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# IPM Research, Extension and Implementation

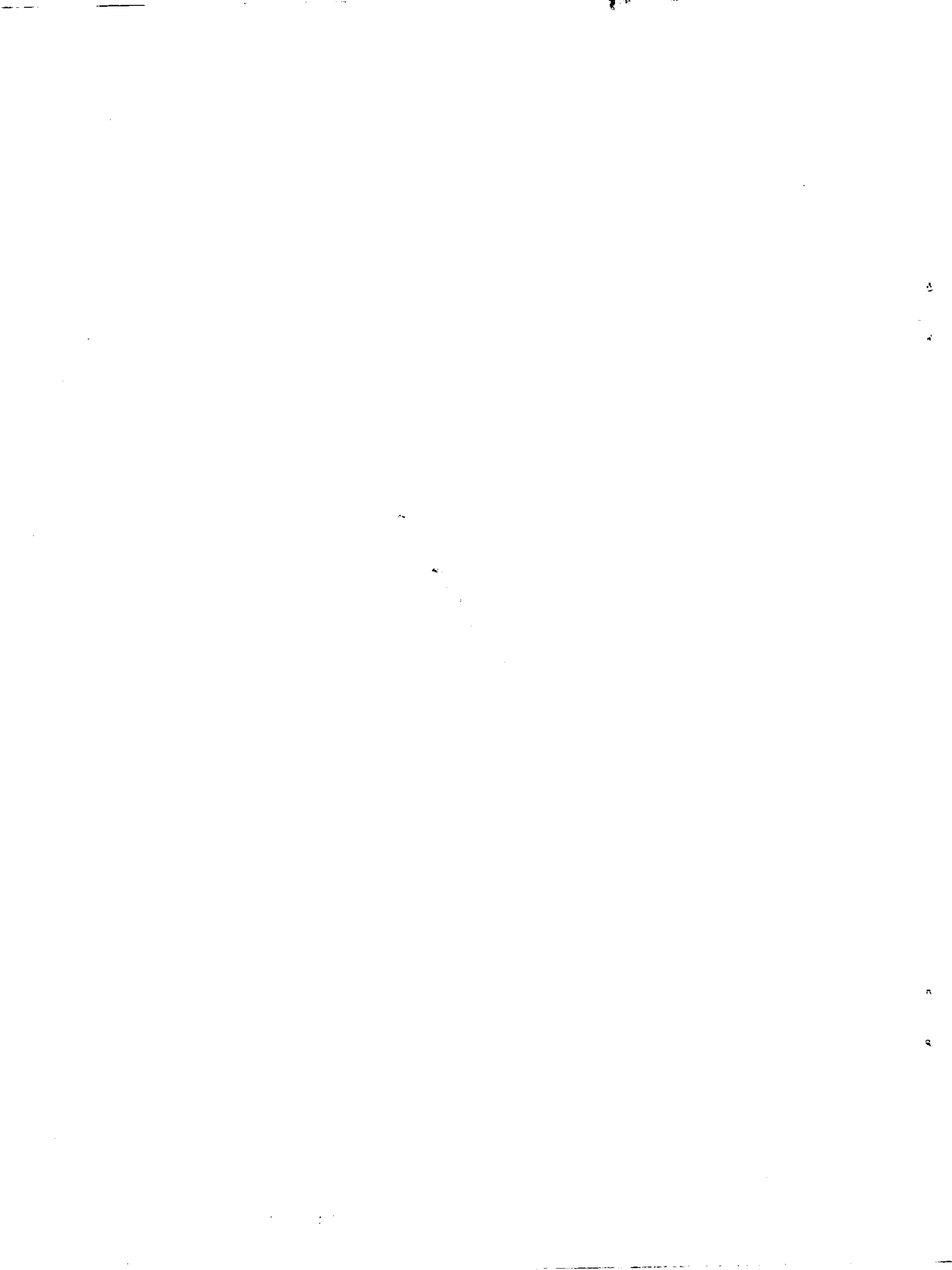
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# 1 The socio-economic context of IPM

## 1.1 Nature of IPM

Many definitions of IPM have been given in literature, of which two are presented here:

1. IPM means a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilises all suitable techniques and methods in as compatible a manner as possible, and maintains the pest populations at levels below those causing economically unacceptable damage or loss (FAO, 1968);
2. IPM is an ecologically based pest control strategy that relies heavily on natural mortality factors such as natural enemies and weather, and seeks out control tactics that disrupt these factors as little as possible (Flint and Van den Bosch, 1981).

Important in both definitions given above are the ecological approach of pest management and the integrated manner of applying all control techniques available. IPM seeks to help farmers become better managers, incorporate natural processes into farming, and reduce off-farm inputs, leading to a more profitable and efficient production, and to better human and environmental health. IPM relies on farmers' increased knowledge, active monitoring and analytic decision making with respect to pest management at the farm level. It preferably applies measures preventing the development of pest populations rather than those controlling pests.

### Exercise 1: Characteristics of IPM

Discuss the differences between the implementation by farmers of two innovations: (1) the use of a pest-resistant high-yielding variety (HYV), and (2) Integrated Pest Management. Write these differences in the table below. From this table, extract the specific characteristics of IPM.

Topic	Difference between	
	pest resistant HYV	IPM
1.		
2.		
3.		
4.		

Topic	Difference between pest resistant HYV                      IPM	
5.		
6.		
7.		

Characteristics of IPM:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_

As all technologies, IPM has undergone an evolution in the course of time as a result of experiences of successes and failures in IPM programmes. Especially in rice IPM, which is most developed thanks to the long-term efforts of the FAO Inter-country Rice IPM Programme in South and South-east Asia<sup>1</sup>, this evolution is obvious. Whereas initially extension workers and farmers were acquainted with sophisticated monitoring schemes and threshold levels, experiences learned that at the farm level these methods were hardly applicable. What seemed to count in the management of rice crops was a sound understanding of ecological processes and some simple guidelines on how to take advantage of these natural processes. Presently, rice farmers in IPM training are acquainted with a set of **principles** rather than with sophisticated technologies. These principles include:

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<sup>1</sup> In full: The Inter-country Programme for the Development and Application of Integrated Pest Control in Rice Growing in South and Southeast Asia. This FAO-managed programme began in 1978, and is funded by the Governments of Australia and The Netherlands.

1. Grow a healthy crop;
2. Observe the field weekly;
3. Conserve natural enemies;
4. Farmers become IPM experts.

With these principles, a set of agronomic and ecological concepts are provided to farmers as tools for their decision making. The farmer becomes (or remains) the central manager and independent decision maker. The knowledge-intensive and farm-specific nature of IPM finds full expression in such an approach.

## 1.2 Actors in IPM

### Exercise 2: Actors in IPM

Discuss and list as many actors involved in IPM research, extension and/or implementation in the table below, as you can think of based on your experience. Actors can be persons or institutions.

Determine for each actor what the field of involvement is by ticking the boxes 'research', 'extension', and/or 'implementation'. Multiple answers are possible.

Actors	research	Involved in extension	implementation
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

In most IPM programmes, farmers are the end beneficiaries, the final IPM implementors and decision makers. Specifically, as derived from the four IPM principles mentioned above, competent IPM farmers display the following behaviours:

- focus on a **healthy crop**, resistant to local diseases and able to compensate for pest damage;
- a **good knowledge of pests and their natural enemies**, not in terms of their (Latin) names, but in terms of function, what they do to plants and to each other at what stage of the crop;
- **regular and systematic observation** in the field, using systematic procedures to assess the occurrence of pests and natural enemies in relation to the crop's development stage;
- **sound decision making** and discussion with other farmers about such decisions. The process of decision making is more important than the decision itself;
- **experimentation** with planting times, varieties, soil cultivation practices, fertilisation, rotations, biological control, etc.;
- **use of relevant, science-based knowledge**, such as the regenerative capacity of crops after pest damage, or the influence of egg parasites;
- 
- 
- 
- 

In most cases, training is required to capacitate farmers for becoming such (competent) IPM implementors. Activities of all other actors in an IPM programme are expected to be directed to the final implementation by farmers. Programmes should, beforehand, determine well who are the specific end beneficiaries, and what are their needs, constraints, possibilities and limitations.

### 1.3 Objectives of IPM and IPM training

#### Exercise 3: Objectives of IPM

Discuss what are the objectives of IPM considering three different angles: (1) agronomy, (2) economy, and (3) social/community aspects. Write the answers in the table below.

Agronomic objectives of IPM
1.
2.
3.
Economic objectives of IPM
1.
2.
3.
Social/community objectives of IPM
1.
2.
3.

As stated before, intensive training is mostly needed for farmers to be able to effectively implement IPM, so that the given objectives can be achieved.

#### Exercise 4: Objectives of IPM training

Discuss what are the **objectives of IPM training**, considering the objectives of IPM determined above, and the expected behaviour of IPM implementors. Write the answers in the table below.

Objectives of IPM training
1.
2.
3.
4.

## 2 Agricultural extension

### 2.1 Introduction

What is extension? This question does not seem easy to answer straightforwardly. In different languages, words with different meanings are used for the comparable set of activities that we usually translate to 'extension' in English. The following list gives a few examples (Wapenaar et al., 1989):

American English: '*extension*', derived from the tradition of universities to **extend** the work and knowledge generated through scientific research to groups outside the walls of the university;

British English: '*advisory work*';

French: '*vulgarisation*', or popularisation, meaning to **simplify** information and concepts for and transfer it to the common people; or '*animation*', meaning animation or inspiration which implies the process of **stimulating** and **mobilising** people;

Spanish: '*capitacion*', indicating that people are **capacitated** to find out for themselves what is best for them, by helping them to determine their needs and goals, and showing them possibilities to achieve these goals;

Indonesian: '*penyuluhan*', and Dutch: '*voorlichting*', both meaning elucidation, enlightening, implying that through **providing information** and **giving an example** a 'light is cast' on unknown matters.

The differences between the various meanings relate to issues such as: (1) whether the extensionist aims at only opinion forming of his/her clients, or also decision making; (2) whether mainly knowledge increase of clients is intended, or also awareness raising, problem identification and setting of own objectives; and (3) whether the extensionist thinks that his/her opinion or decision is the best for the client, or rather assists the client to make his or her own decision. This diversified understanding of extension has resulted in numerous definitions of extension. Rather than stating some of these definitions, some essential elements that occur in most of the definitions are given in Box 1.

#### Box 1

##### Basic elements of extension (Röling, 1988)

1. Extension is an intervention.
2. Extension uses communication as its instrument to induce change.
3. Extension can be effective only through voluntary change.
4. Extension focuses on a number of different target processes and outcomes which distinguish it from other communication interventions.
5. Extension is deployed by an institution.



Against this background, the following sections discuss several aspects of agricultural extension, including the processes of extension (§ 2.2), extension approaches in connection with research, extension and farmer linkages (§ 2.3), and some basic elements of planning extension activities (§ 2.4). For further reading on extension science, the books written by Van de Ban and Hawkins (1988) and Röling (1988) are recommended.

## 2.2 Processes in extension

### *Top-down and bottom-up*

Extension activities are usually planned and implemented in cases where problems have arisen and a change is desired. In the most favourable situation from an extension point of view, it is the final target group who identifies the problem and requests for specific assistance of some extension agency (the bottom-up approach). In some cases (like the Dutch private agricultural extension service), the clients even pay for the advice given to them. In other cases, however, it are government officials, researchers or foreign development workers who "decide" that the people are experiencing some problem and need assistance, or that the nation is disadvantaged by the behaviour of certain groups in the community (the top-down approach).

Extreme examples of top-down interventions are the (often coercive) introduction of high-input technologies during the early days of the Green Revolution in many parts of Asia, and aggressive campaigns to promote family planning in several developing countries. Most often, a problem is, indeed, felt by the target group, but it are the researchers, extensionists and/or government officials who decide what measures and assistance is needed to solve the problem, which is still considered a top-down approach. Sections 2.3 will give examples of top-down and bottom-up extension models.

### Exercise 5: Examples of top-down and bottom-up extension programmes

Give two examples of agricultural extension programmes or activities, one of which applies a top-down approach, and the other of which a bottom-up approach. Describe some characteristics of the two programmes following the aspects given in the table below.

	Top-down	Bottom-up
Title of project		
Cropping system		
Main goals		
End beneficiaries		

	Top-down	Bottom-up
Actors/executing institution(s)		
Type of extension activities		
Features making the activity top-down/bottom-up		

As stated in Box 1 above, extension can be **effective** only through voluntary change. This point is of major importance, and bears the inherent consequence that the intervening party (the extensionist) can only use the intervention to **assist** clients in achieving their objectives. This implies a bottom-up approach of extension. Researchers and extensionists have to listen well to farmers and help them identify what are their real problems, and what are feasible solutions. Extension is **not** an instrument that can force people against their will, although sometimes extension programmes are accompanied by policy measures, such as subsidies and regulations. Such measures often have a strong influence on people's behaviour.

#### *Communication*

Communication as the instrument for extension can, in itself, be very powerful, provided that it is employed in a strategic and tactical way, and serving clearly defined objectives. Communication can be defined as **'the process in which information is transferred from a sender via a channel to a receiver, aiming at inducing a certain effect within the receiver'** (Van Cuilenburg and Noomen, 1984). As Röling (1988) states, communication requires shared meaning, otherwise the encoding of a message by the sender and its decoding by the receiver would not lead to the intended effect on the receiver. The strategic use of communication to induce behaviour change is, therefore, dependent upon the extent to which meaning is shared between the intervening party (e.g. the extensionist) and target clients (e.g. the farmer). Another important consideration is that communication intervention aims at changing **people, not things**.

