Implementing IPM:  
Policv and Institutional Revolution

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ABSTRACT  
IPM technology for tropical irrigated rice in Asia was developed almost 20 yr ago, but its extension has only recently made a significant impact. Initially, national extension systems were unable to deliver training of adequate quality by using conventional training methods. Recently, Indonesia’s National IPM Training and Development Programme, with technical support from the FAO Inter-country Programme for IPM in Rice in South and Southeast Asia, developed a more effective training approach by using farmer-participatory nonformal education methods. This training paradigm is revolutionary in that it transforms the roles of trainer and farmer, and thereby transforms the training process. Farmer-participatory training has the potential to facilitate the large-scale extension of IPM and other elements of integrated crop management. However, wide application of this new approach probably would require radical change in agricultural development policy and institutions.

KEY WORDS  
Rice, crop protection, plant protection, integrated pest management, IPM, farmer participation, multidisciplinary research, extension training, agricultural policy, Farmer First

The word “revolution” is disquieting, but it is an accurate description of the new movement toward farmer participation in agricultural research and development. This paper explains this view in the context of a case study of farmer-participatory extension; namely, integrated pest management (IPM) implementation in Indonesian rice. This case study is complementary to Dr. Bottrell’s paper on farmer-participatory rice research, published as part of this proceedings.

Rice IPM: An Extension Challenge

The value of IPM is well proven for tropical irrigated rice in Asia. Rice can be grown virtually without pesticides by using pest-resistant cultivars and preventative pest control methods. Untrained farmers customarily spray their crop with

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insecticides several times each season, usually with no economic benefit (Marciano et al. 1981, Litsinger 1984, Matteson 1986, Kenmore 1987, Smith et al. 1989, Escalada 1992, Medrano et al. 1993, Rola & Pingali 1993). Moreover, insecticide overuse is known to trigger outbreaks of the key insect pest, the brown planthopper *Nilaparvata lugens* Stål, by killing the natural enemies that usually keep it under control (Kenmore et al. 1984, Ooi 1984).

The International Rice Research Institute (IRRI) and Asian national research programs have been developing IPM technology since 1972 (Reissig et al. 1985, Hansen 1987). Nevertheless, rice IPM extension has only recently made a significant impact (Useem et al. 1992, Matteson et al. 1994). The problem is the difficulty of delivering training of adequate quality on a large scale. IPM is an educational challenge because it is relatively complex and management-intensive. Farmers must learn principles plus the knowledge and skills necessary to apply them. Training must leave farmers confident enough to make independent decisions based on their specific farm conditions.

Interdisciplinary teams tested several rice IPM extension training approaches in Philippine villages between 1978 and 1980. Philippine rural sociologists, community organizers, and extension officers collaborated with an IRRI anthropologist and entomologists to determine the following requirements for effective training (Goodell et al. 1981, 1982, Goodell 1984, Litsinger et al. 1984):

1. Group training so that farmers can learn from each other, with frequent discussions and group reinforcement of decisions;
2. A curriculum pared down to essentials, simplified and with the most important points repeated often;
3. Twenty to 40 hr of good quality instruction in the rice paddy, distributed so that farmers can practice skills and crop protection decision making each week during an entire growing season;
4. Class experiments and demonstrations that engage farmers' curiosity and encourage imaginative inquiry and self-reliance; and
5. Periodic follow-up for one or two seasons while farmers gain confidence in their independent decision making.

These training guidelines worked well on a pilot scale when used by highly motivated, intensely supervised field officers. Even 3 to 5 yr after training, trained farmers' insecticide use averaged one-third less than that of untrained farmers, while their rice yields were equal or higher (Kenmore 1987, Kenmore et al. 1987). However, when extension responsibility was handed over to national agricultural extension systems in the Philippines, Sri Lanka, and Indonesia, the quality and intensity of training dropped too far to change farmers' practices substantially.

