a catastrophe caused predominately by entomologists working in the USA. Following the introduction of DDT into agriculture and the airplane as an application device after WWII, the staple crop (analagous to rice in Indonesia) in the southern USA--cotton-- blossomed. Farmers and the agricultural infrastructure which supposedly served them, in general, abandoned the search for ecological balance in favor of chemical prophylaxis demanded by the now common Green Revolution, high yielding varieties. Within a very short time, pests began to be resistant to even 3 times the standard dosage of a given pesticide. By that time, however, someone had invented a new chemical and the process was repeated. Use of cocktail mixtures of pesticides was common.

By the late 1950's in Texas, Mississippi and parts of neighboring Mexico, cotton literally collapsed under the onslaught of resistant pests. What emerged from this disaster was something called IPM. The fundamental premise of IPM is **ecological balance;** i.e., IPM is first and foremost a philosophy about how to achieve balance.

Two predominant philosophical camps formed almost immediately in response to this new approach called IPM. The first made concessions to the interests of the pesticide industry and chose as its platform the idea that "we must work with the pesticide industry". This group gave rise ultimately to the idea of economic injury levels and thresholds which

are, fundamentally, tools to make decisions about when to spray pesticides. Worldwide, the majority of agriculturists who claim adherence to IPM are descendents of this school of thought. Their basic approach is to monitor a crop and spray only when necessary.

The second philosophical camp said, in essence, "to hell with the pesticide companies". The accepted leader for this camp was the late Dr. Robert van den Bosch whose book *The Pesticide Conspiracy* evoked nasty responses. This camp, much smaller in size, focused exclusively on a thorough understanding of the underlying ecological mechanisms governing crop-pest dynamics as the **only** first step toward design of sustainable IPM strategies. Some 40 years later, we can conclude that camp 1 predominated, but camp 2 was right.

The IPM program in Indonesia is the most intensive and broad- based effort to bring IPM to Asian farmers in history. To appreciate the true significance of the Indonesian IPM program, we must first consider the fact that more people are involved in Asian rice cultivation than any other occupation on the planet. The Indonesian experience has proven that these farmers can not only understand and implement IPM, but can actually help in spreading IPM techniques to other farmers. From this perspective, IPM in Indonesia is more than an interesting side in the story of rural development: it is an historic watershed in world agriculture.

Among some of the lessons that can be learned from the Indonesian experience are the following:

1. The location of a program within the national government has a lot to do with success, especially early on.

2. A rigid training model approach is not optimal, nor even desirable. Most IPM programs (indeed, most training programs regardless of subject content) choose a training method and force participants to adopt it as if they were a homogeneous herd of cattle — all identical in desire, capability and insight. The Indonesian national IPM program has maintained a highly diverse selection of applied research activities, field exercises, written materials, videos, and university curricula which are driven by training and in turn afford an opportunity to tailor training to varying needs. Other IPM efforts lack such training versatility.

3. Training cannot focus exclusively on technical skills, but must also deal with interpersonal skills. It does little good to train extension workers and pest observers to be better pest managers unless you simultancously give them the skills needed to teach what they know to others.

4. IPM is, in fact, founded in population and community ecology and such concepts must be taught if farmers and those who support farmers are to understand the real meaning of an IPM program.

5. Research feeds training. This program is replete with examples that rather simple, yet applied, field demonstrations can be used to simultaneously answer pertinent questions about IPM and ecology and provide fodder for improved practical training. Such an approach allows research findings to feed into general agricultural knowledge almost immediately. This does not happen when research is aimed at professional journals rather that at agricultural users.

6. Farmers can and should be trained to become better managers of their land and that when such is accomplished there is an upward ripple effect through the national agricultural infrastructure. This approach is markedly different from most IPM training and extension efforts which view farmers as passive recipients of information, often mere messages. The approach taken in Indonesia permits, even encourages, farmers to be innovators and suggestors of new kinds of research. This is rare in virtually all developed countries.

7. Pedagogical materials cannot drive a training program. Such materials do not set the pace of training, rather they augment and supplement training. This program is replete with curricular materials; yet, they are kept in perspective as supportive to the experiential training which occurs in the paddy.

8. Tremendous amounts of personal energy must be focused and concerted if realized outcome is to match proposed outcome.

9. Communications capacity is essential to success. This program might be criticized by some who have grown used to the seeming reality that, if one works in agriculture, he/she must work miracles with virtually nothing. Obviously, our medical and legal counterparts have not suffered from this mental malady. This program has excellent

computer, phone, fax and staff support which has to be credited to some extent for the successes seen to date.

10. The regional IPM rice program has essential in starting the national prograt the pace required by GOI policy makers. It remains vital in maintaining close ties to sources of expertise in other national and international IPM programs, and in supporting new innovations, such as work with NGOs, that fall outisde the mandate of the national program. Both the regional program and FAO itself as an organizations have helped to feed the Indonesian IPM message to the world community.

11. CONCLUSIONS AND RECOMMENDATIONS

11.1 General Conclusions

The mission review team found that significant progress has been made toward achievement of the original project objectives. Success to date speaks positively of the demonstrated ability of all project entities to resolve philosophical and programmatic difficulties as efficiently as possible and to the appropriateness of the original program approach to training-driven-research, research-fed training.

The review mission feels a real strength of this project is its adaptability. Rather than beginning with a fixed training model, the project has adopted a practical and flexible approach. Overall project objectives do not change; however, permutations do occur for site-specific objectives as needed so that applied research can feed experiential training. The results are indeed impressive.

It is important to remember that the Indonesians themselves have been responsible for carrying out this national IPM project. FAO program staff provide training opportunities and technical expertise in order to initiate and support the process where needed.

The impact of this program to date is phenomenal. The mission review team heard story after story (from all aspects of the agricultural community) of farmers who survey their fields now and make every effort to conserve natural enemies. Where training has taken place, there is strong evidence that virtually no pesticide is being utilized, and yields are not suffering but rather increasing. This project has initiated a totally new mentality about pest

control in Indonesia, and the Indonesians themselves are the ones putting it into practice. FAO personnel in Indonesia provide ideas and technical assistance, but the Indonesians are the ones responsible for program success. Unrefutably, this scenario offers the highest potential for long term sustainability of IPM as the norm.

At various times, World Bank, Inter-American Development Bank, GTZ, CIDA, JICA, and USAID have been involved in international development projects in IPM or closely related areas. Various institutions in the CGIAR network have long term programs in IPM. The mission Team Leader (CSB) has studied IPM programs in some 40 countries worldwide and has served as co-principal investigator of a large USAID IPM project in Honduras since 1984. There are no examples of IPM training projects which come close to the impact and productivity of the Indonesian national IPM program. It truly appears that the project in Indonesia, due in part to design and in part to chance, assembled the right people at the correct time and location and within the right political climate to insure success. Such conditions occur rarely; thus, the situation for long term impact may not be this opportune again for decades.

Sustainability of the Indonesian National IPM program will depend upon two key elements. First, the commitment to IPM must be fundamental; i.e., the Indonesians must support the IPM approach at all levels of government and production. This aspect deals with sustainability of the idea of IPM. Second, there must be monetary sustainability from combinations of internal and external sources. The review mission has been impressed with the broad-based commitment to IPM as a result of the type of experiential training and research which the project has brought about. Large numbers of farmers, technicians, extension workers, pest observers, and various government officials have, from all appearances, bought into the idea of IPM. This has not occurred simply as a result of the 1986 national decree; rather, it has occurred due to the impact of the current program which, importantly, has been carried out by the Indonesians themselves.

The review mission feels the national IPM program in Indonesia has been designed with clear vision and is immensely relevant to all sectors of the agricultural community. Original goals for large-scale met training are being and, in addition, applied research is ongoing for support of solutions to pest problems and as inputs into training.

The 1986 presidential decree was a significant policy step for the Indonesian Government. There are, however, several issues which apparently need the attention of the

Government of Indonesia if IPM is to be allowed to mature. These relate to (1) the government "credit system" for extension workers which now places far more value on extension workers attending training sessions than working with farmers; (2) the respective roles of extension workers and pest observers; (3) potential use of DITLIN labs in some capacity other than for their current use as pest forecasting facilities. The mission review team feels these and related issues should be clarified; otherwise, they may impede rapid and widespread adoption and support of IPM as the routine philosophy of pest control in Indonesia. The Recommendations section deals with the review mission's suggestions for how to deal with these issues.

Crop Protection, Extension & Training, BIMAS, Research & Development, BAPPENAS and FAO are all represented on the Working Group which provides overall program guidance (Annex 4). A grant from USAID funded the national program and allowed expanded training and pertinent research. Liaison has been established with Indonesian NGO's and various program consultants (Annex 3). Extension field workers have been recipients of IPM information directly and from trained pest observers, and the Ministry's Extension & Training Divisions has been an integral part of program guidance via input to the Working Group. It appears that most pertinent parts of the Indonesian Government play significant roles in the national IPM program.

Since 1980 IPM for rice farmers in Indonesia has been pioneered with the support of the FAO-executed "Inter-country programme for the development and application of integrated pest control in rice in South and Southeast Asia". The Japanese Government has provided financial assistance for construction of pest control and forecasting laboratories which have been used for IPM training in addition to their pest forecasting function. To insure effective coordination between the Indonesian national program and the regional FAO-executed IPM program based in Manila, Philippines, the coordinator of the regional program (Dr. Peter Kenmore) was named the Chief Technical Advisor for the Indonesian national program. Thus, the FAO-executed regional program has worked from the onset in concert with the Indonesian national program.

The benefits of this program are legion.

First, Indonesian rice and palawija farmers have achieved increased yields and profits as a direct result of this program. The net income to individual farm families has increased as a result.

Second, local communities have learned new and creative ways to organize community labor for dealing with pests and various agronomic issues in concerted fashion. The mission review team witnessed multiple examples of a new "community spirit" regarding IPM. Obviously, such organizational structures will serve Indonesian farm communities far beyond mere IPM.

Third, the general Indonesian environment is safer as a result of much less toxic pesticide being sprayed. While no medical evidence has yet been systematically compiled under the auspices of the program, evidence in other world locations strongly indicates fewer acute and chronic problems with personal and ecological health as a result of dramatic drops in use of synthetic organic pesticides. This should translate into reduced expenditures on medical care, strain on the national medical system and days lost from productive employment. Not too long ago, Indonesia was a rice importing nation. Now, it is self-sufficient in rice. The shift in approach from a total dependency on pesticides to IPM can take a significant percentage of the credit for this situation. Malaria is not a rampant problem in Indonesia — present but not rampant. In Latin America, many malaria episodes can be traced to heavy use of toxic pesticides in adjacent farming areas. With fewer pesticides being used in Indonesia, chances for periodically resurging malaria outbreaks have been reduced. This program can take at least partial credit for moving Indonesian agriculture toward stability and security in its most important crops. The job is not yet complete, but remarkable progress has been made in a short period of time.

Fourth, Indonesia is in the process of becoming a nation with a literal army of trained agriculturists. The type of training being received (experiential and practical) should serve Indonesia far beyond IPM and agronomics. Development of group dynamics and interpersonal skills are also a part of this training, and these skills apply to virtually all aspects of life.

11.2 Recommendations

RECOMMENDATIONS OF THE MID-TERM REVIEW MISSION FOR PROJECT UTF/INS/067/INS: TRAINING AND DEVELOPMENT OF INTEGRATED PEST MANAGEMENT (IPM) IN RICE-BASED CROPPING SYSTEMS

Issue 1: Project Continuation

Rationale:

The project has been operational for only two years. In that short time a considerable impact has been made. The mission is fully convinced of the value of IPM to Indonesia's farmers and the effectiveness of the broad lines of approach adopted by the project to date for the introduction of IPM in Indonesia. It is now essential that:

- the IPM approach in rice be disseminated broadly to farmers;
- the methodology for training farmers and arrangements for the training of plant protection staff and extension workers (including women PPLs) be institutionalized;
- the technology base for IPM be extended into other economically important crops.

This will not be possible without expanded project support and, within this context, extension of IPM to the mass of farmers must take absolute priority. Although a core of IPM extension support staff (PHP) has been established in the major rice producing areas, a framework for reaching the mass of farmers is not yet firmly in place and technology development for broadening the IPM methodology to other crops is only beginning.

Recommendation 1: The project should be continued for an additional five years, actively seek external and national donors, and be designed to: (1) fully

implement the ongoing system of field extension training for IPM begun under the current phase — particularly to a broad array of farmers; (2) construct a research and development effort aimed at supporting the development of IPM in crops other than rice; and (3) consolidate IPM as the official crop protection policy in Indonesia for a broad range of crops including horticultural and palawija (secondary field crops in rotations with rice) crops. A fully representative formal program research sub-committee should be formed and used to coordinate and guide the mixture of technical and social research required by the program.

Expected Outcome:

Changing the typical practice among Indonesia's approximately 20 million farm families planting rice to adopt IPM as the preferred crop management and crop protection method.

An exemplary and trend-setting model of how to establish IPM as national crop protection policy and how to train the bulk of farmers to change to IPM practices not only in developing countries, but in advanced national economies as well.

Ensure the long-term sustainability of the program.

Suggestions:

- Over the coming five years, the project team and the steering committee might develop a comprehensive plan for transfer of budget responsibility from external sources to the appropriate levels of government (National, Provincial, District and Local) in order to ensure long term sustainability of IPM as the method of crop protection in Indonesia.

Issue 2: Obtaining Expanded Base for Funds

Rationale:

Without expanded resources, including financial resources, the mass of farmers can never be reached. Additional funds will be needed for farmer training for the duration of the recommended project extension.

Recommendation 2: BAPPENAS and the FAO managerial staff should develop and obtain Government of Indonesia approval for a plan to match funds for research and farmer training originating from external donors with national funds, aimed at the provision of matching financial support of Farmers' Field Schools (SLPHT) during the next phase of the project.

Expected Outcomes:

In a village which mobilizes sufficient funds to initiate a Farmers' Field School, the project would match the local payment with the equivalent. A similar formula could be applied to the mobilization of district, provincial and national funds. There would be created an incentive in the system for regular budgeting of field training, which would create better opportunities for long term sustainability of the program.

Issue 3: Institutional Supports for IPM Training

Rationale:

The training model requires that the Pest Observer (PHP), trained as an IPM Specialist, give training to farmers' groups which have been convened and organized by the Field Extension Specialist (PPL), whose job this is. However, the PPL receives very little credit for field work. There is a need to change the credit system by which PPLs are evaluated in their jobs so that more credit is allocated for direct field work, which is the category of work appropriate for IPM Field Schools (SLPHT). In addition, the PPL is burdened with certain non-extension tasks which work against his interests as a Field Extension Agent and conflict with the promotion of IPM or any other agricultural technology. The present set of responsibilities for a field extension worker give him little time and no incentive to organize Farmers' Field Schools (SLPHT).

Recommendation 3: The Government of Indonesia should consider policy modifications which accomplish the following: (1) allow extension field workers and pest observers to work together in the field; (2) assign extension field workers responsibilities for organizing Farmers' Field Schools (SLPHT)

and, with support from PHPs, training farmers in IPM; (3) change the incentive structure and the credit system now employed for extension field workers to give maximum credit points for field work and resolution of farmers' problems; and (4) identify IPM field schools as THE official vehicle for IPM training.

Expected Outcome:

Better institutional support for carrying out Farmer Field Schools (SLPHT); Official approval of the role played by PHPs in carrying out training in the SLPHT; better cooperation between the PPL as Field School Organizer and facilitator, and the PHP as IPM Specialist or facilitator; more rapid diffusion of IPM practices.

Suggestions:

PHPs could undergo periodic in-service training in new IPM developments. This will also serve to maintain the current high levels of morale. Newly recruited PHPs can, for the moment, receive their initial training in provinces wherever courses are currently available.

* The Project might explore approaches for offering more intensive training of trainers to subject matter specialists (PPS), selected farmers and especially for field extension workers (PPL) to enable them to take the central role in conducting the Farmer Field Schools (SLPHT) for IPM.

* The program should, in an experimental format, test the efficacy of the current field school models and also conduct research on patterns of informal diffusion of information and training about IPM. Such a study might:

  - Track application of IPM principles;
  - Gather information about new experiments in IPM which farmers have carried out on their own;
  - Identify factors which either promote or inhibit the application of IPM principles.

- The Project might carry out an Information Diffusion Study, which would primarily aim at determining the patterns of information diffusion. Respondent groups should be selected from among those thought to most directly benefit from IPM, in order to gauge information transfer within that category. It should attempt to gather two kinds of information:

  - Qualitative information in the form of anecdotes and cases where IPM has been heard of or learned of by people who have never attended a Farmer Field School (SLPHT).

  - Quantitative information, to determine what aspects of IPM the respondents have heard about, how many heard, what aspects they have applied and the sources of the information.

- Models to be experimented with, on a small scale, to determine how cost effective the results are could include the training of one or two sets of farmer trainers per village. Four to five farmers would be trained from each farmers' group, and they would be expected to jointly train their groups in the second season of their own training.

Issue 4: Trainee Selection

Rationale:

Although little solid information exists, the impression gained by the mission is that the farmers' groups trained so far do not generally include all segments of the village community. The poorest farmers and women are unlikely to be represented in large numbers. To date, selection of farmer trainees has been in the hands of local government officials and farmers group (Kelompok Tani) officials, following the principle of local control. However, many Farmers' Group organizations tend to overlook women, who are often not selected to participate in Farmer Field Schools by their own Farmers' Group. In addition, in some areas small subsistence farmers and sharecroppers are overlooked. Where this has been the case, these small farmers and sharecroppers also should be brought into the program.

Recomendation 4: The Program should make a concerted effort to train women, small farmers and other farmers not enrolled in organized farmers' groups (Kelompok Tani).

Expected Outcome:

A widened base of farmers participating in the Farmer Field Schools, including more diffusion of information among rural women who often occupy a key decision-making role.

Suggestion:

The Field Extension Workers who organize the Farmer Field Schools, and the PHPs who guide the learning experiences, might receive instruction in broadening target group selection as part of their training.

Issue 5: Exchange of Information

Rationale:

The key to success in IPM training and the delivery of IPM technologies hinges on communication skills and the relative involvement of the user clientele (farmers) in both. Thus, a forum is needed which systematically and purposefully brings together farmers and various elements of their support system so that open discussions can be held on how to improve all aspects of IPM development and delivery. This forum can be used to increase overall understanding of IPM, air concerns about technologies and delivery systems, and evaluate the performance of all aspects in the agricultural support system.

Recommendation 5: The program should organize multi-disciplinary workshops at the WKBPP (extension subdistrict) and Kabupaten (district) levels designed to bring together extension field workers, pest observers and farmers to discuss pest management and how to make IPM function better at the farm level. Field school design and evaluation, follow-up of previous trainees, and relative roles in delivering IPM would be topics for discussion.

Expected Outcome:

Farmers, extension field workers, pest observers, agricultural officials, and trainers will improve their mutual understanding of the needs and constraints to further development of IPM. All levels of the agricultural system will participate in the performance evaluation of field training, IPM technical support, and the utility of IPM technologies. A plan for technical backstopping and follow-up for previous trainees will emerge from the workshop which will further solidify IPM as the national approach to pest control.

Suggestions:

Widen the exchange of information among participating farmers, as well as Pest Observers (PHP) and Field Extension Agents (PPL) and other officials by:

* Holding joint workshops for Pest Observers (PHP) and Field Extension Agents (PPL) for comparison of results on both effective group support techniques, new learning exercises, and field observation results.

* Increasing involvement, which has already begun, of Health officials in supporting the program at the field level (farmers have asked for this in some areas) and in strengthening the health aspects of IPM, which now deal mostly with agro-ecological aspects.

* Holding joint workshops for farmers, showcasing results of applied IPM field investigation done by farmers, either under the guidance of the Pest Observer (PHP) or on their own initiative.

* Holding workshops in the local Extension Center (BPP) to promote local dissemination of IPM, including Farmer Field Schools (SLPHT) in the Extension Center itself.

Issue 6: Organizational Arrangements for Mapping and the Geographic Information System (GIS)

Rationale:

There was no clear picture of crop areas down to various crops, particularly rice, in the diverse agro-ecologies of Indonesia. The project has thus initiated a Geographic Information System. This system is unique in Indonesia, which has not completed comprehensive mapping of soils, topography, climate, vegetation and cropping patterns. The project system, which has been built-up in the context of plant protection, already contains information of importance to a much wider circle of potential users and provides a basis for the entry of additional data. Possible applications extend beyond the Ministry of Agriculture into such applications as irrigation planning and beyond agriculture into a huge variety of planning applications, such as the siting of feeder roads.

Recommendation 6: The FAO program staff should continue their work on GIS development and elaborate a more detailed strategy for use of cartography based on a detailed needs assessment. Concerted efforts should be made to identify the broadest applications of mapping.

Expected Outcomes:

The mapping and Geographic Information Systems will provide planners with a valuable tool for coordinating and planning pest management and training strategies as well as other development activities across administrative boundaries.

Issue 7: Public Awareness and Program History

Rationale:

What has occurred since the mid-1980's in Indonesia is by any standards remarkable—even amazing. The only nation to officially declare IPM as the national pest control strategy for rice and ban 57 highly toxic pesticides outright, Indonesia has remained self-sufficient in rice even with more than a 65% reduction in the

volume of pesticides applied. **What** occurred is known by policy makers around the world only to a very limited extent. **How** it occurred has hardly been publicized at all. This is a story which absolutely must be told as an example that the "conventional wisdom" of pesticides being mandatory for production is categorically incorrect in rice.

Remmendation 7: Before the completion of this phase of the current project, a document should be published which provides the details of how Indonesia transformed from pesticide-dependency to Integrated Pest Management for rice. This document should be replete with color photos, graphs, tables and a novel-like text which can be used as a guide to a world audience.

Expected Outcome:

To enable donors, policy makers, the press, universities, agricultural development especially plant protection programs/projects, relevant government agencies and conservationists worldwide to become familiar with this important trend-setting program.

Issue 8: Use of Field Training Schools as Land Learning Laboratories for Exposure to a Wider Community

Rationale:

The Indonesian IPM Program is both trend setting and an example of enormous importance to other countries, both developing and technologically advanced. Officials not only from the field of crop protection, but from a range of other disciplines, including health and ecology, will become increasingly interested in viewing the results of this project, both in terms of how is was designed and how it is being carried out.

At present, visitors from other countries participating in the FAO Regional IPM Program periodically come to Indonesia for training and to see how the project has been structured and is being carried out, but no systematic arrangement for dealing with these or with the increasing numbers of visitors who can be expected to want to see this important project has yet been worked out.

Recommendation 8: The GOI and FAO should work to organize a Land Learning Laboratory in Indonesia for explicit purposes of educating government officials, policy makers, plant protection specialists, conservationists, and practitioners from other disciplines throughout the world about the history, successes, pitfalls, and current methods of Indonesian rice pest management.

Expected Outcome:

A working Land Learning Laboratory to showcase the results of the Indonesian IPM Program and to provide orientation and training for officials and practitioners in the field of crop protection and other disciplines.

Suggestion:

The project might also conduct a national level workshop offering the Land Learning Laboratory as a model to other agricultural projects.

Issue 9: Education for IPM

Rationale:

IPM is an agricultural method which is important not just to farmers, but to the nation as a whole. It brings with it benefits that improve the well being of every segment of society. It is therefore not just farmers who need to learn about IPM, but society in general.

Who needs to know what about IPM? It may only now be possible to make first attempts at answering this question. Education is an important ingredient in any answer.

The National IPM Program has already instigated many educational efforts both at the secondary school and university level. Further effort in this area is necessary if all segments of the society are to learn what is necessary about IPM.

Recommendation 9: The program should make efforts to infuse secondary and university academic and agricultural institutions in Indonesia with the materials, methods and philosophies of IPM.

Expected Outcome.

Indonesians will begin to develop a nationwide consciousness of IPM as an appropriate agricultural production technology with consequences for health and the environment.

Detailed Suggestions:

* Encourage faculty members in Departments of Agriculture in universities throughout high rice production provinces to support research efforts (skripsi; dissertation) that examine different aspects of the National IPM Program, both from a technological and social standpoint.

* Concentrate on a few promising organizations within institutions of higher education for contracting studies. This will both improve the experience and reliability of these organizations, and benefit the IPM Program by establishing longer term relationships with specific research bodies.

* Continue to give feedback based on field experiences to the five universities offering the D-1 diploma in crop protection.

* Continue efforts to establish working relationships with the KKN program in the five universities with which the project is already working.

* Make efforts to have a Sarjana IPM degree program approved by the consortium of 5 universities already affiliated with the National IPM Program; one year of the degree program should include the training now given to PHP to become IPM Specialists, including planting and monitoring a rice crop and a palawija (secondary) crop.

* Make efforts to expand the curriculum of the Diklat APP to include IPM training.

- Make efforts to have information on IPM made available to primary and secondary schools for classroom presentations and field exercises.

Issue 10: Rural Health

Rationale:

According to WHO estimates, the numbers of agricultural workers occupationally poisoned by pesticides each year in Indonesia is over 300,000. There is an inordinate loss to the country in sick days, long term disabilities, added health care support and household economic disruption. In crops other than rice, pesticide applications can rise many fold. Indonesian farmers cannot use most commercially available insecticides safely because the minimum protective clothing causes rapid dehydration, heat exhaustion and stroke under Indonesian climatic conditions. Such problems are compounded by misleading labelling or inappropriate packaging. GOI policy makers are demanding evidence on health impact because it is a sensitive and salient part of pesticide policy.

No systematic study of occupational health impact of pesticides on small farmers has ever been conducted, mostly from lack of resources and expertise.

Recommendation 10: A study should be undertaken to assess the rural health of Indonesians as affected by pesticide use. This could be carried out with the close involvement of the regional IPM project which would have the advantage of drawing on similar experiences from a wide range of country situations.

Expected Outcome:

An accurate and detailed picture of the consequences of pesticide use as it affects farmers and agricultural workers and their families in rural areas and detailed suggestions on how to alleviate the problems identified.

Valuable information gained from this study will benefit other countries in the regional IPM program, and will contribute to training programs at all level, as well as international agreements on pesticides.

This information could also be used in efforts to improve information about pesticides and to improve packaging and handling.

Issue 11: Expanded Pesticide Ban

Rationale:

Banning 57 broad-spectrum pesticides (mostly organophosphates) on rice and eliminating the pesticide subsidy have resulted in more than a 65% reduction in pesticide use since 1986. Tremendous health and environmental benefits have resulted, and rice production has continued to increase as it did before Presidential Decree No. 3/86 to its highest level in 1990. In fact, reduced pesticide use probably contributed to higher production by conserving natural enemies and reducing the risk of crop loss caused by the brown planthopper. Given the lack of positive correlation found between yield and pesticide use, as well as the health and environmental benefits of reduced pesticide use, it is worthwhile to expand the ban from rice, where savings have been proven, to soybeans and other palawija (secondary) crops.