Communication always takes place within a certain **context** (Wapenaar et al., 1989). Three aspects of context seem to have a major influence on communication processes, which are:

1. Cultural aspects: language, prevailing values, opinions, customs and habits;
2. Sociological aspects: social and power structures within a community, position of intervening party in these structures;
3. Economic aspects: economic impact as a result of the intervention, cost of the intervention itself (efficiency, cost-benefit ratio).

### Learning

Learning is a process that takes place in the brain as a result of new information and experiences. It is an indispensable process preceding changes in knowledge, attitude and skills of a person, and, therefore, of utmost importance for extension programmes. In fact, extension seeks to facilitate the learning process of the target clients in order to make them more capable to fulfil (social) tasks and/or to achieve their own objectives. Learning, and thus facilitation of the learning process, can be done in various ways (see Box 2).

### Exercise 6: Several ways of learning how to make a knot

Type of knot	Colour of yarn	Succeeded?	Method of instruction/ way of learning
Eight-knot	blue		
Lasso noose	yellow		
Bowline knot	green		
Reef knot	red		

Effectiveness of learning depends on the method of instruction or facilitation of the learning process, the way of absorbing the new information or experience, but also on the learner his or her habits of learning. A student who is used to following lectures daily will more easily gain knowledge from listening to the lecturer and reading books than a farmer who is out in the field and learns continuously from observations, experiences and experiments. When the farmer is invited to a lecture at the university (which might contain very applicable information for his farming practice), he or she maybe falls asleep after half an hour. Vice versa, if the student is invited to the field to learn about pest insects and natural enemies, he or she might faint after half an hour because of the burning sun, and probably does not notice half of the insects that the farmer spots at a glance. Nevertheless, people can **learn to learn** in a certain way.

Through learning one thing, people often **unlearn** other things. This can be either favourable or unfavourable. An example was observed among Indonesian rice farmers who as a result of the national rice intensification programmes **learned** to use high-yielding varieties, fertilisers and pesticides (Van de Fliert, 1993).

**Box 2**  
**The philosophy of learning**  
(Source: Indonesia National IPM Programme)

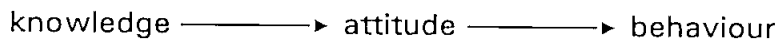


If I hear it, I forget it  
If I see it, I remember it  
If I practise it, I understand it  
If I discover it myself, I own it for life

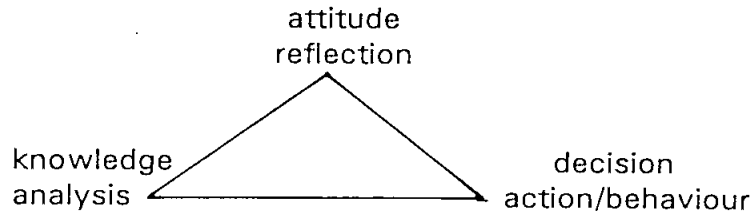
These inputs were all provided in a ready-made package that only needed to be applied. However, many of them **unlearned** to think for themselves, observe their field and assess what their crops really needed. In cases of pest outbreaks, they were often too late to apply a control measure, because they did not know what was happening in their fields. In extension (and other intervention) programmes, we have to be very careful and aware of the unwanted effects that we might induce as a result of our intervention.

*Decision making and behavioral change*

In sociological sciences, a change in behaviour is often considered to be a result of, first, a change in knowledge, and, second, a change in attitude, a causal relation which can be depicted as follows (Wapenaar et al., 1989):

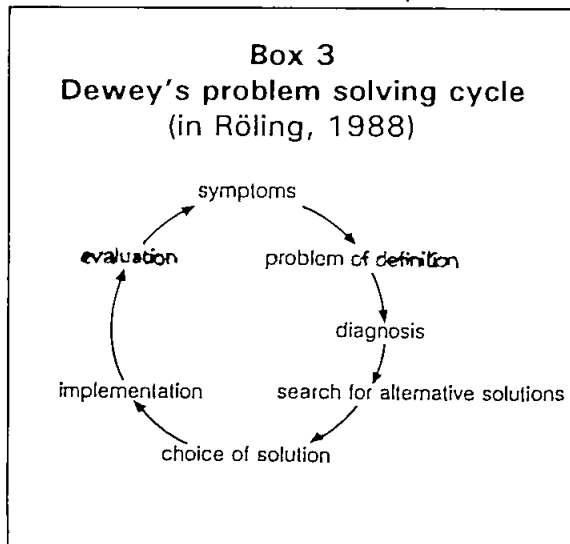


Based on this assumption, many so called 'Knowledge, Attitude and Practice' (KAP) studies have been conducted to plan and evaluate intervention programmes. However, there is no hard proof that this causal relation is true, and there are many cases showing behavioral change as a result of other processes. Therefore, another picture showing aspects related to behavioral is suggested (Wapenaar et al., 1989):



The sequence of the various aspects is not of major importance, but what counts is that the aspects are mutually consistent. This means that in an extension intervention, we have to assess the 'status' of the independent factors, and see how we can best intervene at what level.

Decision making is an important (and complicated) element in the whole process of coming to a change in behaviour. Since agricultural extension programmes intend to influence farmers decision making, it is useful to understand the process of decision making a little bit better. One model for decision making is presented in Box 3: Dewey's problem solving cycle (in Röling, 1988). An extension programme can intervene and help at all steps of the cycle (Wapenaar et al., 1989):



(1) assist in problem identification and definition, (2) assist in determining causes of the problem(s), (3) providing alternative solutions, (4) assist in weighing advantages and disadvantages when choosing an appropriate solution, (4) training in skills, and (5) help analyse the impact during the evaluation process.

It should be realised that the problem solving cycle in Box 3 is a normative model, implying that there is no start and finish, and that the sequence of the steps that are taken is not fixed. In practice, when taking a decision, we often jump several steps ahead or even backwards.

*Adoption and diffusion of innovations*

Adoption is an **individual** process of decision making whether to adopt or reject an innovation or a new concept. **Diffusion** is a social process of how an innovation spreads within a community after having been introduced. Rogers (1962; 1983) determined the following stages in the adoption process:

1. Awareness: first hear about the innovation; knowledge;
2. Interest: seek further information about it; persuasion;
3. Evaluation: weigh advantages and disadvantage; take a decision;
4. Trial: test the innovation on a small scale; implementation and confirmation;
5. Adoption: apply the innovation on a large scale; internalisation (or rejection).

Exercise 6: Characteristics of farmers which are favourable and unfavourable to the adoption of innovations

What characteristics of farmers are favourable to the adoption of modern agricultural technologies? Discuss and list these in the table below. Do the same for the characteristics unfavourable to adoption.

Favourable	Unfavourable
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.

Numerous studies have been done on adoption and diffusion of innovations. The table in Box 4 shows a selection of 15 variables that were found to be related to innovativeness (or adoption index).

It is debatable whether the variables in Box 4 hold for all innovations or new concepts introduced to communities. IPM, for instance, enhances changes in farmers' decision making behaviour. Therefore, it is hardly appropriate to call it an 'innovation'. Most of the extension programmes that have been studied in adoption research were technological innovations, often applying a top-down approach. Common symptoms of such programmes are that the technology is usually adequate only for a top layer of already modern, innovative farmers, and that the farmers approached by the extensionists are exactly these better-off farmers. As Röling (1988) stated it: 'Extension workers and progressive farmers attract each other like magnets.' And Havelock (1969): 'Those who need information less get most of it.' In different situations there are different reasons for this phenomenon.

**Box 4**  
**Selection of 15 variables related to innovativeness,**  
**and percentage of studies supporting relationship**  
 (Röling, 1988, based on Rogers, 1983)

Variables related to innovativeness	percentage of studies	number of studies
<i>Socio-economic variables</i>		
1. Education (positive)	74	203
2. Literacy (positive)	63	24
3. Social status (e.g. income, possession of wealth, self-perceived social class (positive)	68	275
4. Size of (farm) unit, access to land (positive)	67	152
<i>Personality variables</i>		
5. Rationality (positive)	79	11
6. Attitude towards change (positive)	75	43
7. Attitude towards science (positive)	74	20
8. Fatalism (negative)	82	14
<i>Communication</i>		
9. Social participation (positive)	73	109
10. Cosmopolitaness (positive)	76	132
11. Change agent contact (positive)	87	135
12. Mass-media exposure (positive)	69	80
13. Exposure to interpersonal communication channels (positive)	77	46
14. Active information seeking (positive)	86	12
15. Opinion leadership (positive)	76	42

Exercise 7: Reasons why progressive farmers benefit most from extension

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_

It is also very interesting to look at reasons for non-adoption. The table in Box 5 gives a good overview of beliefs and approaches through history. Whereas in the early days the farmers were considered stupid and not knowing what was good for them, later it was understood that it was mostly the technology that

**Box 5**  
**Research and extension: beliefs and modes, 1950-2000**  
 (Chambers, 1991)

	Explanation non-adoption	Prescription	Key activities	(Socio-economic) research frontier
1950s 1960s	Ignorance	Extension	Teaching	Adopters/ laggards etc.
1970s 1980s	Farm-level constraints	Remove constraints	Input supply	Constraints analysis FSR
Late 1980s 1990s	Technology does not fit	Change the process	Farmer participation	How to enhance farmers' analysis, competence, experiments, choice Also "our" behaviour and attitudes

did not fit to the majority of farm(er)s in a heterogenous populations. It is realised that farmers know exactly what is best and applicable for them.

Rogers (1983) recognised four characteristics of an innovation affecting the rate of adoption and, in turn, the rate of diffusion:

1. relative advantage;
2. compatibility;
3. complexity;
4. triability, and
5. observability.

Relative advantage, defined as the degree to which an innovation is perceived better than the idea it supersedes was considered to be determined by economic factors (e.g. profitability, low initial cost, savings in time and effort) and social status aspects.



## 2.3 Extension approaches and research-extension-farmer linkages

### *Transfer of technology*

The conventional approach of agricultural extension is the Transfer of technology (ToT) model. The model represents a linear information flow:



Research generates a new technology which is transferred through the extension service to be utilised by the farmers. Linkages are simple and one-way, there are no feedback mechanisms. The ToT model is deeply embedded in our thinking, and many development programmes still rely heavily on the approach (although many variations have evolved in practice). Although it has worked in the past in several cases of industrial and Green Revolution agriculture, history has shown that this approach is not the most effective model of extension, especially not for the resource-poor farmers.

### *Training-and-Visit system*

The most widely applied extension model using a ToT approach is the Training-and-Visit (T&V) system. T&V is introduced in at least forty (most developing) countries by the World Bank, and intends to be a form of extension management that relies heavily on diffusion processes (Benor and Harrison, 1977). It emphasises regular training of village extension workers and designated 'contact farmers'. In addition, it seeks to enhance linkages between extension and research. The system aims at upgrading the technical content of field extension activities, while making the field workers' contacts more predictable and thus more accessible to farmers, and more enforceable to the supervising ranks of the extension service.

The extension channels in the T&V system comprise several levels, in that village extension workers who operate at the field level are supervised by extension officers at subdivision level, who in turn are supervised by officers of the next administrative level, and so on until direct supervision by the extension headquarters. Subject Matter Specialists (SMS), in close contact with research institutions, are designated to support the various levels with the latest information on agricultural technology developments. The village extension workers are trained on a biweekly schedule by their direct supervisors supported by SMSs. They receive chunks of information to pass on to their farmers in the next period of two weeks. Farmers in the jurisdiction of a village extension worker are divided into farmer groups. About 10% of the farmer group members are selected to become 'contact farmers'. These farmers have to be visited once in two weeks to receive the recommendations for that period. The contact farmers, in turn, are supposed to convey the extension messages to 'follower farmers'. With this system, information is expected to flow from research via subject matter specialists and (village) extension workers, to contact farmers and, finally, to follower farmers.

### *Constraints of T&V*

According to the T&V model, village extension workers are supposed to meet representatives of each of their farmer groups once in two weeks in order to convey the recommendations received in their own training. In practice, this is seldom realised (e.g. Wijeratne, 1989; Moris, 1983). Often heard complaints of village extension workers are that the working area is unmanageable, and that incentives are not equivalent to the tedious work of paying field visits to farmers in often remote locations, day after day. In Indonesia, for instance, village extension workers often need to have other income-generating activities, such as trading and farming, which might take so much time of the extension worker that there is little time (and motivation) left for visits to farmers' fields. Extra incentives are obtained from a credit point system determining the career advancement of extension staff (Box 6).

#### **Box 6**

#### **The credit point system in Indonesia's extension service**

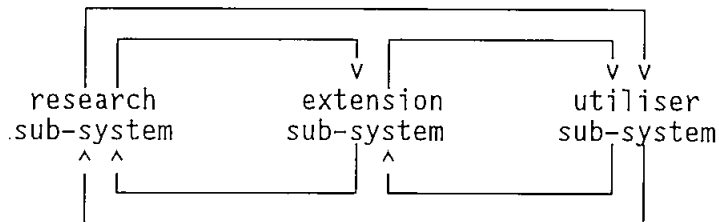
An extension worker in Indonesia must have a certain number of points to be promoted from one career level to the next. It becomes increasingly difficult: as one gets higher, one needs more points to make the next step. Points are awarded by superiors for specific activities. This credit point system does not favour services to farmers. A visit to a farmer group gives only 0.007 points, whereas making a seasonal work plan gives two points, and participating in a 60-hour training course at central in-service training centres, one point. With such a system, it is not hard to imagine that extension workers can sooner be found at the REC writing reports than in the field.