**Extension Systems, Motivation, and Training Quality**

National agricultural extension systems in developing countries generally operate according to the "technology transfer" paradigm, under which agricultural research and development is carried out stepwise by a large, multipurpose hierarchy (Fig. 1) (Röling & van de Fliert 1991). Recommendations
RESEARCH
1. Fundamental
2. Applied
3. Adaptive

EXTENSION
1. Specialists
2. Field agents

FARMERS
1. "Contact" farmers
2. "Follower" farmers

Fig. 1. The "technology transfer" paradigm of agricultural research and development.

for farmers are defined after several stages of research. Next, instructional messages about technical packages are passed through a chain of extension officers to a subset of farmers, who are supposed to communicate them to others. In theory, messages pass in the opposite direction as well; in practice this is a "top-down" approach with experts in charge and little feedback from farmers.

The style of extension training at all levels is conditioned by this hierarchical system. Trainer and trainee assume a traditional teacher/student relationship. The trainer, as "expert," dominates, defining the curriculum and tending to lecture. Trainees are expected to be interested, deferential, and unquestioning (Table 1). This type of instruction often fails to motivate trainees because of their lack of involvement, the absence of dialogue, and the resulting unresponsiveness of the training to their actual needs and ideas.

Where training content is concerned, rank and Science are allowed to overshadow farmers' needs. The lower the rank of an extension officer (i.e., the closer the officer is to farmers), the less training and rewards extension officers receive. They are customarily trained between cropping seasons, mostly with classroom lectures on technical subjects. There is little opportunity for hands-on field practice. The curriculum is oriented toward transmitting recommendations;
Table 1. Assumed trainer and trainee roles, conventional vs. participatory nonformal extension training.

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<tr>
<th>Conventional Training</th>
<th>Participatory Nonformal Training</th>
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<td>Trainer</td>
<td>Trainee</td>
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<td>Teacher</td>
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The average extension agent working under these conditions does not deliver the quantity or quality of training that rice IPM requires. Indifference, incompetence, and many conflicting responsibilities result in too few IPM training classes being offered. Classes that are convened often meet in classrooms rather than in the field, with trainers falling back into the accustomed lecture mode. Farmers, unmotivated for the same reasons their trainers are, stop attending classes, and there is no follow-up (Matteson et al. 1994).

The “Revolution” of Farmer Participation

The paradigm described above embodies elitism and authoritarianism, resulting in communication through directives and lack of accountability. These are the things that spark revolutions. In 1789 they allowed Marie Antoinette to tell the starving French people that they should eat cake. They were behind “taxation without representation” in England’s American colonies before 1776. More recently, they have inspired countless occupations of university administration buildings by students protesting against the Ivory Tower.

In the case of IPM extension, “revolution” refers to the demand for change in the current assumptions and procedures of agricultural development institutions and their staff. Democracy and equality must replace authoritarianism and elitism; communication should be through dialogue, not directives; and agricultural development programs have to be answerable to
farmers. This can only be achieved by changing roles and process. Farmers, extension agents, and researchers should work together as equal partners. Each has specialized skills and knowledge to contribute: researchers and extension agents are a source of new technologies and information, and farmers' knowledge, experience, and ideas are invaluable for the development and extension of locally appropriate pest management methods.

Field scientists who belong to what is sometimes called the “Farmer First” school of agricultural development see this new paradigm as a technological necessity (Chambers et al. 1989, Scoones 1994). They argue that conventional top-down agricultural research and development usually fails to produce appropriate innovations. Best results are achieved when farmers participate in every step of the process, applying their intimate understanding of local conditions and constraints, their innovativeness, and their skill at making the best possible living with limited resources.

Conventional top-down extension training is replaced by a more robust training process that centers on farmer participation. Paulo Freire, a Brazilian educator, is a chief proponent of this approach to non-formal education (NFE). He pointed out that adults are most motivated to learn things that relate directly to their life experience. Interest and exhilaration in learning is connected with understanding why things happen as they do and the presentation of knowledge as a tool for action, so that people can change their lives for the better. Freire stresses the need for scientists and extension officers to become collaborators, facilitators, and consultants, empowering farmers to analyze their own situation, to experiment, and to make constructive choices (Table 1). Learning should be dynamic and liberating, spurring people who were passive to become searchers and innovators (Freire 1981, Röling 1992).