In light of the high budgetary cost to the GOI of over US$100 million per year (1990 dollars) in pesticide subsidies between 1974 and 1988, there is no justification for reinstating the pesticide subsidy or lifting the ban of the 57 pesticides on rice.

Recommendation 11: As soon as IPM technology becomes available, expand the ban to include a prohibition on the use of the 57 pesticides for crops other than rice. Such technology already exists for several major crops. Continue the policy of no pesticide subsidy. The Government of Indonesia should scrutinize all WHO Category I pesticides and, if found meritorious, consider banning all of them from use in Indonesia.

Expected Outcome:

The GOI will continue to reduce unproductive expenditures which support pesticides, both in the form of limited government revenues and precious farmer capital. The risk of crop loss will be reduced, leading to higher average yields than

when larger amounts of broad-spectrum pesticides are used. The economic incentive to use less pesticide will remain with accompanying beneficial effects on the environment and the quality of life of farmers in terms of improved health and higher profits. Economic incentives (higher pesticide costs) will continue to encourage farmer participation in IPM training, contributing to the empowerment of an increasing proportion of the farm population with the ability to make sound management decisions.

Issue 12: Priority Program for FAO

Rationale:

The Indonesian IPM program is highly successful and the flag- ship of the FAO Intercountry Rice IPM Program. The Indonesian program is a matter of high government priority, central to its policy of maintaining rice self-sufficiency. In addition, it fits well with the FAO environmental priority. Those projects which are shown to have absolute priority for national governments and are achieving real development impact should be given high priority by FAO.

Recommendation 12: FAO should develop a category for high priority, fast-track projects into which this project should be placed and its needs serviced accordingly. Administrative processing and personnel recruitment should continuingly be handled on a priority basis.

ANNEX 1

TERMS OF REFERENCE OF THE REVIEW MISSION

MID-TERM REVIEW MISSION OF THE GOVERNMENT OF INDONESIA AND FAO IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management in Rice-Based Cropping Systems

MISSION REPORT

July 1991

REVIEW MISSION OF THE GOVERNMENT OF INDONESIA AND FAO

UTF/INS/067/INS
Training and Development of Integrated Pest Management In Rice-Based Cropping Systems

1. BACKGROUND

Rice growing is the most important agricultural activity in Indonesia, where some 10 million hectares are grown annually. As a result of a recent government rice production intensification programme, Indonesia has become self-sufficient in rice production after a long history as a net importer. The intensification programme was based on the development of improved infrastructure such as irrigation and the introduction of farm input packages including high level use of farming inputs in the form of high yielding varieties, credit, fertilizers and pesticides.

As a result of the bundling of pesticides in the input package, and their subsequent indiscriminate use, the rice brown planthopper became a major resurgent pest in rice threatening national production and the maintenance of self-sufficiency. In response to this threat, and based on findings from joint research by the Government of Indonesia and FAO, Presidential Decree No. 3, 1986 was issued declaring IPM as the national crop protection strategy and banning 57 broad spectrum pesticides from use on rice. In the following years pesticide subsidies were decreased and finally completely removed and extension worker and farmer training begun. The five-year target for training was set at 2,5 million.

A grant from USAID was partly allocated for IPM implementation. As FAO had been demonstrating in South and South East Asia (including Indonesia since 1982) the validity of IPM for rice, the Indonesia Government decided to contract to FAO the implementation of the national IPM program. On 12 May 1989 the Document for Project UTF/INS/067/INS with a total budget of US$ 4,177,805 was signed, and on 22 May 1990 Amendment No. 1 providing an additional US$ 2,153,413.

With the assistance of five internationally recruited long term Experts and a number of consultants, under the overall guidance of the FAO Chief Technical Adviser,

Mr. Peter E. Kenmore, of the Regional IPM Programme for Rice, and making heavy use of the many National Trainers and Experts already trained in the IPM approach, the Project has provided training in rice production to 500 IPM Field Specialists (MOA) for three seasons: 1,000 Extension Workers (MOA) for one season; 400 Extension Workers (MOA) in rice based cropping systems; 50,000 farmers for one full season (one day training per week for ten weeks). At the present moment an additional 50,000 farmers are being trained.

The Project uses a field based non-formal education approach to teach farmers to become better managers of their land. They learn to make decisions in their own fields, not only in relation to pest management but for all crop management practices.

Development of management support is also included in the IPM curriculum. Extension Workers learn to master planning and management skills, group dynamics, evaluation procedures and outputs.

2. PURPOSE OF THE REVIEW

The project document calls for the project to be visited by a mid-term review mission and subsequently by an evaluation team. In view of the project's comparatively short duration and the need to examine the overall follow-up in integrated pest management in Indonesia it has been decided to combine the two missions into one substantial review. This will examine Indonesia's overall progress in IPM and future follow-up needs as well as the specific role of FAO and any further need for external assistance. In view of the innovative approach to pest management and the efforts towards mass extension, the results of the evaluation are believed to be of interest to an audience extending beyond Indonesia.

3. SCOPE OF THE REVIEW

The review will assess the technical, economic and institutional validity of the Indonesian approach to Integrated Pest Management (IPM) in rice based cropping systems; the role played by external agencies and in particular the contribution of FAO, through this and previous projects. In this context it will examine.

1. clarity, relevance, priority and realism of original project development and immediate objectives, including specification of targets and identification of areas of geographic concentration, beneficiaries and prospects for sustainability. The way in which objectives have been modified during the course of the project will be examined and the justification for this;

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ii. quality, clarity and likely efficiency of project design including: clarity and logical consistency between inputs, activities, outputs and progress towards achievement of objectives (quality, quantity and time-frame); realism and clarity of specification of prior obligations and prerequisites (assumptions and risks); realism and clarity of external institutional relationships, the managerial and institutional framework for implementation and the work plan;

iii. effectiveness, efficiency, problems and successes of project implementation, including the quality and timeliness of input delivery by both FAO and the Government of Indonesia; adequacy of monitoring and reporting: the extent of national support and policy commitment; administrative and technical support by FAO; efficacy of the project's institutional and managerial framework as currently coordinated by BAPPENAS (the National Development Planning Agency); operational linkages and buy-ins at the provincial, district and local level including interfaces with Governmental and non-governmental development agencies.

iv. project results to date including:

- a full and systematic statement of activities and outputs produced to date as compared with the project document and subsequent revisions; and the complementarity of those outputs with those generated by other national institutions and other development agencies working in similar areas;

- the project's contribution on further IPM policy formation and implementation;

- project impacts to date and the prospects achieving a sustained flow of project generated benefits at the farmer level.

The mission will especially review:

a) The effectiveness of the project institutional and managerial framework bringing together many units of Government. Links and complementarity with other international development agencies active in the programme should be examined as well as links with governmental and non-governmental organizations which interface

with the IPM programme without being directly involved in it. How well the project IPM approach has been integrated into agricultural extension as a whole will need to be examined as well the relationship between this national project and FAO's regional programme in IPM;

b) The efficiency, cost effectiveness, impact and institutional replicability of the training approach pursued by the project and its applicability in the different types of community situation and institutional capability found in Indonesia. Particular attention should be given to the innovative aspects of the training approach which includes a pyramid structure relying heavily, at the base, on farmers themselves as trainers and motivators. Participation by farmers in the development of training including learner-generated materials and experiential training for farmers and extension staff, will also be reviewed. It is important to establish the extent to which the project has demonstrated the efficacy of a more bottom up approach;

c) Research/extension linkages including the concentration of research on practical problems identified during extension and training and the feedback for testing or innovative approaches developed by farmers themselves;

d) How the project has contributed to formulation of policy in Indonesia for pest management and extension and its adequacy to fulfil this role;

e) For the individual farm family, the local community and the nation: the potential and actual economic, environmental and health benefits from applying the technical innovations promoted by the project, as well as the overall effect on family and national food security.

In arriving at its findings the mission with take account of both gender and poverty issues and constraints.

Based on the above analysis the review will draw specific conclusions and make proposals for any necessary further action by Government and/or FAO to ensure development which is economically, institutionally and environmentally sustainable. This will include any need for additional assistance, which should be specified in detail, and a proposed work-plan for the final months of the on-going project (UTF/INS/067/INS). Any proposal for further assistance should include precise specification of objectives and the major suggested outputs and inputs.

The mission will identify lessons of general interest for Indonesia and elsewhere on: IPM; extension; and farmer driven research.

4. ORGANIZATION OF THE REVIEW

Before the arrival of the review mission, project personnel and/or independent national consultants will compile to the extent possible information on:

a) The grass root workings of the training approach (numbers actually covered, quality of the training process, effectiveness of training of fieldworker and farmer level);

b) Overall and comparative costs of the training approaches and models within the project, numbers reached at different levels, and direct costs per farmer trained under specific conditions and delivery models;

c) The impact of IPM training upon farmer practice and a projection of benefits based on comparisons with untrained farmers in the same village as well as farmers coming from communities where no training has been given.

At the same time the project will prepare a background brief of factual information on the project, including background on the complex institutional structure and mechanisms in Indonesia.

The mission will comprise:

a) Plant Protection Specialist/Team Leader with background in agricultural economics or extension/training (to be nominated by FAO);

b) Evaluation Specialist with background in agricultural economics and organizational/ institutional development (to be nominated by FAO);

c) Extension/Training Specialist (to be nominated by FAO);

d) IPM Specialist (to be nominated by Indonesian Government);

e) Extension Specialist (to be nominated by Indonesian Government);

f) Agricultural Policy/Sector Analyst (to be nominated by Indonesian Government).

5. TIMETABLE AND ITINERARY OF THE REVIEW

a) The mission will take place tentatively from 17 June to 3 July 1991, in Indonesia. Immediately upon reaching a basic agreement concerning review arrangements, the FAO Evaluation Service (PBEE) will provide a suggested check list of points and framework of analysis as input to the project mission. A check list for the background report (to be produced by the project) will also be provided;

b) The mission will be of three week's duration of which 10 days will be devoted to field visits in Java, Sulawesi and Sumatera;

c) The mission will be briefed and debriefed by the Government of Indonesia, USAID and FAO in Jakarta. The FAO participants in the mission will be debriefed at FAO Headquarters;

6. CONSULTATIONS IN THE FIELD AND AT HEADQUARTERS

The mission will maintain close liaison with BAPPENAS of the GOI e.g. the Project Steering Committee or its designated representative, as the project holder, USAID and the FAO Representative in Indonesia as well as national and international project staff. Although the mission should feel free to discuss with the relevant authorities and agencies concerned anything relevant to its assignment, it is not authorized to make any statements or commitments on behalf of the Government of Indonesia, USAID or FAO.

ANNEX 2

2.1 Itinerary of Travel
2.2 Map Displaying Sites Visited
2.3 Composition of Review Mission
2.4 List of Officials Interviewed

MID-TERM REVIEW MISSION OF THE GOVERNMENT OF INDONESIA AND FAO IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management in Rice-Based Cropping Systems

MISSION REPORT

July 1991

2.1 Itinerary of Travel

Schedule Of Tri-partite Mid-term Review Mission

Team A : Ir. Padmanagara, Salmon; Dr. Roberts, Roland; Dr. Barfield, Carl Stephens

Team B : Dr.Ir. Soehardjan; Dr. Markle, John; Dr. Mangan, James William

No	Date Day	Activities	Place	Time
TEAM A and TEAM B				
1	16 June Sunday	Arrive in Jakarta	Hotel Indonesia	
		Dinner	IPM Secretariat Jakarta Jl Ki Mangunsarkoro No 5 Jakarta Pusat	19:00 - 21:00
2	17 June Monday	Briefing Field Activities	IPM Secretariat Jakarta	09:00 - 10:30
		Briefing with FAO	FAO Representative Jl M.H. Thamrin	11:00 - 12:00
		Luncheon		13:00 - 14:00
		Field Trip Preparation	IPM Secretariat Jakarta	14:00 - 15:30
		Briefing with GOI	Meeting Room D BAPPENAS Jl. Taman Surapati No 2 Jakarta Pusat	16:00 - 17:30
		Dinner	Hotel Indonesia	19:00 - 21:00

TEAM A				
3	18 June Tuesday	Depart for Medan	Soekarno- Hatta Airport	9:05
		Arrive in Medan	Polonia Airport	11:05
		Luncheon		12:00 - 13:00
		Depart for Tanjung Morawa		13:00 - 13:45
		Review Rice IPM Training	FTF Tanjung Morawa Balai Benih Induk Tanjung Morawa Km 24	13:45 - 18:00
		Depart for Medan		18:00 - 18:45
		Dinner		19:30 - 21:00
4	19 June Wednesday	Depart for Deli Serdang	Hotel Dharma Deli	7:00 - 8:00
		Follow Up IPM Training	Rural Extension Center in Deli Serdang District	8:00 - 12:00
		Luncheon		12:00 - 13:00
		Meet local officials		13:30 - 14:30
		Internal Meeting		15:00 - 18:00
		Dinner	Hotel Indonesia	19:30 - 21:00
5	20 June Thursday	Depart for Jakarta	Polonia Airport	10:00
		Arrive in Jakarta	Soekarno - Hatta Airport	12:15
		Luncheon		13:30 - 14:00

		Briefing PANTURA Activities	IPM Secretariate Jakarta	14:30 - 17:00
		Dinner	Hotel Indonesia	19:00 - 20:00
6	21 June Friday	Depart for PANTURA	Hotel Indonesia	7:00
		Arrive in Rawamerta Lab		8:30
		Visit Farmers' Training	Rawamerta Subdistrict	8:30 - 12:00
		Luncheon	Lab Rawamerta	12:30-13:30
		Review Lab Rawamerta	Lab Rawamerta	13:30-17:00
		Depart for Jakarta		17:00
		Arrive in IPM Secretariat		18:30
		Dinner		19:30 - 21:00
7	22 June Saturday	Depart for Yogyakarta	Soekarno-Hatta Airport	10:00
		Arrived in Yogyakarta	Adisucipto Airport	11:05
		Luncheon		12:00 - 13:00
		Review Material product - at Secretariat IPM Yogyakarta	IPM Secretariat Yogyakarta Jl Bulaksumur A-16	13:00 - 18:00
		Dinner		19:00 - 21:00

TEAM B				
9	18 June Tuesday	Depart for Ujung Pandang	Soekarno-Hatta Airport	7:35
		Arrive in Ujung Pandang	Hasanuddin Airport	10:55
		Luncheon		12:00 - 13:00
		Depart for Batangkaluku		13:00 - 13:30
		Review Palawija IPM Training	BLPP Batangkaluku Gowa District	13:30 - 17:00
		Depart for Ujung Pandang		17:00 - 17:30
		Dinner	Makassar Golden Hotel	19:00 -21:00
10	19 June Wednesday	Depart for Gowa/Maros Dist		7:30 - 8:30
		Visit Farmers Training	Gowa/Maros District	8:30 - 12:00
		Depart for Ujung Pandang		12:30 - 13:00
		Luncheon		13:00 - 14:00
		Meet local officials		14:00 - 15:00
		Internal Meeting	Makassar Golden Hotel	15:00 - 18:00
		Dinner	Makassar Golden Hotel	19:00 - 21:00
11	20 June Thursday	Depart for Surabaya	Hasanuddin Airport	9:40
		Arrive in Surabaya	Ir.H Juanda Airport	10:05
		Luncheon		12:00 - 13:00

		Depart for Kepanjen		13:00
		Arrive in Kepanjen		15:00
		Visit FTF Kepanjen	UPT BAT(Perikanan) Jl Panggungrejo, Kepanjen	15:00 - 17:00
		Depart for Malang		17:00
		Arrive in Malang	Hotel Montana	17:40
		Dinner	Hotel Montana	19:00 - 21:00
12	21 June Friday	Depart for Malang District		7:30 - 8:00
		Visit Farmers Training	Malang District	8:00 - 12:00
		Luncheon		12:00 - 13:00
		Internal Meeting	Hotel Montana	13:00 - 18:00
		Dinner	Hotel Montana	19:00 - 21:00
13	22 June Saturday	Depart for Malang District (Check Out Hotel)		7:30 - 8:00
		Visit Extension Workers-Training in REC	Rural Extension Center (REC) in Malang Districts	8:00 - 10:00
		Depart for Surabaya		10:00
		Arrive in Surabaya		11:30
		Luncheon		11:30 - 12:30

		Depart for Yogyakarta	Ir.H Juanda Airport	13:30
		Arrive in Yogyakarta	Adisucipto Airport	14:40
TEAM A and TEAM B				
14	23 June Sunday	Depart for Borobudur	Hotel Santika	
		Arrive at Borobudur	Borobudur Temple	
		Luncheon	Natour Restaurant Borobudur	12:00 - 13:00
		Depart for Prambanan	Natour Restourant	
		Arrive at Prambanan	Prambanan Temple	
		Depart for Yogyakarta	Prambanan Temple	
		Arrive at Hotel Santika	Hotel Santika	
		Dinner	Hotel Santika	
15	24 June Monday	Depart for Bantul District		7:30 - 8:00
		Field Visit : - Habitat Study Presentation	Lab Habitat Study Bantul	8:00 - 11:30
		Luncheon	Pesta Perak	12:00 - 13:00
		Field Visit : - Visit Farmers Training	Bantul District	13:00 - 17:00
		Depart for Yogyakarta		17:00 - 17:30

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		Dinner	Hotel Santika	18:30 - 19:30
		Ramayana Ballet	Prambanan Temple	20:00 -
16	25 June Tuesday	Depart for Bantul District		7:30 - 8:00
		Field Visit - Visit Extension Training	Bantul District	8:00 - 11:30
		Luncheon	Suharti Fried Chicken	12:00 - 13:00
		Internal Meeting	IPM Secretariate Yogyakarta	13:00 - 18:00
		Dinner	Legian	19:00 - 21:00
17	26 June Wednesday	Briefing : - Training and Extension Approach	Griya Sidomukti Hotel - Santika	8:30 - 10:30
		- Strategic Extension/support-communications	Griya Sidomukti Hotel - Santika	10:30 - 12:30
		Luncheon	Hotel Santika	12:30 - 13:30
		- IPM Supporting Studies	Griya Sidomukti Hotel - Santika	13:30 - 15:30
		- Impact Study	Griya Sidomukti Hotel - Santika	15:30 - 17:30
		Dinner	Hotel Santika	19:00 -21:00
18	27 June Thursday	Visit PUSKAT, Audio Visual	Kotabaru, Yogyakarta	8:00 - 11:00
		Luncheon	Hotel Santika	12:00 - 13:00

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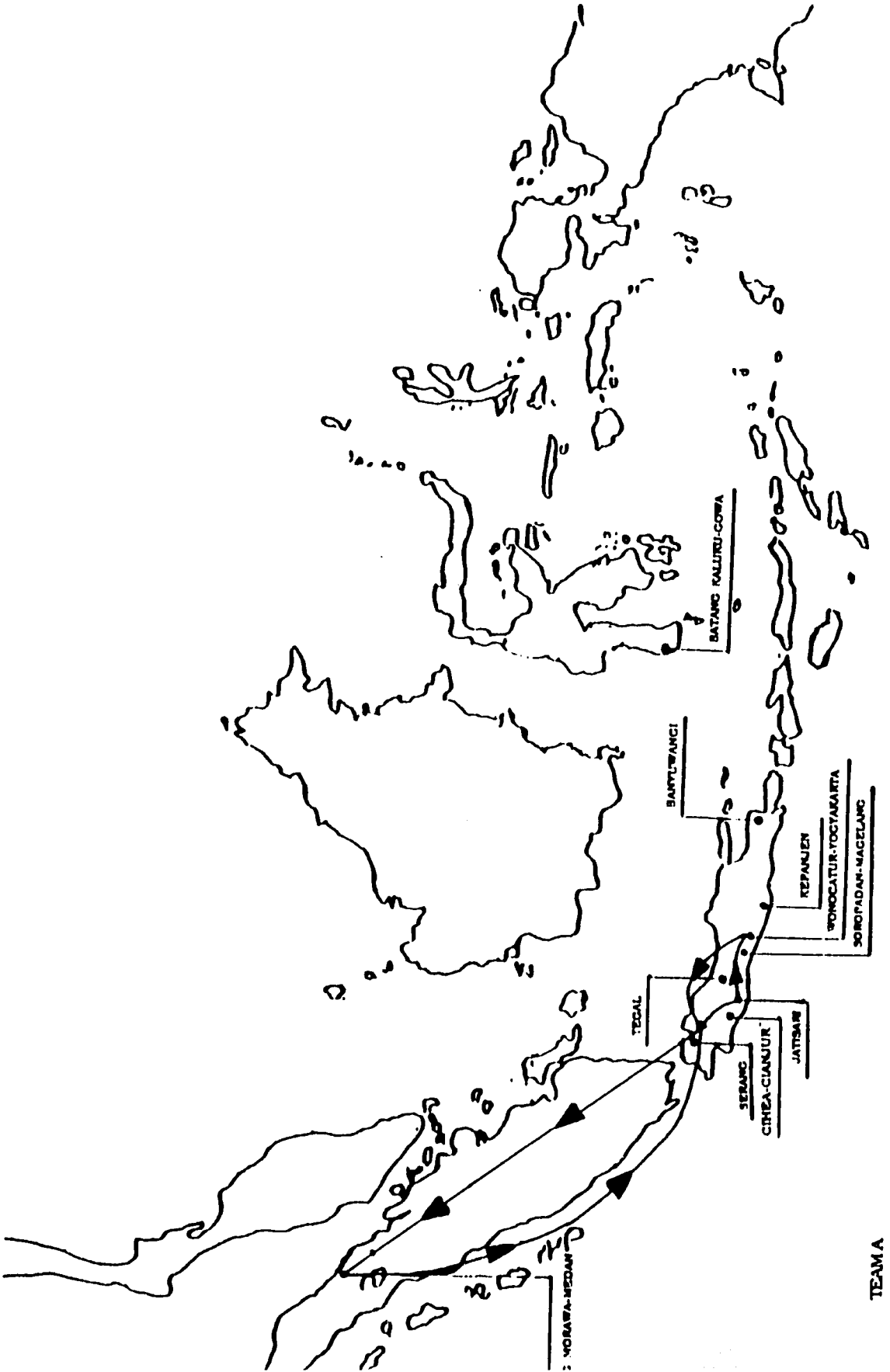
		Internal Meeting	Griya Sidomukti Hotel Santika	13:00 - 18:00
		Dinner	Hotel Santika	19:00 - 21:00
19	28 June Friday	Depart for Jakarta	Adisucipto Airport	8:00
		Arrive in Jakarta	Soekarno-Hatta Alport	9:00
		Depart for Bogor		9:00
		Arrive at IPM Bogor Secretariate	Bogor IPM Secretariate	10:30
		Briefing Agro-ecosystem mapping and GIS development	Bogor IPM Secretariate	10:30 - 12:00
		Luncheon		12:00 - 13:00
		Briefing Agro-ecosystem mapping and GIS development	Bogor IPM Secretariate	13:00 - 17:00
		Depart for Jakarta		17:00
		Arrive at Jakarta	Jakarta IPM Secretariate	18:00
		Dinner	Hotel Indonesia	19:00 - 21:00
20	29 June Saturday	Meeting with Research Commission on IPM Supporting Studies	Meeting Room D BAPPENAS	9:00 - 12:00
		Luncheon		13:00 - 14:00

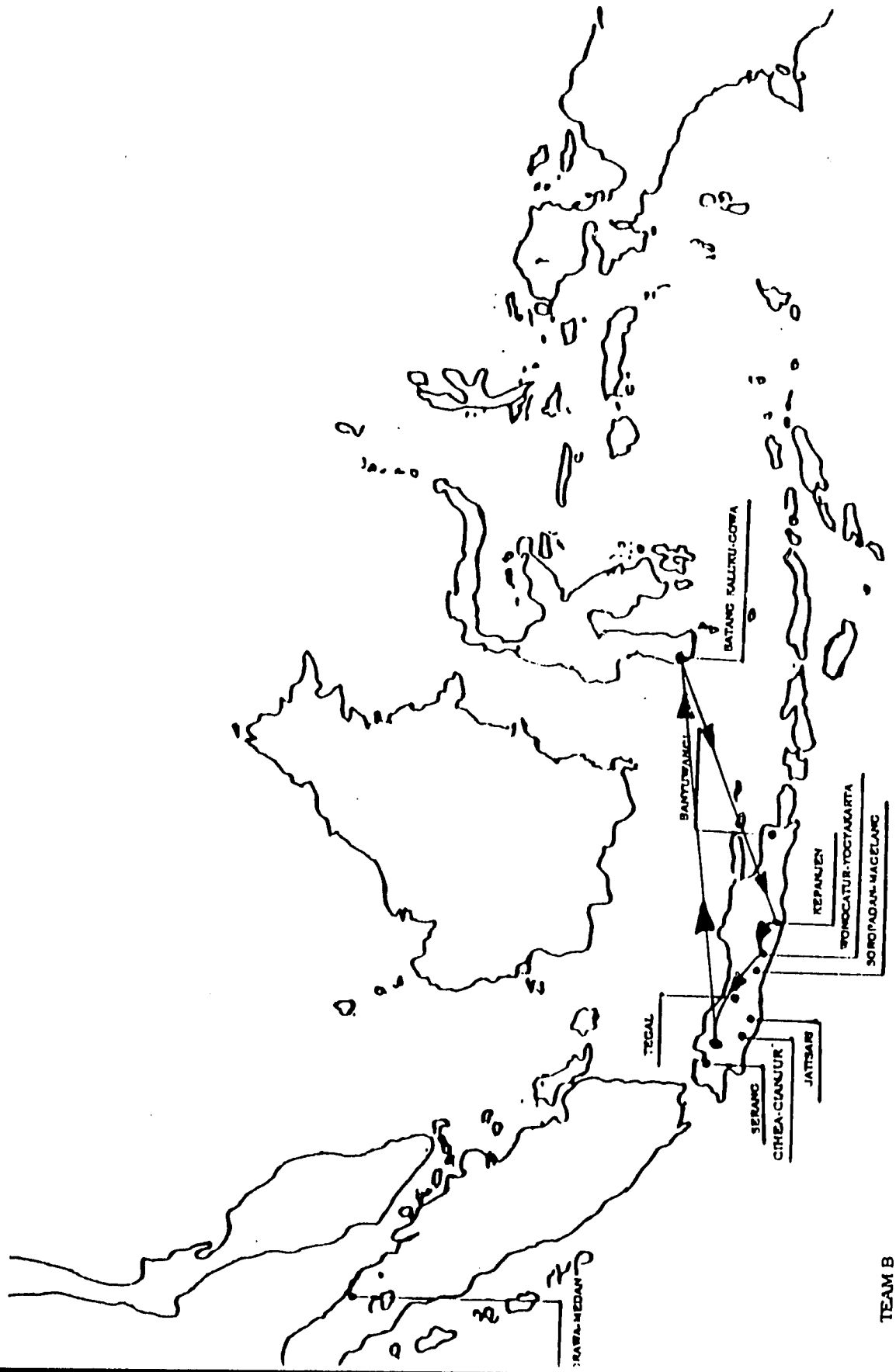
		Internal Meeting Dinner	Jakarta IPM Secretariate Hotel Indonesia	14:00 - 18:00 19:00 - 21:00
21	30 June Sunday	Tour to Taman Mini Indonesia Indah (Free Day)	Taman Mini Indonesia Indah	10:00 - 16:00
22	1 July Monday	Courtesy call to Junior Agriculture-Minister of Republic of Indonesia Meeting with related Agency Officials Luncheon Internal meeting and Report Writing Dinner	Agriculture Department Office Agriculture Department Office Hotel Indonesia Hotel Indonesia	8:00-8:30 9:00-12:00 12:00-13:00 13:00-18:00 19:00-21:00
23	2 July Tuesday	Internal meeting and Report Writing	Jakarta IPM Secretariat	8:00-18:00
24	3 July Wednesday	De-briefing with GOI, USAID,FAO	Meeting Room D	9:00 - 12:00 BAPPENAS