Other commonly observed weaknesses of the T&V approach are that messages conveyed to farmer group leaders are not implemented, and/or do not trickle down to the follower farmers as expected according to the model. Several reasons have been mentioned in the literature to explain these phenomena. The biweekly chunks of information passed on to village extension workers are often not appropriate to the conditions in the field and the practices of farmers by the time the recommendations reach them (Wijeratne, 1989). Farmers having contact with extension workers are usually the better-informed, more innovative and wealthier farmers anyway (Havelock, 1973; Röling, 1988), who can afford to try out new technologies. Dissemination through communication between these and other farmers is not guaranteed, intentional or not. The 'trickle-down' approach is often criticised for increasing the gap between rich and poor (Adams, 1982).

### *Need for alternatives*

In extension science, the concept of agricultural information systems, which applies a systems approach to extension (Röling, 1988), made us understand

that extension is a sub-system that can not be looked at in isolation from the research and utiliser subsystems. For effective communication (the instrument of extension), these sub-systems need to be mutually linked and in continuous interaction with each other, allowing ample opportunities for feedback, as is illustrated in the following model of a simple agricultural information system:



For agricultural information systems to function well and be meaningful, the origin and focus of all activities should be the needs of the farmers. These needs should be well identified together with the farming community, not to forget that the farming community is not homogenous and consists of various categories of farms and farmers.

Alternative extension approaches different from the transfer of technology model have drawn a great deal of attention in recent years. Over the last two decades On-Farm Research and Farming Systems Research gained interest from researchers, although research activities on farms have taken many forms (Chambers et al., 1989). Some researchers have essentially transplanted research objectives and methodologies from the experiment station to the farm, while others attempted to incorporate the farming system and the farm family in the research. Lately, the emphasis is rather on building of farmers' capacity to access external information when they need it, on developing farmers' ability to experiment and draw conclusions, on enhancing farmers' individual and collective ability to take sound decisions, and on 'empowerment' to improve their socioeconomic position vis-a-vis other groups. A few of these approaches are discussed below.

#### *The five-element model*

An important development in recent years is the recognition that innovations usually do not only require external supply of new technology, but also the development of internal capacity to innovate. In other words, it is not only the supply side that counts, but also the demand side. External input of technology and capacity development are complementary essentials for innovation. Most public sector extension agencies focus only on transfer of technology. As was described above, this often leads to innovation among those farmers who have the capacity to innovate already. Especially small farmers are by-passed and eventually squeezed out of farming. In response to this world-wide phenomenon, another approach has been developed, especially by NGOs. This

approach, coined the **five element model** (Röling and De Zeeuw, 1983), recognises that five elements form an essential 'mix' (Box 7).

### Box 7

#### The five element model

The "five element model" comprises a mix of the following five elements essential for rural development (Röling and De Zeeuw, 1983):

1. **mobilisation** to create awareness and commonality of purpose;
2. **organisation** to create platforms for consensus building and for taking communal action;
3. **training** to empower, capacitate and provide skills (e.g., leadership, bookkeeping);
4. **tangible opportunities**, e.g. credit, markets, technologies, which allow improvement of livelihoods;
5. **mix management**, usually by an NGO, or an apex organisation of farmers, to coordinate the elements and help protect the initial stages of the process from vested interests.

Most effective agricultural knowledge systems are characterised by a high degree of farmer control over research, extension and other institutions (Röling, 1988). In the Netherlands, for instance, farmers routinely form part of programming committees for research and extension. Through their organisations, they wield considerable power at the political level. They run the (cooperative) agricultural banks and auctions. Through their organisations, they determine how the budgets of experiment stations, experimental farms and the recently privatised extension service, to which government contributes only 50% of the costs, are to be spent.

#### *Nonformal Education principles*

An alternative perspective on extension to discuss next is **Nonformal Education (NFE)**. NFE is defined as 'the fostering of quality-of-life enhancing learning outside the formal school system'. It explicitly recognises human values as a pre-requisite for learning and is based on Paulo Freire's (1972) perspective on education as a problem-solving, consciousness raising strategy for empowerment. Education as an empowering process places importance on how educational processes and relationships affect the learners, not only on the contents (Kindervatter, 1979). Therefore, NFE emphasises experience-based learning linked to living problems. It seeks to empower people to actively solve those problems by fostering participation, self-confidence, dialogue, joint decision making and self-determination. Group dynamics exercises are an important part of learning because they improve the capacity to learn and take decisions. Large-scale IPM programmes in Asia applying principle of NFE in training are achieving amazing results, indicating that this approach is very suitable for extension for sustainable agriculture (Van de Fliert, 1993).

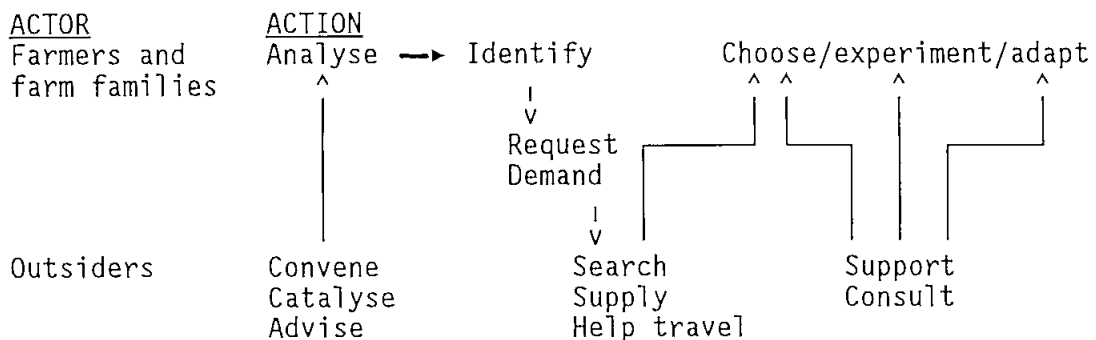
An important element of NFE is group dynamics since good group collaboration can reinforce the learning process (and collective application afterwards of what was learned, something of major importance for IPM). Group dynamics exercises can serve various purposes: facilitate introduction of group members and acquaintance, be an ice-breaker, enhance creativity, collaboration and communication.

*Participatory technology development*

Chambers and Jiggins (1986) reversed conventional thinking by emphasising that farmers are experimenters and technology developers themselves, instead of only users of the findings of scientists. In fact, the entire development of agricultural systems before 1850, including irrigated rice systems in Java, was developed by farmer-researchers. An important approach to developing agriculture is, therefore, to assist farmer experimentation by (1) creating stable networks of experimenting farmers as platforms for reaching consensus about problems for research, and for discussion of experimental design and its results, and (2) by training farmers to set-up and draw conclusions from experiments. Systematic attempts to assist farmers in becoming better researchers are emerging across the globe.

*Farmer First approach*

A far-going approach applying the concept of participatory technology development, recently gaining more and more attention, is the 'Farmer First' model (Chambers et al., 1989). This model evolved out many research experiences in which farmers were heavily involved. In several cases, the ideas and objectives for research even came from farmers. Farmers' major activities in the collaboration with researcher are **analysis, choice and experiment**. Roles of scientists and extension worker change dramatically, which appeared not always easy to accept. 'Farmer First' does not depart from the vested institutions, but leaves it to the farmers' demands what persons or institutions are needed to assist them in a certain situation. A picture showing linkages between farmers and outsiders (researchers, extension workers) looks as follows (Chambers, 1991):



Extension workers and researchers become conveners, catalysts and consultants, searchers and suppliers, and maybe even travel agents in some cases to enable farmers to go and learn from others. In Indonesia, cross-visits and seasonal meetings among farmer groups have proven to be very effective mechanisms for farmers to learn, compare, analyse results, adapt technologies tested, and plan new activities (Van de Fliert and Velasco, 1994). This effectiveness is mainly a result of the fact that farmers learn much more and better from other farmers who speak the same language, than from outsiders (often urban-based and scientific). Having the experience of developing or adapting technology themselves, farmers appeared to become very strong trainers for other farmers.

There is evidence and argument that farmers' participation in the research process can be crucial for later implementation and dissemination (Chambers, 1991). This approach contrasts with the transfer of technology mode, but should also be seen as a complementary means to (more fundamental) research in research stations, not as an alternative or replacement. The table in Box 8 compares several aspects of the two approaches.

**Box 8**  
**Transfer of technology and farmer-first compared**  
 (Chambers, 1991)

	Transfer of technology	Farmer-First
Main objective	Transfer technology	Empower farmers
Analysis of needs and priorities by	Outsiders	Farmers assisted by outsiders
Transferred by outsiders to farmers	Precepts Messages Package of practices	Principles Methods Basket of choices
The 'menu'	Fixed	<i>A la carte</i>
Farmers' behaviour	Act on precepts Adopt, adapt or reject the package	Apply principles, use methods, choose from basket, experiment
Outsiders' desired outcomes emphasize	Widespread adoption of package	Wider choices for Farmers' enhanced adaptability
Main mode of extension	Agent-to-farmer	Farmer-to-farmer
Roles of extension agent	Teacher Trainer	Facilitator, searcher for and provider of choice

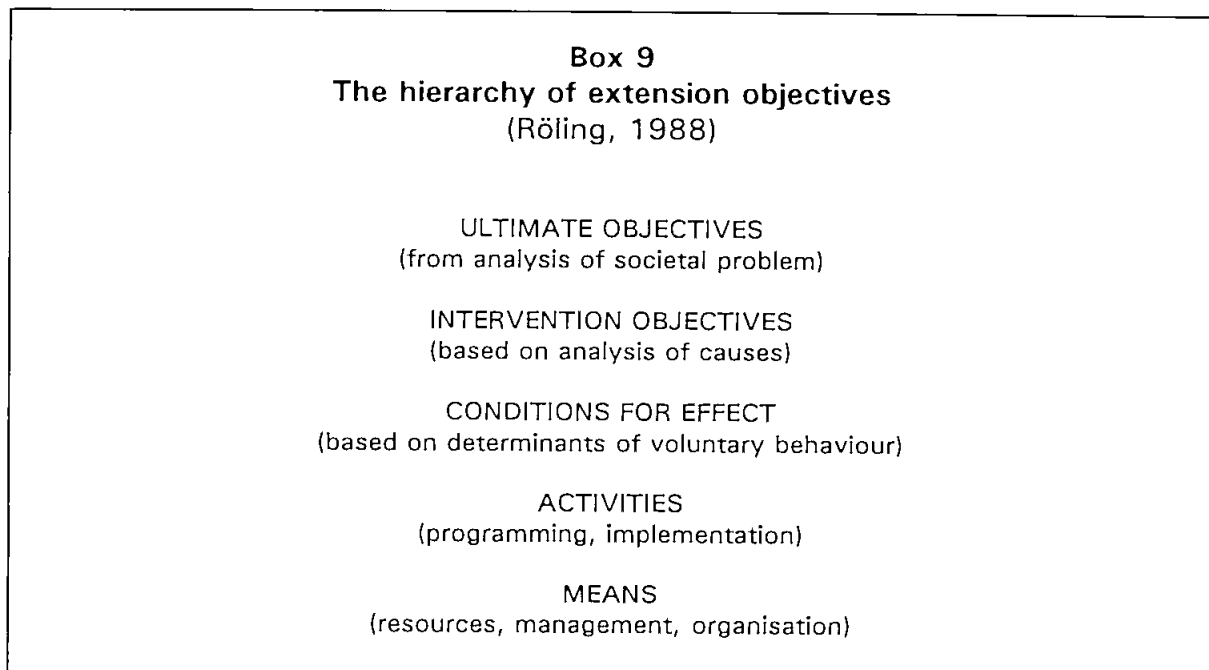
## 2.4 Planning of extension activities

### Exercise 8: Steps in planning an extension activity

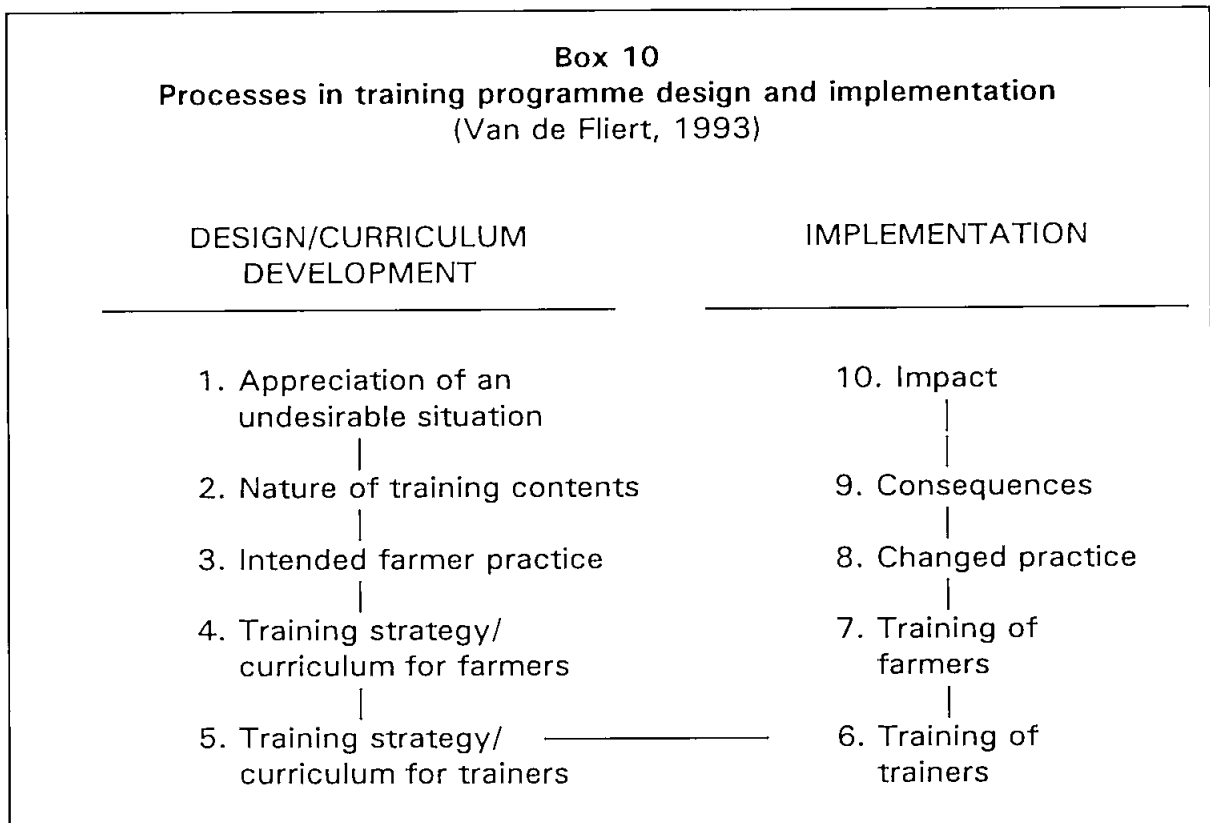
List the activities that have to be undertaken when planning an extension activity, e.g. a small-scale training programme on the use of biological control in upland cabbage. Determine the order in which action should be taken.

