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# Rice insect pest management technology and its transfer to small-scale farmers in the Philippines

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In 1978 the International Rice Research Institute (IRRI) formed an interdisciplinary team to test and improve IRRI's integrated insect pest management (IPM) technology for farmers tilling small irrigated plots in Southeast Asia. This paper decribes how the team developed the technology from an initial Western orientation to its present form.

IPM focuses on the fact that pests (insects and rats) move from field to field, a particularly grave problem in the tropics where the climate does not reduce the pest population annually by winter fallow. In Southeast Asia, where farms are small, entomologists advocating IPM assert that pests will be more effectively controlled if many small plots are managed as a single field.

IPM then calls for the consolidation of many small plots into a single management unit. The entomologists could not improve pest management technology and test it in the field unless farmers were willing to organize themselves by contiguous fields and practice IPM recommendations as a group. The interdisciplinary IPM team had two tasks. First, it had to persuade the farmers that the new pest management technology would offer them significant benefits. Second, the team had to devise ways to help the farmers organize themselves. The team recognized from the outset that while its technological recommendations were fairly well worked out, further development of the technology would be required.

## THE PROJECT

Because IPM depends heavily on cooperation among farmers tilling adjacent fields, it was imperative to study ways in which farmers organized themselves for collective action.

Lowland Filipino culture generally is known for a marked absence of long-lasting

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and cohesive organizational forms other than the family. When the hacienda system was operating full force, group crop management was largely enforced by the photoperiod-sensitive varieties themselves, by landlord control of supplementary irrigation (where that existed), and by the top-down supervision by the landlord's foremen. But the hacienda system broke down during World War II. Even where landlords remain they rarely enforce group farming.

A strong peasant movement in Central Luzon in the late 1940s and 1950s left no sociopolitical structures still intact, and few active local leaders. Indeed, it made the rural population highly suspicious of outsiders, especially of young organizers.

Furthermore, within a single decade, the farmers here have received land reform, a vast new irrigation system, almost universal double-cropping enabled by the new rice varieties, and generous agricultural loans extended season after season despite low repayment — theirs is hardly a climate of communal self-help. Years before our project the government attempted to impose certain superficial groupings upon the farmers, such as irrigators' associations, but none functioned for long, deepening the farmers' cynicism of their own organizational abilities.

The anthropologist had generalized the sociological approaches used to organize farmers in the Philippines into two broad categories: top-down and bottom-up.

The top-down approach is more authoritarian. It is typically used by banks, other credit institutions, and the National Irrigation Administration (NIA). Farmers consent to follow centralized management directives in exchange for the services of such institutions.

The bottom-up approach is more participatory. It is typically used by Catholic and other religious groups to spark self-help projects among the poor and help them make collective demands for improved government services. The NIA has made some moves toward the bottom-up approach in organizing irrigators' associations.

The interdisciplinary research team set out to test IPM by organizing one top-down and one bottom-up project, each comprising five villages, and introducing IPM into one control area in which no attempt would be made to organize the farmers. The Agency for Community Educational Services, Manila, was contracted to organize the farmers in each of the 5 bottom-up study villages. The agency provided one organizer for each village.

The villages, typical of Central Luzon, are in Nueva Ecija Province 120 km north of Manila, in an extensive fertile plain served by a large irrigation system. All of the arable land is planted to rice in the wet season (August-November) and 75% of the farmers grow rice in the dry season as well (January-May). All villages can be reached by unpaved roads within 5-10 km of a paved highway. None is more than an hour by public transportation from the provincial capital. Eighty percent of the villagers are leaseholders, with about 2 ha/family. At the time of the project, 90% of the farmers grew insect-resistant varieties whose average yield was 4.5 t/ha. Only a fraction of their annual income, which ranged from $900 to $1030 per family, was derived from nonagricultural sources.

The project anthropologist lived in three of the villages, each representing one of the three organizational approaches being studied, to closely observe the methods used to organize farmers into groups.

The project began in the wet season of 1978, and was to last for 2 1/2 years or 5

cropping seasons.

Throughout the study, the anthropologist collaborated closely with the entomologists in focusing the research on nearby villages of comparable agricultural, demographic, economic, and social characteristics so that a difference in these factors would not bias the research results. Our evaluation will deal only with the interdisciplinary research conducted in the bottom-up villages, where the project enjoyed considerably more success than in either the top-down or the control areas.

## THE TECHNICAL CHALLENGE

IPM was developed in European and American agriculture and in plantation agriculture in the Third World. It tries to replace a pesticides-based pest control system with a cheaper and more holistic one to avoid many instabilities caused by pesticide dependence. Neither its underlying complexity nor the high motivation it assumes has been considered a constraint. It calls for monitoring pest populations, calculating damage thresholds to decide when insecticides are economical, and adopting crop management practices to reduce pest populations and increase the populations of their natural enemies.