2.2 Map Displaying Sites Visited

2.2.1 Team A:



2.2.2 Team B:


BATANG KALTIM-COWA
BANTUWANGI
KEPANJEN
SOROCATUR-YOGYAKARTA
SOROPADAN-MAGELANG
TEGAL
JATISARI
SERANG
CIMEA-CIANJUR
RAWA-MEDAN
TEAM B

2.3 Composition of Review Mission

MEMBERS OF THE TRI-PARTITE REVIEW MISSION

Training and Development of Integrated Pest Management (IPM)
in Rice-based Cropping Systems
UTF/INS/067/INS

1. Dr. Carl S. Barfield (Team Leader)
   5705 NW 54th Way, Gainesville
   FL 32600, Florida, USA
   Phone: 904-392-1965
   Fax: 904-392-7127
   Telex: 568757

2. Dr. James Mangan
   Jalan Ampera Raya no. 16 Apt#8
   Jakarta, Indonesia
   Phone: 62-21-780-6316

3. Dr. John Markle
   Food and Agriculture Organization of the United Nations
   Via delle Terme di Caracalla
   00100, Rome, Italy
   Phone: 39-6-57971
   Fax: 39-6-578-2610, 579-3152
   Telex: 610181 FAO 1
   Cables: FOODAGRI ROME

4. Ir. Salmon Padmanagara
   Jalan Siaga II/24
   Jakarta, Indonesia
   Phone: 62-21-799-4672

5. Dr. Rolland Roberts
   US Agency for International Development
   Jalan Medan Merdeka Selatan 3
   Jakarta, Indonesia
   Phone: 62-21-360-360 Ext. 2230

6. Dr. Ir. Soehardjan
   Jalan Bondongan 216
   Bogor, Indonesia
   Phone: 62-251-326-366

2.4 List of Officials Interviewed

Prof. Dr. Syarifuddin Baharsyah	Junior Minister of Agriculture
The National Development Planning Agency (BAPPENAS)	
Dr. Ir. Alirahman	Head of Agriculture and Irrigation Bureau, Chairman of National IPM Steering Committee
Dr. M. Anwar Wardhani	Head of Industry and Trade Bureau, Chairman of National IPM Working Group
Prof. Dr. Soemartono Sosromarsono	Member of IPM Steering Committee
Dr. Ida Nyoman Oka	Member of IPM Steering Committee
Dr. Ir. Kasumbogo Untung	Member of IPM Steering Committee
Prof. Dr. Ir. Fachruddin	Member of IPM Steering Committee
Ir. Rusli Djalil, MPM	Secretary of IPM Working Group, GOI Project Manager of IPM
Department of Agriculture, Jakarta	
Ir. V. L. Tjandrakirana	Head, Sub-Directorate of Pest Mgmt, Directorate of Plant Protection, Directorate General Of Food Crops, Member of IPM Steering Committee
Medan (North Sumatera)	
Ir. Sutarto Alimoeso	Head of Center for Plant Protection I North Sumatra and Aceh, Head I of Field Training Facility (FTF) Tanjung Morawa
Iing Sutisna, MEd	Head of Agricultural Training Center in Medan Head II of FTF Tanjung Morawa
Ir. Gunawan Adjas	Project Administrator of FTF Tanjung Morawa
Ir. Usman Sembiring	Field Leader I FTF Tanjung Morawa
Saring Pramudiya	Field Leader I FTF Tanjung Morawa
Ujung Pandang (South Sulawesi)	
M. Ali Rotib, ME	Head of Agricultural Training Center in Batangkaluku Head of FTF Batangkaluku

Ir. Shagir Sama	Head of Center for Plant Protection IX -- Sulawesi Head II of FTF Batangkaluku
M. Anas Amir, SH	Project Administrator FTF Batangkaluku
Ir. Muh. Ferial Zawawi	Field Leader I, FTF Batangkaluku
Ir. Muh. Ishak Andi Parenrengi	Field Leader I, FTF Batangkaluku
Kepanjen (East Java)	
Drh. Darwis Miga	Head of Agricultural Training Center Ketindan, Head I of FTF kepanjen
Ir. R. Djoko Soepraptono	Head of Center Plant Protection VI East Jawa, Head II of FTF Kepanjen
Ir. IGA Suneri	Project Administrator, FTF Kepanjen
Soehardi	Field Leader I, FTF Kepanjen
Bambang Djakfar Sodiq	Field Leader I, FTF Kepanjen
Ir. Kuswiyanto	Widyaiswara, FTF Kepanjen
Wonocatur (Yogyakarta)	
Ir. Toto Sumarta, Ks	Head of Agricultural Training Center, Wonocatur Head I of Field Training Facility, Wonocatur
Hardjono, BSc	Representative of Plant Protection Center V in Yogyakarta Head II of FTF Wonocatur
Ir. Soejitno	Head of Center for Plant Protection V. Central Jawa & Yogyakarta
Ir. Kussriherni	Project Administrator FTF Wonocatur
F. Nangsir Soenanto	Field Leader I, FTF Wonocatur
Kasir	Field Leader I, FTF Wonocatur
IPM Field Lab. Rawamerta (West Java)	
Ir. Hermanu T, Msc	Lecturer, Bogor Institute of Agriculture Head, IPM White Stemborer Research in Rawamerta

ANNEX 3

SUMMARY OF INPUTS BY GOI AND BY FAO

MID-TERM REVIEW MISSION OF THE
GOVERNMENT OF INDONESIA AND FAO
IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management
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3.1 FAO Inputs

Staff and Consultants (1 June 1989 - 31 May 1991)

NAME	AREA	MONTHS
Longterm		
Peter Kenmore	CTA (Reg)	-
Russ Dilts	Team Leader	24
Kevin Gallagher	IPM Specialist	24
John Pontius	Training Specialist	08
Laurie Adams	GIS/Cartography	12
Bill Settle	Habitat Study	5
Ida Nyoman Oka	National Expert	12
Bernadette J. Florendo	Programme Officer (Reg)	-
Hermanu Triwidodo	National Expert	12
Elsa Rubia	IRRI (Reg)	10
Elske Van de Fliert	APO	24
Short term		

(Reg) = Regional Program

Training and Materials Development

Marlinda Baker	Field Site Coordination	6
Asna Othman (Reg)	IPM extension	1
Lou Setti	Nonformal Education	2
F. Wibowo and team	Comm., Video, Theater	14
YIS Training Team	NFE and TOT	2
Driya Media Team	Materials Development	2
Haris Mudjiman	Training Curriculum	2
Simon HT	Facilitator Skills/TOT	4

Research and Development

Remedios Aguda (Reg)	Field Study design	1
Miguel Salac (Reg)	IPM Field Training	7
Cornelio Peralta (Reg)	Rats, Field Training	6
J.P. Bandong (Reg)	Field Trial Evaluation	2
G.S. Arida (Reg)	Field Trial Evaluation	2
A. Barrion (Reg)	Field Taxonomy	1
Sam Turnipseed	Palawija study	2
B.Merle Sheppard	Palawija study	2
H. Musen	Palawija study	1
G. Mueller	Palawija study	1
R. Denno	Habitat Study	1
G. Roderick	Habitat Study	1
H. Doebel	Habitat Study	1
Wimar Witoelar	MicroComputers	3
Mochtar Lubis	Press Training	-
Tom Gillespie	G.I.S.	1
Sean Foley	G.I.S.	3
Shahid Telukdar	Nonformal Education	1

Agricultural Research Centers

Staff (9 Persons)	Palawija Training	4

Evaluation/Monitoring/Analysis

A.P. Vayda	Anthropology	2
I.Tjitradjaja	Anthropology	3
Y. Winarto	Anthropology	3
Anto Achadiyat	Anthropology	3
Niels Röling	Extension	1
J. Pincus	Impact Study	3
H. Waibel	IPM Economics	1
M. Useem	Organizational Dev.	1

Health

B. Hirschhorn	Epidemiology	1
M. Djajadisastra	Public Health	4
M. Moeliono	Health surveillance	2
M. Frith	Public Health	1
Widodo B.	Health Training	1

National Staff in Jakarta Secretariat

Heru Soetrisno
Arianto Wibowo
Kerny Moning
Nugroho Wienarto
Hari Wibakti
Latifa Nurhidayati
Rini Astana
Hendra Hendarsono

National Staff in Yogyakarta Secretariat

Handoko
Kartini Indah K.
Ratna Budhi
John Priyadi
Lilies

Equipment

Limited personal computers, vehicles, office equipment, supplies for operations at program sekretariats

3.2 GOI Inputs

The Government of Indonesia undertook a massive procurement effort that managed to have the first Field Training Facility equipped and operational only 2 months after the signing of the project document. 9 Additional Field Training Facilities plus program sekretariats were equipped, staffed, and operational within 8 months of program start-up and ahead of schedule for training activity initiation in each location.

1 Central Secretariat in BAPPENAS including office space, phone lines, computers, furnishings, supplies, and administrative/technical staff contributed by the GOI from BAPPENAS, Department of Finance, and Department of Agriculture.

3 Program Secretariats in Jakarta, Bogor, and Jogyakarta including computers and printers, building rental, photocopiers, utilities, phone lines, office furnishings, upgrading, airconditioning, office supplies, vehicles, drivers, office staff/watchmen, and facilities maintenance.

10 Field Training Facility Secretariats including computers, facilities upgrading, office equipment, operational supplies, utilities

Training Materials and supplies from paper notebooks to rice seedlings were supplied on-time at all training locations (example: nearly 500,000 crayons produced specially for the IPM program have been delivered on-time to over 3000 IPM Field Schools across the country). The GOI has also provided funds for printing and distribution of program materials plus funds for coordination meetings and strategic extension activities.

Manpower: 110 Field Trainers assigned full-time to the project for 3 years, 1000 Pest and Disease Observers assigned to full time training and fieldwork for 14 months each; 2000 Agricultural Extension Workers assigned fulltime for a whole season by provincial agricultural offices; up to 8-10 support staff at each program Field Training Facility; field research assistants for supporting studies field activities.

Local Government and Community Contributions

To date, an estimated Rp. 150 million has been contributed to field training activities from local government coffers. Additionally, sub-district/village government and farmers themselves have contributed cash and in-kind to the development and operation of over 400 'farmer to farmer' field school programs across program areas.

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ANNEX 4

4.1 Steering Committee and Working Group of The National IPM Program of Indonesia

4.2 Organogram of The National IPM Program

MID-TERM REVIEW MISSION OF THE GOVERNMENT OF INDONESIA AND FAO IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management in Rice-Based Cropping Systems

MISSION REPORT

July 1991

4.1 Members of Steering Committee & Working Group of The National IPM Program of Indonesia

Steering Committee

1.	Dr. Ir. Alirahman Head of Agriculture and Irrigation Bureau BAPPENAS	Chairman
2.	Drs. Kunaryo Head of Financing Bureau BAPPENAS	Deputy Chairman
3.	Prof Dr. Soemartono Sosromarsono Pest and Disease Department Bogor Institute of Agriculture	Member
4.	Prof. Dr. Fachruddin Pest and Disease Department Hasanuddin University	Member
5.	Dr. Kasumbogo Untung Pest and Disease Department Gajah Mada University	Member
6.	Dr. Ida Nyoman Oka Bogor Research Institute of Food Crops Agency of Agricultural Research and Development Ministry of Agriculture	Member
7.	Dr. M. Satta Wigenasantana Head of Food Crops Protection Directorate Directorate General of Food Crops Ministry of Agriculture	Member
8.	Drs. Abdurrazak Head of Training and Education Center Agency of Agricultural Training and Education Ministry of Agriculture	Member
9.	Dr. Effendi Pasandaran Head of Agro-Economics Research Center Ministry of Agriculture	Member
10.	Ir. Soelbijati Soebroto Head of Food Crops Extension Directorate Deirectorate General of Food Crops Ministry of Agriculture	Member

11.	Ir. Rini Suroyo Head of Horticultural Production Directorate General of Food Crops Ministry of Agriculture	Member
12.	Ir. V.L. Tjandrakirana Head of Pest Management Sub-directorate Directorate General of Food Crops Ministry of Agriculture	Member
13.	Drs. Abdul Salam Staff of Assistant III of Coordinating Minister for Economy, Finance and Industry	Member
14.	Dr. H. Sofyan Mukti MSc. Head of Environmental Health Directorate Ministry of Health	Member
15.	Dr. K. Tjang M. Sutamihardja Staff of Assistant II of State Minister of Population and Environment	Member
16.	Dr. Soemitro Head of Planning Bureau BIMAS, Ministry of Agriculture	Member
17.	Drs. Suwandi Head of Agricultural and Industrial Statistic Center Bureau of Statistics	Member
18.	Head of Plantation Crops Protection Directorate General of Plantation Crops Ministry of Agriculture	Member
19.	Dr. Peter E. Kenmore Regional Programme Coordinator FAO IPM Regional Programme	Member
20.	Dr. Wolfgang Linser Harvard Institute for International Development	Member

Working Group

1.	Dr. M. Anwar Wardhani Agriculture and Irrigation Bureau BAPPENAS	Chairman
2.	Ir. Rusli Djalil, MPM Socio-Economic and Regional Planning Bureau BAPPENAS	Secretary
3.	Prof Dr. Soemartono Sosromarsono Pest and Disease Department Bogor Institute of Agriculture	Member
4.	Prof. Dr. Fachruddin Pest and Disease Department Hasanuddin University	Member
5.	Dr. Kasumbogo Untung Pest and Disease Department Gajah Mada University	Member
6.	Dr. Ida Nyoman Oka Bogor Research Institute of Food Crops Agency of Agricultural Research and Development Ministry of Agriculture	Member
7.	Ir. V.L. Tjandrakirana Head of Pest Management Sub-directorate Directorate General of Food Crops Ministry of Agriculture	Member
8.	Ir. Mad Rais Zauhari Head of Pest and Disease Surveillance and Forecasting Sub-Directorate Directorate General of Food Crops Ministry of Agriculture	Member
9.	Sofyan Arsyad, MA Training and Education Center Agency of Agricultural Training and Education Ministry of Agriculture	Member
10.	Dr. D. Russell Dilts In-Country Team Leader UTF/INS/067/INS, FAO	Member
11.	Dr. Wolfgang Linser Harvard Institute for International Development	Member

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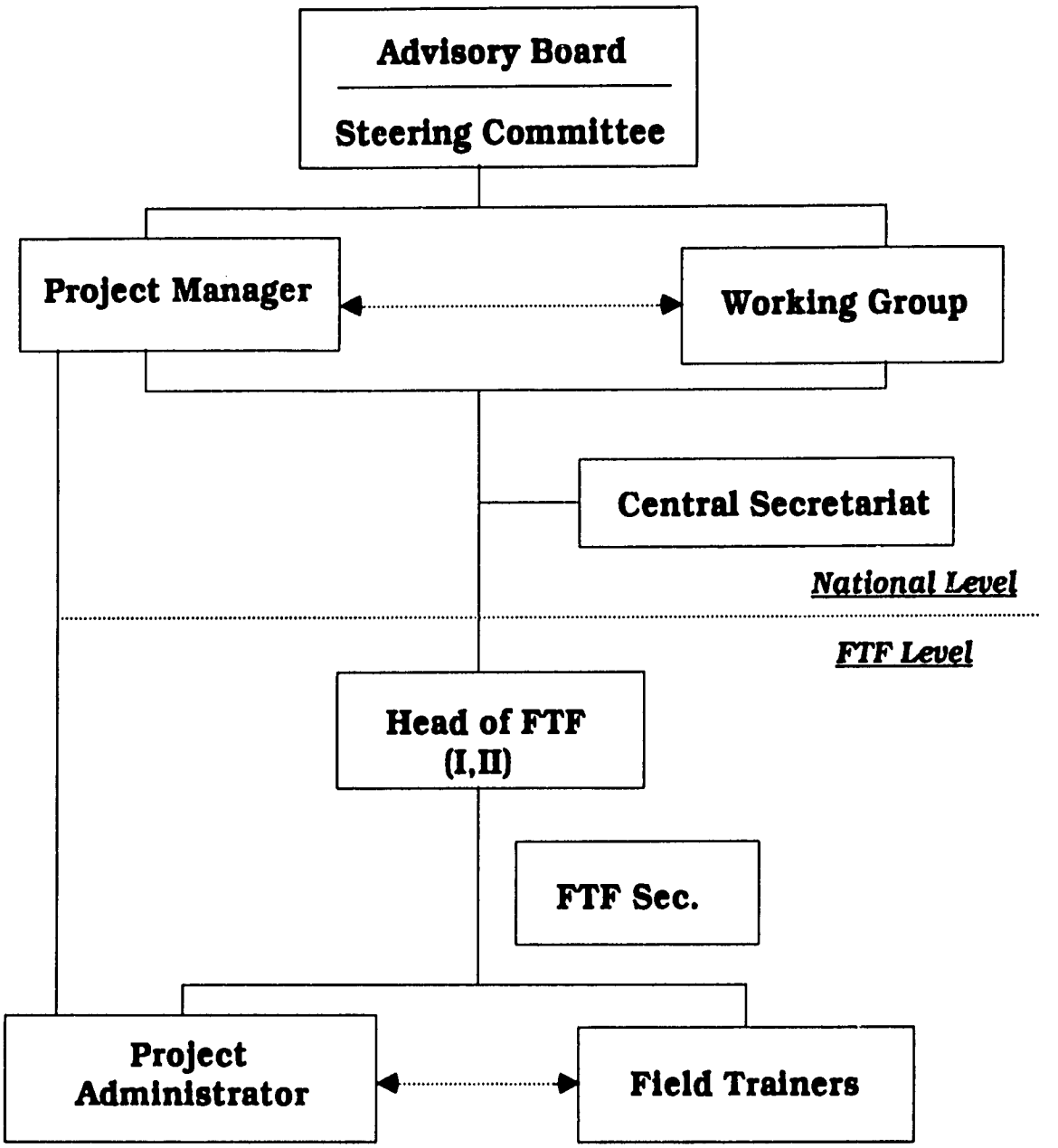
4.2 Organogram of the National IPM Program of Indonesia



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ANNEX 5

STRUCTURE AND RELATIONSHIPS AMONG EXTENSION, PLANT PROTECTION, AGRICULTURAL EDUCATION AND TRAINING SYSTEM

MID-TERM REVIEW MISSION OF THE
GOVERNMENT OF INDONESIA AND FAO
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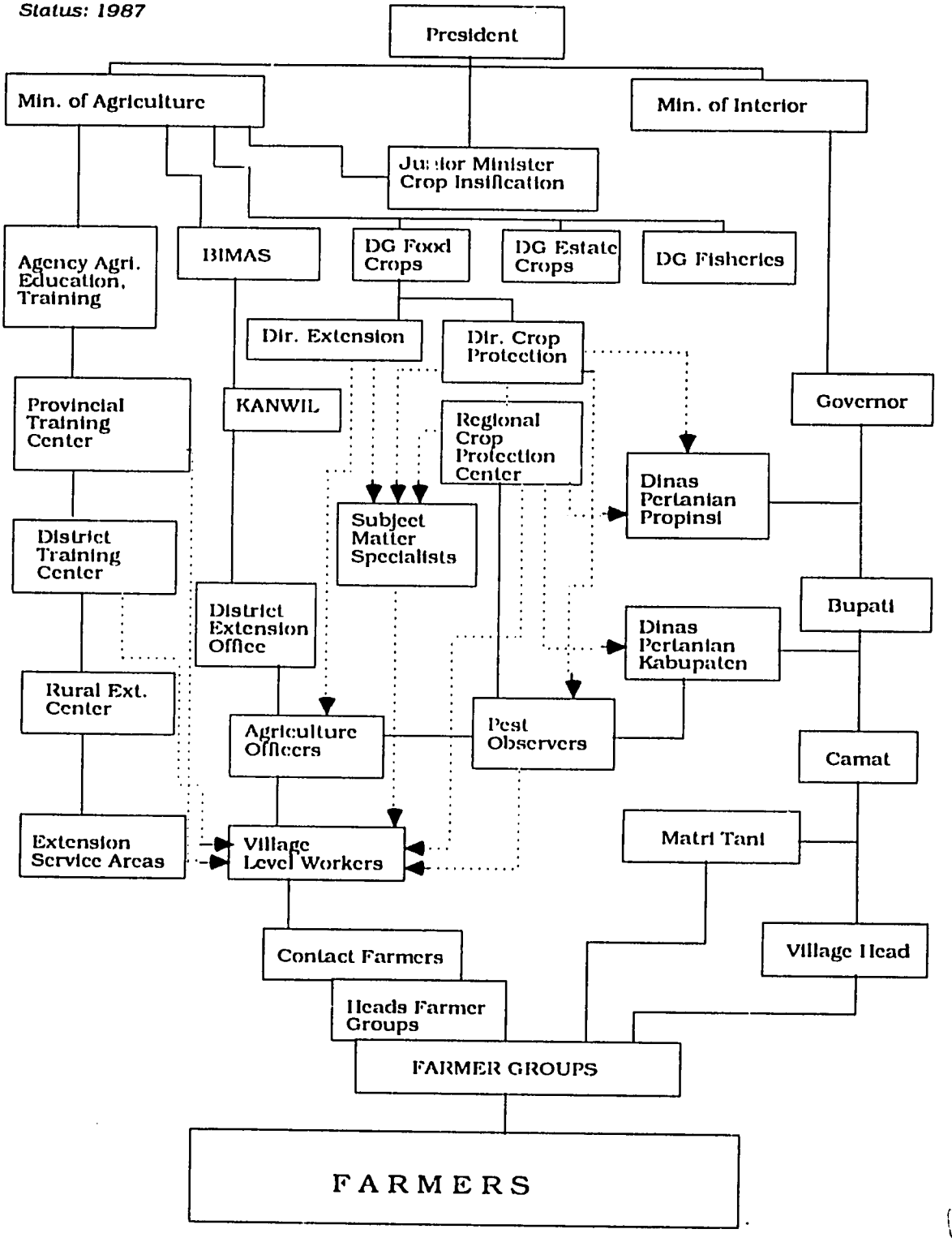
STRUCTURE AND RELATIONSHIPS AMONG EXTENSION, PLANT PROTECTION, AGRICULTURAL EDUCATION AND TRAINING SYSTEMS

Status: 1987



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ANNEX 6

ACHIEVEMENT OF PROJECT OUTPUTS

MID-TERM REVIEW MISSION OF THE
GOVERNMENT OF INDONESIA AND FAO
IN ASSOCIATION WITH USAID

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6.1 Expected Project Outputs

NO.1: Ten Field Training Facilities Operational including procurement of equipment, lodging, materials, staff and practice fields

NO.2: Training Curriculum for Rice IPM Completed, including basic texts, field guides, field trials manual, brochures, hand-outs, and other materials.

NO.3: Curriculum for IPM Extension Training Completed, based on IPM Rice for farmer level training has been developed, field tested and disseminated.

NO.4: Curriculum for IPM Palawija Training Completed including development and testing of field guides, field trials manual, plus supporting materials.

NO.5: University IPM Curriculum Developed in the form of Block Lecture to be delivered during IPM field training.

NO.6: Training of Trainers (50-70 persons)

NO.7: 500 Trained PHP per year produced

NO.8: 1000 PPL Trained per year

NO.9: Baseline and KAP Surveys undertaken

NO.10: IPM Field Training for 50,000 Farmers per year

NO.11: Supporting Study I: Database

NO.12: Supporting Study II: Habitat

NO.13: Supporting Study III: Durable Resistance

NO.14: Strategic Extension Campaigns

6.2 Progress Toward Outputs

During the first two years of the project nearly all project output objectives are near completion or have already been surpassed both quantitatively and qualitatively. A number of evolutionary changes in the project setting have resulted in unanticipated additional activities within the program as will be explained below.

NO.1: Ten Field Training Facilities Operational including procurement of equipment, lodging, materials, staff and practice fields

1) FTF Wonocatur (active 31 July 1989)
2) FTF Soropadan (active 4 January 1990)
3) FTF Tegal (active 4 January 1990)

4) FTF Kepanjen (active 4 January 1990)
5) FTF Banyuwangi (active 4 January 1990)
6) FTF Jatisari (active 4 January 1990)
7) FTF Cihea (active 4 January 1990)
8) FTF Serang (active 4 January 1990)
9) FTF Tanjung Morawa (active 4 January 1990)
10) FTF Batang Kaluku (active 4 January 1990)

These training locations were selected based on a detailed mapping of agro-ecosystems within the country. When coupled with further delineation of Rural Extension Center (BPP) and PHP work areas, the program has been able to draw trainees from areas comprising 75% of national rice production.

The Organizational and Managerial Structure of the project comprises personnel from the key agencies within the Department of Agriculture (Extension and Training, Crop Protection, BIMAS) plus representatives from the Ministry of Health, Ministry of Population and Environment, Coordinating Ministry of Economic Affairs, and Central Bureau of Statistics. The program's National Steering Committee and Working Group was established by Decree of the State Minister for Development Planning No. 075/KET/9/1989. The organization and task descriptions for training management at the FTF level was set by Decree of the State Minister for Development Planning No. 136/KET/12/1989.

Procurement and financial management is handled by the Project Director who is also the Secretary of the Working Group. For financial management he is assisted by an official from the Department of Finance.

NO.2: Training Curriculum for Rice IPM Completed, including basic texts, field guides, field trials manual, brochures, hand-outs, and other materials.

The Training Curriculum for IPM Rice was developed and field tested during the pilot training season at FTF Wonocatur (Sept-Dec. 1989). Subsequently it was revised, reproduced, and used in training at 9 other project FTF's. The second revision of the curriculum is now being employed in the second cycle of training. The curriculum is based on knowledge, skills, and competencies necessary to be able to implement IPM in the field and to train others in IPM. Materials in the curriculum include basic reference texts, field exercise manuals, and field study guides with

supporting materials such as translations from IRRI materials, posters, and brochures.