- 1.
- 2.
- 3.
- 4.
- 5.

Before planning and implementing an extension activity, objectives of the intervention have to be clearly defined. Röling (1988) distinguishes five major extension objectives that stand in a hierarchal relation to each other (Box 9). This hierarchy of objectives derives logically from the problem solving cycle presented in Box 3.



The **ultimate objectives** of extension are the overall goals to which the extension intervention hopes to contribute to help solve a societal problem (likely through more interventions than extension only). The **intervention objectives** are those which the extension intervention is supposed to achieve as a direct result of its own effort. These objectives must always be phrased in terms of changing some voluntary behaviour. The **conditions for effect** are those which must be satisfied to realise the determinants of the voluntary behaviour seen as a cause of the problem. The **activities** constitute the planning and use of methods. At last, the **means** refer to the equipment, money, staff, organisation and management skills available to carry out the intervention. Often, most attention is paid to the last two levels, but these can only be effectively handled when the first three objectives are clearly defined.



Planning and implementation of an extension activity should also follow a logical sequence. Box 10 presents the stages for design and implementation of training programmes. This framework has been used as a guideline in a village level evaluation study of the National IPM Programme in Indonesia (Van de Fliert, 1993). Stage 1 in the framework is the actual situation in which problems have occurred giving the impetus for planning an intervention to change. Stages 2 to 5 on the left are the elements and processes in the planning, design and curriculum development of a training programme to meet these problems. Nature of the training contents and the intended practice of the beneficiaries are



defined, from which training strategy and curriculum for, first, farmers and, then, trainers are deduced. The stages on the right describe what happens when the programme is implemented: training activities in stages 6 and 7, and outcome of training in the stages 8, 9 and 10. Outcome distinguishes three different levels: effects of the training at the level of farmer practice (including perceptions and decision making) in stage 8, consequences of changed practice at the farm level in stage 9, and the impact of the implementation at a higher level of communities and their environment in stage 10. Elements in the implementation phase relate to elements in the design phase on the same horizontal line.

A last subject to be discussed here is the targeting of extension interventions. Prior and careful targeting is of major importance in order to reach the appropriate target audience and to make sure that certain groups or are not overlooked (which often happens, for instance in the case of resource-poor and women farmers). It is not realistic to perceive communities as homogenous (target) groups, as everybody knows but which is often not reckoned with in planning extension activities. Within a target community, various target categories (as well as non-target categories) can be distinguished. These target categories should be well defined first, using well defined criteria, before deciding on contents of a programme, methods and means. Certain technologies might not be applicable for certain groups of farmers. Determining and deciding on target categories to be addressed by the extension activity should be done at an early stage of the programme planning, and best be related to the defining of objectives.

### 3 Role of extension in IPM

#### 3.1 Introduction

As discussed in the previous chapters, IPM can be characterised by its knowledge-intensive and farm-specific nature which requires strong decision making skills of farmers. To such an approach of IPM, preset recommendations in a package had proven to be inadequate as an extension medium. Instead of mechanical instructions for field sampling and spraying based on centrally determined economic threshold levels, IPM requires a more ecological approach. Instead of instructions and standard packages, IPM a better served with a set of principles. This has major implications for the mode of extension to be used for the dissemination of IPM.

This chapter will discuss some common constraints occurring in IPM programmes (§ 3.2), the nature of IPM extension (§ 3.3), and the evaluation of IPM programmes (§ 3.4). Viewpoints and examples in this chapter are biased to humid tropics/rice cropping systems and to Asia, since the author's experiences lie mainly in these areas.

#### 3.2 Common constraints in IPM programmes

##### Exercise 9: Constraints experienced in IPM programmes

Discuss in small groups what constraints have been experienced, so far, in conducting IPM programmes. Group the constraints distinguishing technical, extension/institutional and socio-cultural constraints, and list them in the table below. State briefly how these constraints can be tackled.

	Possible solution(s)
<u>Technical constraints:</u>	
1. _____	
2. _____	
3. _____	
4. _____	

<p><u>Extension/Institutional constraints:</u></p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p> <p>4. _____</p>	
<p><u>Socio-cultural constraints:</u></p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p> <p>4. _____</p>	

The National Research Institute (NRI) conducted a postal survey several years ago investigating six IPM programmes in different crops and different countries. The results published in a book (Iles and Sweetmore, 1991) report an interesting collecting of constraints (realising, though, that in this survey only programme managers were heard, not farmers and field staff), of which a part is presented here:

**Technical:**

- adaptive research is deficient (pasture, Costa Rica);
- there is a need for adaptation of the recommended economic injury levels for insects causing new problems (soybean, Brazil);
- the technologies of IPM which originated in the developed world (aiming at maximum profit per area unit) are not always relevant to tropical agricultural systems (in need of sustainability and highest return to local investment) (maize, Latin America);
- technological packages offered are often too complicated and not easily absorbed by the traditional farmer (maize, Latin America);
- research is needed on weeds (soybean, Brazil), and rats (rice, Asia);
- there is conflict between national and international research centres (rice, India).

**Extension/Institutional:**

- the quality of the extension service varies from region to region (soybean, Brazil); extension service is ineffective or inadequate (sweet potato, Taiwan);
- extension work at the farm level should be more aggressive - extension workers are in competition with chemical companies which have invested heavily in trying to sell their products (soybean, Brazil);

- extension workers are not rewarded for visiting farmers (rice, S/SE Asia);
- extension staff tend to be of urban origin, lacking a real understanding of the traditional farming situation (maize, Latin America);
- links between research and extension are poor, and even poorer are the links to and from farmers (rice, S/SE Asia);
- to achieve successful implementation, IPM programmes need to be long-term (10-15 years) (rice, S/SE Asia).

**Socio-cultural:**

- trained farmers fail to encourage other farmers to follow recommendations, which is desired since complete cooperation of the community is essential for the success of IPM (sweet potato, Taiwan)
- it is difficult to achieve a widespread adoption of IPM due to the intrinsically individualistic nature of farmers, and the wide range in their level of understanding (sorghum, India);
- to obtain inputs, farmers are often dependent on loans from retailers whose advice may be biased (sorghum/pigeon pea, India);
- sometimes, farmers are reluctant to kill pests (rats) for religious or superstitious beliefs (rice, S/SE Asia).

Some of the constraints mentioned are specific for certain cropping systems or certain countries, but equivalents can often be found in different situations. When we listen to the opinion of farmers about IPM programmes, we might, for instance, hear that the technology is too complicated and not applicable or hardly workable (e.g. economic threshold levels), that final pest control decisions are still centrally made by officials, that non-trained farmers do not believe that pesticides can be reduced which hampers dissemination, that extension workers hardly ever visit the villages, that these officers have no adequate knowledge of farming, anyway, and that several layers in the community (women and resource-poor farmers) are never involved in extension activities.

To make IPM work, we have to anticipate these constraints as much as possible. The type of constraints that we can handle most easily are the technical constraints. Therefore, let's have a closer look at the nature of IPM in relation to the theories of adoption of innovations (Rogers, 1983) as was outlined in section 2.2.

Exercise 10: IPM and rate of adoption

Qualify to what extent Rogers' characteristics of an innovation, which are supposed to affect the rate of adoption, apply for IPM. Explain in the table below and tick whether there is a positive or a negative relation to the rate of adoption. Draw an overall conclusion on whether IPM is easy to be adopted and disseminated or not. What could be done to anticipate non-adoption?

	Adoption/diffusion of IPM	Pos/Neg
Relative advantage: economic aspects		Pos/Neg
social status		Pos/Neg
Compatibility		Pos/Neg
Complexity		Pos/Neg
Triability		Pos/Neg
Observability		Pos/Neg
Overall conclusion:		
How to anticipate non-adoption?		

### 3.3 Nature of IPM extension

This section gives several (general) suggestions on how an IPM extension programme could look like, based on the previously determined nature of IPM, intended behaviour of IPM farmers, and common constraint in IPM programmes. These suggestions are grounded on experiences in rice cropping systems in Asia, and should be regarded in this context. Although some aspects of IPM and IPM extension are considered generally applicable, IPM programmes in other cropping systems and other places might need adaptation or even a different approach.

#### *Extension methods*

The nature of IPM (being knowledge-intensive, farm-specific, complex, requiring group implementation/collective action, decision making as primary tool) requires an intensive mode of extension for farmers to develop strong decision making skills. **Group training in the field** is, therefore, the evident extension method for IPM. Mass media are considered to be of complementary use only to enhance awareness raising on IPM and IPM related issues, and to counterweigh aggressive pesticide promotion through mass media.

#### *Content of training*

As stated before, IPM is best served with principles as tools for decision making, rather than with preset recommendations and package technologies. In order to develop strong decision making skills among farmers, sound knowledge

about ecological and physiological processes of the agroecosystem is required. This knowledge should be functional and applicable to farmers' daily practices. Since farmers are out in the field daily, they already possess a lot of knowledge and experience, the use of which they are not always aware of. Farmers' existing knowledge and experience, which is likely to be adequate for their specific farm management practices, should be the base for more learning. Training is, then, meant to put existing knowledge in place, to show how new observations and experiences serve as opportunities for more learning, and to provide external information that is requested by the farmers.

Concretely, the content of IPM training would suffice with existing field problems. Focusing on pest problems seems logical, since many pests and their natural enemies are easily observable and, therefore, very good material to learn about ecological processes. However, sound IPM goes beyond pest problems, since a healthy crop is a premise to prevent economic damage due to pests. Observation, analysis, discussion, collective decision making, and experimentation are key activities in IPM training.

#### *Training approach*

The different approach to IPM requires a different approach to extension. Farmers are not considered as passive receivers and acceptors of external recommendations, but as active learners and expert masters in their own fields. A training process providing opportunities to develop and reinforce practical field knowledge and skills should definitely not be one of instruction in a classroom. IPM training should be field-based, season-long to learn processes at all stages of the crop, focus on occurring field problems, as well as empower and organise farmers. The Non-Formal Education approach is responding to such needs through its methodology emphasising experiential learning and group dynamics. Trainers are facilitators of the learning process, rather than instructors.

#### *Institutional framework*

The institutional framework for an IPM programme will largely depend on the existing structure and resources of research and extension institutions. A few general remarks, however, are posed here. First, an interdisciplinary composition of the team should be guaranteed. IPM programmes tend to be overrepresented by entomologists, and often strangely lack plant pathologists, weed and rodent experts, and extension and education specialists.

Second, the position of IPM trainer (or better, facilitator) for farmers is best held by field officials who have are likely to develop an institutional commitment to IPM training. They should not have many other (extension) duties, because this work might interfere with the needs of intensive IPM training. In Indonesia, pest observers instead of extension workers were upgraded to become IPM primary trainers. Several efforts to actively involve extension workers in the expansion of IPM training yielded mediocre success. Extension workers are often too much stuck in a system that requires them to be instructors rather

than facilitators, and to be involved in input distribution and other practices not compatible with IPM. No matter how much training they will receive, possibly attained commitment is not likely to endure.

In Indonesia, farmers training other farmers in IPM has been a major new departure (Van de Fliert and Velasco, 1994). The success of this departure has been remarkable and will provide the basis for expanded IPM programming in the future. Pre- and post-tests indicated that farmers participating in farmer-led IPM training achieved similar scores to those achieved by farmers trained by official IPM trainers. Farmers enjoyed and appreciated learning from other farmers, who speak the same language and have similar daily work experience. The real key to IPM training has been that a dialogue is created among farmers and between farmers and facilitators. A good and sincere dialogue will happen when participants and facilitator speak the same language and mutually respect each other, which is most likely when the facilitator is a farmer. Similar successes with farmers as IPM trainers have been achieved in the Philippines and in NGO-managed IPM programmes.