The main components of IPM, or group pest management, are:

- synchronous planting — farmers over a large area plant varieties of the same maturation date at almost the same time;
- group pest monitoring — farmers examine their fields systematically and arrive at group decisions about pesticide use;
- group fallowing — preferably by plowing under stubble after harvest; and
- group pesticide purchase.

Group pest monitoring requires farmers to calculate damage thresholds to decide when pesticides are economical. It replaces spraying by the calendar or other control decisions that do not depend upon the presence of pests in numbers sufficient to justify the cost of the treatment.

IPM has been researched at IRRI since 1972, particularly when brown planthopper outbreaks seem to follow intensive insecticide use.

The original technological questions IPM research faced were:

- Did farmers planting wetland irrigated rice, even in the more progressive regions of the Philippines, have IPM components and were those implemented?
- Could small farmers implement group management?
- If IPM were implemented by group farming, could it actually reduce rice pest infestation and the costs of pest control?

Through the interaction with the anthropologist and the farmers in the research project, the entomologists have been able to answer some of these questions. But more important, they have begun to realize that their original questions were backwards. That is, if technology is to be used by farmers, its development must start with them and not on the research stations. Table 1 lists the technological starting points the entomologists considered important and the technology's *finished product* at the end of the study.

Initially, the entomologists needed the anthropologist to describe and interpret farmers' pest control practices, their receptivity to the new technology, constraints

Table 1. Modification of integrated pest management technical assumptions during the course of introducing the technology in 5 villages in Nueva Ecija Province, Central Luzon, Philippines, July 1978-December 1980.

| Scientists' initial technological assumptions | Technological positions after 2-1/2 years collaborative work with anthropologist |
|---|---|
| Farmers' strong interests in pest problems will motivate them to adopt IRRI's IPM once it's demonstrated. | Farmers are not motivated to adopt complex IPM technology on their own, but work with technology presented in a personal context. |
| Postseason questionnaires provide reliable data on pest perception and control practices. | Ideally, farmers' pest control practices should be observed, not queried. Frequent queries are better than one postseason survey. |
| Pests significant to farmers throughout a village can be specified beforehand for all practical purposes. | Unexpected pests such as rice semi-looper make field trials less useful than feedback from farmers in making village level recommendations. |
| Rice whorl maggot is a serious seedling pest. | Rice whorl maggot is not a serious pest in isolation, but only in certain environmental contexts. |
| Government agencies can provide village level monitoring after training in IRRI surveillance methods. | Monitoring can be expected only from farmers, not agency technicians. Surveillance methods are being redesigned with farmers for farmers. |
| Frequent quantitative monitoring of trap catches and field populations is within the capacity of most farmers. | Light traps and most quantitative tools are tedious for farmers. The light traps are dropped and the tools redesigned to be qualitative. |
| Graphing of insect populations is within the capacity of better educated farmers. | Graphing insect populations is too abstract. Concrete infestations or damage levels at particular times are more usable. |
| Farmers' ineffective use of insecticides can be remedied by more careful measurement. | Excessive frequency of farmers' insecticide applications have been reduced, but dosages are still low. Scientists have not yet developed simple methods for farmers to calculate dosages accurately. |
| Quantitative economic thresholds for pest control decisions can be used by farmers and technicians. | Quantitative economic thresholds are not yet simple enough; qualitative decision rules are more usable. |
| The problems of insecticide use being tied to credit schemes can be circumvented. | Credit schemes still pressure farmers to spray too frequently (some of the best IPM practices occur in areas where credit is short). |
| Soil incorporation of carbofuran can be so profitable that farmers will try it despite initial expense. | Farmers don't incorporate carbofuran; it is dropped from recommendations. |

Continued on opposite page

Table 1 continued

| Scientists' initial technological assumptions | Technological positions after 2-1/2 years collaborative work with anthropologist |
|---|---|
| Cultural pest controls have great potential as low-cash technologies. | Large area-wide stubble plowdown is impractical and expensive. |
| Synchronous planting is an attractive IPM technology for organized farmers' groups, the larger the better. | The minimum effective size of a synchronous area is only now being determined. |
| Varietal resistance to insect pests is a foolproof foundation for IPM. As varietal resistance to a given pest becomes available, insecticides are no longer required for that pest. | Farmers' ignorance of the identity of a variety's resistance means they spray for pests already controlled. |
| Sustained baiting for rat control is a valuable addition to or replacement for farmers' practices. | Sustained baiting is less attractive than current farmers' methods of rat control. |
| Identifications of discrete pest entities and their causal relationships to yield losses are prerequisites for successful understanding and use of IPM. | Farmers perceive pests as part of a crop context; translating our cause-effect relations into contextual terms is a major challenge. |
| Clear classroom presentations, planned field demonstrations, and handouts in the local language are the key to transferring IPM technology. | Frequent personal visits by technicians responding to farmers are the key to transferring IPM. |

otherwise not anticipated, and the farmers' alternate views of pests that the scientists had not picked up in their surveys.