**Participatory Nonformal Education for Rice IPM Extension**

Involving farmers in the technology development process is wholly consistent with the IPM goal of making them confident managers and decision makers, eager for new ideas and information but free from dependence on a constant stream of pest control directives from outside. In that spirit, Asian trainers have contributed to the new paradigm. Indonesia’s National IPM Training and Development Programme, with technical support from the FAO Inter-country Programme for IPM in Rice in South and Southeast Asia, custom-designed a participatory NFE approach for rice IPM (Useem et al. 1992, Matteson et al. 1994). Dr. Peter Kenmore, Coordinator of the FAO Programme, catalyzed the key collaboration between an IPM scientist, Dr. Kevin Gallagher, and a training specialist, Dr. Russ Dilts.

“Apa ini.” The same IPM training guidelines (described above) are followed, but the training process and the relationship between extension agent and farmer are changed (Table 1). *Apa ini* means “What is this?” in Bahasa, the official Indonesian language. It is a catchword for the dialogue that ensues because trainers are taught to answer questions with further leading questions instead of acting as the “expert.” They give trainees missing information when it is needed, but only to enable farmers to observe and think for themselves.
Dialogue and discussion guide a discovery learning process in the field. Farmers make their own observations and draw their own conclusions.

**Agroecosystem analysis.** Every week the *apa ini* learning process is combined with agroecosystem analysis for class decision making about pest control. For agroecosystem analysis, a training class of about 25 people divides into five small groups. In sprayed and unsprayed plots, each group notes the stage of the crop and observes field conditions. Then each farmer group analyzes the field situation by making a diagram of that rice ecosystem. Two rice plants, one sprayed and one unsprayed, dominate the diagram. Tiller number, diseased leaves, water level, weather, rat damage, weed density, pests, and natural enemies are all drawn, by using live specimens brought from the field.

With the diagram as the focus of their discussion, group members decide whether any pest control action is necessary and what the general needs of the crop are in the coming week. Then each group presents and defends its summary to the class. Discussion follows. The trainer facilitates by asking questions or adding technical information if necessary. In this way, farmers practice and integrate their skills and trainers evaluate their progress.

**Experimentation.** Farmers' own experiments support this active learning. They keep "insect zoos" to observe life cycles, predation, and parasitism. By removing different proportions of leaves from small marked sections of the paddy, farmers see for themselves how much defoliation the young crop can compensate for. Spraying dyed water (surrogate "pesticide") while wearing white clothes and face mask demonstrates the amount of pesticide to which various body parts are exposed. Plant cuttings absorbing dye in a jar of colored water show how systemic pesticides work and why they can't be washed off of food before consumption.

**Group dynamics.** Games, skits, and songs are a part of the curriculum, as well as the fun side of training classes. They are designed to stress the importance of unity, good communication, and group action. A strong *espirit de corps* is developed among trainees. The group dynamics skills imparted by example during training and exercised in the games prepare farmers to train other farmers in turn.

Farmers and trainers enjoy this participatory training process. Hands-on exploration in the rice paddy is a welcome replacement for the boring lecture mode of most extension training. Both farmers and trainers are motivated by the excitement of new discoveries and the reinforcement of sharing them publicly with others.

The results of this IPM training are the best achieved to date in Asia, in terms of farmers' changed behavior (Useem et al. 1992, Matteson et al. 1994). Experimental data indicate that, on average, insecticide application is economically justified in Asian tropical irrigated rice only once every two seasons, at most (Marciano et al. 1981, Litsinger 1984, Matteson 1986, Kenmore 1987, Smith et al. 1989, Escalada 1992, Medrano et al. 1993, Rola and Pingali 1993). Nevertheless, farmers who have received even the highest-quality IPM training by using conventional teaching methods, while reducing their pesticide use, still typically spray their crop once or twice a season (Kenmore 1987,
Kenmore et al. 1987, Adalla 1990, Matteson & Senerath, unpublished data). In contrast, the first 50,000 farmers trained in Indonesia reduced their insecticide applications from an average of 2.8 sprays/farmer/season to less than one, with the majority of trained farmers not using insecticide at all. This was accomplished without any loss in rice yield (Pincus 1991).