A third institutional aspect to discuss here is the possible need for policy interventions additional to training. Political commitment to IPM is essential for a successful programme, and one can think of several policy measures to reinforce IPM implementation. So far, several Asian countries have declared IPM the national crop protection strategy. Governments should not apply free pesticides to farmers. Subsidies on pesticides should be abolished. Broad-spectrum pesticides should be banned for crops that do not actually need them.

A last point to mention is that dissemination of IPM (from trained farmers to the surrounding community) should be anticipated in the programme activities. Considering the characteristics of IPM (low observability, complex, etc.) we can not rely on autonomous diffusion processes. Do we really want IPM to work, then we have to make sure that it expands, and that it expands to all layers within the community. The processes and channels through which expansion and dissemination materialises, will depend on many factors, which have to be carefully analysed during the stages of programme planning.

### **3.4 Evaluation of IPM programmes**

The World Bank's efforts to introduce the Training-and-Visit (T&V) system in many developing countries, the biggest extension programme so far, consumed immense investments in the course of time. Therefore, considerable attention was paid to the evaluation of these programmes. Previous activities of the World Bank in evaluating its T&V system focused on farm level effects such as yields, production and farm income (stage 8 in the analytic framework in Box 10), and tried to show causal relationships between these effects and the extension services (stage 6) (Murphy and Marchant, 1988). The main variable

for the evaluation of extension process was the number of visits by the extension worker to the farmers, whilst no attention was paid to more crucial aspects such as farmer practice and decision making (stage 7) leading to the farm level effects measured.

A more recent strategy used by the World Bank considers four main concepts for evaluation: inputs, outputs, effects and impact (Röling, 1992). The inputs are the resources made available, whereas outputs are the extension activities actually implemented. These lead to the direct effects of the intervention, which cause a certain (long-term) impact. In evaluation, **efficiency** of resource use is determined by comparing inputs and outputs. The **effectiveness** of the activities is assessed by comparing output and effect, and **significance** of the intervention (e.g. for policy objectives) by comparing effects and impacts (Patton, 1986). Intended practice in T&V interventions is the adoption of the technology offered. Therefore, the key factor in measuring extension effects is the adoption rate of the innovation (Murphy and Marchant, 1988). Röling (1992), however, argues that adoption is not a good measure of effect, since a farmer must have access to factors (such as credit, markets, etc.) other than those provided by the intervention only (technology and knowledge) to be able to adopt. The World Bank's evaluation approach does not consider this. Evaluation is primarily seen as an activity useful for programme management and indispensable for funding agencies.

Evaluation of extension models different from the transfer of technology mode, as IPM extension is considered to be, is assumed to be different, too. In contrast to the objectives of the T&V extension model, the principal aim of IPM programmes is that trained farmers become more able to take considered decisions. As suggested by the analytic framework in Box 10, such an aim requires a different approach to all aspects of programme design and implementation. Applying the stages of the analytic framework for training programme design and implementation to IPM programmes, shows more clearly why the model for IPM training is different.

1. **Appreciation of an undesirable situation:** research creates awareness that pest outbreaks occur because of pest resistance to pesticides and destruction of natural enemies, as well as negative effects of pesticide use on human health and environment; the current extension approach overlooked many of the farmers' problems and interests, therefore did not work effectively;
2. **Nature of training contents:** defined by IPM principles, such as in the case of rice IPM in Asia: grow a healthy crop, conserve natural enemies, observe the crop weekly, and farmers become IPM experts;
3. **Intended practice:** informed pest management decision making takes a central position; desired field activities and perceptions of farmers are deduced from the IPM principles;



4. **Training strategy/curriculum for farmers:** farmer training focuses on experiential, field-based learning;
5. **Training strategy/curriculum for trainers:** consistent with farmer training strategy: technical, communication and management skills needed to facilitate farmer training;
6. **Training of trainers:** primary IPM trainers are trained using methods to replicate with the farmers;
7. **Training of farmers:** farmers participate in season-long and field-based training;
8. **Changed practice:** farmers' practices, knowledge and perceptions relating to pest management, in particular pest management decision making;
9. **Consequences:** effects at farm level economy and ecology as a result of a changed practice of farmers;
10. **Impact:** possible economic, ecological and health impacts at community, ecosystem and national level.

Sound evaluation of an IPM programme should consider the individual levels of programme implementation (training process, implementation by farmer, farm level effects as result of farmer behaviour, and environmental impact) reflected against the objectives of the corresponding levels in programme planning.

Exercise 11: Variables to measure impact of IPM training

When evaluating IPM, the variables to be measured should be defined as operational as possible. They should directly relate to project objectives. What are the variables to measure the impact of IPM training for farmers? In other words, what are the characteristics of a good IPM farmer?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_



## **4 Examples of IPM extension activities**

### **4.1 Rice IPM through T&V**

(Source: Van de Fliert, 1993)

Major efforts in IPM training in irrigated rice have been carried out in Asia by the United Nations' Food and Agriculture Organisation through the 'Inter-country Programme for the Development and Application of Integrated Pest Control in Rice in South and South-east Asia'. In the pilot phase of the programme in 1978-80, basic training principles were developed and a pilot training programme was conducted in the Philippines (Matteson et al., 1992). Farmers were trained in groups throughout a growing season. Weekly two-hour sessions were organised that were dominated by practical field activities and group discussions. Real plants and insects were used as training materials instead of handouts. Lectures were avoided and technology was greatly simplified. The result was notable: farmers were able to identify pest problems better and trusted more in their own decision making ability. Pesticide use, and thus pest control costs, by trained farmers decreased (Kenmore et al., 1987). In several cases, it was found that rice yields increased, probably as a result of increased fertiliser use that could be purchased from the money saved on pesticides.

In the first and second implementation phases of the Inter-country Programme (1981-90), similar IPM training were delivered in several Asian countries through T&V extension services. Training intensity and quality, however, deteriorated as the programme scaled up. In the Philippines, it was obvious that the same enthusiasm that had inspired the pilot group of IPM trainers could not be achieved on a larger scale. Trainers fell back on their conventional ways of lecturing in the classroom. In Sri Lanka, T&V village extension workers did not deliver more than half of the scheduled training sessions.

Farmer group training were supplemented by multimedia strategic extension campaigns in Malaysia, Thailand and Sri Lanka. Evaluation findings about the impact of the campaigns were not very encouraging (Matteson et al., 1992). The influence of the persistent pesticide promotion through the same media is considered a major factor having caused this low impact.

Training efforts through local NGOs complemented national IPM extension activities. Satisfactory results were achieved, since activities were implemented on a small scale with highly motivated staff. Although contributive, especially in generating innovative ideas, NGOs are not likely to become the main channel for extending IPM to the millions of Asian rice farmers, among others because of the small-scale operation of most NGOs.

In Indonesia, efforts to introduce IPM had started as early as 1979. The attempts followed the technology transfer approach which had been so successful in the national rice intensification programmes. IPM training activities focused on packages and prescriptions, and were incorporated in the routine extension meetings. Abundant spraying of pesticides was applied over whole areas at once with government pesticide aid, based on pest status assessments of agricultural officers. No impact of these activities on farmers' behaviour has ever been reported. In contrast, a field evaluation of IPM demonstration areas was conducted in 1984, yielding the astonishing result that pest populations in some of these areas appeared to have increased. A workshop was organised in which university entomologists presented data of more field studies concluding that occurrence of high pest populations was strongly related to an intensive use of pesticides with respect to both number of applications and number of types used. This intensive pesticide use in an IPM programme was the result of the (inappropriate?) use of threshold levels.

When nationwide brown planthopper outbreaks occurred, a crash IPM training programme was conducted through the T&V extension system. FAO's Inter-country Programme provided specialist training for newly recruited pest observers. A tremendous effort was made to train trainers and to develop trainers' guides, flipcharts, slide-audio modules, leaflets and pamphlets of which 150,000 copies were distributed all over the country. Coordination meetings at several official levels were organised, and two-day farmer training were planned. Although the activities had Presidential priority and special facilitation by the Finance, Planning and Economics Ministries, training funds did not reach training centres earlier than four days before the courses began. Training materials arrived mid-way through courses, often too late to be used. Years later, hundreds of these materials can still be found neatly wrapped in their original plastic containers at provincial training centres. In spite of repeated meetings on the subject, only 25% of the training groups actually entered a rice field. The goal of the crash training programme was to train 125,000 farmers, but only 10,300 actually received training. Only 8.5% of the allocated resources could be delivered to the field to train less than 10% of the farmers targeted. Where farmers were reached, trainers used top-down approaches and did not use fields or farmers' own experiences. According to the immediate evaluation of the Indonesian crash IPM programme, trained farmers' pesticide use decreased and their yields increased (FAO, 1988). However, desired changes in their behaviour did not occur, which makes the sustainability of the results doubtful.

## 4.2 Rodent IPM in Indonesia

(Source: Van de Fliert, Van Elsen and Soenanto, in press)

Rats are, by far, the most damaging pest in rice crops in Indonesia, as well as in many other countries in Asia. In order to develop a rat management system for small rice farmers in Indonesia, the FAO Inter-country Rice IPM Programme in cooperation with the Government of Indonesia's Directorate of Food Crops Protection started to design and implement a pilot programme on Integrated Pest Management (IPM) for rodents in 1989. Whereas earlier aid focused on the technology of rat control, this pilot programme applied an approach emphasising the **organisation of the community** at the village level, because whatever method or technology is used, the people have to do it, continuously and on a large scale. The pilot programme was implemented during three rice growing seasons in the provinces of West and Central Java.

### *Principles of rodent IPM*

Some definite differences between IPM for insects and rats exist, that have consequences for the design of the pest management system. Dealing with rats, the following points have to be considered:

- rats are highly developed animals;
- rats can move over long distances, thus rat management needs to be implemented over large areas;
- rat control on a small scale is not effective, thus large scale planning and collective mass involvement is necessary;
- biological control by saving and encouraging natural enemies needs to be done in a collective way;
- rice rats are not host specific, thus control should not be limited to rice fields only;
- rats are usually active at night and hide in the daytime, thus monitoring of rat populations needs to be done by way of damage and habitat assessment;
- preventive control measures play an important role, but only include some cultural practices like cropping pattern and sanitation; there are no resistant varieties.

These considerations lead to the following main principles for an integrated rat management system:

1. Community involvement: all groups in the community play a role in rodent IPM, including farmers, women, prominent persons in the village, village officials, and field extension staff;
2. Cooperation: rodent IPM is done as a collective activity of all farmers within and among farmer groups;
3. Planning: rodent IPM should be well planned and use an appropriate time schedule;

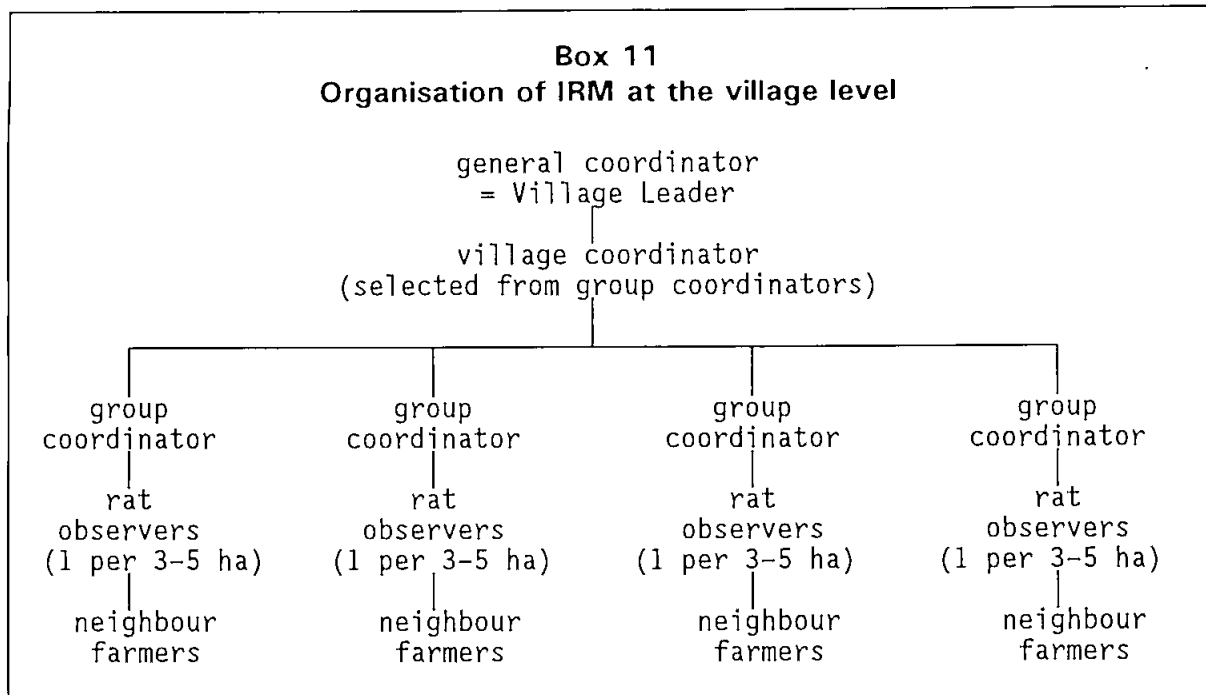
4. Organisation: rodent IPM is organised at the village level with the village leader as the general coordinator;
5. Appropriate control: various, appropriate control methods are used, rodenticide application being the last resort and always based on monitoring. Measures are applied timely and continuously.