NO.3: Curriculum for IPM Extension Training Completed, based on IPM Rice for farmer level training, this approach model has been developed, field tested and disseminated.

The Extension Training curriculum can more appropriately be called an approach model, or delivery system. The content of training activities is drawn from IPM Rice training. The model was developed and field-tested through a Pilot Extension Season involving 5200 farmers Jan. - March 1990. After review and refinement this approach has been used successfully in all project locations and is currently being implemented for Second Cycle training in East Java. Variant delivery models (Farmer to farmer, 'Pemasyarakatan', etc.) have emerged based on the basic model. In all, the Extension Training Model utilizing the 'IPM Farmer Field School' has been used to provide full-season IPM training to over 80,000 farmers.

NO.4: Curriculum for IPM Palawija Training Completed including development and testing of field guides, field trials manual, plus supporting materials.

The IPM Palawija Curriculum, following the Rice IPM process model, has been developed, field tested, reviewed, and revised both during a pilot season and after the first full season of implementation. The second revised curriculum is now being implemented in South Sulawesi. This curriculum, including field training exercises and field studies, has been developed and revised with the input of national and international experts in IPM for secondary crops. During the Pilot Season national level review workshops were held to analyze and revise the curriculum based on experience generated.

NO.5: University IPM Curriculum Developed in the form of Block Lecture to be delivered during IPM field training.

This curriculum has been developed by a national university consortium comprising 5 state universities under a separate contract with BAPPENAS. The curriculum combines weekly lectures given during the field training programs with a full semester on campus leading to the D-1 certificate in

crop protection. 500 PHP have completed their D-1 programs during the first two years of the program.

NO.6: Training of Trainers (50-70 persons)

120 Core Trainers (Field Leaders) have been trained through TOT programs, refresher courses, field apprenticeships, and periodic workshops. These Core Trainers receive not only technical input (field study design, taxonomy, plant physiology) but also training skills sessions and management inputs (budgeting, computer utilization, planning, and evaluation). All of these trainers have been seconded full-time to the program by the Department of Agriculture for 3 full years.

NO.7: 500 Trained PHP per year produced

The first group of 500 PHP trainees have completed their 14 month programs and have returned to their normal postings to begin follow-up activities. The second batch of 500 PHP are currently in IPM training programs at the 10 project FTF's. All PHP trainees are officially assigned to the program for the full 14 month period by the Director General of Food Crops. The addition of 2 FTF's in 1991 will increase yearly PHP training capacity by 20% and expand IPM outreach in the Outer Islands.

NO.8: 1000 PPL Trained Per Year

1000 PPL per year will be trained through the Extension Training season which includes one week of training at project FTF's plus a full season of apprenticeship organizing and running Farmer Field Schools. At present, 1000 PPL from the first cycle of training have gone through this process. A great number of additional PPL have been trained through supplemental training programs unforeseen in the project document including: PANTURA Mass Action Training (590 PPL), 'Pemasyarakatan' Programs (1220 PPL), and Follow-up IPM Training (more than 1600 PPL). These additional efforts increase by over 300% the number of PPL receiving IPM training under the program.

NO.9: Baseline and KAP Surveys Undertaken

A four season longitudinal KAP survey is in progress in 4 villages in Central Java

- Field anthropologists (14 persons) are currently following Field School activities in West Java

- A Baseline Survey has been contracted separately to the National Agro-Economic Research Center and is in progress.

- An Impact Study involving interviews with 2300 program trained farmers in 6 provinces has been completed.

- A large scale Health Impacts survey is in the design stage, while a pilot health survey involving 200 highland vegetable farmers is near completion

NO. 10: IPM Field Training for 50,000 Farmers per year

The program's first cycle of Extension Training provided full-season Farmer Field School training in 2000 locations for 50,000 farmers. Subsequent dissemination and special programs have added an additional 100,000 farmers to this total during the first 2 years of the program. With PHP's completing their 14 month programs; the training, management, and logistical capacity will be in place by late 1991 to train 250,000 farmers per season through an array of delivery models (see attached matrix for types and numbers of trainees).

NO. 11: Supporting Study I: DATABASE

- A computerized database comprising the names, age, education, locations, landholdings, pre/post test scores, and field trial results for the 50,000 farmers involved in Farmer Field Schools has been completed during the first cycle of training. This involved the development of special Indonesian language micro-computer programs and the training of project field staff at all locations in the use of the database. The database program is currently being expanded to include other training delivery systems.

- A geographical information system is under development including cartography work to map the major agro-ecosystems involved in the project. The mapping team has completed the Pantura ricebowl and is working on Central Javanese systems. Map-Database linkages are being developed using micro-computer application programs.

NO. 12: Supporting Study II: Habitat

This ecological study of the interactions of insects, crops, and their local ecosystems has been underway since January 1991 in Yogyakarta, based at the Bantul Field Laboratory.

NO. 13: Supporting Study III: Durable Resistance

This study has been cancelled as a 'stand-alone', and will be incorporated into the research agenda to be undertaken by national universities and research agencies.

NO. 14: Strategic Extension Campaigns

A wide range of activities have been conducted to spread information about IPM to the general public as well as to key functionaries necessary to support IPM implementation. Strategic extension activities utilize a variety of media to reach specific clientele, including the following:

- Video/Television: 6 television ready video presentations have been developed; additionally, 3 special television programs have been developed and broadcast by the national television network. IPM program activities have received wide local television and radio coverage.

- Field Days: at both FTF and village level bring together farmers and officials to review program activities and learn from field study results.

- Coordination Meetings: at national, provincial, and district levels provide orientation to the program for all related government agencies.

- Printed Media including the 'Spiders' newsletter for ex-trainees and extension personnel; IPM posters, supplemental and publicly sold IPM books and translations, and program brochures are widely distributed.

- Press Orientation: the national press has received field orientation to the IPM program, resulting in serial articles on IPM in a number of national

newspapers plus a re-orientation of environmental/agricultural reporting perspective in general. This press training will be followed-up by programs from the Press Foundation of Asia.

6.3 Additional Activities

Adjustments, changes, and additions in content and direction have occurred during the course of the project, as can be seen in:

6.3.1. Additional major training activities above and beyond those envisioned in the project document have taken place including:

- Mass-Action training for white rice stemborer (75,000 farmers and local officials),
- 'Farmer to Farmer' training and special training for 'farmer facilitators' in West and Central Java.
- 'Pemasyarakatan' training (Popularization) in all locations increasing the number of Agricultural extension workers trained by 1000,
- Coordination workshops at provincial and district level including province wide meetings in Central and East Java chaired by the provincial Governor,
- Press orientation training,
- Rat Control training in 3 locations,
- NGO workshops and training in West Java, Jakarta, and D.I. Aceh.
- IPM Theater training in nearly 200 locations,
- Follow-up training by returned trainees in all locations.

- Additional FTF's: Plans have been made for the opening two additional Field Training Facilities in September 1991 serving in West Sumatera and Bali provinces with funding from the GOI.

6.3.2. The Supporting Studies Component

- Palawija/Secondary Crops: originally to be carried-out under a separate contract; in May 1990 an addendum to UTF/INS/067/INS was signed with FAO for US$2.3 million for obtaining the assistance of an international university to handle these studies. After negotiations broke down with the designated sub-contractor, the program Steering Committee in October 1990 decided to re-organize this study into two components, one part to be handled by a newly formed national IPM development committee, and one segment to be given for direct hire of short and long term experts by FAO.

  Studies be undertaken are broad, covering some topics in rice as well as IPM issues in secondary crops and supplemented by international experts recruited by FAO. The studies will be over a one year period beginning July 1991. At present 33 research programs have been selected for funding out of 135 submissions from State Universities and Department of Agriculture Research Stations. The Durable Resistance study was dropped as it would be covered by this more comprehensive research effort.

6.3.3 Additional Supporting Study efforts not in the original document include:

- two research programs to address the white rice stemborer outbreak. This effort links research and extension activities to address and immediate farmer problem through the development of village based research stations (28 field researchers) linked to outreach activities. This program is undertaken collaboratively with the Bogor Institute of Agriculture. Another program involves a field research from IRRI, the Philippines working on plant physiology in collaboration with the Sukamandi Agricultural Research Station.

- Initial health impact studies have been started including a training

program for doctors at local health centers conducted in collaboration with the Department of Health

Other more minor supporting studies including work by field anthropologists, experts on community participation, microcomputer applications, baseline surveys, etc. have all been initiated during the first two years of the program.

6.3.4. University Block Lectures and D-1 Diploma: in the project document a separate contract to a university consortium would provide 'block lecture week' inputs to field training. This has been changed such that each week IPM trainees receive one full day of University lectures. A 'fourth season' has been added where trainees spend one semester (3.5 mo.) on the campus of a state university in order to fulfil requirements for their D-1 Diploma in Crop Protection.

6.3.5. 3-Year Time Frame: to accommodate the additional research components plus the expanded 14 month training calendar for basic IPM training, the National Steering Committee has extended the time frame of the program from 2 to 3 years. Project end date of the program is now June 1992 for this phase of activities.

6.4 Summary of Persons Trained by IPM National Programme
August 1989 - May 1991

I. IPM Training Phase I (August 1989 - March 1991)

No	Description	Tj Morawa	Serang	Jatisari	Cihea	Tegal	Soropadan	Wonocatur	Kepanjen	Banyuwangi	Batangkaluku
1	Pest and Disease Observers	50	40	55	55	50	52	50	50	50	50
2	Extension Workers	100	80	110	110	100	104	100	100	100	100
3	Farmers	5,000	4,000	5,500	5,500	5,000	5,200	5,000	5,000	5,000	5,000

II. IPM Pantura Crash Programme (15 - 24 April 1991)

No	Description	Tj Morawa	Serang	Jatisari	Cihea	Tegal	Soropadan	Wonocatur	Kepanjen	Banyuwangi	Batangkaluku
1	Pest and Disease Observers	-	-	120	-	-	-	-	-	-	-
2	Extension Workers	-	-	590	-	-	-	-	-	-	-
3	Local Government Officials	-	-	1,300	-	-	-	-	-	-	-
4	Local Agriculture Officials	-	-	134	-	-	-	-	-	-	-
5	Farmers	-	-	76,783	-	-	-	-	-	-	-

III a. IPM Popularization Programme (October 1990 - March 1991)

No	Description	Tj Morawa	Serang	Jatisari	Cihea	Tegal	Soropadan	Wonocatur	Kepanjen	Banyuwangi	Batangkaluku
1	Pest and Disease Observers	10	11	10	10	5	52	5			
2	Extension Workers	81	93	117	109	50	520	50			
3	Local Government Officials	-	21	10	16	15	156	15			
4	Local Agriculture Officials	20	28	20	23	10	104	10			
5	Farmers	2,500	2,325	2,925	2,725	250	5,200	250			

III b. IPM Popularization Programme (April 1991 - July 1991) *

No	Description	Tj Morawa	Serang	Jatisari	Cihea	Tegal	Soropadan	Wonocatur	Kepanjen	Banyuwangi	Batangkaluku
1	Pest and Disease Observers								10	10	-
2	Extension Workers								100	89	480
3	Local Government Officials								40	6	-
4	Local Agriculture Officials								21	48	96
5	Farmers								1000	980	1400

IV. IPM Facilitator Farmers Programme (9 January 1991 - 26 February 1991)

No	Description	Tj Morawa	Serang	Jatisari	Cihea	Tegal	Soropadan	Wonocatur	Kepanjen	Banyuwangi	Batangkaluku
1	Local Government Officials	-	55	-	-	-	-	-	-	-	-
2	Local Agriculture Officials	-	143	-	-	-	-	-	-	-	-
3	Farmers	-	226	-	-	-	-	-	-	-	-

V. IPM Farmer to Farmer Programme (August 1990 - May 1991)

No	Description	Tj Morawa	Serang	Jatisari	Cihea	Tegal	Soropadan	Wonocatur	Kepanjen	Banyuwangi	Batangkaluku
1	Farmers	-	2,550	725	450	-	-	-	-	-	-

VI. Field Lab White Rice Stemborer

No	Description	Rawamerta
1	Local Government Officials	-
2	Local Agriculture Officials	-
3	Farmers	541

VII. IPM Training Phase II (January 1991 - May 1992) *

No	Description	Tj Morawa	Serang	Jatisari	Cihea	Tegal	Soropadan	Wonocatur	Kepanjen	Banyuwangi	Batangkaluku
1	Pest and Disease Observers	53	50	50	50	46	60	54	50	50	52
2	Extension Workers	-	-	-	-	-	-	-	100	100	-
3	Farmers	-	-	-	-	-	-	-	5000	5000	-

VIII. Follow Up By IPM Specialist (Feb - July 1991) *

No	Description	C. Java	E. Java
1	Pest and Disease Observers	-	-
2	Extension Workers	1500	800
3	Farmers	-	-

*** In Progress**

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ANNEX 7

MATERIALS DEVELOPED BY THE PROJECT

MID-TERM REVIEW MISSION OF THE GOVERNMENT OF INDONESIA AND FAO IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management in Rice-Based Cropping Systems

MISSION REPORT

July 1991

MATERIALS DEVELOPED BY THE PROJECT

This is a list of materials which are designed to support the field training activities. None of the titles can be considered the 'text' of the course since the training depends in a large part on field situation. Day-to-day topics are determined by the stage of the crop, although specific activities are scheduled during the season.

The materials support both training of pest observers and farmer training. Some materials, especially videos and information brochures, are designed for middle-level government managers who will eventually determine the daily work program of the trainees after they have completed training.

All materials are in Indonesian except where noted.

7.1 General National IPM Program Information Brochures, Booklets

1. National IPM Information Book (Buku Informasi)
2. IPM: What is it? (PHT: Apakah Itu?)
3. Rice IPM Training Methodology Process (Proses Latihan PHT Padi)
4. Rice IPM Dissemination Methodology (Proses Penyuluhan PHT Padi)
5. Farmers As Experts; The Indonesian National IPM Program (in English)

7.2 IPM Slide Show and Videos

1. IPM: The Best Mix (PHT: Berarti Perpaduan yang Terbaik) (slide show)
2. How do we Safeguard Production and the Environment (Produksi Aman, Lingkungan Nyaman)
3. IPM White Stemborer Express Training (Latihan Kilat Penggerek Batang di Jalur Pantura)
4. Ever Development Opportunities (Peluang untuk Semakin Berkembang)
5. Computers in Integrated Pest Management (in English)

7.3 Materials for IPM Training:

1. Introduction to Integrated Pest Management, 1981, M.L. Flint and R. van den Bosch. translation of first 6 chapters. Published locally by Kanisius Press as PHT: Sebuah Pengantar

2. Guidelines for an Effective IPM Field Leader (Kiat-Kiat Pemandu Lapangan PHT)
3. IPM 'Clip Art' Drawings (Buku Kumpulan Gambar PHT)
4. Field Ecology Methods (Metode Ekologi Lapangan)
5. Descriptions and Keys to Insect Orders and Families (Deskripsi dan Kunci Determinasi Ordo-ordo dan Famili Serangga dan Laba-laba)
6. Insect and Plant Collection Methods (Cara Mengumpulkan Serangga dan Tanaman)
7. IPM especially for Rats (PHT3)

7.3 Materials on Rice IPM

1. Rice IPM: An Ecological Approach (PHT: Sebuah Pendekatan Ekologi) (also in English)
2. Rice Pests and Natural Enemies color leaflet (Hama dan Musuh Alami di Sawah)
3. Field Guide Exercises for Rice IPM (Petunjuk Lapangan PHT Padi) (also in English)
4. Rice IPM Field Experiments (Petunjuk Percobaan Lapangan PHT Padi)
5. Friends of the Farmer, translation of IRRI book (Mitra Petani)
6. Field Problems of Rice, translation of IRRI book (Masalah di Sawah)
7. Farmer's Primer to Tropical Rice, translation of IRRI book.

7.4 Materials on Soybean IPM

1. An Introduction to Some Main Pest of Soybean (Pengenalan Beberapa Hama Utama Kedelai)
2. Palawija IPM Field Experiments (Petunjuk Percobaan Lapangan PHT Palawija)
3. Field Guide Exercises in Palawija IPM (Petunjuk Lapangan PHT Palawija) (also in English)
4. Soybean Pests and Natural Enemies color leaflet (Hama dan Musuh Alami di Sawah)
5. Growing Soybeans in Rice Fields, translation of IRRI book (Bertanam Kedelai di Lahan Sawah)

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ANNEX 8

IMPACT STUDY

MID-TERM REVIEW MISSION OF THE
GOVERNMENT OF INDONESIA AND FAO
IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management
in Rice-Based Cropping Systems

MISSION REPORT
July 1991

FARMER FIELD SCHOOL SURVEY:

IMPACT OF IPM TRAINING ON FARMERS' PEST CONTROL BEHAVIOR

IPM National Program

Jakarta Secretariat

26 June 1991

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I. INTRODUCTION

This report presents results from an impact study of IPM farmer field schools. The study was conducted from March to June of this year and consisted of interviews with more than 2,000 IPM field school graduates across five provinces. The main purpose of the study was to evaluate the effectiveness of IPM field school training one season after completion of the training course.

IPM training in rice agriculture provides instruction in basic recognition, diagnosis and ecosystem analysis. With improved field skills, farmers are able to reduce pesticide applications and thereby obtain higher profits. Rice cultivation in Southeast Asia does not require more than about one pesticide application every two seasons on average. Since higher levels of application reflect poor management practices (and not endemic pest problems), a simple and revealing measure of the effectiveness of IPM training can be obtained by comparing total applications before and after field schools.

In addition to quantitative measures such as total pesticide applications, the study was also concerned with qualitative indicators of farmers' management skills, such as their own descriptions of application targets and decision making processes. Such indicators help shed light on farmers' ability to decide when pesticide applications are warranted on economic grounds.

Another important objective of the study was to involve IPM staff, trainers and field leaders in the program review process. The guiding philosophy of the study was that research is much more than the sterile collection of facts: research, when done well, involves processes of exploration, inquiry, communication and rethinking of preconceived notions and prejudices. These "participatory" aspects of research were considered too important to be left to outside researchers not directly involved with IPM training. IPM workers at all levels worked together on the design, preparation and implementation of the study, and in doing so were asked to reflect on the goals of the program, the successes and failures of IPM as well as their own role in the training process.

A. IPM Farmer Field Schools

IPM farmer field schools consist of a ten-week participatory training course in IPM farm management methods. The schools concentrate on practical experience in agro-ecosystem analysis providing the basic tools farmers need to make informed decisions about pest control, use of farm inputs and other aspects of rice farming. The training method emphasizes experimentation and horizontal communication: trainers and participants learn IPM together and from each other as they practice it. The primary role of the trainer is to facilitate group dynamics which foster participation, self-confidence and critical thinking, qualities that later help farmers become more effective decision makers.

Field schools center around a comparison between two rice fields, one employing a generalized IPM program, and the other replicating the local officially-recommended production package. While the two fields are similar with respect to NPK fertilizer dosage, rice variety and planting time, the IPM approach omits carbofuran applications at planting time as well as foliar fertilizer applications at flowering. The timing of fertilizer applications also differs between the two fields, with the IPM program emphasizing observation of rice crop growth in contrast to the pre-programmed, schedule-based applications of the local package.

The field comparison is not intended as a demonstration of IPM as a "model" field which is to be mimicked by farmers. Instead, IPM training stimulates the practice of observation skills, critical thinking and creativity to enable farmers to make better decisions based on observations of conditions in their own fields.

Each week IPM field school participants meet and proceed directly into the comparison fields, where they observe changes in water level, weed density, tiller number, plant infection by disease, plant damage by pests, and the presence of beneficial insect predators. The meaning of the data collected during the observation is then expressed on paper in the form of a drawing of the rice plant in its ecosystem. The symbolic representation of plant conditions, pests, predators, fertilizer applications, weather conditions and so forth are the core of agro-ecosystem analysis. The drawings provide a focus for discussion and help stimulate questions that relate conditions in the field (or the agro-ecosystem) to potential management decisions by the farmer. The discussion continues until agreement is reached on practical steps to be taken that week to resolve agronomic and pest problems

encountered in the field.

IPM field schools also include weekly activities which illustrate specific aspects of IPM, including basic recognition of insects, the function of insects, life cycles, food webs, plant physiology, and the effects of pesticides on predator insects. Other topics include community rat control, pesticide poisoning and economic thresholds.

B. Design of the Impact Study

Most training programs are intended to transfer knowledge or to change attitudes within the target community. These goals are notoriously difficult to measure. Large sample surveys may provide important descriptive information about populations, but they are unsuited to the task of explaining the complex causal mechanisms which lie behind the observed changes. On the other extreme, intensive case studies are a more effective means of generating hypotheses about the social, institutional and cultural mechanisms at work, but do not achieve the representativeness needed to examine change in the population as a whole.

The choice between sample surveys and in-depth case studies need not be an irresolvable dilemma. As Casley and Lury point out in their book on project evaluation, the solution often lies in combining elements from both methods.[1] Data concerning readily-measured indicators of change taken from a large sample can be integrated with open-ended interview questions with the aim of obtaining both information about generalizable trends and the specific forces shaping them.

Success in using hybrid methodologies of this sort hinges on the skill of the interviewer and his or her knowledge of the subject under investigation. The present study was designed with this basic fact in mind. It was recognized from the outset that an accurate evaluation of IPM training would require interviewers who understood the principles and practice of IPM as well as communication techniques that would enable them to obtain in-depth information about farmers' responses to IPM training.

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[1]Dennis J. Casley and Denis A. Lury, Monitoring and Evaluation of Agriculture and Rural Development Projects, Baltimore: Johns Hopkins University Press for the World Bank, 1982, Part 5.

The obvious candidates were IPM trainers themselves. Trainers possess the necessary knowledge of IPM and horizontal communication techniques practiced during the course of farmer field schools. However, since most trainers had little or no experience in social science research, we recognized that they would need additional instruction in interviewing skills and a chance to practice these new skills under the supervision of experienced researchers. Workshops were organized for this purpose at each of the five field training facilities (see Section C below).

Having spent considerable time and effort practicing case-study methods with participating trainers, we felt that the study could include both standard survey-type questions about changes in farmer behavior and more open-ended questions that probe the various influences lying behind farmers' responses to training.

Measuring the effects of IPM training is made easier by the fact that the content of the training itself is extremely practical. Field school participants learn IPM in their own villages and in their own fields. Farmer-trainees can immediately put into practice skills they have learned that very day. Hence there is a direct and immediate link between the training and management decisions later taken by farmers. The sample survey component of the study focussed on these concrete decisions — for example, the number of applications per season — in examining the connection between IPM training and changes in the pest control habits of farmers. Simple, tangible measures relating to specific actions performed by respondents tend to produce the most reliable results, since they are easily recalled and less subject to error than more complicated indicators.

In order to examine the mechanisms underlying these changes, we also asked trainers to engage farmers in informal discussions about the reasons for decisions taken in their fields. As we shall see later in the report, the information obtained in these unstructured interviews provides important information invaluable for formulating hypotheses about the causes of changes in farmers' behavior.

The survey asked farmers to describe their use of pesticides over two planting seasons: one season prior to the farmer field school and one season after training. For ease of comparison, both seasons selected were wet seasons (1989-1990 and 1990-1991). The before-after format was prefered over the use of a non-IPM control because of the impracticality of the latter method. As Casley and Lury note, the success of the experiment-control format depends on the identity of the two groups before "treatment" (in this case

training). It is, of course, impossible to obtain identity between two groups of farmers. What is often overlooked, however, is that even "equivalence" — or a close match across a limited number of social-economic-cultural variables — is highly unlikely in a developing country context.[2] Casley and Lury therefore suggest the use of "quasi-experimental" methods, such as the one adopted in this study.

Below is a list of some of the questions farmers were asked:

1) Landholding size and status
2) Number of pesticide applications
3) Type of pesticide applied
4) Dosage
5) Cost of pesticides
6) Time of application in plant growth cycle
7) Cost of renting sprayers and other equipment
8) Cost of labor for pesticide application
9) Reasons, in the farmer's own words, for choosing given pest control method
10) Other additional explanations of pest control behvior specific to the farmers particular conditions

The methodology chosen for the study also reflects principles shared by members of the study team about the uses and goals of social-economic research in rural Asia. In our experience, many studies in Indonesia — both official and individual research efforts — have been overly concerned with matters such as the "objectivity" and "randomness" of samples, while not giving careful thought to the interview process or even the basic aims of the research itself. Scores of enumerators, armed with official-looking questionnaires and sharp pencils, descend on villagers to collect "data" which are later analyzed by "experts" back in Jakarta or Bogor. But is the information collected in these surveys accurate? Or is it more a reflection of the enumerator's haste and farmer's well-rehearsed answers to official questions? What does "objectivity" mean when enumerators are not taught to spend the time and effort to attempt really to communicate with farmers? Have the interviewer or the farmer gained anything from the interview or were they merely passive participants?

[2]Ibid., p. 22.

We feel that these questions are of more than academic interest. Our hope was that the survey would encourage trainers, field leaders and secretariat staff to think creatively about IPM goals, their own role in the IPM training effort and the future direction of IPM in Indonesia. The interviews were seen as an excellent opportunity for trainers to obtain direct feedback from farmers about the benefits of IPM training as well as problems encountered after the completion of the field school. Data collection was supervised by IPM field leaders who attended the interview-training workshops and were encouraged to attend as many interviews as possible.

C. Training of Interviewers

Five separate two-day "Impact Study Orientation" workshops were held in each of the five provinces presently hosting IPM field training facilities. Workshop participants included IPM trainers, field leaders, secretariat staff, a specialist in adult education and an experienced field researcher.

The goals of the workshops included the following:

1) Acquainting participants with the need for and objectives of the impact study;

2) Introducing and practicing interview techniques which create a relaxed environment and which enhance the respondent's capacity to recall key information;

3) Emphasizing the importance of honest reporting and accurate results;

4) Conducting trial interviews with farmers under the supervision of the workshop team.

Trainers practiced conducting interviews using IPM techniques such as agro-ecosystem drawings and actual field observations. Interviewers were also urged to leave the survey questionnaire at home and take notes on a blank sheet of paper; to dress informally (no official uniforms); to visit the farmers at home or in their fields rather than at the village office or other official meeting place; and to conduct interviews at times of the day normally

associated with relaxed, informal discussion, such as late afternoon or early evening. It was hoped that these small changes would remove the air of officialdom from the interviews and thereby encourage more accurate reporting by farmers.

The workshops were also intended to reinforce horizontal and informal learning methods which form an integral part of the IPM process. The sessions contained a minimum of formal instruction and consisted almost entirely of practice sessions, discussions, role-playing exercises and other group activities.