Developing the technology — or, what the entomologist considered adapting it to the Asian farmers needs — required various contributions from the anthropologist that laymen, even well-meaning biological scientists with some experience in social science, could not at first supply for themselves.

When the project began the staff assumed that there would be basic government extension services at the village and farm level to complement the scientists' and organizers' efforts to teach farmers the basic components of the new technology. The staff also expected sufficient government monitoring services to provide the farmers and technicians with regional and local pest information. Finally, the staff expected some government action to ensure that farm credit would be adequate, that pesticide sales would not be tied to farm credit, and that the integrity of pesticides would be monitored by a government agency. Virtually none of these government services operated at the village level.

Even among the farmers easily induced to try group crop management, the relatively low level of government or banking services meant additional burdens for the researchers, and additional hurdles for the acceptance of the technology, should it prove simple, cheap, and beneficial. The team then had to incorporate into IPM technology many components they originally expected the government to help provide. For instance, farmers would have to do their own monitoring and not rely on regional backup from the government.

On the other hand, these inadequacies made the community organizers' job easier. Even if most farmers were not immediately attracted to working together for group crop management, they were rather more easily inspired to group action demanding better services from the government. This gave farmers the chance to identify their leaders and to learn basic organizational skills. They could move on to the more complex challenges of group crop management once these lessons had been mastered. As farmers learned organization at this early stage, the organizers were able to evaluate the strengths and weaknesses of the budding groups. This slower start also allowed the anthropologist to appraise the farmers' group action so she could begin to predict the success of the new technology.

In the preliminary work, building farmers' groups that focused on government services, the scientists and the anthropologist realized that in developing new technology one must begin where the farmers are organizationally, just as one has to accept where they are technologically. The feasibility of group action must first be tested on genuinely felt needs before scientists can evaluate how well farmers might learn to organize themselves for goals that we think are important.

But even when active villagers formed groups to demand improved services, that did not mean that with a bit more practice, skill, and perhaps incentive, they would automatically succeed in group crop management. The anthropologist pointed out to the research team and the professional organizers that group crop management calls for collaboration among field neighbors who may have relatively little in common with one another economically or socially, who rarely are relatives or house neighbors, and who sometimes live in different villages. Particularly strong social pressure would be required of these field neighbors because even one individ-

ual's deviation from group action might destroy the effectiveness of the technology for everyone. (For instance, one green field among many fallow ones can be a pest nursery for those surrounding it.) Sociologically speaking, group crop management calls for a different principle of organization than kinship, neighborhood groupings, or even traditional village politics. One cannot assume that in every 50-ha area a farmer with outstanding leadership abilities will emerge.

## THE ANTHROPOLOGIST'S TECHNOLOGY

Group crop management in various forms has been a goal of many rural development projects in the Philippines over the past half century. Traditionally, outsiders have tried to organize farmers to manage their plots together for more efficient use of scarce irrigation water, for more efficient delivery of extension services, and for administrative savings in agricultural credit programs.

The anthropologist anticipated that farmers in some areas would share these organizational objectives, particularly after adopting IRRI's new high-yielding rice varieties. Because farmers already recognized that those who plant out of synchrony suffer severe rat infestations and high crop losses, adding the IPM objective seemed only to strengthen the case for group crop management. The anthropologist took entomologists beyond their own discipline by suggesting how the entomologists' technology might be closely connected to other agricultural problems of the farmers. This proved important when farmers suddenly discovered that pest management is indeed related to irrigation on the one hand and to credit policies on the other.

The technology changed drastically through the 2 1/2-year study, mainly because of intense interaction between the farmers and the scientists. The anthropologist's main contribution was in helping this direct interaction take place, although she contributed in other important ways as well.

The anthropologist analyzed ways to organize Asian (or at least lowland Filipino) farmers consistent with their culture. She evaluated community organizers that would be needed to organize farmers for testing IPM technology.

She continually monitored the organizational side of the research so that causes of the technology's success or failures could be accurately pinpointed. In this way, a shortcoming in the technology would not be attributed to sociological factors. Nor could the technology's feasibility and popularity be attributed solely to effective organizational approaches.