These principles served as the main guideline for the pilot programme aimed at developing, together with the farming community, an integrated rat management system that is economic for farmers and safe for the environment.

#### *Activities*

In order to achieve active community involvement, the following activities per location per season were, initially, organised:

- **baseline survey** to identify farmers' problems and social aspects that might influence the programme, assess the history and level of rat attack, and make an inventory of farmers' current practices;
- **training of trainers**, who were the Directorate of Food Crops Protection's Pest Observers and the field level extension workers; training involved both community organisation and rat management technology;
- **coordination meeting** with farmer group leaders, village officials, and representatives from the regional Agriculture Service in order to plan the programme's activities and adjust to local circumstances;
- **preliminary meeting** with farmers to explain the purpose and activities of the programme and motivate them to participate;
- **training for participating farmers** selected on a basis of area (one farmer per 5 hectares), capability and motivation; training took place at the stage of soil preparation; it included both rat management organisation and technology, but firstly emphasised awareness building; trainees became "rat observers", in charge of monitoring rats in the area and of motivating their neighbour farmers to participate in collective control;
- **weekly monitoring** by the rat observers coordinated per farmer group; collective decision making and control measures;
- **mid-season evaluation meeting** with the rat observers and village officials to evaluate the current situation regarding rat occurrence and the tentative results of the activities;
- **field day** just before harvest with other farmers and village officials from the village and neighbouring villages to present the result of the activities and motivate them to participate the following season;
- **season evaluation** which includes:
  - **evaluation meeting** with the rat observers and village officials;
  - **individual interviews** with both rat observers and untrained farmers, as well as with farmer group leaders and village officials.



### *Organisation*

To achieve implementation of integrated rat management, including collective monitoring, decision making and applying control measures on a large scale, an organisation structure at the village level, as given in Box 11, was developed. The core of the structure consists of the rat observers. Each area of 5 hectares is represented by one farmer who is trained to become a rat observer. At the same time, he or she is a motivator in the defined area to involve his or her fellow farmers in collective rat control measures.

Coordination at both farmer group and village level is essential in the current setting of Javanese village power structures. Group and village coordinators are selected by the members of the rat observer group. The philosophy behind this structure is that if people are given a definite task and responsibility, better participation, higher commitment and enthusiasm can be expected.

### *Technology*

Routine, coordinated field monitoring formed the basis for the rodent IPM technology applied in the pilot programme. Rat observers from one farmer group monitor for rat occurrence all on the same day in the week, and afterwards meet to put the scores together and estimate the total rat occurrence in the area. At the vegetative stage rat occurrence is estimated through monitoring of plants (counting new damage, for which a threshold level of 25% of observed plants was applied), while at the reproductive stages monitoring of active burrows. The assessment of rat occurrence can be further supported by

monitoring with the use of (plain) bait and observing rat sources, e.g. dikes along irrigation channels, train rails, and hedges of banana trees.

It was emphasised to always use **simple, cheap and appropriate** control measures. Farmers in one of the implementation villages together with the programme staff developed a very simple, hands-on trap that can be used at all stages of the crop. Farmers were very satisfied with the effectiveness and simplicity of the trap. Poison baiting with first generation anti-coagulant rodenticides was recommended as a last measure only to be used if the observed damage exceeded the threshold level.

### *Results*

In all the pioneer implementation villages, farmers were able to reduce rat populations, and, thus, damage to a considerable extent. Measures applied included rat drives (hunting and direct killing with use of sticks, traps, nets and/or dogs), fumigation with sulphur, and poison baiting. Synchronized planting over a large area including neighbouring farmer groups and villages was urged, and during the second season realised in most places. Except for one location, it was easy to get farmers together for training, routine and evaluation meetings, and collective control activities, even though farmers were not given any incentive or compensation whatsoever. To achieve this active participation, some exercises were done at an early stage of the programme on raising farmers' awareness regarding rat problems, e.g. through an analysis of the financial loss caused by rat damage at farmer group and village level, and a comparison of rat control with traditional (effective) safeguard systems in the village. Another element to support active involvement of the participants was the field-oriented approach of all activities.

Because of these high rat populations and the serious financial situation of the farmers after crop failure for so many seasons, rodenticide was supplied to the programme locations, whereas the farm families supplied the bait. This aid of rodenticide had a twofold purpose: firstly, to knock down rat populations to a level where rats could be controlled solely with mechanical measures by the farmers themselves, and secondly, to give an example to the farmers of the effectiveness of a first generation anti-coagulant rat poison (coumatetralyl). This was necessary because farmers evaluated the result of rodenticide application by the number of dead rats visible in the field. With the slow working anti-coagulants where rats will die in their burrows after a few days, such an evaluation leads to erroneous conclusions. The group of rat observers were responsible for the preparation, distribution, and correct application of the poisoned bait.

### *Conclusions*

From the experience of the rodent IPM pilot programme in Central and West Java the following conclusions can be drawn:

- intensive monitoring of rat occurrence, observed as crop damage and active burrows, is the basis for an effective integrated rat management system;
- active involvement of a large group of people is needed for coordinated rat management at the village level;
- support and involvement of the village leader and/or prominent persons in the village are important for the success of rat management activities;
- rat management can only be effective if it is implemented collectively, over large areas, and continuously;
- well-planned rat drives on a regular basis with mass community involvement proved to be an effective, cheap and safe control measure;
- poison baiting with a first generation anti-coagulant rodenticide at the moment rat damage exceeded the threshold level of 25% newly damaged hills at the vegetative stage of the rice crop was effective so that at the reproductive stage rats could be controlled with non-chemical measures;
- farmers generally did not adopt the use of bait stations and anti-coagulant rodenticides.

Many of these conclusions hold for the small rice farmers in Javanese rural areas. For implementation of the concept in other areas, key factors in both social and environmental conditions will have to be identified first in order to design an adjusted system appropriate for the local setting.

#### *Lessons learned and discussion*

Developing an effective and efficient strategy for integrated rat management can not be done by developing only a sound technology or only a workable coordination system, but by integrating both technical and social aspects. This makes it difficult to define a general concept for an integrated rat management strategy, since each community requires a specific, adapted social and, in many cases, technical approach. The experience of the pilot programme in Java taught some lessons that might help future, large-scale programmes in defining strategies.

The activity of monitoring rat occurrence by a group of trained farmers was not only useful as a tool in decision making, but also, or maybe particularly, as a mechanism to keep a core group of people continuously involved and responsible in the battle against rats. Technically, the monitoring system proved to work. One field observed per 5 hectares seemed a reliable sample for decision making, provided that data over a large area were assembled, and the 25% damage threshold was low enough not to result in any significant yield loss.

Although chemical control is an option in an integrated pest management system, it is recommended that rodenticide use be not included in integrated rat management community programmes (in areas comparable to Java) for several reasons:



- farmers do not easily adopt the less dangerous, but more expensive, slow-working anti-coagulant rodenticides and the safer application method with using bait stations;
- rat drives were reported by farmers to be the most effective control measure; and
- other measures involve the community more actively which is necessary for a sustained management of the rat problem.

Farmers have to be aware and knowledgeable about the disadvantages and dangers of poison baiting, especially with acute poisons.

As said before, the approach used in the rodent IPM pilot programme in Indonesia was specific for the local setting. More experience through adjusted implementation of the concept in other areas is necessary to help develop an effective and efficient integrated rat management system.

### 4.3 The IPM Farmer Field School: Indonesia's National IPM Programme

(Source: Van de Fliert, 1993)

Since 1989, the Indonesian Government, in collaboration with FAO, conducts a national, large-scale IPM programme which applies an innovative training approach. So far, the programme has been highly successful, and has become the model for other IPM training activities in the region.

#### *A favourable political context*

The first effort of the Indonesian government favouring more sustainable agricultural practices were some major policy measures relating to pest management. After the second nationwide brown planthopper outbreak in 1985-86, seriously affecting the recently achieved self-sufficiency in rice production, the negative side effects of pesticides were finally recognised as a cause of pest outbreaks. In November 1986, the Government of Indonesia announced a presidential decree, INPRES 3/86, that primarily aimed at the control of the brown planthopper by declaring:

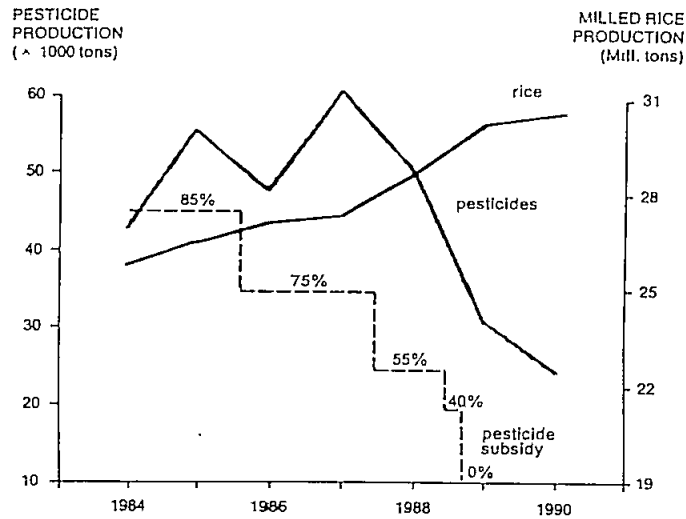
- the ban of 57 broad-spectrum pesticides on rice crops;
- Integrated Pest Management (IPM) as national pest control strategy;
- the creation of 1,500 new pest observer positions.

The ban of the fifty-seven brands of pesticides left ten brands with only four different active ingredients available for rice treatment. The number of pest observers, who are field officers employed by the Directorate of Food Crops Protection (DITLIN) and responsible at subdistrict level for reporting pest damage, totalled 2,900 persons throughout the country after INPRES 3/86. A first activity resulting from the presidential decree was a pilot training for master trainers, pest observers, village extension workers and farmers in Integrated Pest Management (see section 2.3). In addition, brown planthopper resistant varieties (IR 36 and IR 64) were more actively promoted, and 'POSKO's' or commando-posts at the subdistrict level were established to take immediate and adequate action with specific pesticides in case of brown planthopper occurrence.

Prior to INPRES 3/86, the Government of Indonesia had reduced state subsidies on pesticide from 85% to 75%. In those years, the subsidies consumed 130-160 million US dollars of the country's annual budget. More radical steps were taken after INPRES 3/86 by gradually reducing these subsidies until complete abolition was realised in January 1989. Accordingly, pesticide production decreased. Contrary to the popular belief fanned by the pesticide industry, total rice production increased, proving that pesticide use is not an imperative for rice cultivation (Box 12).

The various policy measures of the Government of Indonesia were enough to bring to an end the threat to food security from massive brown planthopper

**Box 12**  
**Pesticide production, rice production and pesticide subsidies**  
**in Indonesia over the period 1984-90.**  
 (Source: National IPM Programme)



resurgence, to save a considerable annual outlay for insecticide subsidies and vastly reduce pesticide imports, and to make farming more cost-effective, a benefit passed on to urban consumers. Moreover, a favourable climate for the implementation of a large-scale IPM training programme was created which started in mid 1989.

*A different approach to training contents and process*

With its broad experience in IPM training in several Asian countries during ten years, the Inter-country IPM Programme was the appropriate partner to assist in the design and implementation of a large-scale National IPM Programme in Indonesia. Heaving learned from these experiences, the Indonesian model embarked upon a new course, with regard to its approach to both training contents and process.

IPM is knowledge-intensive and farm-specific for which preset recommendations in a package had proven to be inadequate. Instead of mechanical instructions for field sampling and spraying based on centrally determined economic threshold levels, the National IPM Programme in Indonesia began to apply a more ecological approach of IPM. IPM was provided with a set of principles instead of instructions. This is the reason why we no longer want to use the term 'technology' for IPM, but will speak of principles, approach, or practice(s) in this book. The IPM principles include:

1. Grow a healthy crop;
2. Observe the field weekly;
3. Conserve natural enemies, and
4. Farmers become IPM experts.

With these principles, a set of agronomic and ecological concepts are provided to farmers as tools for their decision making. The farmer remains the central manager and independent decision maker. One obvious example of the different approach is the changed concept of economic threshold. Instead of presenting a precise but unworkable coefficient, the programme developed the concept of 'experience threshold' which develops as farmers learn and experience, and is applicable under specific farm conditions. A threshold that builds on farmers' expertise and experience fits better into the consideration of farmers as independent decision makers. The behaviour which IPM promotes subsequently include regular observation and informed decision making about pest control.

This different approach to IPM requires a different approach to extension. Farmers are not considered as passive receivers and acceptors of external recommendations, but as active learners and expert masters in their own fields. Therefore, the principles of nonformal education seemed appropriate as an approach to training farmers in IPM. The principles applicable in this respect are learning through experience, focusing on field problems, and empowering farmers. This approach to farmer training, in turn, has important implications for extension staff training and for the institutional design of the extension service.

#### *Actors in the programme*

The **National IPM Programme** is a temporary structure that will be continued for a limited number of years. The first phase (1989-92) was financed by donations from USAID to BAPPENAS, the national planning agency, that were originally meant for pesticide subsidies. The second phase (1993-98) is sponsored by the World Bank. The programme is implemented with technical expertise from FAO. It is run by both expatriate and local experts. There are no senior counterparts in the traditional sense of the word. A Steering Committee, an Advisory Board, and a Working Group with members from various government institutions and universities were called into being to assist the programme management. For management and curriculum development, special **secretariats** were established in Jakarta and Yogyakarta. The programme works intensively within the country's existing framework, putting strong emphasis on creating linkages and contracting for specific jobs, such as curriculum development and training. In addition to training of extension staff and farmers, the programme supports research activities such as a field laboratory in West Java focusing on white stemborer problems, a health impact study in a pesticide-intensive area in Central Java, insect habitat studies, studies on IPM in secondary food crops, and several training evaluation studies.