D. The Questionnaire

The questionnaire was designed by 30 IPM trainers at the first impact study orientation held in Cihea, West Java April 4-6. Design was based on the trainers' understanding of the kinds of information that farmers would be able to recall with minimum amounts of error. The final result is presented (in English translation) in Appendix A. Certain questions, such as rice yields, fertilizer use and information about other cultivating practices, were ruled out as impractical.

Yields per hectare are an interesting example. Although some trainers wanted to include yields in the questionnaire, it was eventually agreed that recall yield data would be practically useless. First, the yields reported would be estimates that would not account for moisture content, mismeasured fields, and so forth. Second, since more accurate data on yields are being collected by other means, it was felt that the collection of inexact yield data would add nothing to our understanding of IPM training.

E. Basic Characteristics of the Sample

One hundred seventeen IPM trainers participated in the study as interviewers. The trainers were selected by their respective field leaders based on the accuracy of their past reports. Each IPM trainer was asked to select a random sample of 20 farmers from a minimum of two field schools.[3] A random sample was then carried out during the impact study workshops and supervised by the study team.

[3]Except in North Sumatra where each trainer selected only ten farmers due to the great distance between locations. This implies a sample of 2140 farmers randomly selected from a total population of 5850 field school participants.

The final sample, after allowing for rejected questionnaires, consisted of 2013 farmers covering 72 districts. The geographic distribution of the sample is shown in Table 1.

TABLE 1: DISTRIBUTION OF STUDY SAMPLE BY PROVINCE

North Sumatra:	196 farmers in 5 Kabupaten
West Java:	580 farmers in 18 Kabupaten
Central Java:*	518 farmers in 24 Kabupaten
East Java:	399 farmers in 14 Kabupaten
South Sulawesi:	320 farmers in 11 Kabupaten
All provinces:	2013 farmers in 72 Kabupaten

* Includes 61 farmers from the Special District of Yogyakarta

Landholding among sample farmers was reasonably reflective of conditions in the respective provinces. Table 2 compares average area operated in the study sample to data from the same provinces taken from the 1983 Agricultural Census. The tables show that the impact study sample was consistent with conditions in the provinces as a whole except for the case of West Java, where the study sample is biased in the direction of larger farms. This difference between the census and impact study sample is due to the overrepresentation of the Pantura districts (Cirebon, Indramayu, Subang, Krawang and Bekasi) in the study sample. Pantura, the Indonesian acronym for the North Coast of West Java, is characterized by large farms and high production costs per hectare. While the study figures do not represent the province, they do, however, represent the distribution of IPM field schools. Another interesting feature of the data in Table 2 is the large standard deviations for the study sample, since these reflect the wide range of farmers — from small farmers to large (in local terms) landholders — who participate in IPM training. This allows us to examine the scale bias of IPM: in other words, whether IPM training favors, is more readily adapted by, or excludes certain classes of farmers.

Similarly, land tenure status within the sample is dominated by owner-operators, as is the case in the population of Indonesian low land rice-cultivating farmers.

TABLE 2: DISTRIBUTION OF LANDHOLDINGS BY SIZE
(Wet Season 1989, 1983 Agricultural Census)

	IMPACT STUDY Mean	IMPACT STUDY Std Dev	AGRIC CENSUS Mean
North Sumatra	0.48	0.32	0.50
West Java	0.63	0.59	0.37
Central Java	0.34	0.44	0.41
East Java	0.45	0.61	0.46
South Sulawesi	0.85	2.00	0.75
All provinces:	0.54	0.945	

** Central Statistical Office, 1983 Agricultural Census, Series A4.

TABLE 3: DISTRIBUTION OF SAMPLE BY LAND TENURE
(Wet Season 1989)

	Owner Operators	Renters	Sharecroppers	Other*
	(%)	(%)	(%)	(%)
North Sumatra	71.0	24.5	3.3	1.2
West Java	75.6	5.6	15.3	3.5
Central Java	69.0	12.3	8.3	10.3
East Java	79.9	11.6	5.4	3.1
South Sulawesi	77.0	1.7	18.1	3.2
All provinces	74.6	9.6	10.9	4.9

* comprises pawned land (gadai), village salary lands, and cases in which land tenure was not specified.

Figures for the distribution of farmers by land tenure for the impact study sample are given in Table 3. Unfortunately, the Indonesian Agricultural Census does not provide figures on sharecropping, renting, pawning and village salary lands, but instead groups the first three of these categories under the single heading "land originating from other parties." Village salary lands (bengkok) are included under owner-operated lands in the Agricultural Census (Table 4), while in the study sample this category appears as "Other."

TABLE 4: PERCENTAGE OF OWNER-OPERATED AND LEASED FARMS WET RICE CULTIVATION, 1983 AGRICULTURAL CENSUS

	Owner Operated	Leased
North Sumatra	0.85	0.15
West Java	0.77	0.23
Central Java	0.78	0.22
East Java	0.82	0.18
South Sulawesi	0.79	0.21

Source: Central Bureau of Statistics, Agricultural Census Series A.4.

The grouping of owner-operated farms and village salary lands in the Agricultura Census accounts for the difference between the impact study sample and the Census i Central Java, where village salary lands are still prevalent. In the impact study sampl sharecropping was most common in West Java and South Sulawesi where average size o holdings are also higher. The coincidence of sharecropping and larger average farm size is consistent with the tendency in small-farmer rice agriculture for diminishing returns t set in even at small farm sizes.

Rice varieties planted by sample farmers show a predominance of high-yieldin varieties, as shown in Table 5. The figures presented are an average of the two season surveyed (there was little difference recorded between seasons). Suitable census data o the distribution of rice varieties are not available for recent years in Indonesia.

TABLE 5: SELECTED RICE VARIETIES PLANTED BY FARMERS IN SAMPLE*

	R64	Cisadane	IR42	IR36	Ciliwung	Other
North Sumatra	44.8	0.4	3.4	1.1	0.3	49.9
West Java	43.8	36.7	2.4	0.9	3.6	12.6
Central Java	31.9	45.1	0.0	6.3	0.5	16.2
East Java	69.8	3.1	0.0	7.4	0.1	19.6
South Sulawesi	4.5	19.6	41.5	2.5	9.9	22.0
All provinces	40.9	24.6	4.7	3.7	2.5	24.6

* For 1989 and 1990 Wet Seasons.

II. SURVEY RESULTS

A. Number of Pesticide Applications

A.1. Total Pesticide Applications

We begin with a basic indicator of farmer behavior, namely, the number of pesticide applications before and after IPM training. A significant change in number of sprays constitutes convincing evidence of the positive effects of IPM field schools on actual farmer behavior.

TABLE 6: NUMBER OF APPLICATIONS — ALL PESTICIDES*
AVERAGE APPLICATIONS PER FIELD

	Before	StDev Before	After	StDev After	F Stat	Sig
North Sumatra	5.17	2.52	1.72	1.59	7.84	.0001
West Java	2.39	1.52	1.04	1.25	48.56	.0001
Central Java	2.23	1.60	1.37	1.50	19.30	.0001
East Java	2.31	2.13	1.17	1.38	19.84	.0001
South Sulawesi	2.33	1.31	0.48	0.76	12.70	.0001
All provinces	2.58	1.94	1.13	1.36	58.51	.0001

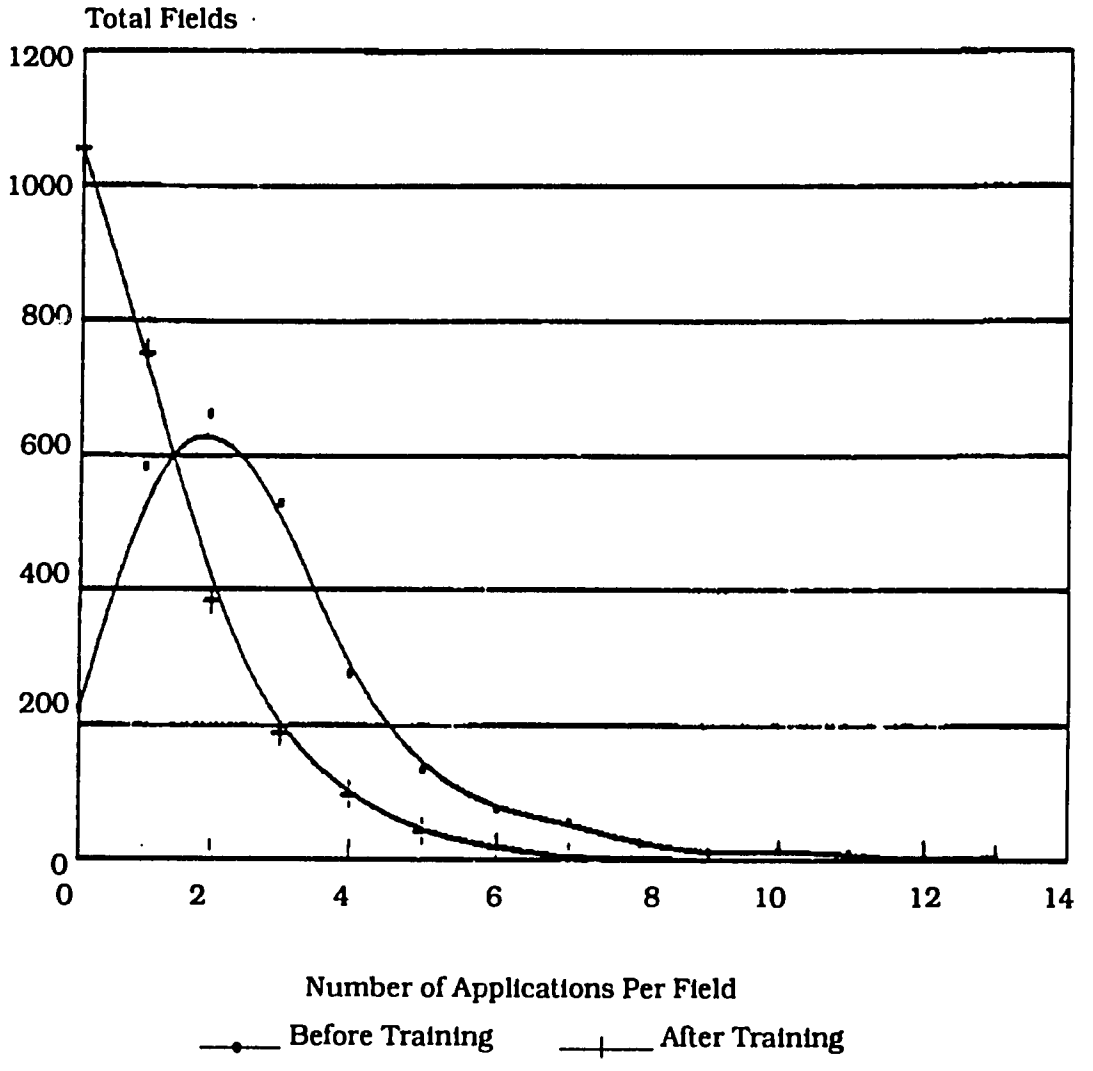
* Includes insecticides, rodenticides, fungicides and herbicides.

Table 6 presents changes in total applications of insecticides, fungicides, herbicides and rodenticides per field by province and for the sample as a whole. As the table shows, total number of applications decreased by 57 percent, from two and one-half per field to about one. The largest decreases were achieved in North Sumatra — which began with a striking 5.2 applications per field — and South Sulawesi, where pesticide use fell by four-fifths. The figures for Central Java represent a continued higher proportion of rodenticide applications compared to other provinces. We will return to this point later in the section.

Of particular interest is the uniform decline in the standard deviation of the mean number of applications across all provinces. This reflects the finding that the distribution of applications in the post-training sample tends to congregate around the lower numbers with far fewer outliers with high levels of applications per season. The change in the frequency distribution of applications by field is illustrated in Figure 1, which shows the large increase in zero and one applications per season in the post-training sample. Lower

standard deviations also reflect the finding (reported in a later section) that after training pesticide targets were more specific; in other words, that pesticide use was less random.

Figure 1. NUMBER OF APPLICATION PER FIELD
ALL PESTICIDES



Another way to look at the same data is to calculate average number of applications per farmer (Table 7). For a number of reasons (such as the particulars of inheritance customs, reduction of production risk) small farmers often cultivate more than one plot in more than one location. Pesticide use, fertilizer use and cultivation practices may differ from field to field. Presentation of results on a per-farmer basis accounts for these differences.

TABLE 7: AVERAGE APPLICATIONS PER FARMER
ALL PESTICIDES*, BEFORE AND AFTER TRAINING

	BEFORE		AFTER		Percent
	Mean	N	Mean	N	Change
North Sumatra	6.39	195	2.09	193	67%
West Java	3.17	580	1.37	576	57%
Central Java	3.10	483	1.93	476	38%
East Java	3.02	394	1.51	384	50%
South Sulawesi	2.99	318	0.58	315	81%
All provinces	3.41	1970	1.48	1944	57%

* Includes insecticides, rodenticides, fungicides and herbicides.

A.2. Total Insecticide Applications

Still more information about changes in farmer behavior can be obtained by disaggregating pesticides into the specific categories of insecticide, rodenticide, herbicide and fungicide. One of the major themes of IPM training is the preservation of natural enemies through less frequent application of insecticides, as well as the elimination of broad-spectrum insecticides now banned for use on paddy in Indonesia. Average number of applications of insecticides per field is given by province in Table 8.

TABLE 8: NUMBER OF APPLICATIONS — INSECTICIDES
AVERAGE PER FIELD

	BEFORE	StDev Before	AFTER	StDev After	Median Before	Median After
North Sumatra	3.90	2.35	0.83	1.25	3	1
West Java	2.16	1.44	0.88	1.11	2	1
Central Java	1.64	1.40	0.89	1.14	1	1
East Java	2.05	2.05	1.00	1.28	2	1
South Sulawesi	2.13	1.19	0.35	0.57	2	0
All provinces	2.16	1.74	0.82	1.12	2	0

Note that the average after training falls to less than one application per plot, reflecting the large number of fields which received no insecticide applications. Whereas only 363 fields received no applications of insecticides before training, 1309 fields received no applications after training. Again, as in the case of all pesticides, dispersion within the sample falls markedly after training. A good indication of this is the median, which falls from

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two sprays per season before training to no sprays after training for the sample as a whole.

Reduction in insecticide use per field by Kabupaten is shown for North Sumatra, Java and South Sulawesi on Maps 1, 2 and 3, respectively. Although change was fairly uniform in North Sumatra and South Sulawesi, Java shows significant variation among Kabupaten even within provinces. For example, the maps reveal that the southern area of West Java, the Special District of Yogyakarta, and Kabupaten Blitar and Banyuwangi in East Java were particularly successful. These Kabupaten do not share easily identified agro-climatic or socio-economic characteristics, a fact which supports the conclusion that variation in field school success has more to do with factors such as leadership qualities among trainers and group dynamics within field schools than simple agronomic or economic determinants. Unfortunately, personal characteristics such as leadership, enthusiasm and cooperation are difficult if not impossible to measure quantitatively.

When the number of insecticide applications is viewed on a per-farmer basis (Table 9), we find a striking 63 per cent overall decline in insecticide applications. In addition, the largest decreases in percentage terms were achieved in provinces with higher absolute levels of insecticide use before training. Thus insecticide applications in North Sumatra, which averaged nearly five per farmer before training, fell to one application after training. Conversely, Central Java, which exhibited relatively low levels of insecticide use before training, experienced less of a decline in percentage terms after training. South Sulawesi's performance showed a remarkable 85 percent decline in insecticide use after training.

TABLE 9: NUMBER OF APPLICATIONS — INSECTICIDES AVERAGE PER FARMER

	BEFORE		AFTER		Percent
	Mean	N	Mean	N	Change
North Sumatra	4.82	195	1.01	193	79%
West Java	2.87	580	1.15	576	60%
Central Java	2.30	483	1.24	476	46%
East Java	2.70	394	1.25	384	54%
South Sulawesi	2.73	318	0.42	315	85%
All provinces	2.87	1970	1.06	1944	63%

A.3. Banned Insecticide Applications

Some of the most impressive evidence of field school success relates to changes in the

use of insecticides banned on rice in Indonesia. These broad-spectrum chemicals were outlawed for use on paddy under Presidential Instruction Number 3, 1986, following a devastating brown planthopper outbreak that year — an outbreak which was attributed to overuse of insecticides. Table 10 presents before and after averages per field for banned insecticide applications. The overall number of applications after field schools declined by 78 percent, with some spectacular provincial level results, for example a 93 percent fall in applications in South Sulawesi and an 84 percent fall in both North Sumatra and West Java. The results are similar on a per farmer basis, as reported in Table 11. Applications of banned pesticides per field are shown at the Kabupaten level on Maps 4 through 9. Again, as in the case of reduction of total insecticide use, the maps show significant variation among Kabupaten in Java. However, the average number of banned insecticide applications per field fell below one in every Kabupaten in the three provinces on Java plus the Special District of Yogyakarta.

TABLE 10: NUMBER OF APPLICATIONS — BANNED INSECTICIDES AVERAGE PER FIELD

	BEFORE	AFTER	StDev Before	StDev After
North Sumatra	2.10	0.34	2.10	0.86
West Java	0.60	0.10	0.97	0.37
Central Java	0.64	0.20	1.05	0.59
East Java	0.80	0.30	1.24	0.73
South Sulawesi	0.87	0.06	0.98	0.25
All provinces 0.83	0.18	1.26	0.57	

TABLE 11: NUMBER OF APPLICATIONS — BANNED INSECTICIDES AVERAGE PER FARMER

	BEFORE	AFTER	Percent Change
North Sumatra	2.59	0.42	84%
West Java	0.79	0.13	84%
Central Java	0.89	0.28	68%
East Java	1.05	0.39	63%
South Sulawesi	1.12	0.07	93%
All provinces	1.10	0.24	78%

Tables 12 and 13 present data on the number of applications of legal and banned insecticides before and after IPM training, categorized by active ingredient. The two tables show that after IPM training farmers not only reduced total insecticide applications, but also took decisive moves away from broad spectrum chemicals, most of which were banned by Presidential Decree but remain available for use on non-rice crops.

TABLE 12: PESTICIDE APPLICATIONS BY ACTIVE INGREDIENT BEFORE TRAINING

	All provinces	North Sumatra	West Java	Centr Java	East Java	South Sulawesi
PERMITTED						
carbofuran	1407	101	516	327	248	215
BPMC	1792	313	603	317	320	239
MIPC	208	18	57	29	43	61
buprofezin	68	2	26	5	35	0
BANNED ON PADDY						
carbaryl	126	29	18	16	2	61
chlorpyrifos	356	47	74	43	72	120
cyholothrin	8	1	1	2	4	0
diazinon	334	54	77	109	45	49
diazinon/BPMC	22	13	0	0	5	4
dichlorvos	9	0	1	1	5	2
endosulfan	406	64	92	84	97	69
fenthion	142	100	14	10	4	14
methamidophos	7	0	0	1	6	0
methomyl	3	1	1	0	1	0
monocrotofos	290	121	34	61	53	21
permethrin	5	4	1	0	0	0
phenetrothion	45	25	9	5	0	6
phenthoate	330	20	119	81	109	1
phenthoate/BPMC	3	0	0	0	0	3
phosphimidon	3	0	0	1	0	2
profenofos	20	9	6	2	1	2
other insecticides banned on paddy	52	17	13	11	8	3
FUNGICIDES						
benomyl/thiram	15	0	1	0	14	0
carbendazim	14	0	4	0	10	0
other fungicide	20	5	12	0	3	0
RODENTICIDES	695	94	141	360	75	25
HERBICIDES	278	185	11	7	23	52

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TABLE 13: PESTICIDE APPLICATIONS BY ACTIVE INGREDIENT AFTER TRAINING

	All provinces	North Sumatra	West Java	Central Java	East Java	South Sulawesi
PERMITTED						
carbofuran	739	5	330	213	143	48
BPMC	763	103	218	224	171	47
MIPC	73	7	26	18	9	13
buprofezin	48	0	18	8	20	2
BANNED ON PADDY						
carbaryl	20	3	2	2	2	11
chlorpyrifos	53	6	1	6	35	5
cyholothrin	12	0	0	0	12	0
diazinon	43	5	1	31	5	1
diazinon/BPMC	0	0	0	0	0	0
dichlorvos	1	0	0	0	0	1
endosulfan	41	6	5	11	17	2
fenthion	13	4	1	4	4	0
methamidophos	0	0	0	0	0	0
methomyl	1	0	0	0	1	0
monocrotofos	95	34	8	25	27	1
permethrin	6	1	0	4	1	0
phenetrothion	10	9	0	0	1	0
phenthoate	111	8	40	31	32	0
phenthoate/BPMC	1	0	0	0	1	0
phosphimidon	3	0	0	3	0	2
profenofos	12	4	0	2	4	0
other insecticides banned on paddy	40	1	17	14	8	0
FUNGICIDES						
benomyl/thiram	4	0	0	0	4	0
carbendazim	19	0	11	0	8	0
other fungicides	31	3	14	2	12	0
RODENTICIDES	440	38	85	287	23	7
HERBICIDES	243	144	8	12	35	44

Another way to look at the same data is to classify banned insecticides by type, as presented in Table 14.

TABLE 14: BANNED INSECTICIDE APPLICATIONS BY TYPE AFTER TRAINING

	All provinces	North Sumatra	West Java	Cent. Java	East Java	South Sulawesi
Organophosphates	1552	389	333	313	295	222
Organochlorines	406	64	92	84	97	69
Pyrethroids	13	5	2	2	4	0
Carbamates	129	30	19	16	3	61
Other	61	17	14	12	13	5
			After Training			
Organophosphates	341	70	51	102	109	9
Organochlorines	41	6	5	11	17	2
Pyrethroids	18	1	0	4	13	0
Carbamates	21	3	2	2	3	11
Other	41	1	17	14	8	1

The three largest categories of banned insecticides all showed similar reductions ranging from 79 to 90 percent. Among all insecticides (both banned and permitted) we find that whereas before training organophosphates accounted for 28 percent of all applications, their share fell to 17 percent after training. This is a welcome effect of training, since organophosphates are the most toxic chemicals to humans used in Indonesian agriculture. The fall in organophosphate applications is particularly encouraging considering the fact that they are also among the cheapest insecticides. Using a narrowly price-driven model of change, one would assume that cheaper pesticides would be more commonly used following the elimination of the pesticide subsidy in 1986 (and the resulting price rises). The drop in organophosphates' share of the market shows that farmers are reducing pesticide applications for reasons other than price.

Carbamates, meanwhile, accounted for 64 percent of total applications before training and 78 percent after training. Carbamates are less dangerous to humans in health terms but also more expensive than organophosphates. Thus, carbamates' increased share of the market after training is further proof that pesticide decisions were not solely price-based. As the table shows, use of banned carbamates fell sharply in absolute terms following training.

Another result worth noting is the 90 percent drop in organochlorine applications — i.e. endosulfan — which are particularly dangerous in aquatic ecosystems connected to paddy cultivation.

Figure 2 shows the overall change in insecticide use according to number of applications before and after training.

A.4. Herbicides

IPM training at present is only tangentially concerned with the use of herbicides, since at present herbicide use is extremely limited and found in significant levels in only a few regions. However, herbicides have been shown to have a serious environmental impact, and their use should be monitored in coming years. In our sample, the highest number of herbicide applications was found in North Sumatra, with South Sulawesi placing a very distant second (Table 15). This result is consistent with the idea that herbicide use will be higher where labor costs are also high, since the main benefit derived from their application is a reduction in the number of person-days required for weeding (See Table 16 for comparison of weeding wages). Labor costs per hour were appreciably higher in the non-Java provinces, which would provide sufficient incentive for farmers to seek to reduce weeding costs through the use of herbicides. Reduction in herbicide use in these provinces was also small, which most likely reflects the continued economic pressure of labor costs on farmers in the sample.

TABLE 15: NUMBER OF APPLICATIONS — HERBICIDES AVERAGE PER FIELD

	BEFORE	AFTER	StDev Before	StDev After
North Sumatra	0.77	0.61	0.82	0.68
West Java	0.01	0.01	0.12	0.10
Central Java	0.01	0.02	0.10	0.16
East Java	0.04	0.07	0.32	0.36
South Sulawesi	0.13	0.12	0.36	0.32
All provinces	0.11	0.10	0.39	0.35

FIGURE 2

Number of Insecticide Applications Before and After Training
(n=2013 farmers)

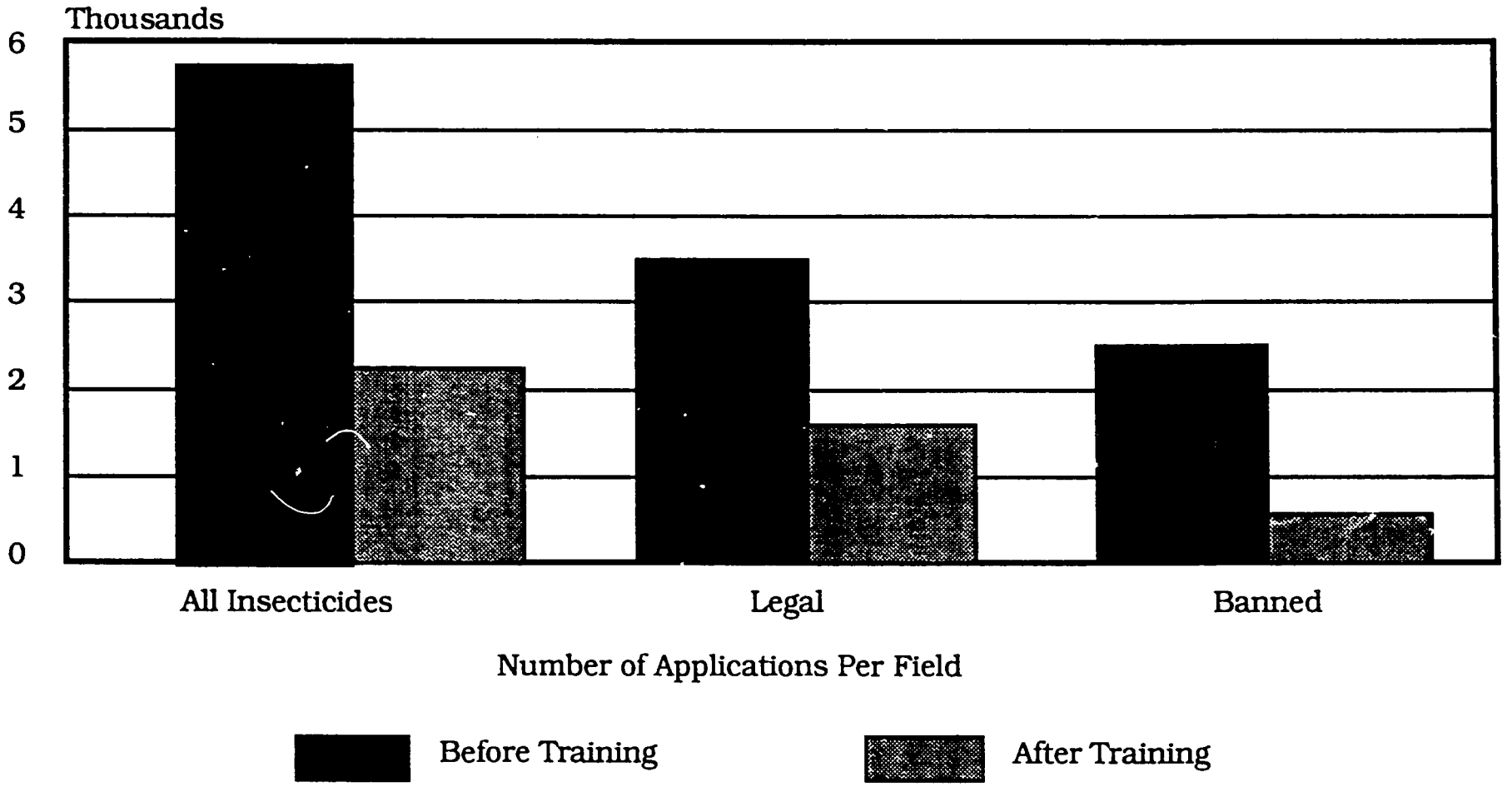


TABLE 16: COMPARISON OF WAGES FOR WEEDING IN FIVE STUDY PROVINCES, RP*

North Sumatra	1,682
West Java	1,063
Central Java	833
East Java	1,041
South Sulawesi	1,443

* For half day (5-6 hours).