Finally, the anthropologist developed techniques to evaluate the structural effectiveness of whatever farmers' groups would undertake group crop management. If one organizational approach proved more effective than others, that approach's performance would be periodically measured to determine when it could be phased out, leaving farmers on their own.

The anthropologist was strongly convinced that the role of mediating between the farmers and the scientists should be temporary, and should not be used as a crutch for either party in the research process or as a rationale for employing anthropologists. Agricultural scientists are a part of the farmers' world and they must come to realize that farmers are a part of theirs. To the extent that feedback from farmers is necessary, and that some farmers are reluctant to deal forthrightly with the scientists

and their staff, then the anthropologist's task is to devise replicable ways whereby scientists and farmers can break through this barrier.

The scientist often overlooks the value of securing the farmers' active participation. But the anthropologists, trained in the holistic fabric of human society, must see the liabilities as well as the promise of long-term development. The anthropologist sees technology as a process in any society's growth. When scientists are working in a highly competitive sector of a society with a long history of colonialism, they must be aware of the farmers' timidity, obedience, and dependence. Scientists developing technology for farmers must bear in mind the infamous history of middlemen who buffer the elite from the farmers and vice versa. The anthropologist wanted to ensure that she did not simply recast these old relationships in a new form.

To the anthropologist, one of the main purposes of forming lively farmers' organization was to help farmers make scientists — and in turn bureaucrats and landowners — interact with them directly as partners in their own development. Because a few IRRI scientists already considered farmers' frank exchange as a requisite to technology development, the anthropologist's systematizing of farmers' feedback was a service to the scientists themselves.

The anthropologist proposed that farmers might be more lively partners if they interacted with the scientists in groups (consolidated by mutual interests and the routine practice of some form of collective action) rather than as individuals in the long, formal, one-to-one interviews standard at the Institute.

This concept of rural development as a process, not a series of technological achievements, was perhaps the anthropologist's most valuable contribution to IRRI.

## MODIFICATIONS TO IPM TECHNOLOGY

In this section we review the changes which took place in the original IPM technology to explore the interaction between the anthropologist, the farmers, and the entomologists, and as a way of examining the anthropologist's impact on technology development. There are four areas of generalization within IPM technology: 1) problem identification, 2) the complexity of the technology, 3) group crop management, and 4) packaging the technology.

### Problem identification

Plot trials in farmers' fields demonstrated that original technology worked, but surveys showed that the farmers were not using the technology. The entomologists concluded that the challenge was one for extension.

But the anthropologist had been constantly critical of the survey technique, particularly when it was used to evaluate something like pesticide use. She had warned that farmers would simply reply to the survey according to what they thought was the correct or desired answer, being strongly influenced by the popular image that a good farmer sprays frequently. To find out what farmers were actually doing, one had to see them do it or talk with them in the field when problems arose.

Initially the anthropologist and research technicians helped answer the entomologists' questions, but the farmers were most vigorous in providing the scientists with

accurate feedback and interpretation. In weekly discussions, attended regularly by the entomologists, it became clear that pests other than those originally expected were causes for concern throughout the season. One pest (rice whorl maggot) the entomologist had thought important by itself in fact affected yield only by a complex interaction with other pests. The farmers described this damage mechanism more accurately than the scientists themselves. Scientists learned that they had to recognize the serious limitations of a technology developed for a nationwide scale when it had not been adjusted for local variations. This in turn made them face the implications of local fine-tuning.

The common understanding is that government research agencies and regional universities or colleges will fine-tune broad technological recommendations to the regional and municipal levels, and the extension service will help fine-tune them to the village and farm levels. But when one realizes the overwhelming problems faced by understaffed and underfinanced government agencies, it strikes many researchers as irresponsible simply to hand over the broad technological recommendations to them in the hope that they will fine-tune the technology to regional and local needs. Knowing that the agencies are not equipped to fine-tune the technology systematically forces scientists, who are developing the technology, to consider how they can help farmers fine-tune it themselves, individually or in groups.

The scientists also began to appreciate how indispensable direct interaction with farmers' groups can be. They began to ask the anthropologist why, when they sat in on field interviews with individual farmers, the technology was never criticized. But those same farmers, responding to the same questions as members of a group called the Farmers' Club, sparked each other to push the questions or issues further. (The anthropologist ultimately articulated how extremely social farmers are in their learning.)