The training described above was carried out on a medium scale (according to Asian standards) by Pest Observers of the Indonesian Crop Protection Directorate, assisted by Extension field agents in an on-the-job training arrangement. The future impact of this IPM training approach as implemented by national extension services and through farmer-to-farmer training has still to be tested. Because of its enhancement of trainer and trainee motivation and the quality of training, this methodology has the potential to boost the effectiveness of large-scale rice IPM training. However, impact on farmers' practices will depend on the quality of the nonformal education process that is fielded.

Policy and Institutional Changes Required

Higher-quality training is needed in response to more complex problems. The participatory NFE approach described above is applicable to all agricultural extension subjects because IPM typifies the integrated crop management that is now required to increase agricultural productivity (Byerlee 1987, Röling & van de Fliert 1991, Pimbert 1991). However, policy and institutional change will be necessary before this type of training can be implemented widely and well (Röling 1992, Barfield & Swisher 1994).

Farmer participation. A genuine capability for, and commitment to, farmer-participatory work is required of both individual scientists and institutions. There is far to go in this regard, the idea having reached only the lip-service stage in most cases. Leaders of agricultural research and development institutions should state this policy often and clearly, incorporate it into program evaluations, and guide by example.

A multidisciplinary approach. Scientists often "cut corners" by trying to meet all program needs themselves, particularly when (as often happens) agricultural development programs are running behind schedule and over budget. An elitist tendency of scientists to underestimate the value of non-science professions and to overestimate the scope of their expertise may play a role. Regardless of how capable scientists are, their best results are unlikely to equal what they would achieve with the help of trained professionals in complementary fields (Barfield & Swisher 1994).

It is not necessary for collaborating specialists to have previous experience with crop protection, as long as they can work closely with a receptive IPM scientist. For example, the social scientists who were instrumental in developing the basic guidelines for effective rice IPM training did so while working with entomologists for the first time (Goodell et al. 1982). Similarly, the Indonesian rice IPM training curriculum and methodology was the fruit of collaboration with a training specialist who had never worked in crop protection before. Scientists simply must be willing to invest time and energy in interdisciplinary dialogue and experimentation. Depending on the specific
needs of an agricultural development program, valuable contributions can be made by specialists in areas as diverse as the social sciences, nonformal education, communications/mass media, women in development, agricultural economics and marketing, environmental ecology, pesticide chemistry, toxicology, medicine, and monitoring and evaluation.

**Human resources development.** The allocation of political support and money for high-quality training is a corollary of commitment to both farmer participation and multidisciplinary work. Appropriate attitudinal and skills training are needed for all levels of staff and for farmers. In extension training, the extension/farmer interface should be given the highest priority. “People skills” such as teaching methodology, communication, and group dynamics are as important as technology. This requires broader instruction and orientation than is presently the norm, and diverse areas of expertise must be melded constructively.

**Decentralization.** Local involvement and accountability reinforce farmer participation (Honadle & VanSant 1985). Decision making about program activities and the way money is spent should be decentralized to facilitate increased responsiveness to local needs. Local government, existing community organizations, and specially formed farmers’ groups should be involved. Likewise, partnership with regional or local agricultural development projects run by non-governmental organizations can be very productive (Matteson et al. 1994).

**New reward systems.** Reward systems will have to be altered to bring about these broad changes. For instance, research funding and topics of study might best be determined by farmer and extension requests from the field, rather than by grants awarded through scientific bureaucracies. Similarly, it might be wise to judge agricultural development scientists by the number of beneficial, farmer-adopted innovations they help develop, rather than by the number of their publications in scientific journals (Barfield & Swisher 1994). Perhaps farmers should play the lead role in the recruitment and evaluation of extension officers.

We are so far from realizing the scenario described in the preceding paragraphs that if those things happen it will constitute a revolution. Except for a few noteworthy examples, some of which have been described in this symposium, agricultural institutions and agricultural scientists still have a long road to travel. That is not surprising, since as in any other revolutionary situation, the people who are presently in control of agricultural development stand to lose most. For this revolution to succeed, we scientists and extensionists must be willing to relinquish much of the power, status, and relative lack of accountability we now enjoy.

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