Source: Central Bureau of Statistics, Farm Wages 1980-1990.

A.5. Rodenticides

Rat poisons may present fewer ecological dangers than insecticides. In fact, some specialists argue that the use of rodenticides are a positive indication that farmers are mindful of the threat of rat infestation. We noted earlier that rodenticide use was most prominent in Central Java. This finding holds for the post-training as well as the pre-training season. The high standard deviations shown in Table 17 indicate that rodenticide use was concentrated in certain areas within provinces and even within Kabupaten where they were regularly applied.

TABLE 17: NUMBER OF APPLICATIONS — RODENTICIDES AVERAGE PER FIELD

	BEFORE	AFTER	StDev Before	StDev After
North Sumatra	0.39	0.16	0.79	0.45
West Java	0.18	0.11	0.62	0.43
Central Java	0.53	0.43	1.06	1.02
East Java	0.15	0.05	0.47	0.23
South Sulawesi	0.06	0.02	0.25	0.23
All provinces	0.27	0.17	0.74	0.63

A.6. Fungicides

Fungicide use increased slightly from a small base in post-training sample, as shown in Table 18. The low levels of fungicide use in Indonesia are a positive result, since these chemicals are ineffective against rice pathogens except as a preventative measure. Some fungicides may also kill natural enemies and therefore contribute to pest outbreaks.

TABLE 18: NUMBER OF FUNGICIDE APPLICATIONS

	Before	After
North Sumatra	5	3
West Java	17	25
Central Java	0	2
East Java	27	24
South Sulawesi	0	0
All provinces	49	54

A.7. Pesticide Applications by Landholding Group

This section of the study has reviewed evidence of decreased pesticide use across the entire range of biocide types. We now move on to consider the question of which farmers performed better than others in terms of reducing pesticide applications after training. In other words, we would like to know about possible biases in IPM training in favor of farmers possessing certain socio-economic characteristics.

Data from the sample allow us to compare the relative performance of farmers grouped by the total amount of land operated in a given season (total area of all fields cultivated). Table 19 presents average number of applications of all pesticides before and after training by landholding group. The table reveals that for the whole sample, and in each province, the best performance in terms of percent reduction in pesticide use was achieved by the smallest farmers; that is, farmers controlling less than half a hectare of rice fields.[4] This is indeed an encouraging finding, since it indicates that IPM training is not biased towards larger farmers and that small farmers — those who can gain the most economically from marginal savings in pesticide expenditures — show a large and positive response to IPM training.

[4]Except in East Java, although this is explained by the small sample sizes among the large landholding groups in this province.

TABLE 19: AVERAGE APPLICATIONS PER FIELD BY LANDHOLDING GROUP

Landholding Group (Ha)	Avg. Before	Avg. After	% Change	N Farmers Before	N Farmers After
All Provinces					
0.01 to 0.25	2.13	0.87	59.4	424	440
0.26 to 0.50	2.56	0.98	61.8	644	627
0.51 to 1.00	2.79	1.22	56.5	597	587
1.01 to 2.00	2.94	1.53	48.1	228	206
2.01 to 3.00	3.20	1.70	47.0	43	55
over 3.01	3.32	1.96	40.8	31	23
North Sumatra					
0.01 to 0.25	5.07	1.73	65.9	31	30
0.26 to 0.50	5.23	1.60	69.4	88	88
0.51 to 1.00	5.80	1.86	67.9	63	61
1.01 to 2.00	5.61	2.99	46.7	12	13
2.01 to 3.00	12.00			1	0
over 3.01				0	0
West Java					
0.01 to 0.25	1.91	0.46	75.9	142	148
0.26 to 0.50	2.01	0.76	62.2	153	146
0.51 to 1.00	2.48	1.16	53.2	160	157
1.01 to 2.00	3.00	1.64	45.3	89	86
2.01 to 3.00	3.15	2.14	32.1	20	23
over 3.01	3.23	2.20	31.9	16	15
Central Java					
0.01 to 0.25	1.82	1.10	39.6	128	129
0.26 to 0.50	2.33	1.30	44.2	171	164
0.51 to 1.00	2.52	1.68	33.3	156	153
1.01 to 2.00	2.75	1.91	30.5	23	23
2.01 to 3.00	2.58	2.20	14.7	4	5
over 3.01				0	0
East Java					
0.01 to 0.25	1.96	1.06	45.9	97	105
0.26 to 0.50	2.07	0.97	53.1	148	140
0.51 to 1.00	2.45	1.28	47.8	101	97
1.01 to 2.00	2.69	1.43	46.8	41	34
2.01 to 3.00	4.08	1.47	64.0	4	5
over 3.01	2.33	0.50	78.5	3	1
South Sulawesi					
0.01 to 0.25	2.00	0.27	86.6	26	28
0.26 to 0.50	2.07	0.15	92.8	84	89
0.51 to 1.00	2.27	0.30	86.8	117	119
1.01 to 2.00	2.59	0.85	67.2	63	50
2.01 to 3.00	2.57	1.17	54.5	14	22
over 3.01	3.68	1.67	54.6	12	7

The second interesting characteristic of Table 19 is the nearly uniform tendency across all provinces for the average number of applications to increase with the size of landholding both before and after training. At present we can only speculate about the causes of this regular relationship between number of applications and landholding group. One simple possibility is that larger farmers have the cash needed to buy pesticides more frequently. It is also possible that smaller farmers use more mechanical means of controlling certain problems like rats and weeds, while larger farmers prefer biocides because of the high labor costs implied by mechanical means of control. In any event, it would be interesting to see if this result is confirmed by other samples of both IPM and non-IPM farmers.

A.8 Pesticide Applications by Land Tenure Status

Analysis of the survey data did not detect a bias in results from training based on land tenure status. Table 20 shows mean number of applications before and after training grouped by land tenure status. As discussed in the introduction, owner-operators dominated the sample, as they do in the population of Indonesian lowland rice farmers.

Mean applications for sharecroppers are not significantly different from owner-operators. Sharecroppers, who in many cases are less affluent farmers than the other groups, seemed to apply pesticides as frequently as other land tenure groups. Moreover, sharecroppers benefited from training to about the same extent as owner-operators.

TABLE 20: AVERAGE APPLICATIONS BY LAND TENURE STATUS
ALL PROVINCES, BEFORE AND AFTER TRAINING

	Before		After		Percent
	Mean	N	Mean	N	Change
Owner-Operator	2.56	1948	1.08	1874	57.8
Renter	3.00*	252	1.49*	242	50.3
Sharecropper	2.49	284	1.08	272	56.6
Pawned Land	2.78	27	1.52	27	45.3
Village Salary Land	2.43	86	1.28	81	47.3

* Significantly different from owner-operator means at the 0.05 level.

F=3.083 F=4.33

Sig=.0153 Sig=.0017

The only group whose mean applications were significantly different from owner-operators was renters. This difference was found both in the pre-training and the post-training season. However, when the provinces are taken separately, this result is no longer statistically significant.

B. The Decision Making Process

In the last section we reviewed the evidence showing significant reductions in the use of pesticide applications following IPM training. From these results it is apparent that IPM training has had a direct and sizeable impact on farmers' decisions about pest control. In this section we will consider this decision making process in more detail, examining some of the reasons farmers gave during the course of the survey for both using and not using pesticides.

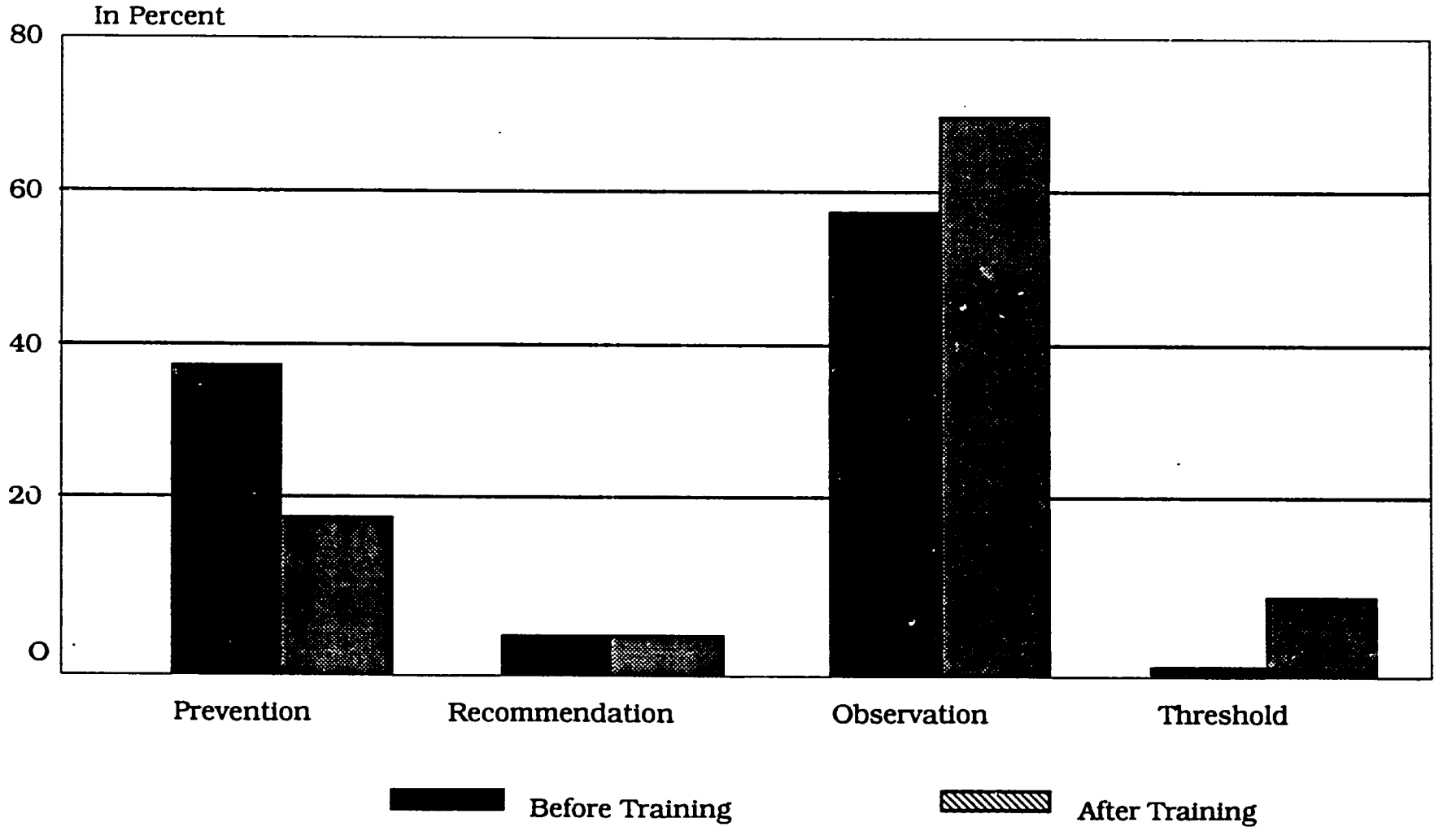
The survey questionnaire for this report did not include structured responses to questions about farmers' reasons for choosing a particular pest control strategy. Instead, interviewers were instructed to conduct informal interviews using IPM techniques such as agro-ecosystem analysis, and to write down comments by farmers relating to the bases of their pest control decisions. In this way the survey sought to elicit spontaneous descriptions from farmers about factors which influenced their decisions.

As was shown in the previous section, the number of farmers applying no pesticides increased markedly in the season following IPM training. According to farmers' own accounts, before IPM training only 61 farmers decided not to apply pesticides based on regular field observations. In the season after training 475 farmers said that weekly observations played a role in their decision not apply pesticides because in their view the balance between pests and natural enemies was satisfactory. The number of farmers not applying pesticides also increased due to a fall in the importance of scheduled or calendar applications without field observations. While in the pre-training season, for example, 944 farmers carried out basal carbofuran applications, this number fell to 348 in the post training season.

Among farmers that did decide to use pesticides, there appears to have been a substantial shift away from preventative spraying towards spraying based on the presence of specific pests. For ease of comparison between seasons, we have organized farmers' responses into four categories, as shown in Figure 3. It should be noted that these four categories do not encompass all farmers' responses, and that not all farmers gave reasons

FIGURE 3

Why Farmers Apply Pesticides Before and After Training



for applying pesticides. However, among the explanations that could be categorized, there was a significant shift away from prophylactic spraying and towards applications based on observation and some kind of economic threshold. Recommendations by agricultural extension workers was an equally infrequent reason for using pesticides after training as well as before.

C. Application Targets

It was noted above that following training a larger share of those applying pesticides did so on the basis of presence or observation of pests than before training. Another related change is the trend towards specificity of targets following IPM training. Figure 4 presents data on pest targets before and after IPM training. During the pre-training season a large share of farmers who applied pesticides were not able to name the pest in question. In the post-training season, however, we see a significant shift away from non-specific targets. This change is an indication that farmers had developed better observation skills during IPM training, spraying less and spraying with specific goals in mind.

A corollary change is the reduction of sprays targeted against defoliators. Since modern rice varieties are able to compensate for defoliator damage early and late in season, in most cases there are actually few benefits to be gained from applying pesticides against these insects. Therefore, fewer applications targeted at defoliators should be viewed as a positive development.

Stemborers and rice bug were important targets both before and after training. Rice bug remains a major cause of concern among farmers in Indonesia's lowland rice-growing regions. Unfortunately, little is known about the damage caused by rice bug, and this situation will not change in the near future unless the pest receives a higher priority within the national and international research establishment.

Rats were a primary target in both seasons, an expected result given the fact that rats cause more damage to rice in Indonesia than any other pest. IPM training focuses on community planning as the most effective means of minimizing rat damage. However, as noted earlier, continued rodenticide use can be viewed as a positive indication that farmers are thinking seriously about the rat problem. The use of rat poisons, while not without health risks, is less hazardous environmentally and economically than the use of insecticides.

FIGURE 4

Application Targets
Number of Applications

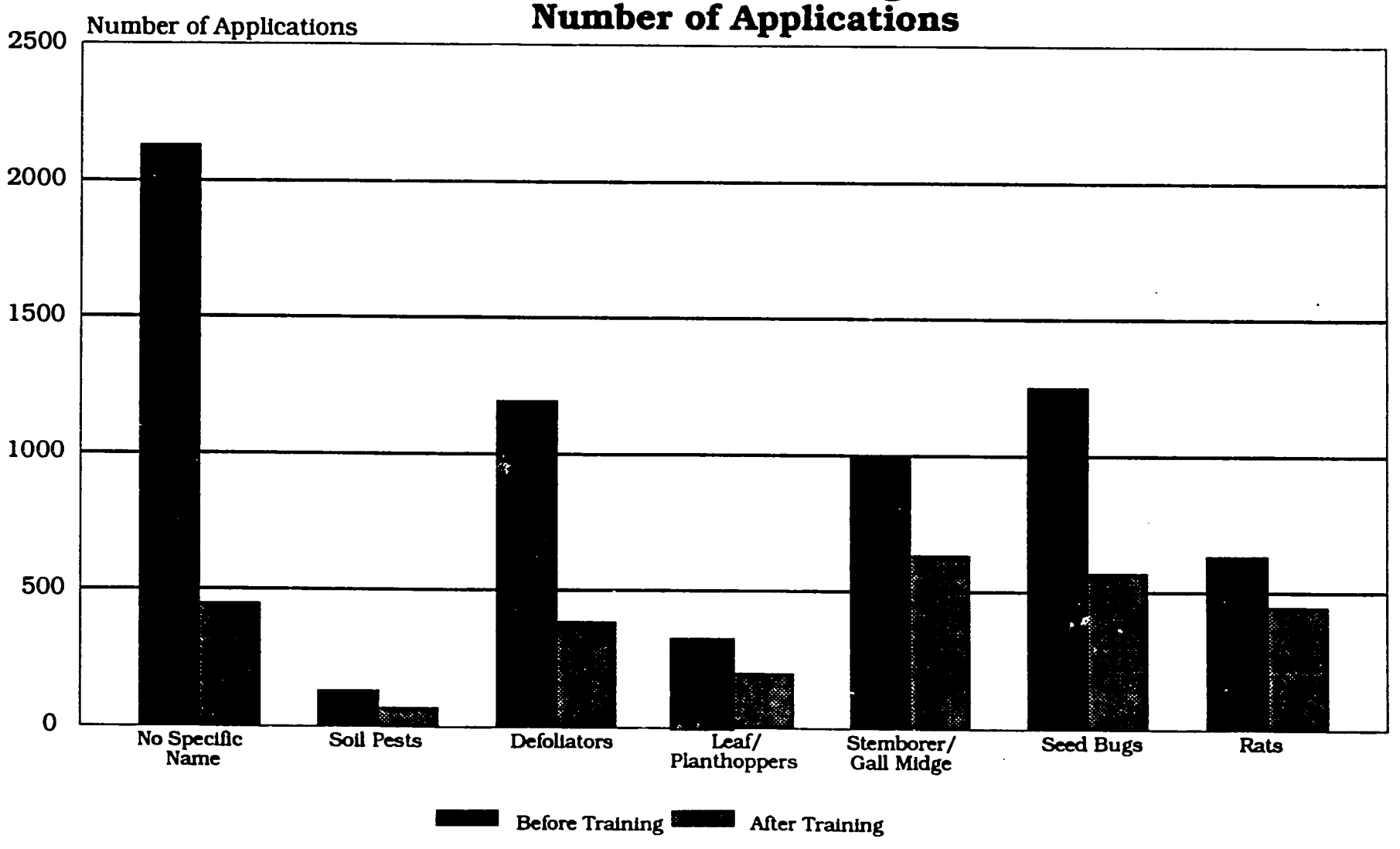


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Figure 4 also shows a reduction in applications against diseases, primarily bacterial diseases. This is a useful development, since in nearly all cases applications against bacterial disease are ineffective.

D. Expenditures on Pesticides

D.1. Cost Reductions Associated With IPM Training

We have seen in the previous sections that the number of pesticide applications both per field and per farmer fell substantially following IPM training. A particularly dramatic drop in applications of insecticides banned on paddy in Indonesia was recorded. We also found that the decrease in pesticide use was linked to a fall in prophylactic spraying and greater specificity of pest targets. One of the most important benefits farmers derive from more selective pesticide use is the reduction of agricultural production costs. Lower costs mean higher profits, which directly translate into higher living standards for IPM rice farmers.

It must be emphasized from the outset that this impact study was not intended as a comprehensive economic analysis of the effects of IPM training. A complete analysis of the economic impact of IPM will have to wait until a more complete survey can be conducted, including changes in fertilizer use and other changes in cultivation practices associated with training. It should also be recognized that the collection of expenditure data in rural Southeast Asia is never a simple matter. Obviously, few farmers maintain records of production costs, without which the accuracy of price data will certainly suffer. There are also predictable biases towards underreporting, since farmers will tend to conceal evidence of wealth in their encounters with local officials. Recording and computing the cost of labor may also be problematic. It is rarely as simple as dividing the daily wage by the number of hours worked (as is frequently the case in rural surveys in Indonesia). First, in much of Indonesia a large share of the daily wage is paid in the form of food, the rupiah value of which can be difficult to calculate. Second, in some areas (for example, South Sulawesi) field hands are frequently hired on an annual basis and paid in kind, which makes figuring an hourly or daily wage nearly impossible.

Nevertheless, we felt it was important at least to make an initial foray into this extremely interesting and important aspect of IPM. Questions concerning the cost of pesticides, the cost of renting sprayers, and labor costs associated with pesticide application were included in the study. By summing these costs, we obtained a figure for total pesticide application costs. Bearing in mind the caveats listed above, the results are consistent with

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what one would expect in light of the evidence of decreased pesticide applications presented in earlier sections of this report: costs of pest control decreased substantially after IPM training.

Tables 21 and 22 present summary figures for the costs of pesticide applications per farmer and per field, respectively. These results are also depicted graphically in Figure 5. These figures are shown in constant January 1990 rupiah deflated by the Central Bureau of Statistics price index for non-labor factors of production in food-crop farming.[5]

Total costs per farmer in current rupiah as listed in the tables decreased by an average of over fifty percent after IPM training. This average for the entire sample conceals a good deal of variation both among and within provinces. South Sulawesi, for example, achieved a reduction in pesticide-related costs of more than four-fifths after training, while post-IPM pesticide costs in North Sumatra fell by two-thirds. In Central Java, on the other hand, where pesticide use was already relatively low prior to IPM training, costs fell by forty percent.

TABLE 21: COST PER FARMER (1990 RUPIAH)

	Before			After			
	Mean	StDev	Median	Mean	StDev	Median	Change
N. Sumatra	27212	37866	18500	8525	11259	5700	68.7%
West Java	31373	58586	10500	19394	65484	2460	38.2%
Central Java	12417	18189	7000	7501	13473	2950	39.6%
East Java	12765	21178	6950	5647	11182	2225	55.8%
S. Sulawesi	22523	29337	12000	3660	9573	0	83.8%
All prov.	21180	38582	9500	10138	37524	2300	52.1%

[5]Central Bureau of Statistics, Buletin Ringkas, April 1991. This index is derived from the CBS's monthly survey of farmer's terms of trade, and includes fertilizers. It would, of course, have been preferable to use a price index specific to pesticides. However, the CBS does not publish these figures separately. According to the CBS, non-labor factors of production increased at an annual rate of 5.50 percent from January 1990 to January 1991. This rate is considerably lower than the overall consumer price index of 9.8 percent for the same period.

FIGURE 5

Expenditure Per Farmer
Before and After IPM Field School

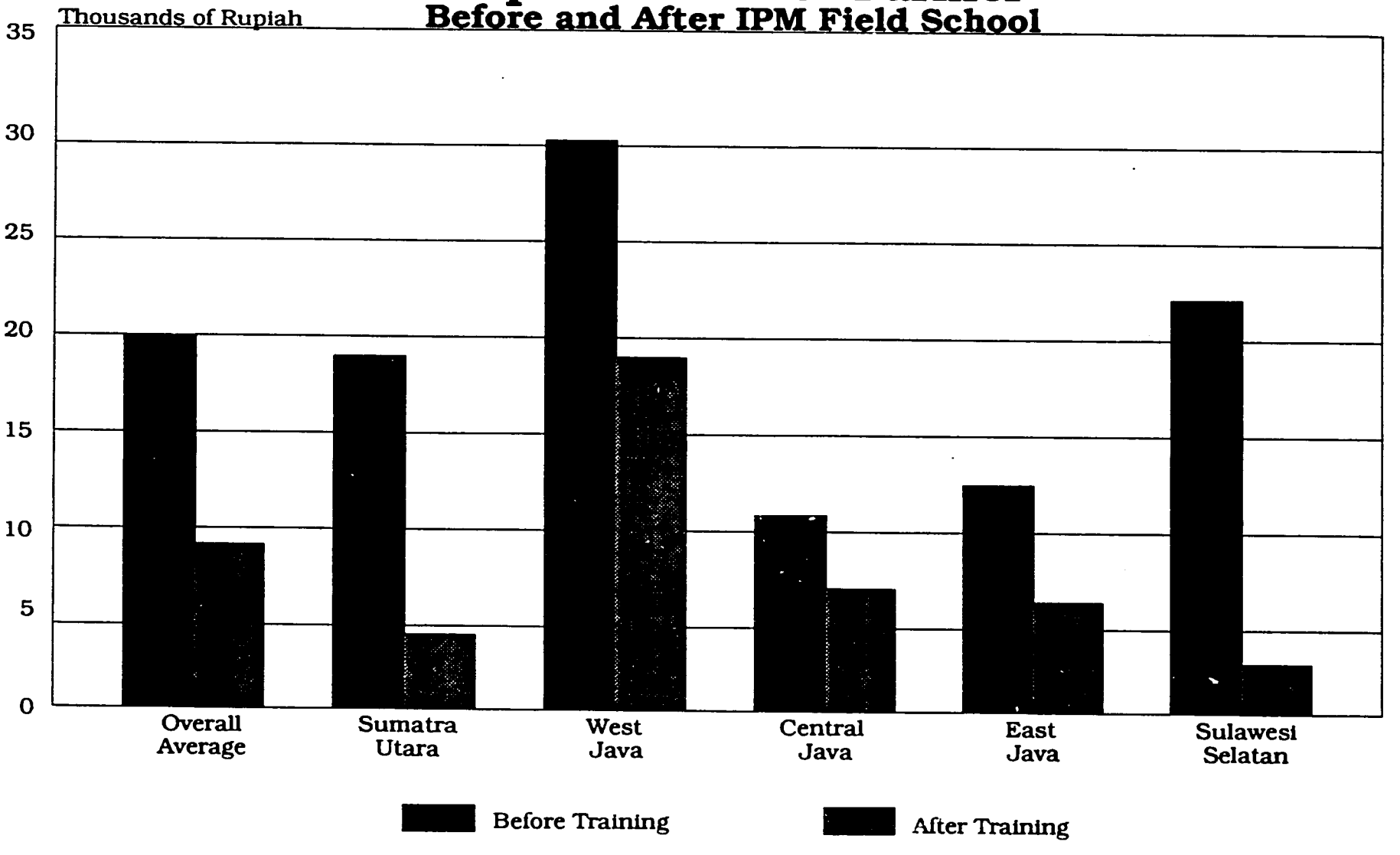

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TABLE 22: COST PER FIELD, ALL PESTICIDES (1990 RUPIAH)

	Before	StDev	Median	After	StDev	Median	Change
N. Sumatra	22018	26743	13550	7002	9317	5100	68.2%
West Java	23662	36557	8800	14746	15533	1860	37.7%
Central Java	8960	12043	5250	5393	9803	1800	39.8%
East Java	9768	15528	6000	4537	9029	2000	53.6%
S. Selatan	17487	22072	10000	3002	7691	0	82.8%
All prov.	16023	25738	7750	7821	24349	1750	51.2%

Variation within provinces is also substantial, as revealed by the consistently large standard deviations, both before and after training. West Java is a particularly interesting case, as this province is responsible for both the highest average costs and the highest level of dispersion as measured by the standard deviation. The cause of this great variation within the province is revealed when the provincial figures are separated into "Pantura" and "Non-Pantura" West Java, as shown in Table 23. Pantura, the Indonesian acronym for the northern coast of West Java, comprises Kabupaten Cirebon, Indramayu, Subang, Krawang and Bekasi. The region is well known for its large farm sizes, high production costs, high levels of farm inputs, and, not coincidentally, yearly large-scale pest infestations.