With the help of the anthropologist and the farmers, the scientists began to see the farmers' pest problems more in terms of damage symptoms as the farmers see them, instead of insisting on defining pest problems on the basis of numbers of pests caught in light traps at particular stages in their life cycles. Sometimes farmers combine the symptoms of several pests into one phenomenon, which guides them in their intuitive pest control measures. By studying these rather than discarding them as wrong, the entomologists began to understand aspects of pests that they had not been aware of when they studied the same pest from a different view on the experimental farm.

### The technology's complexity

The staff rapidly began to appreciate how confused the farmers were about rice pests, their prevention, and the damage they caused. For example, the farmers were unable to identify some of the major pests at all, and lumped various pests together as worms. They considered the most threatening ones to be planthoppers and leafhoppers, although their rice varieties were resistant to these pests. Sometimes the farmers unnecessarily spent $50 ha per season to spray against these pests.

With dozens of pesticides under labels that change every few years (sometimes the same one under several different labels by the same company), and with many specialized pesticides requiring different dosage rates (some in the metric system,

others not) how could the farmers choose the right one? To make matters worse, some of the most popular chemicals were those that had been implicated in causing pest outbreaks.

The farmers were satisfied that they were applying enough insecticide in proper concentrations. In reality, when pesticides were needed, the farmers' dosage was but half the correct strength 80% of the time. They did not realize that spraying highly diluted pesticide kills only the natural enemies of the pests, causing more harm than good. Nor did they understand that an expensive pesticide requiring a low dosage is more economical than a cheap one requiring a high dosage. But figuring dosages correctly is extremely complex. Calculations often are in sprayloads per hectare, despite the fact that one rarely sprays an entire hectare at once.

Then there were the problems of when to spray. Farmers sprayed early in the season when, in fact, the plants were most vulnerable to insect pests later on. They often sprayed according to schedules recommended by the extension service, not waiting until they actually had a pest problem in the field. If they had first determined whether economic thresholds had been exceeded, they might have saved as much as their entire pesticide bill for the season. The anthropologist, herself dizzied by all these identifications, calculations, and choices, had a first-hand taste of the farmers' confusion. She appreciated the laboriousness of going to distant fields every day just to determine (by a percentage formula when one had no grasp of percentage) whether the pests were there in significant numbers. She experienced the difficulty of calculating different economic thresholds for different pests at different stages of their own and the plants' life cycles. She understood the extraordinary complexity of figuring dosages when one didn't even understand liters vs gallons, cost tradeoffs, or the English instructions on the labels. The farmers were simply too confused and too overawed to express their discouragement; they needed someone such as the anthropologist to articulate it for them.

It seemed to the entomologists that they had already exceeded their limit in compromising the scientific accuracy of the original technology, long ago having lost sight of their colleagues' standards for centralized computer-based pest management across whole counties in California's Imperial Valley. Whose standards? What standards? The anthropologist, joined in time by the research technicians and the farmers themselves, shed a different light on the challenge. Why should the farmers be interested in IPM, much less adopt it?

IPM entomologists may be certain that carbofuran should be incorporated into the soil before transplanting rice, but when one imagines all the things that can wipe out a crop in the monsoon tropics, isn't it a foolish risk to invest in it even before the seedlings are planted? The same objection held for sustained rat baiting, which should be started before the farmers see any rats and must be sustained even if they never see a single rat killed by the poison. Furthermore, the farmers worried about killing the snails, fish, and crabs, and about poisoning the transplanting crews, children, and buffalo that might walk around in the mud after the carbofuran had dissolved.

Why should one apply concentrated dosages and increase the costs if the intricacies of pesticides remain a mystery anyway? And how could the scientists insist that farmers spray, if need be, only once in a season when a misstep in that single spraying

might destroy an entire family's livelihood for half a year?

Entomologists argue the need to be ready when a region-wide pest outbreak occurs, as they are sure it inevitably will — an argument far more appealing to intellectuals than to farmers. But if the farmers are well protected by resistant varieties and if the nation has not suffered a serious pest infestation for more than 6 years, what is going to make them worry about IPM? Finally, if the pesticides are diluted before the farmer buys them (this had never occurred to the entomologists, but reconnaissance studies suggested the practice may be rather widespread), or if the purchase of pesticides (whether needed or not) from the bank's retail store is a condition of the farmer's agricultural loan, then don't the identifications, distinctions, and calculations required by IPM seem futile? Farmers could save money if they knew IPM. But with the vagaries of the monsoon climate, the uncertainty of the scientists themselves about some issues, the economic realities of pesticide sales, and the overwhelming abstraction of the technology, was any of this worth it to the farmers?