At the regional level, the programme operates from twelve **Field Training Facilities** (FTF) in the eight main rice-growing provinces where, in total, around three-quarters of the nation's rice is produced. Existing Agricultural In-Service Training Centres were partly transformed into IPM FTFs. Primary trainers at the FTFs are the **Field Leaders I** (PL I, 21 in total) who are assisted by **Field Leaders II** (PL II, 129 in total), and by some training experts of the training centres where the FTFs are hosted. Most of the Field Leaders belong to the group of pest observers upgraded in the crash IPM training in 1986 to become IPM master trainers. The development of a strong and qualified cadre of trainers is given high priority in the IPM programme, since it is the key factor for the training of the millions of Indonesian rice farmers. Field Leaders I assisted in designing the final curriculum and field guides for staff and farmer training.

**Pest observers**, whose numbers were doubled by INPRES 3/86, were assigned to become the trainers at the field level. They were all previously trained in the crash IPM programme in 1986-87. To date, some 1,120 pest observers received intensive IPM training through the National IPM Programme and function as the IPM trainers at the Regional Extension Centres to train both farmers and extension staff. This means that all officers intensively involved in the IPM programme (PL Is, PL IIs and pest observers) belong to the Directorate of Food Crops Protection (DITLIN), and **not** to the departments of the extension service. The Rural Extension Centres (RECs), however, which fall under the responsibility of the Agricultural Service, are the base from where all IPM training activities executed by the pest observers at the field level are organised. It was obvious from the beginning that the village extension workers are not very suitable candidates for introducing IPM. They have many tasks, among which pest control extension is a relatively minor one. They are heavily involved in the T&V routine and in input distribution activities which conflict with the nature of IPM.

**Rice farmers** are, obviously, the ultimate beneficiaries of IPM training activities. At first sight, they seem similar in their cultivation practices. However, as will be described in Chapter 4, farmers differ a great deal in terms of their use of inputs, farm size, tenure status, the type of off-farm jobs they engage in, the activity in farmer groups and so on. The villages in which farmers live also show great diversity due to geographical and infra-structural isolation, leadership, history, and other factors. Farmers are formally organised by the Agriculture Service in farmer groups, but seldom are these groups active.

**Vested interests** in pesticide use are not immediately apparent beyond the agro-chemical companies. But pesticide production is an enormous industry with a turn-over valued at some US\$ 1.5 billion per year. Involvement in this industry can be found in various sectors and levels, including salesmen, organisations such as the KUD (the village cooperatives), village officials and extension workers. Influence of these interests on the result of IPM training and implementation should not be underestimated.

**Policymakers** are critically concerned with food security. Varying individual interests, however, sometimes result in a mixed support for the IPM Programme. But increasingly, senior policymakers recognise that the programme has energised farmers, given them new confidence, and captured their imagination. Many consider this a welcome change from the existing farmer groups and extension approaches which fail to engage farmers beyond token and formal participation.

**Research institutes and Universities** have only been marginally involved so far. The universities have trained the pest observers for a few months to provide them with a diploma which allows them to advance in salary scale. Much greater involvement of research institutes and universities is expected in the future.

#### *Farmer training in IPM farmer field schools*

Farmer training is organised in so-called **IPM farmer field schools** (Photo 1). The philosophy behind this name is that farmers go back to school, a place reputed for **learning**, where they can obtain a diploma (a certificate) allowing them to be IPM experts and trainers. Key ingredients of the IPM farmer field school are the following:

- a field school group consists of **twenty-five farmers**, selected either from one farmer group, or across the farmer groups from the same village;
- in the field school, farmers work in **subgroups of five**, the optimal size according to NFE principles;
- training starts with a **pre-test** and ends with a **post-test of knowledge**. Twenty five 'ballot boxes' with three slots representing multiple-choice answers are made of carton and placed in the field. A question is posted above the box concerning a field problem, and the three possible answers are indicated with ropes leading from the box to a damaged leaf, an egg mass, or a similar item. Farmers enter a chit with their number on it in the slot with the appropriate answer for each box. The scores of the tests, in themselves fairly meaningless, are a great motivational device for the participants, and give an important diagnosis of trainees' ability;
- the field school lasts the main part of an **entire season**, so that farmers can work with each stage of rice plant development. This is very important, because pest problems change with the stage of the crop. The groups meet once a week for some ten weeks;
- each field school group has a **demonstration field**, consisting of an IPM plot where IPM principles are used to take pest control decisions, and a plot where the recommended package of the Dept. of Agriculture is applied;
- there is hardly any lecturing during the training. The pest observers have been carefully trained not to allow themselves to be forced into the position of an expert, but to be a **facilitator of the learning process**. They are not to answer questions directly, but instead, make the farmers think themselves. 'What do you think?', 'What did you find?', 'What did it do?'. This is called the '**Apa**

- ini?* principle, Indonesian for 'What is this?'. A question answered with a clear answer is a lost opportunity for learning;
- farmers meet somewhere **in or close to the field** under a tree or in a small shack which provides some shade;
  - the main activity, and first in the morning, is to step into the demonstration fields in groups of five and **observe** sample rice hills, usually chosen at random along a diagonal across the field (Photo 2). Notes are made of insects, spiders, damage symptoms, weeds and diseases, observed at each hill. The growth stage of the plant is carefully observed, as is the weather condition. Interesting insects and other creatures are caught and placed in small plastic bags.
  - in subgroups, the observations are collated in drawings, the **agroecosystem analysis** (Photo 3). On large sheets of cheap paper fixed to a sheet of plywood, using different coloured crayons, farmers draw the rice plant at its present growth stage, with pests and natural enemies of the moment. A leaflet with pictures of pest insects and natural enemies, distributed to each subgroup, is used as a reference. A conclusion about the status of the crop and possible control measures is drawn by the five members together and noted down on the paper;
  - the subgroups' agroecosystem analyses are **presented** to the whole field school group. The conclusions drawn from the field observation with respect to pest control are discussed in the entire group. The field has become the main training material and farmers' own observations the source of knowledge for the group;
  - during each session, **special subjects** are introduced (Photo 4). The trainers' training provided the pest observers with a substantial repertoire of carefully developed modules. Special topics relate to field problems, such as rat population growth, effects of pesticides on natural enemies, and life cycles of rice field inhabitants;
  - **group-dynamic exercises** enliven the field school and create a strong sense of belonging to the school;
  - farmers often keep an 'insect zoo', plastic netting around four bamboo poles set around a rice plant. Inside this insect zoo, various pests and predators are introduced, and watched by farmers. Through own **experiments and observations**, farmers gain ecological knowledge;
  - active group members are encouraged to train other groups. This **farmer-to-farmer training** is an important strategy for mass replication;
  - a **field day** is organised at the end of the season in which the result of the farmer field school is presented to the surrounding community, including village and subdistrict heads in order to obtain (financial) support for follow-up activities.

Photo 1:  
The field school is located in the field



Photo 2:  
Field monitoring by farmers



Photo 3:  
Agroecosystem analysis

Photo 4:  
Farmers do experiments





Farmers participating in the IPM field school receive a compensation of Rp. 1,000 (approximately US\$ 0.50) per day from the programme to remunerate possible loss of income when spending time in the training. Many groups use these monies for buying uniform caps and T-shirts, decorated with the emblem of the programme and their farmer group name, visibly increasing group spirits. Some groups also use (a part of) the compensation to go on excursions, for instance to experiment stations or training centres.

Horizontal communication on IPM was encouraged in various areas through folk theatre. Some IPM field school groups were given additional training on the principles of theatre by a local NGO active in the field of communication. The groups were guided in designing and performing their own IPM play for the whole village community.

### *Training of trainers*

The type of farmer training discussed above requires different staff training. The training of trainers (pest observers) and of extension worker is based on the same principles as the farmer training. The NFE approach to train the first pilot batch of fifty-two field trainers began in earnest in July 1989 at the FTF in Yogyakarta, followed by training cycles in, first, six, and later eight provinces throughout the country. As for the farmers, the two main principles of staff training are (1) agroecosystem analysis based on careful field observation; and (2) dialogue instead of lecturing. Key elements of the training of pest observers are the following:

- training takes fifteen months and consists of the following components:
  - . rice IPM training (3.5 months);
  - . extension training in IPM farmer field schools (3.5 months);
  - . dry secondary food crops IPM training (3.5 months);
  - . a diploma course at the university (4.5 months).
- one FTF training group consists of fifty people, divided into subgroups of five;
- rice and secondary food crop IPM training takes place at the FTF where the pest observers grow their own crops. They have to become farmers first before they can face farmers in a position as trainers;
- training curriculum is completely field-oriented. The '*Apa ini?*' principle is the basis for learning. Problems discovered in the field become topics for discussion. Carefully designed field experiments, such as comparison of varieties, fertiliser treatments, and variations in pesticide treatments, as well as a range of special topics are executed and discussed;
- extension training takes place in the home areas of the pest observers where they conduct four IPM farmer field schools each during one season. In this training, two village extension workers per pest observer are trained in IPM on-the-job;
- Field Leaders I and II facilitate the FTF training, and supervise the extension training in the field;

- a field day is organised at the end of the rice IPM season on which the result of the training is presented to policymakers at regional and national levels in order to obtain (financial) support for follow-up activities.

The goal of training the pest observers is to make them confident IPM experts, instill an attitude of self-learning through experimentation, and to develop a cadre of effective trainers of farmers and village extension workers. Since 'the methods we learn from are the methods we fall back on when we teach others', the methods used during pest observer training are those they are expected to use with farmers. During their training, pest observers work in their fields every morning, a rare event for civil servants. The special topics are presented in a set of modules which pest observers feel confident to handle with farmers or extension workers. Pest observer training is supported by elaborate manuals.

During the extension training, one pest observer has to choose two village extension workers from her or his REC to form a team with for farmer training. The extension workers are given a one-week introductory training at the FTF in which they are acquainted with the principles of IPM and with the farmer field school training approach. The trainer teams formulate work plans for farmer training. One team conducts two farmer field schools, which implies four field schools per pest observer. During the implementation of the farmer field school, the pest observer is the main facilitator, whereas the extension worker assists where necessary and, at the same time, learns on-the-job to become IPM facilitator.

#### *Evaluation of the IPM Farmer Field School*

(Source: Van de Fliert and Winarto, 1993)

Two indepth, village-level evaluation studies were conducted within the programme, one in Central Java (Van de Fliert, 1993) and one in West Java (Winarto, 1992). The IPM farmer field schools observed in Central and West Java were implemented successfully. The high attendance of the trainees of over 90% during the whole season showed that farmers were committed to participate. Favourable changes in group coherence and farmers' perceptions of the rice ecosystem and (chemical) pest control were visible from the third training session onwards.

Field school farmers were generally excited about what they learned in the field school. Especially pest and natural enemy identification, the ecological importance of natural enemies, and analysis of costs and benefits in pest management were their favourite topics. They also became better aware of the hazardous effects of chemical pest control to the rice ecosystem. The farmers highly appreciated the field-oriented and facilitation approaches that were applied in the field school. The many discussion opportunities left ample room for farmers' local knowledge to be integrated with the programme's guidelines. Some old farmers, for instance, reintroduced an indigenous practice of trapping rice seed bugs by burning paddy crabs. A direct achievement of the IPM farmer

field school in one of the villages in Central Java was the initiative of the IPM group for collective rat control activities, eliminating rat damage to a minor problem within two seasons.

*IPM in practice, effects and impact*

During the seasons after training, several changes in the pest management practices of IPM field school graduates showed that they found the IPM training worth putting into practice. Regular field monitoring was practised well by the larger part of the IPM farmers, leading to better informed decisions.

In Box 13, the pesticide application behaviour and yields of IPM farmers, as an average of two villages in Central Java, are compared over four seasons (before, during and after training) with non-IPM farmers. The seasons before and during training were comparable with regard to climatic conditions and pest occurrence. In the first post-training season, rice crops in the area were heavily attacked by rice stemborers, whilst the second post-training season was almost free from pest attack, and with optimum weather conditions. The frequency of pesticide sprays by IPM farmers decreased after IPM training to a level consistently lower than that of non-IPM farmers. Consequently, IPM farmers' expenditures on chemical insect control decreased. The number of IPM farmers not applying pesticides at all increased.

**Box 13**  
**Chemical control practices, expenditures and yields**  
**of IPM and non-IPM farmers in two villages in Central Java,**  
**before, during and after IPM training.**

	before	IPM			before	non-IPM		
		during	after 1	after 2		during	after 1	after 2
Frequency spray applications (no./season)	1.4	0.7	0.8	0.3	1.5	1.5	1.3	0.8
Frequency granular applications (no./season)	0.4	0.7	0.7	0.6	0.3	0.9	0.8	0.7
% farmers not using pesticides	26%	41%	46%	50%	31%	19%	24%	43%
Average insect control cost (Rp 1,000/ha)	32	18	18	9	22	31	21	19
Average yield (tons/ha)	5.38	5.77	3.70	6.38	5.11	4.64	3.11	5.68
<i>N</i>	44	48	46	42	134	129	120	115

IPM farmers obtained higher yields than non-IPM farmers, which, in addition to lower pest control expenditures, resulted in higher returns of rice production. Although proportionally the gains in returns were only a minor part of the total paid-out costs for rice production, in absolute amounts they were tangible in the household budget of Javanese rural families. Additionally, yields of IPM farmers were more equally distributed after training than those of non-IPM farmers, indicating a less riskier management under IPM regime. Since other cultivation practices of IPM and non-IPM farmers, such as fertilisation, were similar, the effects on yield and yield distribution can supposedly be attributed to IPM practices. Timeliness and adequacy of various cultivation and pest control practices, resulting from better monitoring and decision making skills, seem to be most important in this respect.