TABLE 23: COST PER FARMER IN PANTURA AND NON-PANTURA WEST JAVA (1990 RUPIAH) (CURRENT RUPIAH)

	Mean	StDev	Median
Pantura			
Before Training	71196	85258	48250
After Training	50299	103276	23430
Non-Pantura			
Before Training	10174	12108	5750
After Training	3122	6816	0

It is apparent from Table 23 that expenditures on pesticides in Pantura are not only well above the West Java average, but significantly above most other regions in the sample. It is also noticeable that after IPM training the median expenditure in Pantura is less than half the mean, and that the standard deviation actually increases as the mean expenditure falls. This reflects the effects of a number of high-spending outliers on the high end of the

falls. This reflects the effects of a number of high-spending outliers on the high end of the distribution, which force up the average expenditure for the region despite an increase in the number of low-spending farmers. In non-Pantura West Java, by contrast, average expenditures start from a low base and fall by about two-thirds after IPM training. These are results which compare favorably to other low-spending provinces such as Central and East Java.

Another interesting feature of Tables 21 and 22 is the high degree of skewedness of the total cost distributions. In every province, and for the sample as a whole, the medians decrease much more dramatically than the means, suggesting that the post-training cost distributions are more sharply skewed towards the lower end while the means decrease less because of the effect of outliers on the high end. This is particularly evident in the case of South Sulawesi, where the median falls to nil after training, but is also true for Central and East Java, where the decline in the median is substantially greater than the fall in the means.

D.2. Estimates of Payback Period for IPM Training

In the previous section we reviewed the amount of money farmers saved in the form of reduced pesticide costs after IPM training. If we compare these savings with the actual costs of training per farmer, we can obtain an estimate of the number of seasons required to translate funds spent on IPM training into an equal amount recouped by farmers.

Training costs per farmer are about Rp. 31,250, or about US$16.25 for the full ten week, 50 to 60 hour field school (these costs are itemized in Appendix C of this report). Using the savings figures derived above, the payback period for the five provinces taken together is equal to less than three planting seasons, or one and a half years. This national average of course conceals a good deal of regional variation. In North Sumatra and South Sulawesi, where pesticide applications were high prior to training, the payback period is less than two growing seasons, or less than one year. On the other extreme, the payback period in Central Java would be approximately five seasons, or two and a half years.

These calculations assume that farmers' patterns of pesticide use would have remained the same in the absence of training. However, with farmers' incomes on the rise and pesticide manufacturers launching ever more aggressive marketing efforts, it is possible that pesticide use would actually increase in the absence of IPM.

The fact that farmers' decisions about pesticides are closely associated with movements of relative prices should also not be overlooked. The cost of pesticides to farmers increased rapidly after 1987 as the Indonesian government began phasing out pesticide subsidies. This process was completed in 1988 when the last of the subsidies was rescinded. From 1988 to 1989 there was a large price-induced reduction in demand for pesticides in Indonesia, a process which had run its course by the time the field schools were launched in 1990. Thus, the cost reductions described in earlier sections are in fact a product of the 'second wave' of savings. However, now that pesticide manufacturers have been charging market prices to farmers for nearly three years it is unlikely that further reductions in pesticide use can be expected as a result of price changes alone.

The payback periods described above are also based on the first season of farmer field schools led directly by pest observers. However, IPM is also being disseminated using two other models: the Pest Observer to Extension Worker to Farmer model, known in Indonesian as "Pemasyarakatan", and the locally based "Farmer to Farmer" model, organized and run by local farmers eager to spread the benefits of IPM to neighbors and friends. Both models build on the gains made in preparing for and carrying out the original extension season, and therefore costs for both are significantly lower. We could therefore expect payback periods for these models to be shorter as well.

Farmers' savings on pest control also have implications for the national economy. By obtaining the same or similar rice yields with lower costs of production, farmers effectively redistribute income away from pesticide manufactures, thus saving valuable foreign exchange. Other national or regional benefits relate to the decrease in harmful chemicals released into the environment. Economists are still developing the tools needed to evaluate the "shadow" or implicit costs associated with environmental degradation, and we will not attempt to assign numbers to these costs in this report. However, it is important not to lose sight of the benefits of clean water, healthier farmers and farm laborers, and other improvements in living standards which can be attributed to reductions in pesticide use.

D.3. Cost Reductions and Farm Size

Evidence from the survey also fails to uncover a bias in IPM training towards either larger or smaller farmers. Table 24 presents correlation coefficients for pesticide-related costs per hectare as compared to area operated. There appears to be a small positive relationship between expenditures per hectare on pesticides and landholding, which

The one highly significant result is found in West Java, where pesticide expenditures are significantly related to area operated. This, no doubt can be traced to effect of combining the southern area of West Java with the Pantura Kabupaten, where both landholdings and pesticide use are large by national standards. The only surprising result from this exercise came in Central Java, where a slight inverse relationship between landholding and pesticide costs before training changed to a significant positive relationship between the two variables post-training. The results generally confirm our impression that IPM training is not scale biased: that is, farmers' ability to understand and implement IPM cannot be traced to simple economic variables such as land holding or other indicators of socio-economic status. If there is a relatioship between savings and scale, it appears that small landholders actually achieved better results.

TABLE 24: CORRELATION COEFFICIENTS FOR AREA OPERATED AGAINST EXPENDITURE PER HECTARE

	Before	After
Sumatra Utara	.1331	-.0128
West Java	.1162**	.3582**
Central Java	-.0146	.1537**
East Java	-.0757	-.1012
Sulawesi Selatan	-.1638**	.1111
All provinces	.0177	.1475**

** Significant at the 0.1 percent level

D.4. Cost Reductions and Land Tenure Status

No regular relationship emerges between the expenditures per field and land tenure status. While there appears to be some difference in expenditure patterns between sharecroppers and owner-operators, these differences were not statistically significant at the 0.05 level. When the provinces are taken individually, the only significant difference among groups by land tenure status appears in West Java, where sharecroppers spent significantly less per field than owner-operators.

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TABLE 25: AVERAGE COST/HA. BY LAND TENURE STATUS
ALL PEST CONTROL COSTS

	Before	After	% Change
All provinces			
Owner-op	16186	7624	52.9%
Renters	15916	10060	36.8%
Sharecrop	13009	4364	66.5%
	F=2.44	F=9.32	
	Sig=.045	Sig=.0001	
Sumatra Utara			
Owner-op	23279	7031	69.8%
Renters	19857	7325	63.1%
Sharecrop	13286	5717	57.0%
	F=0.69	F=0.08	
	Sig=.561	Sig=.92	
West Java			
Owner-op	24561	13922	43.3%
Renters	35996	29990	16.7%
Sharecrop	8790*	4506	48.7%
	F=9.96	F=9.11	
	Sig=.0001	Sig=0001	
Central Java			
Owner-op	8387	5443	35.1%
Renters	8793	6268	28.7%
Sharecrop	12590	4611	63.4%
	F=1.93	F=0.810	
	Sig=.104	Sig=.519	
East Java			
Owner-op	9622	4771	50.4%
Renters	7583	2486	67.2%
Sharecrop	9955	5109	48.7%
	F=3.51	F=1.16	
	Sig=.015	Sig=.324	
Sulawesi Selatan			
Owner-op	16827	2764	83.6%
Renters	13857	992	92.8%
Sharecrop	21172	3500	83.5%
	F=0.83	F=0.33	
	Sig=.476	Sig=0.804	

This lack of a predictable relationship between tenure status and pesticide expenditure is consistent with the survey finding that only 6 percent of sharecroppers reported that decisions about pesticide use were controlled by the landlord rather than the sharecroppers themselves. Although it would be imprudent to rely too heavily on such reports (there are many reasons why a sharecropper would not wish to answer questions about control honestly) the sharp reduction in pesticide expenditures by IPM-trained sharecroppers in all provinces suggests that these farmers for the most part have a good deal of influence over

all provinces suggests that these farmers for the most part have a good deal of influence over pesticide-related decisions. At the very least there seems to be no reason to favor owner-operators over sharecroppers in the selection of field school participants.

III. CONCLUSIONS

This study, the first large-sample study of IPM farmers in Asia, set out to answer two questions. First, did farmers change their pest control behavior after IPM training? And second, can these effects be attributed to the training itself, or were other factors more important?

Having reviewed the evidence of reduced pesticide applications, drastically lower use of banned insecticides, and decreased expenditure on pest control, we can answer the first question with an unambiguous "yes." Farmers reduced the number of applications per season by more than one half on average, and much more in the non-Java provinces. Use of pesticides banned on paddy under Presidential Instruction No. 3, 1986 fell by a dramatic 80 to 90 percent; this despite the fact that the relative prices of the most dangerous of these chemicals dropped sharply after 1986 (in other words, the price of organophosphates rose more slowly than the price of less hazardous pesticides). Finally, farmers in all regions achieved significant savings, savings that equalled the original cost of training within three seasons.

The study also uncovered evidence that these reductions are directly linked to training. We saw that pest targets were rationalized and that the decision-making structure of farmers was radically different after training. These results indicate that the drop in applications was an outcome of IPM training, and not random or solely price-related phenomena.

Finally, we found that small farmers did better on average than larger landholders, and that tenure status was not related to either IPM performance or number of pesticide applications. This result is at odds with those who claim that training programs always favor wealthier farmers, and that small farmers are too risk adverse to try new technologies.

This study is obviously not the last word on the impact of IPM training. Intensive case studies are needed to examine better mechanisms at the village level that influence IPM farmers. Village-level economic studies of IPM farmers are also needed. We hope that this study is just the first step towards a better understanding of IPM in Indonesia and other Asian countries.

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Central Bureau of Statistics, "Statistical Buletin (Buletin Ringkas)", Jakarta, April 1991.

Flint, Mary Louise and Van den Bosch, Robert, Introduction to Integrate Pest Management, New York, Plenum Press, 1981.

APPLICATION DATA MT 1989 - 1990 BEFORE FIELD SCHOOL

FIELD I: AREA (HA) _____ RICE VARIETY: _____

1. LAND TENURE STATUS: (check one)

- [ ] *Owner Operator*
- [ ] *Renter*
- [ ] *Sharecropper*
- [ ] *Pawned Land (cultivates land as collateral from owner)*
- [ ] *Village Salary Land*

2. If you are a sharecropper, did you receive credit from your landlord? (yes/no)
3. If you are a sharecropper, did you or your landlord make most decisions concerning pesticide use?

ORDER	PESTICIDE	PHASE OF GROWTH AT TIME OF APPLICATION	AMOUNT APPLIED KG. OR LT.	COST OF PESTICIDE FOR THIS APPLICATION	COST OF RENTING SPRAYER	TOTAL HOURS WORKED		TOTAL COST OF LABOR (RP)	REASON FOR USING PESTICIDE
						BY FARMER	BY HIRED LABOR		
1	2	3	4	5	6	7	8	9	10
1									
2									
3									
4									
5									
6									
7									
8									

Notes and Explanations:

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APPLICATION DATA MT 1989 - 1990 BEFORE FIELD SCHOOL

FIELD II: AREA (HA) _____ RICE VARIETY: _____

1. LAND TENURE STATUS: (check one)

- [ ] *Owner Operator*
- [ ] *Renter*
- [ ] *Sharecropper*
- [ ] *Pawned Land (cultivates land as collateral from owner)*
- [ ] *Village Salary Land*

2. If you are a sharecropper, did you receive credit from your landlord? (yes/no)
3. If you are a sharecropper, did you or your landlord make most decisions concerning pesticide use?

ORDER	PESTICIDE	PHASE OF GROWTH AT TIME OF APPLICATION	AMOUNT APPLIED KG. OR LT.	COST OF PESTICIDE FOR THIS APPLICATION	COST OF RENTING SPRAYER	TOTAL HOURS WORKED		TOTAL COST OF LABOR (RP)	REASON FOR USING PESTICIDE
						BY FARMER	BY HIRED LABOR		
1	2	3	4	5	6	7	8	9	10
1									
2									
3									
4									
5									
6									
7									
8									

Notes and Explanations:

APPLICATION DATA MT 1989 - 1990 BEFORE FIELD SCHOOL

FIELD III: AREA (HA) _____ RICE VARIETY: _____

1. LAND TENURE STATUS: (check one)

- [ ] *Owner Operator*
- [ ] *Renter*
- [ ] *Sharecropper*
- [ ] *Pawned Land (cultivates land as collateral from owner)*
- [ ] *Village Salary L ınd*

2. If you are a sharecropper, did you receive credit from your landlord? (yes/no)
3. If you are a sharecropper, did you or your landlord make most decisions concerning pesticide use?

ORDER	PESTICIDE	PHASE OF GROWTH AT TIME OF APPLICATION	AMOUNT APPLIED KG. OR LT.	COST OF PESTICIDE FOR THIS APPLICATION	COST OF RENTING SPRAYER	TOTAL HOURS WORKED		TOTAL COST OF LABOR (RP)	REASON FOR USING PESTICIDE
						BY FARMER	BY HIRED LABOR		
1	2	3	4	5	6	7	8	9	10
1									
2									
3									
4									
5									
6									
7									
8									

Notes and Explanations:

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APPLICATION DATA MT 1990-1991 AFTER FIELD SCHOOL

FIELD I: AREA (HA) _____ RICE VARIETY: _____

1. LAND TENURE STATUS: (check one)

- [ ] *Owner Operator*
- [ ] *Renter*
- [ ] *Sharecropper*
- [ ] *Pawned Land (cultivates land as collateral from owner)*
- [ ] *Village Salary Land*

2. If you are a sharecropper, did you receive credit from your landlord? (yes/no)
3. If you are a sharecropper, did you or your landlord make most decisions concerning pesticide use?

ORDER	PESTICIDE	PHASE OF GROWTH AT TIME OF APPLICATION	AMOUNT APPLIED KG. OR LT.	COST OF PESTICIDE FOR THIS APPLICATION	COST OF RENTING SPRAYER	TOTAL HOURS WORKED		TOTAL COST OF LABOR (RP)	REASON FOR USING PESTICIDE
						BY FARMER	BY HIRED LABOR		
1	2	3	4	5	6	7	8	9	10
1									
2									
3									
4									
5									
6									
7									
8									

Notes and Explanations:

APPLICATION DATA MT 1990-1991 AFTER FIELD SCHOOL

FIELD II: AREA (HA) _____ RICE VARIETY: _____

1. LAND TENURE STATUS: (check one)

- [ ] *Owner Operator*
- [ ] *Renter*
- [ ] *Sharecropper*
- [ ] *Pawned Land (cultivates land as collateral from owner)*
- [ ] *Village Salary Land*

2. If you are a sharecropper, did you receive credit from your landlord? (yes/no)
3. If you are a sharecropper, did you or your landlord make most decisions concerning pesticide use?

ORDER	PESTICIDE	PHASE OF GROWTH AT TIME OF APPLICATION	AMOUNT APPLIED KG. OR LT.	COST OF PESTICIDE FOR THIS APPLICATION	COST OF RENTING SPRAYER	TOTAL HOURS WORKED		TOTAL COST OF LABOR (RP)	REASON FOR USING PESTICIDE
						BY FARMER	BY HIRED LABOR		
1	2	3	4	5	6	7	8	9	10
1									
2									
3									
4									
5									
6									
7									
8									

Notes and Explanations:

DRAFT NOT FOR QUOTATION

APPLICATION DATA MT 1990-1991 AFTER FIELD SCHOOL

FIELD III: AREA (HA) _____ RICE VARIETY: _____

1. LAND TENURE STATUS: (check one)

- [ ] *Owner Operator*
- [ ] *Renter*
- [ ] *Sharecropper*
- [ ] *Pawned Land (cultivates land as collateral from owner)*
- [ ] *Village Salary Land*

2. If you are a sharecropper, did you receive credit from your landlord? (yes/no)
3. If you are a sharecropper, did you or your landlord make most decisions concerning pesticide use?

ORDER	PESTICIDE	PHASE OF GROWTH AT TIME OF APPLICATION	AMOUNT APPLIED KG. OR LT.	COST OF PESTICIDE FOR THIS APPLICATION	COST OF RENTING SPRAYER	TOTAL HOURS WORKED		TOTAL COST OF LABOR (RP)	REASON FOR USING PESTICIDE
						BY FARMER	BY HIRED LABOR		
1	2	3	4	5	6	7	8	9	10
1									
2									
3									
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6									
7									
8									

Notes and Explanations:

Appendix B

TOTAL COSTS: FARMER FIELD SCHOOLS
(Rupiah, Thousands)

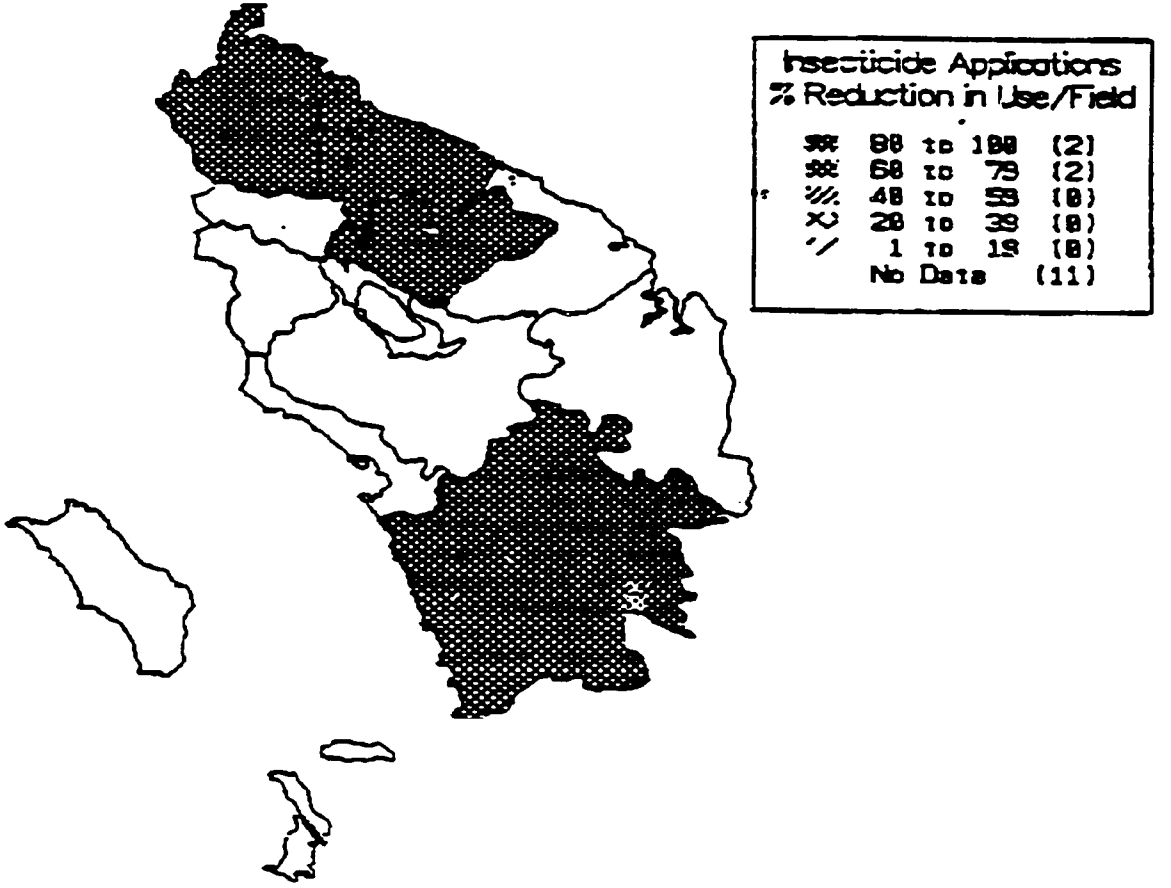
Honoraria	
Honorarium, Field Leader 1	8540
Honorarium, Field Leader 2	27792
Honorarium, Pest Observer	89660
Honorarium, Extension Agent	60240
Materials	
Photocopying	12078
Practice Materials	244505
Documentation	8400
Raincoats	640
Transportation	
Participants and Trainers	3780
Field Leader 1	3000
Orientation for Trainers	19750
Preparation for Schools	5500
Other	
Van Rental	4356
Trainers' Health/Medical	8685
Opening Day Activities	67700
Field Day Activities	87800
Opening Activities, School	10400
Meals, Participants/Trainers	152874
Rent, Practice Fields	60240
Fuel, Pest Observer	5152
Fuel, Field Leader 1	3990
Dormitory, Pest Observer	3540

Dormitory, Field Leader 1	1725
Dormitory, Field Leader 2	7350
Honorarium, Head BPP	21720
Honorarium, Farmer Group Leader	27000
Farmer Compensation	495648
Farmers' Snack	127075
TOTAL	1569140
Total Farmers	50200
COST PER FARMER (Rp., Thousands)	31.26
Exchange Rate (Rp./US$)	1925
COST PER FARMER (US$)	16.24