"Because entomologists are excited by pest control research and its results, we tend to cling to our tools when attempting to explain IPM technology to farmers," one entomologist reflected. If paid villagers could be trained in the IPM technology, then could their neighbors and kinsmen master the technology? The entomologists had gone to great lengths to devise tools, such as the light trap, which were cheap and easily made, only to be told by farmers that they were too tedious to use.

The entomologists switched first from quantified measures to rough ball park averages (Table 2), then abandoned quantification altogether for qualitative measures such as *eyeballing* the field once a week. Soon farmers expressed a lively curiosity about aspects of the technology that stimulated their imagination and made intuitive sense, such as protecting the natural enemies of rice pests. Scientists realized how complexity intimidated farmers and suppressed their genuine enthu-

**Table 2. Research technician and farmers' modification of rice insect pest economic thresholds from quantitative units to those more familiar to farmers.**

| Pest | Economic thresholds | |
|---|---|---|
| | Original | Modified |
| Whorl maggot | 15% damaged leaves 14 DT.[a] | 6 damaged leaves in one hill 2 weeks after transplanting. |
| Caseworm | 15% cut leaves. | 50 cut leaves observed by crouching in one location in the field. |
| Stem borer | 15% deadhearts before panicle initiation. | 8 deadhearts in one hill before panicle initiation. |
| | 5% deadhearts after panicle initiation. | 3 deadhearts in one hill after panicle initiation. |
| Leaffolder | 25% damaged leaves before booting. | 8-10 damaged leaves in one hill before booting. |
| | 15% damaged leaves after booting. | 5 damaged leaves in one hill after booting. |

[a]DT = days after transplanting.

siasm. In two of the project study areas, the scientists' barrio research technicians were able to move farmers up to more sophisticated use of the technology once they had gained confidence through the simpler guidelines.

The entire team learned not to take farmers' motivation and interest in technology for granted without weighing what each component means from their viewpoint. The new rice technology has spread so rapidly in many wetland irrigated areas of Southeast Asia that scientists have become spoiled — and perhaps too self-assured. When something is not adopted they are loathe to blame themselves. That farmers might not want to exert themselves to carry out the experiments to the same degree that paid villagers would surprised the scientists. They asked the anthropologist rather sharply, "But what are farmers doing all day during the off-season that they don't have time to monitor their pests properly?" Her answer was, "Nothing, they aren't that busy. But IPM is a lot of bother." The incentive to save $50 a season was simply not strong enough, all things considered.

**Crop management**

Farmers were aware of a number of management practices for pest control:

- using resistant varieties,
- irrigating (to flood out mole crickets) in midseason,
- removing infested plants and weeds,
- using plant parts as repellants, and
- synchronous planting.

Except for a rather loose form of synchronous planting imposed on them by the irrigation system, farmers were not implementing any of these measures in groups over large fields. They knew that weeds along one farmer's field might harbor pests that could damage his neighbors' crops, and they were painfully aware that when one farmer delays land preparation and planting long after his neighbors, his field is apt to be entrapped by those around it at later stages of crop growth. Access to his field by buffalo is difficult or access to water is impossible when the adjacent fields are ready to drain before harvest.

Since resistant varieties have protected the farmers from serious pest outbreaks for more than 5 years, they are not inclined to master new forms of social organizations to protect themselves from a threat they do not feel. Even in the developed countries farmers have rarely accepted the far more intensive IPM techniques until they have suffered a disaster.

On the whole, the bottom-up community organizers have been only partially successful in prompting the farmers to attempt group crop management over some 150 ha. It is still difficult for the entomologists to appraise the technology on a large scale, but the 150 ha does provide them with fields large enough to test whether group crop management reduces infestation or lowers costs significantly. The anthropologist has recommended that the research project be continued until the permanence and replicability of this initial success can be determined.

Two factors suggest that the project may be short-lived:

1. The one area in which the farmers have taken an interest in group crop management was organized by the most seasoned community organizer.
2. Most of the area overlaps a critical drainage problem, which has given farmers

more dramatic and palpable incentive for departing from their traditional forms of social organization and collaborating as field neighbors.

Once again the anthropologist, living with the farmers at the village, sees how agriculture in the field crosses the scientists' disciplinary specialization. From the farmers' experience, solving the technology of drainage may facilitate experimenting with the technology of pest control.

The team's efforts to promote group crop management for IPM has led to certain changes apart from the success and possible enlargement of the present area. When the team began to realize the difficulty of organizing farmers, the entomologists started to ask whether much would be lost by not consolidating fields under single management, especially because the irrigation system imposes a loose form of synchronous planting. They have now resolved to address this issue as well as its corollary — how large an area should be farmed together for optimal results? The entomologists are finally responding to a question the anthropologist has been asking for 3 years and farmers began asking soon after they started interacting with the scientists.