In West Java, the IPM field school farmers also reduced their frequency of pesticide sprays, even more drastically than their colleagues in Central Java since they started at a much higher level of pesticide use. One farmer reported that he could save Rp. 25,000 (US \$ 12.50), or 7% of the production cost for his 0.7 ha rice field. However, the IPM farmers continued to apply granular pesticides (carbuforan) preventively, out of habit by mixing these granules with fertiliser.

All groups had some members who felt insufficiently convinced to rely on the IPM principles, and still gave preventive pesticide applications. These farmers were usually the previously high-pesticide users with a risk-avoiding attitude. Especially in the case of a rice stemborer outbreak, many of them panicked and fell back on the practices that were taught for years as the adequate means against pests. Some farmers blamed the field school for not paying enough attention to this important pest problem, which was a result of the low stemborers population during the training season. This event, indeed, shows a weak side of the experiential learning approach.

The benefit of IPM felt by the West-Javanese farmers was mainly the lower production costs, whereas Central-Javanese farmers more often mentioned knowledge increase as a reward of IPM training and implementation. The value given to knowledge increase puts farmers' perception of crop management into a different light. Farmers are excited that they are now considered independent farm managers, which contrasts highly with the way they have been treated by the government for years, as passive package adopters. This gives them more self-confidence, which is considered of major importance for the sustainability of the changed crop management behaviour instilled by the IPM farmer field school. As one farmer expressed it: "Since I followed the IPM farmer field school, I have peace of mind. Because I know now how to investigate my crop, I do not panic any more when I discover some pest symptoms in the field."

An nationwide economic impact study executed in 1991 by the National IPM Programme among more than 2,000 field school graduates showed that trained

farmers evidently changed their pest control behaviour (Pincus, 1991). Reduced pesticide applications, lower use of banned insecticides, and decreased expenditures were measured. The study also indicated that these results were directly linked to the IPM training. Pest targets were rationalised, and a radically different decision making structure of trained farmers was observed.

The effects on farmers' practices as a result of IPM training are a start of a process that is set in motion. Something has changed in the minds of most farmers that is, considering the learning experience they have gone through, likely to develop by itself. Much, however, will depend on counter-pressures that exist at the village level, causing constraints to committed implementation of IPM.

#### *Constraints in IPM implementation*

The positive result of decreased pesticide sprays in Central Java contrasted with a small increase in the frequency of (often preventive) granular pesticide applications (carbofuran) during the IPM training and the first post-training seasons. This temporary increase occurred only in the villages where heavy promotion of carbofuran was exerted by the extension worker. Additionally, farmers purchasing inputs on credit from the KUD (the village cooperatives) were obliged to take the complete package (including often unwanted pesticides and foliar fertilisers), despite central government regulations that the packages can be obtained on a need-basis. After the farmers realised that they wasted their money on carbofuran - these chemicals are relatively expensive, and effects on crop health were not convincing - many of them stopped using it, showing that they had learned to learn from experiences.

A similar conflict between IPM implementation and KUD/extension worker policies occurred in West Java. The IPM group had decided to apply for a partial credit by not taking the liquid pesticides and foliar fertilisers in the KUD input package to save costs that were considered a waste. However, they did not succeed to convince the KUD authorities of their needs, and were even not allowed to refuse the complete package and purchase the inputs needed on cash. They were simply told by the extension worker (who had been involved in the IPM field school as co-trainer!) that taking the complete credit package was obligatory, and that "pesticides are still necessary to prevent pest attack". The actual fact was that KUD managers and extension workers considered partial credit packages a trouble and a loss. This "loss" mainly referred to their own personal commissions that would be cut if they did not sell the complete package. These commissions are often an indispensable extra income for extension workers whose salary is hardly sufficient to support a family.

The contradictory information received (IPM versus conventional recommendations) from the same responsible agricultural institutions made the farmers in both areas question about the value of extension interventions. Farmers often react to contradictory information by just picking up whatever

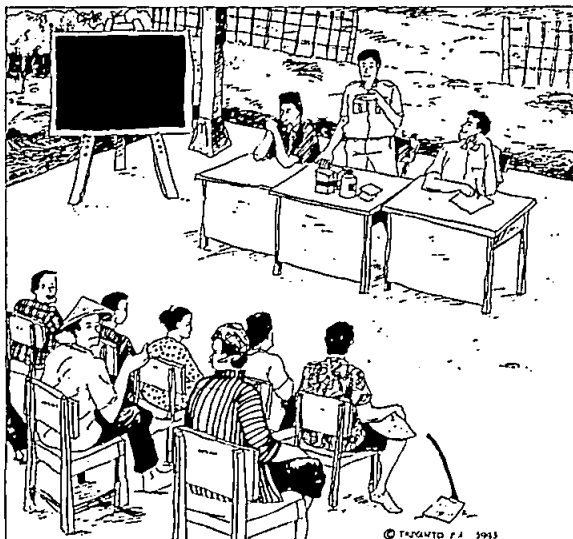
they find applicable. They experiment with recommendations that look valuable, and adapt practices according to their own opinion and experiences. Many farmers already have this habit of experimentation, but the IPM field school tried to enhance their ability to discover adapted practices through experimentation.

The role of the village extension worker in input distribution often causes major conflicts to the introduction of IPM at the village level, although many exceptions of IPM-committed extension workers can be met. More deliberate follow-up activities of the IPM field school would have enhanced farmers' IPM practising and confidence. The IPM Programme presently pays more attention to these follow-up activities and to farmer-to-farmer training.

### Conclusions

The IPM farmer field school model seems suitable to achieve changes in farmers' perception of the rice ecosystem, leading to more sustainable crop management practices. A more independent and responsible status received (and accepted) by farmers through empowerment in the field school is an important contribution to sustain change. Not all farmers trained had complete confidence in the new practices, which could be expected considering the long period they had been exposed to high-external input technologies and top-down extension methods, and considering the counteracting forces of the conventional structures still existing at the village level. Nevertheless, the experience of the Indonesian IPM Programme seems to provide a start for more sustainable practices in intensive food production, and for more sustainable, farmer-oriented extension methods. However, some major changes in the institutional framework of the IPM Programme (being implemented as a government activity through government structures) are probably needed to reduce the constraints for the committed implementation of more sustainable practices by individual rice farmers.

Picture 1:  
A conventional training session



Picture 2:  
A Farmer Field School session



## References

- Adams, M.E. (1982). *Agricultural Extension in Developing Countries*. Intermediate Tropical Agricultural Series. Burnt Mill (Essex): Longman Group Ltd.
- Benor, D. and J.Q. Harrison (1977). *Agricultural Extension: The Training and Visit System*. Washington: The World Bank.
- Chambers, R. (1991). Scientist or resource-poor farmer - whose knowledge counts? In: *Proc. of a Seminar on Crop Protection for Resource-Poor Farmers*. CTA/NRI, Isle of Thorn UK), 4-8 Nov. 1991.
- Chambers, R. and J. Jiggins (1986). *Agricultural Research for Resource-Poor Farmers: A Parsimonious Paradigm*. Discussion Paper 20. Brighton: IDS.
- Chambers, R., A. Pacey and L.A. Thrupp (eds) (1989). *Farmer First: Farmer innovation and agricultural research*. London: Intermediate Technology.
- Flint, M.L. and R. Van den Bosch (1981). *Introduction to Integrated Pest Management*. New York: Plenum Press.
- Food and Agriculture Organisation of the United Nations (1968). *Report of the First Session of the FAO Panel of Experts on Integrated Pest Control*. FAO Meeting Report No. PL/1967/M/7. Rome: FAO.
- Food and Agriculture Organisation of the United Nations (1988). *Integrated Pest Management in Rice in Indonesia. Status after Three Crop Seasons, Perspectives for Farmers' Training*. Jakarta: Food and Agriculture Organisation.
- Freire, P. (1972). *Pedagogy of the Oppressed*. Harmondsworth (UK): Penguin Books.
- Havelock, R.G. (1969). *Planning for innovation through dissemination and utilisation of knowledge*. Ann Arbor: University of Michigan, Institute of Social Research/Centre for Research of Utilisation of Scientific Knowledge.
- Havelock, R.G. (1973). *Planning for Innovation through Dissemination and Utilisation of Knowledge*. Ann Arbor: University of Michigan, CRUSK.
- Iles, M.J. and A. Sweetmore (eds) (1991). *Constraints on the adoption of IPM in developing countries - a survey*. NRI.
- Kenmore, P.E., J.A. Litsinger, J.P. Bandong, A.C. Santiago and M.M. Salac (1987). *Philippine Rice Farmers and Insecticides: Thirty Years of Growing Dependency and New Options for Change*. In: Tait, Joyce and Banpot Napompeth (op. cit.), p. 98-108.
- Kindervatter, S. (1979). *Nonformal Education as an Empowering Process, with Case Studies from Indonesia and Thailand*. Amherst: Univ. of Massachusetts, Center for Int. Education.
- Matteson, P.C., K.D. Gallagher and P.E. Kenmore (1992). Extension of Integrated Pest Management for Planthoppers in Asian Irrigated Rice. In: Denno, R.F. and T.J. Perfect. *Ecology and Management of Planthoppers*. London: Chapman and Hall.
- Moris, J.R. (1983). *Reforming Agricultural Extension and Research Services in Africa*. Discussion Paper 11, Agricultural Administration Network. London: Ag. Adm. Unit, ODI.
- Murphy, J. and T.J. Marchant (1988). *Monitoring and Evaluation in Extension Agencies*. World Bank Technical Paper No. 79, Monitoring and Evaluation Series. Washington: World Bank.
- Patton, M.Q. (1986). *Utilisation-focused Evaluation*. Second Edition. Newbury Park (CA): Sage.
- Pincus, J. (1991). *Farmer Field School Survey: Impact of IPM Training on Farmers' Pest Control Behavior*. Jakarta: IPM National Programme.
- Rogers, E.M. (1962, 1983). *Diffusion of Innovations*. New York: Free Press.
- Röling, N. (1988). *Extension Science: Information Systems in Agricultural Development*. Cambridge: Cambridge University Press.
- Röling, N. (1992). *The Effects of Applied Agriculture Research and Extension: Issues for Knowledge Management*. Submitted to Journal of Extension Systems.

- Röling, N. and H. de Zeeuw (1983). *Improving the Quality of Rural Poverty Alleviation*. Report of the Working Party "The Small Farmer and Development Cooperation". Wageningen: Int. Agricultural Centre.
- Van Cuilenburg, J.J.N. and G.W. Noomen (1984). *Communicatiewetenschap*. Muiderberg: Coutinho.
- Van de Fliert, E. (1993). Integrated Pest Management: farmer field schools generate sustainable practices. A case study in Central Java evaluating IPM training. *Wageningen Agric. Univ. Papers* 93-3.
- Van de Fliert, E., K. van Elsen and F. Nangsir Soenanto (in press). Integrated Rat Management: A Community Activity. Results of a pilot programme in Indonesia. *FAO Plant Prot. Bull.*
- Van de Fliert, E. and L.R.I. Velasco (1994). *Project review report for Action Learning to Promote Improved Environmental Management and Advocacy (IEMA) through Popular Participation with Indonesian Nongovernmental Organizations - phase I*. Jakarta: World Education Inc.
- Van de Fliert, E. and Y.T. Winarto (1993). From technological packages to ecological principles: rice IPM in Indonesia. *ILEIA Newsletter* (9)2: 16-18.
- Van den Ban, A.W. and H.S. Hawkins (1988). *An introduction to extension education*. Burnt Mill: Longman.
- Wapenaar, H., N.G. Röling and A.W. van den Ban (1989). *Basisboek voorlichtingskunde*. Meppel: Boom.
- Wijeratne, M. (1989). *Farmer, Extension and Research in Sri Lanka: An Empirical Study of the Agricultural Knowledge System with Special Reference to Rice Production in Matara District*. Wageningen: PUDOC.
- Winarto, Y.T. (1992). *Farmers' Agroecological Knowledge Construction: The Case of Integrated Pest Management among Rice Farmers in the North Coast of West Java*. Paper presented at IIEDS/IDS Beyond Farmer First: Rural People's Knowledge Agricultural Research and Extension Practice Workshop. IDS, Univ. of Sussex, 27-29 Oct, 1992.



## List of abbreviations

BAPPENAS	Indonesia National Planning Board
DITLIN	Indonesia Directorate of Food Crops Protection
FAO	Food and Agriculture Organization of the United Nations
FTF	Field Training Facility
HIV	high-yielding variety
IPM	Integrated Pest Management
KAP	Knowledge, Attitude and Practice study
KUD	Koperasi Unit Desa = Village Cooperative
NFE	Non-Formal Education
NGO	Nongovernmental Organization
PL I/II	Field Leader I/II of Indonesia National IPM Programme
REC	Rural Extension Centre
SMS	Subject Matter Specialist
T&V	Training-and-Visit extension model of the World Bank
ToT	Training of trainers
USAID	United States Agency for International Development