NB: Excludes Field Training Facility fixed costs

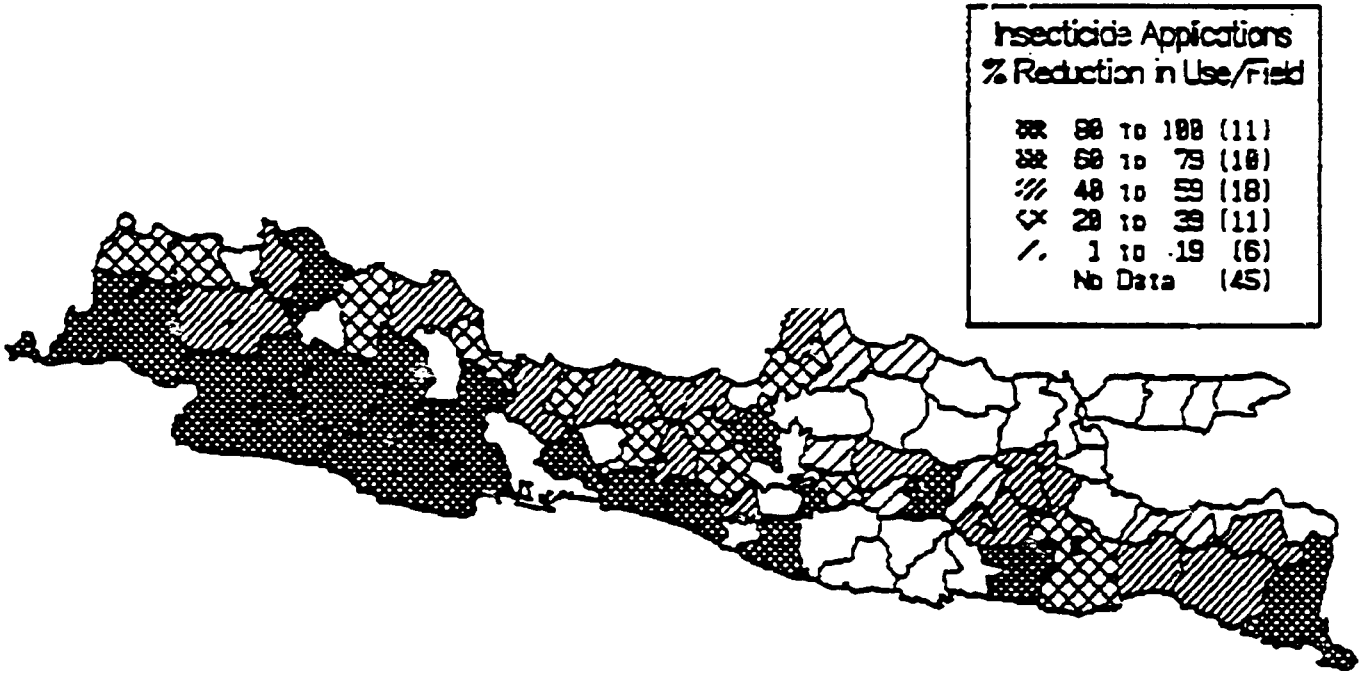
Map 1

Reduction in Insecticide Applications



Map 2

Reduction in Insecticide Applications



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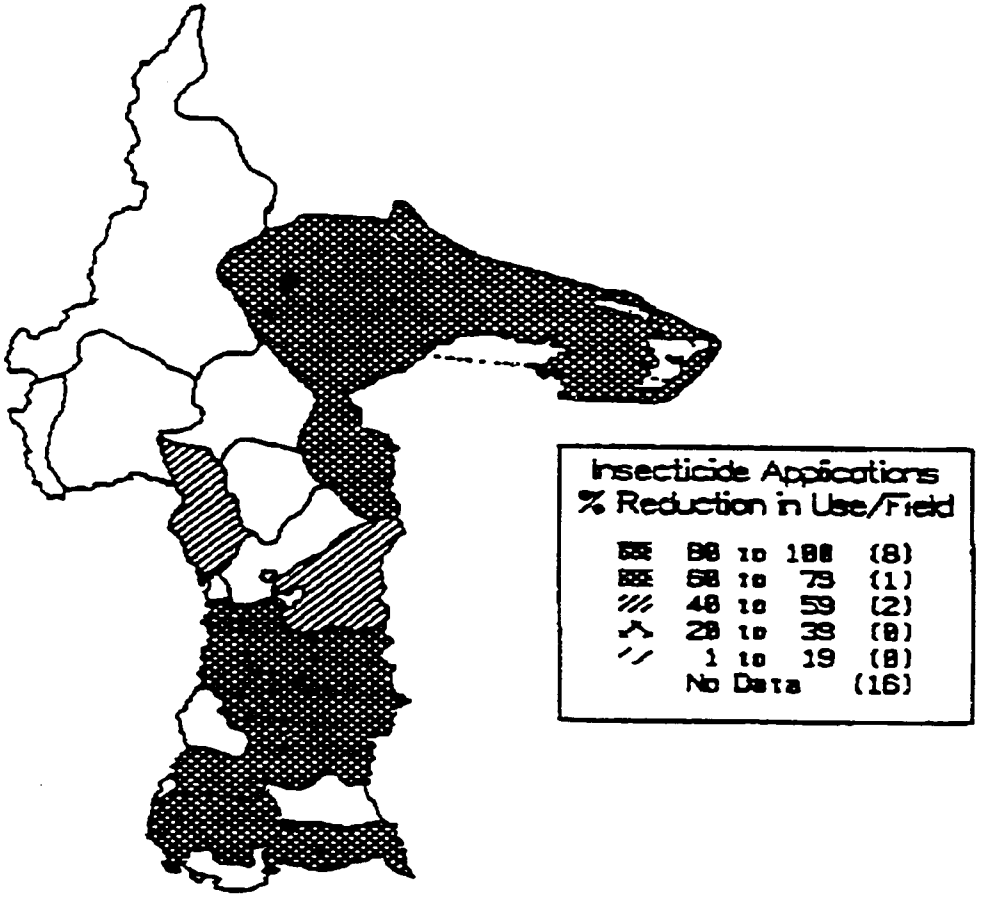
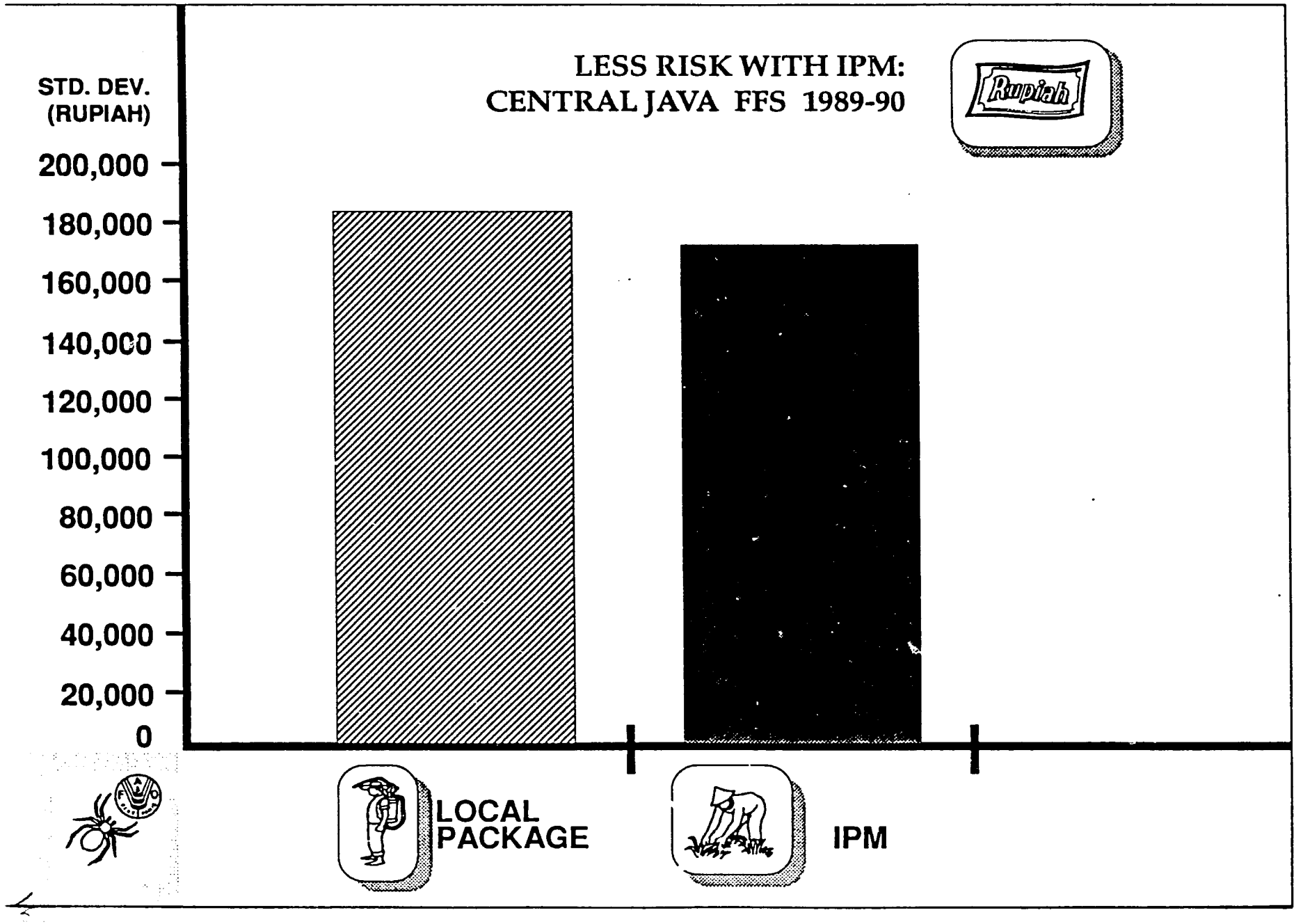
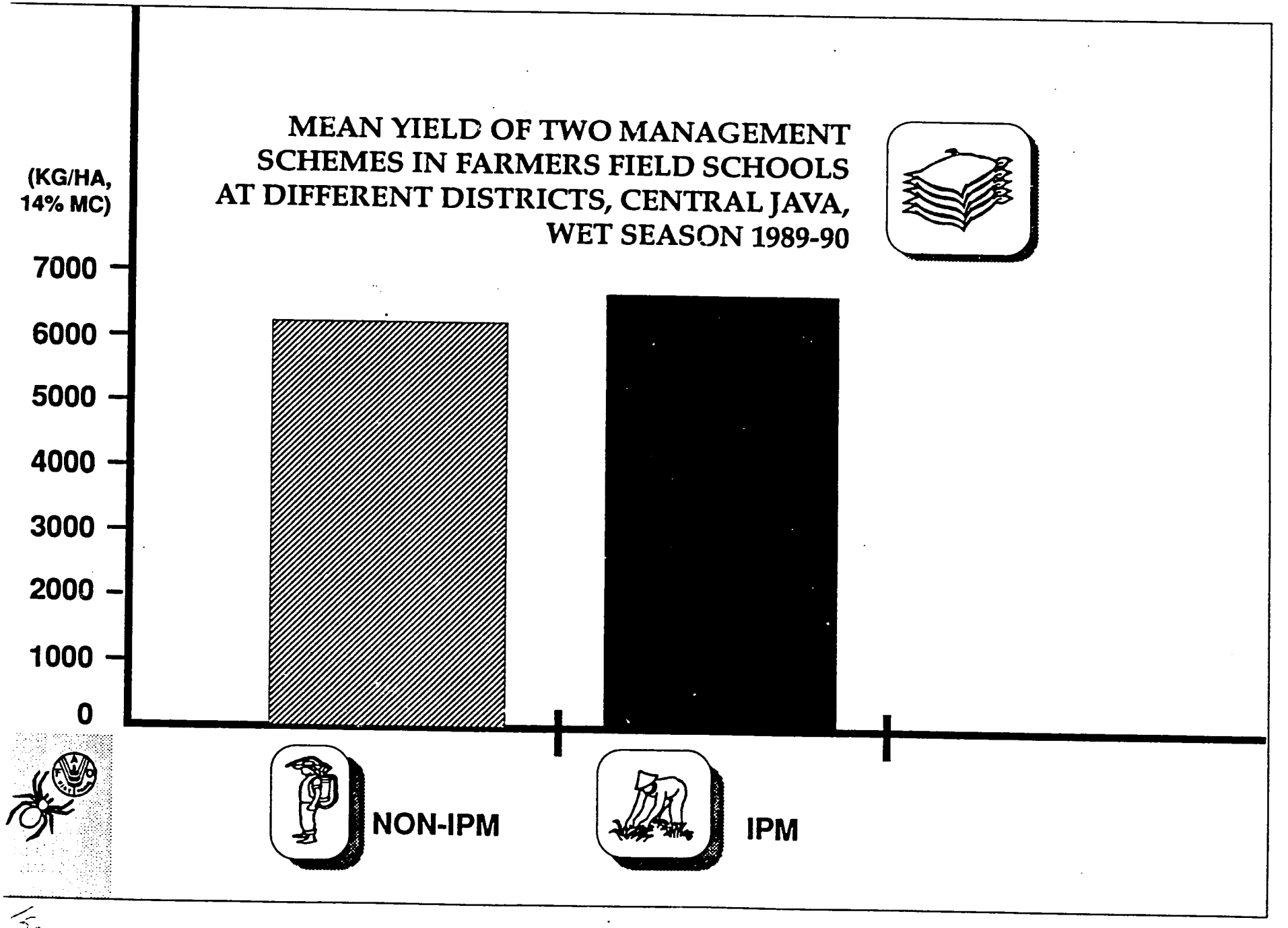
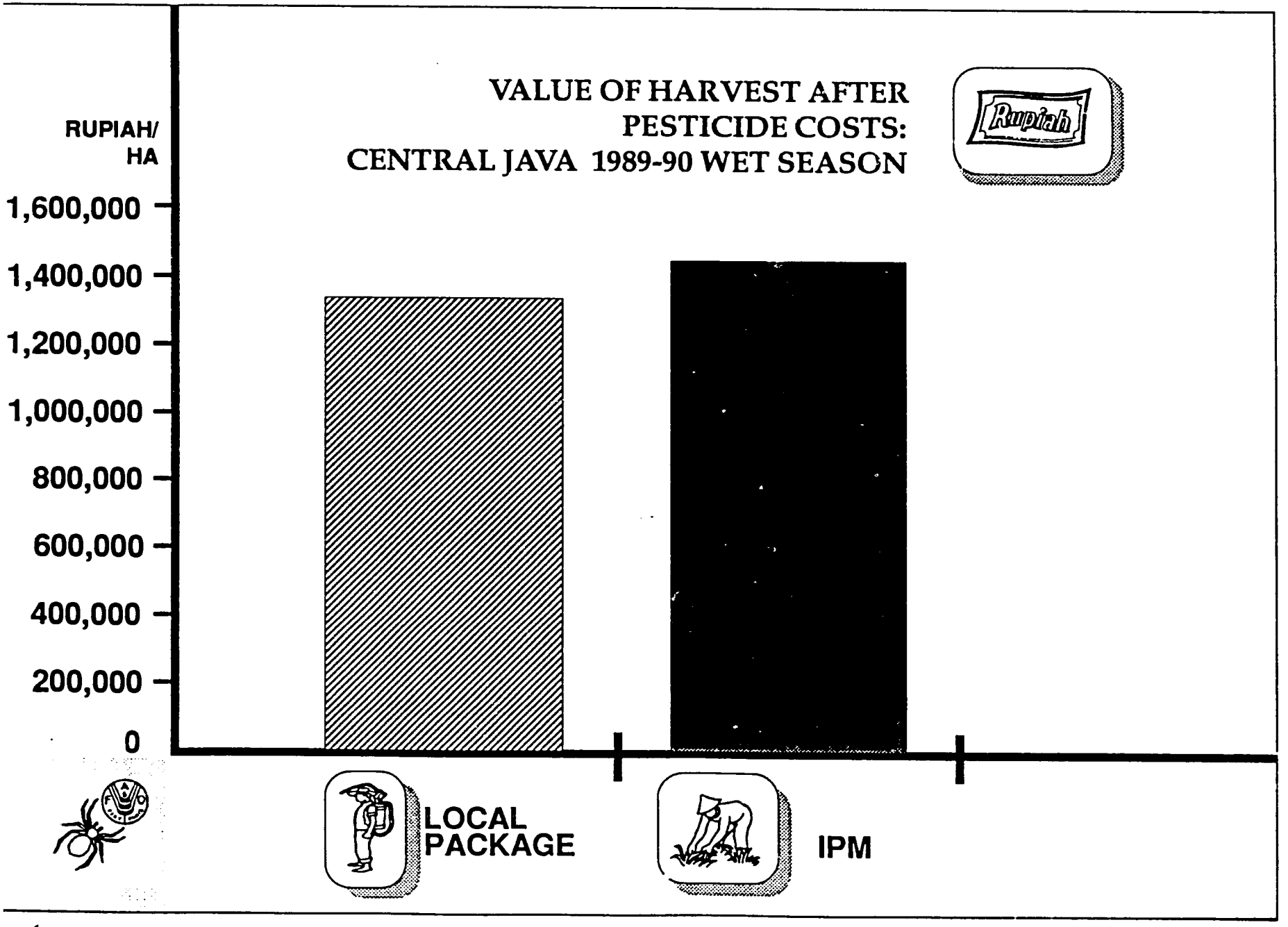
Map 3

Reduction in Insecticide Applications




LESS RISK WITH IPM:
CENTRAL JAVA FFS 1989-90
Rupiah
STD. DEV.
(RUPIAH)
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
LOCAL
PACKAGE
IPM


MEAN YIELD OF TWO MANAGEMENT SCHEMES IN FARMERS FIELD SCHOOLS AT DIFFERENT DISTRICTS, CENTRAL JAVA, WET SEASON 1989-90
(KG/HA, 14% MC)
7000
6000
5000
4000
3000
2000
1000
0
NON-IPM
IPM


VALUE OF HARVEST AFTER
PESTICIDE COSTS:
CENTRAL JAVA 1989-90 WET SEASON
Rupiah
RUPIAH/
HA
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
LOCAL
PACKAGE
IPM

DRAFT NOT FOR QUOTATION

ANNEX 9

LIAISON WITH NGOs

MID-TERM REVIEW MISSION OF THE
GOVERNMENT OF INDONESIA AND FAO
IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management
in Rice-Based Cropping Systems

MISSION REPORT

July 1991

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LIAISON WITH NGOS

The Program works with the NGO community in several modes:

1. NGO's are Training Resources

2. NGO's as clients and consumers

3. NGO's as collaborators

As Resources the program has tapped expertise from several prominent national NGO's with solid track records in fieldworker training and community development. Yayasan Indonesia Sejahtera (YIS) provided trainers for 'Group Dynamics' and Nonformal education components of the programs training of trainers activities. PUSKAT Audio Visual has provided expertise in training methodologies, horizontal communications, 'IPM People's Theater' development and implementation, and assistance in the development of 6 television ready video presentations on the program.

As Clients the program works with a parallel NGO program coordinated by the Pesticide Action Network (PAN Indonesia) and the international PVO World Education. This coalition is implementing an IPM program with 18 local NGO's across the country which includes components popular research, farmer training in remote communities, and public advocacy on consumer and environmental issues. This project is partially funded by the Regional Inter-Country IPC Program. The National IPM programs provides materials, trainers, resource persons, and technical backstopping to this effort, linking local NGO programs with ongoing IPM efforts.

As Collaborators a program is being developed with the Provincial Government of Aceh Province, Sumatera involving the National Program and the international PVO Save the Children. The program has already supplied field training for SCF staff and their counterparts, and in August 1991 a provincial level coordinational meeting will be held to plan follow-up activities.

In the area of health, the Program collaborates with YIS, a national NGO with a long track record in the area of public health programs and community based health care systems.

For public advocacy, the Program collaborates with Yayasan Obor in the translation and publication of books for the general public related to IPM, such as the recent release of the Indonesian version of 'Silent Spring'. Additionally, plans for direct advocacy work have been discussed with the Indonesian Consumer Protection Foundation, the parent organization of PAN.

ANNEX 10

CREDIT POINTS FOR EXTENSION STAFF

MID-TERM REVIEW MISSION OF THE
GOVERNMENT OF INDONESIA AND FAO
IN ASSOCIATION WITH USAID

UTF/INS/067/INS

Training and Development of Integrated Pest Management
in Rice-Based Cropping Systems

MISSION REPORT

July 1991

Decree of the State Minister
The Civil Services

No. 73/Menpan/1985

Attachment:

THE CREDIT POINT SYSTEM FOR THE FUNCTIONAL POSITION OF AGRICULTURAL EXTENSION AGENTS

(Excerpted to show relevant weighting)

I. Component: Education

Sub-component	Item	Points
1. Formal diplomas	a. Doctorate in Agriculture	150
	b. Post-Graduate in Agriculture	100
	c. Diploma IV	75
	d. Diploma III, Graduate of Agricultural Academy, Bachelors Degree in Agriculture, Diploma II in Agriculture	50
	e. Diploma I in Agriculture and Senior Agriculture High School Diploma	25
2. Certified training	a. Longer than 960 hours	15
	b. 641-960 hours	9
	c. 481-640 hours	6
	d. 161-480 hours	3
	e. 81-161 hours	2
	f. 30-60 hours	1

II. Component: Agricultural Extension Activities

1. Extension and field trials	a. 2 or more hours of extension work with a farmers' group	0.007
	b. each demo-plot/field trial	0.15
2. Community mobilization	a. organized problem solving activity involving a minimum of 10 persons	0.07
	b. farmers' group assisted so that it gains one step in classifications	0.10
	c. perform evaluation activity at Rural Extension Center level or higher involving:	
	- 15 or more groups	0.75
	- 11-15 groups	0.65
	- 5-10 groups	0.45

		d. organize study tours with a minimum of 10 persons	
		- more than 2 days	0.11
		- 2 days	0.09
		- less than 2 days	0.07
		e. hold farmer workshop or seminar	0.38
3.	Program planning	a. develop work area monography:	
		- more than 90 pages	1
		- 60-90 pages	0.90
		- 30-59 pages	0.65
		- less than 30 pages	0.35
		b. identify problem factors:	
		- at national/provincial level	1.25
		- at district level	0.85
		- at REC level	0.65
		- at extension area level	0.45
		c. serve as a resource person at meetings, planning extension programs	
		- more than 6 times	1.70
		- 4-6 times	1.30
		- 1-3 times	0.85
		d. develop extension workplan	
		- at provincial/national level	1.10
		- at district level	0.90
		- at REC level	0.85
		- at extension work area level	0.35
4.	Farmer training	- for every two hours as trainer in farmer training course	0.007
		- for every two hours as assistant trainer	(60% of above)
5.	Training other extension workers	- each two hours as trainer	0.007
		- each person trained/assisted	0.007
6.	Develop extension information materials	- book over 30,000 words	5.60
		- book 21-30,000 words	4.30
		- book 10-20,000 words	3.20
		- book 1-10,000 words	2.10

III. Component: Research and Development of Extension

1.	Undertake scientific inquiry/research	a. develop formal publication based on field research, surveys, or evaluation activity	
		- more than 30,000 words	12.25
		- 20-30,000 words	11.00
		- 10-20,000 words	9.00
		- 1-10,000 words	7.00

IV. Component: Supporting Activities

1.	Develop operational plans	- develop operational plan for agricultural development that is used by supervisor	1.25
2.	Evaluation	- serve as evaluation team member, each year:	
		- more than 20 persons	3.75
		- 15-20 persons	3.00
		- 10-14 persons2	2.25
		- 5-9 persons	1.50
		- 1-4 persons	0.75
3.	Formal writing	- write an educational book based on own experience for use in formal agricultural education	7.50
4.	Translation	- translate a book for university level use or a semi-popular technical book of over 30,000 words	7.50
		- translate a semi-popular scientific book of between 1,000 and 30,000 words	5.50
		- write an abstract of a scientific article that is published, per 10 abstracts	1.50
5.	Take part in a scientific proceeding	- edit results of proceedings	3.00
6.	Service recognition	- receive a Certificate of Service for work performance:	
		- national/international	3.00
		- provincial	2.50
		- local	2.00
7.	Training at Agricultural Training Center	- for each 2 hours of training	0.007

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V. Component: Community Service

1.	Improving community welfare	- take part in youth activities/ organizations, each year	0.25
		- teach agriculture in formal schools, each 2 hours	0.007
2.	Improve community economic status	- member of village development council, each year	0.25

DRAFT NOT FOR QUOTATION

ANNEX 11

SPECIAL CHARACTERS OF THE IPM TRAINING PROCESS

MID-TERM REVIEW MISSION OF THE
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SPECIAL CHARACTERS OF THE IPM TRAINING PROCESS

A more detailed description of the Training Method is necessary in order to understand both the context and the nature of the recommendations.

Learning by Doing. Perhaps the most impressive feature of the training approach of Pest Observers (PHP) is that they learn by doing. This is unusual in a country in which professors of agriculture never venture into the mud, but at best send orders to field hands to carry out trials and bring back an occasional sample. Many get no closer to the fields than their desk tops.

The approach to training in the National IPM program, however, requires that the trainees — the Pest Observers (PHP) who will become trainers for farmers and Field Extension Agents)PPL) — grow their own crop from start to finish. For rice, the only operations that are done beforehand are field preparation (harrowing, etc.) and planting the rice seedbed. All other operations, including transplanting, are done by the trainees.

It should be pointed out that the great bulk of people in the Department of Agriculture, including Field Extension Agents (PPL) and Pest Observers (PHP), have never planted their own crop. The University curricula for agriculture do not sufficiently emphasize individual field work. Many have no idea what it is like to plant and harvest their own crop, and most Field Extension Agents (PPL) offer advice based simply on book recommendations and prescriptions. There will be further mention of this in the section below on adjustments to University curricula based on IPM Project research findings.

The FL-Is who conduct this training have developed an ingenious set of support practices to help these neophyte trainees through this process. Some are as follows:

- Discussing with newly arrived trainees (Pest Observers, PHP) the need to serve the farmer and the necessity therefore, to know what the farmer has to do.

- Setting an example by leading the trainees in every field activity. If the activity happens to be transplanting, the FL 1 instructors are the first to doff their shoes and step into the wet paddy field to begin the work.

- If individuals claim to be sick from too much work (many have done this kind of work for the first time), a group helps them in their work, accompanying them in their field tasks and working alongside them.

- If some individuals are lazy or slacking off, a group of trainees plus the trainer will come and assist that individual in carrying out the task — e.g. weeding

- At least four night a week in the training center, there is one group (based on one or two dormitory rooms in the training facility) which discusses problems of this sort. Every trainee attends one of these small group meetings per week.

- Once a week, there is a plenary discussion meeting of all trainees plus trainers, during which personal problems or difficulties regarding field training — or even developments in one's personal life which may be interfering — can be discussed.

In short, the approach is one which takes trainees from an education and job environment which places next to emphasis on field work and hands-on experimentation, and produces trainers who can make judgments and give explanations based on their own experience in the field rather than what they have memorized from a ———

Training of Farmers. Perhaps the most remarkable feature of the training program is how farmers are trained. It is remarkable because it stands in such dramatic contrast to the typical approach of agricultural extension. The typical approach of extension is to treat the farmer as an unknowing and uneducated listener to messages which are in his or her best interests, even though (s)he doesn't know it. The IPM approach is to require that the farmer become his own decision maker and field manager—the best expert on the condition and needs of his own fields. This is not a mere emphasis; it is the key to the whole IPM approach.

It was discovered in earlier trials that IPM is too complex to lend itself to a simple set of rules based on pest level and thesholds. The insect fauna of one region may be quite different from that in a neighboring region. Moreover, IPM simply cannot be reduced to a single message, such as "don't spray". It was found after much tryout, failure, and through before the present project that it is not at all a technology—or more appropriately, a method—that lends itself to recipes and messages.

Instead, IPM requires that the farmer first grow a healthy crop. It also requires continuous monitoring of complex, constantly shifting faunas of insects and even fungi. As

a consequence, it was discovered that the only way to deal with such a complex issue as crop control and promotion of IPM was to enable the farmer to make decisions about his own operation.

The training program was carefully crafted to enhance and increase farmer's ability to make decisions about his or her own field. To do this, the farmer had to learn to become a field observer, and had to understand the elements of insect ecology. One consequence of this was the discovery that most farmers do not know there are beneficial insects in their fields. Many, it turns out, do no understand the process of metamorphosis—that grubs and hornworms are the larvae of moths. The beneficial role of spider si generally poorly understood by farmers—if understood at all.

The Approach to Learning. An important feature of this farmer training (and, indeed, all other levels of training) is a question based approach to learning. Instead of lecturing to the farmer, the Extension Agent asks questions in return.

EXAMPLE:

FARMER: What's this thing here?
TRAINER: Looks like a bug. Where'd you find it?
FARMER: On a rice plant in my field.
TRAINER: Oh? That's interesting. Where on your rice plant?
FARMER: Down near the water, at the base of the plant.
TRAINER: Is that so? What was it doing there?
FARMER: Looked like it was jumping around and then just staying still—maybe sucking or something.
TRAINER: How interesting. Do you know, the brown planthopper does that? Let's see, what color is it.
FARMER: A pale, coffee color. See?
TRAINER: Yes I see. What do you think that means?
FARMER: It's probably a brown planthopper. I've heard they're terribly dangerous. Do you think I should spray?
TRAINER: I don't know. What other things did you see in you field?
FARMER: What do you mean?
TRAINER: Other things. Bugs. Surely there must have been some other kinds of bugs in there.

FARMER: Yes, I think there were some ... uh ... spiders, maybe. But I didn't look too carefully...

TRAINER: Let's take a look together and see what there is. Them maybe we can put them together in a cage or plastic bag, and see what happens.

FARMER: Why do that?

TRAINER: Just to see who eats who. Some kinds of bugs eat other bugs, you know.

FARMER: Spiders do. I've see·. 't.

This is called the Apa Ini ("What's This") approach. Direct answers and lectures do nothing to increase the trainees powers of observation or ability to manage his own fields. An answered question is regarded as a lost learning opportunity. The impact of this method is especially powerful in a society in which schooling is almost exclusively memorization and rote learning, and where information almost always comes packaged in an unstimulating and soporific lecture.

Evidence of the success of this approach is everywhere to be seen. Farmers are actually carrying out independent experimentation to and new methods of IPM as well as to determine where the spraying threshold might be.

EXAMPLE: In South Sulawesi, one farmer found that there was an infestation of Brown Planthopper (BPH) in his field. He sprayed. Three days later, it had reappeared. He decided to introduce 64 frogs into his field and two days later there were no BPHs left. He now actively promotes frogs in the rice paddy as a method of pest control.

EXAMPLE: In the Yogyakarta Region, farmers saw a gradual increase of BPHs in proportion to natural predators. They wanted to determine what the spraying threshold might be, so they placed 20 BPHs with a rice plant inside a plastic bag, and introduced a small orb weaving spider. Within two days, all the BPHs were gone. Their decision: don't spray. The levels of beneficial predators in the fields were adequate to control the BPHs.

This independent experimentation (and thee are many more examples) is strong indication of the success of the IPM training in making the farmer the independent decision maker for his or her own crop. Among the incentives farmers experience in the IPM 10 week training are the following:

- The (almost always surprising) realization that there are beneficial predators of pests in their fields, who are allies of the farmer;

- The (often startling and shocking) realization that pesticides are in fact poisonous to human beings and other animals—which most Indonesian farmers seem to not yet understand (the word for pesticide in Indonesian literally translates as "pest medicine").

- Increased confidence in their own judgment; the confidence that they are competent manager of their own fields, and that they are the best judge of whether or not spraying is needed on their fields;

- A sense of relief resulting from having pesticides removed from their environment, resulting in the removal of a public health threat;

- Savings resulting from not using pesticides in their crops.