**Packaging the technology**

The scientists began to realize the importance of packaging the technology. The farmers did not directly demand this of the scientists, but unwittingly did so by requesting the scientists to conduct a pest management course in exchange for their willingness to try group crop management. The entomologists drew up a 13-lesson farmers' class in the barrio and sponsored it 7 times during the study.

The entomologists and the principal research assistant came to recognize the highly beneficial discipline that packaging the technology for farmers' classes forced upon them. What began as a vehicle to persuade farmers to test the technology soon became a creative challenge in itself, requiring the scientists to understand their own technology so thoroughly that they could apply it in the field.

The anthropologist led the interdisciplinary team to explore how cultural differences influence the perceptions of individuals. The anthropologist was increasingly aware of the close link between technology and management. She realized how cultural differences between the farmers' management approaches and those that the scientists had in mind for the IPM technology must somehow be compromised if a useful technology were to be developed. Western trained scientists perceive the agroecosystem as an assemblage of linear processes or components, which can be observed and manipulated in isolation. Indeed, the explicit goal of the entomologists' research at the experiment station is the development of IPM *component* technology.

In contrast, Asian farmers and business managers do not break down phenomena into discrete, linear processes. Rather, their management perception is of the contextual whole of the system and balancing its parts. The developing crop is a series of multiple impressions, not a flow of serial processes. The Western notion of cause and effect, damage and yield loss may be less central to such contextual thinking, which sees the crop, water, weather, insects, weeds, frogs, and damage symptoms as a whole.

The distinction calls for the scientists to move from the general, abstract, and

future orientation to the immediate and concrete. From visits to other Asian IPM projects, the anthropologist learned that IRRI was the only one teaching IPM with such abstract tools as printed handouts, classroom instruction before field visits, and efforts to prepare the farmer for the unforeseen. Asians teaching IPM in Thailand, India, and elsewhere in the Philippines interpreted the technology to the farmers by repeated visits to farmers' fields. They introduced IPM at the pace at which nature and farmers raised problems.

While classes helped the IRRI scientists and farmers become acquainted and began a process of vocabulary sharing, it became clear that the technology should provide the farmers with much more concrete, systematic, and equilibrium-focused management practices and perceptions. The anthropologist's recognition of the effects of cultural differences on perception and management, and her efforts to describe these differences, metaphorically when necessary, were indispensable.

The entire research team now sees agricultural research in the Third World in a completely new light. Even if new technology could be handed over to efficient monitoring and extension services for implementation, the exchange between the farmers and the scientists would still be essential to the process of technology development itself. It is difficult now to imagine any technology as in-place before scientists have involved themselves in extension efforts. In retrospect we realize that scientists all too often drop out of the process of technology development long before it has been completed. The discipline of bringing technology fully to the level at which farmers can use it should be central to all research in technology development.

## PROBLEMS OF INTERDISCIPLINARY RESEARCH

One major problem the scientists on the team had was taking the anthropologist seriously, a problem that persisted throughout the project. Conventions for establishing biological conclusions stress statistical analyses of controlled experiments. Conventions for establishing anthropological conclusions involve repeated observations, cross-cultural comparison, and verification. To a biological scientist analysis always requires quantification. Prose is condescendingly considered as description. To an anthropologist analysis requires only that the scientist satisfactorily address the questions of how and why. Statistics often seem merely to document what we already know, or circularly, what the scientist set out to prove rather than what he actually found. Charts and graphs may be used as gaudy shields to hide the lack of common sense. The anthropologist seems far more willing to give the biological scientists the benefit of the doubt than vice-versa.

When an entomological survey asked farmers to identify insects from pictures or pinned specimens, the scientists concluded that those who could correctly name the insects knew them and the damage they caused. But when the anthropologist insisted that *aksip* was a brown or whitish discoloration near the water surface having to do with storms, irrigation, and fertilizers, the entomologists dismissed her observation as farmers' ignorance of what scientists were sure from their surveys to be whorl maggot.

Indeed, it required the entire 3 years of the project for the scientists to begin to take seriously questions such as whether farmers know or do not know whorl maggot,

whether they perceive it as a part of a more complex phenomenon, and, if so, how the technology should be adjusted.

When the anthropologist predicted that light traps would not work because they were too tedious, the entomologists' response was, "show us statistics." The insights growing from her emergence in village life seemed flimsy and even mystical to the entomologists and prevented them from heeding ex ante warnings that often were correct. That the anthropologist was often proved correct instilled in the team entomologists confidence in her suggestions, but still they were poorly equipped to justify their acceptance to other biological scientists who demand proof in terms of biological conventions.

The most frustrating situation for the anthropologist was to receive the reply, "Sorry, Grace, that's just not possible," when she suggested that technology be developed along certain lines and when she asked earthy questions that the entomologist could not answer. As Table 1 shows, the pest control measures recommended by the entomologists were supported by the literature rather than by their experience. The scientists tended to pass off cracks in their cases as socioeconomic problems. "Get the farmers to plant together and then we can tell you how large a consolidated field is necessary."

The anthropologist at last resorted to putting one of her queries into a trip report after visiting IPM projects in India and Thailand. "What is the minimum size of a group crop management area for effective IPM?" This written challenge to IRRI entomologists sparked a 7-member research project to try to answer the question. Because her question was uncomfortable and the entomologists did not share her perspective nor that of the farmers, it took a formal presentation to push them into action.

Shifting the focus of the team's problems now to the anthropologist's contributions, the staff found that while the entomologists made many miscalculations in devising their original technology, the anthropologist had miscalculated her technology as well. She too operated on some fairly tenuous assumptions. Although she was fully aware that Western forms of organization are rarely found in Southeast Asia and that social and political organization are not easily changed, she did not take advantage of her own knowledge. On the organizational side then, she assumed too readily, just as the entomologists had, that Western models could be made to fit the field challenge at hand. The team's experience suggests that biological scientists too can err in placing too much faith in social science.

Neither the anthropologist nor the entomologists were sufficiently familiar with the givens of the challenge to accurately evaluate *what* should be required, *where* problems would arise, and how *serious* the problems would be. Had they been required to submit a feasibility study, it would have proven to be far off the mark. What the entire team expected to be the *final stage* of technology development turned out to be the beginning of the process instead.

A second bias that the anthropologist brought to the project was that one cannot learn much about farmers' real attitudes, perceptions, and practices from surveys. One of her most vivid first impressions of IRRI had been shock at the extent and manner in which Institute economists frequently surveyed hundreds of peasant households over the large areas on detailed matters (*detailed*, *frequently*, and *large*

all measured by anthropology's norms) without being in the least disturbed by the liabilities of the method.

In addition, the anthropologist had never worked in Southeast Asia before and had not had the opportunity to read the anthropological literature about the region before her appointment. Feeling that she had no foundation on which to judge what to believe from Filipino farmers' reports of their behavior (especially when labor and money were involved), and still reacting strongly to IRRI's unquestioning confidence in the survey method, the anthropologist's bias for seeing rather than asking was strongly reinforced. This was particularly true when investigating central questions about farmers' organizations, with the knowledge that these had become virtually a national fad during the past several decades.

The anthropologist's professional bias to work intensively at a microlevel, at least at first, was greatly strengthened by the research conditions and challenge she faced. Far from being willing to take on survey research, she considered her professional skills stretched to the limit in having to study three villages at once. To a great extent the central research question that IPM development posed called for this intensity and was appropriate to the discipline. To determine whether Filipino farmers could learn to work together in a sustained way along lines of common interest rather than through personal bonds, one would have to know the members of seemingly successful groups quite well.

The anthropologist acquired a working command of Tagalog and of the ethnographic background of each of the villages. She formulated a theoretical understanding of rural social organization for the region and appraised the top-down and the bottom-up approaches within this context. She played a unique role in the development of the new technology by helping the entomologists' understand farmers' agronomic practices and their constraints.

One must, however, explicitly recognize the importance of the microlevel and highly concentrated methodology in anthropology, at least for an anthropologist unfamiliar with a given culture and working on technology development problems that require fine-tuned monitoring. This methodological requirement is fundamental not only to the discipline, but to professional legitimation among one's colleagues and vis-a-vis others (above all, as a pioneering anthropologist in an international agricultural research center).

Yet this methodology poses a serious initial constraint to interdisciplinary work. It means that anthropologists cannot easily leap from one culture to another without a rather intense transition period. And until this period has passed, anthropologists are in no position to produce the vast quantities of information, much less the statistics that institute scientists require as affidavits.

Working in an intellectual environment hostile to qualitative analysis, especially when the hostility comes from social scientists, the anthropologist is seriously handicapped in basic communication skills. Actually this problem never arose with her biological science partner, presumably because he could verify her conclusions for himself in the field. But the problem continually arose at Institute headquarters.

Even her economist colleagues frequently inquired, "How long does an anthropologist need before he or she can start making a survey?"

The point is that regardless of its intellectual merits and its contributions to the interdisciplinary team developing new technology, the anthropologist's traditional methodology may be viewed as inappropriate within the larger sociopolitical context of many research institutions.