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The potential for farmer field research in tropical Asia

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Abstract

The case is made that farmer field research in rice-based agriculture not only empowers farmers but is essential, because of the heterogeneity of agricultural settings. The farmer field school paves the way for farmers to experiment, however, further facilitation is often required to initiate original field research conducted by farmers. Research typically follows a learning cycle of asking and answering questions, which involves elements of, both, art (in terms of generating curiosity, creativity and avoiding reductionism) and science (in terms of principles and steps of scientific method which avoid ambiguous results). Facilitating the research process requires an accurate balance and steps taken at the right moment. Problems with farmer field research are discussed which often relate to shortcuts taken during the learning process, especially at formulating a research question or designing a study. Examples of short-term and long-term facilitation of farmer field research are compared, drawing on experiences from Indonesia. It is argued that, as part of implementation programs, a flexible curriculum can help safeguard that farmers are in control of the research process while opportunities for learning are not being missed. Farmer-to-farmer training and the encouragement of regional forums to exchange research experiences can assist in continuation and expansion of farmer field research.

Introduction

Modern agricultural developments, for example in rice production, have often overlooked the importance of farmer involvement. Intensification programmes discouraged farmers' traditional skills, including the habits of questioning, testing and reflecting because they merely aimed at adoption of introduced technology. As a result, farmers became increasingly reliant on the technology. Agricultural systems were homogenised in terms of synchronised planting and modern varieties, but in reality, variation in soil properties, water supply, a dynamic environment and a rich agroecosystem remained. It has become

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increasingly clear in crops like rice and soybean that a more localised approach to decision-making and adaptation is required which deals with the environmental variables ignored in the transfer of technology. An analysis of results from a large number of farmer studies indicated a high potential to increase yield and to reduce agrochemical inputs. By experimenting in their fields, farmers can adjust their practices according to local circumstances. Farmers are integral part of their farming systems, interacting with their crops through their knowledge, skills and cooperation among each other. Farmers themselves are a crucial factor in the development process because they alone have the potential to make innovative adaptations within their local situation.

The FFS: introducing science

The farmer field school promotes experiential learning through observations in the field. First-hand experiences have a more lasting effect than information received from others. Moreover, this approach implies a shift of decision-making from extension to farmers themselves. Hereby, crop management decisions and practices become better adapted to local and dynamic environmental conditions. The decision-making is not preset but depends on a number of field variables. Consequently, farmers learn to refine their intuitive skills and art of decision-making by enriching their ecological understanding of natural processes and balances.

This approach of 'open-system thinking', whereby there are no fixed answers to questions, is not only a prerequisite for experiential learning, but is also necessary to deal with, both, the complexity and variability of tropical agricultural systems. The complexity of systems requires farmers as decision makers to increase their understanding of the components and interactions that make up the system. For this reason, integrated pest management in rice has expanded its scope to include beneficial organisms, crop physiology, agronomy and soil health. The variability of systems requires farmers to conduct their observations timely and locally. Insect populations, for instance, are difficult to predict while the conditions for a crop to grow can vary greatly from place to place.

Practical learning and independent decision-making opens the way for original field research by farmers. The uncertainty of what is best in their particular field situation is a motive not only for observation but also for experimentation. Moreover, through casual comparisons between neighboring fields, farmers see differences in plant condition causing them to speculate about the causes of those differences.

The exercise of ‘agroecosystem analysis’ in the farmer field school answers questions but also raises new questions. Thus, by looking deeper into the crop’s ecosystem farmers become increasingly aware of the functions and relations of organisms. There is always the risk, however, that the exercise of 'agroecosystem analysis' reverts back into a closed-system approach, whereby simplificiation and routine create new rules of thumb to be followed without questioning. For example, the ratio of pests versus natural enemies has been used in field schools to decide whether or not to spray: "if more pests than natural enemies, then spray". But pest-natural enemy ratios take no account of actual population levels, let alone plant condition. The problem with rules of thumb is that they can lead a life on their own and remove the element of critical thinking and thus the motive to experiment. Many efforts have been made to strengthen the qualitative aspects of the exercise on agroecosystem analysis, by looking into the functional relationships between organisms. Hence, organisms are caught during field observations and observed inside small transparant containers to study their feeding habits, which aids in decision making.

The field school curriculum also adds two comparitive studies. First, the IPM plot is compared with the farmer practice plot. Second, a plant clipping experiment is conducted to let farmers discover that plants can tolerate a certain extent of insect damage to leaves, stems or fruiting parts. Damage by stemborers, for example, is imitated by clipping tillers (i.e. independent shoots) of rice plants at different levels, or at different times, within small marked plots. Plant growth and yield in the clipped treatments are compared with the control. Both comparative studies have clear learning objectives and are thus not original farmer field research. By participating, however, farmers gain experience in the process of experimentation.

The emphasis in the farmer field school is to improve farmer skills of decision making and to enhance group building. The curriculum does not purposely prepare farmers to do their own research, but it provides a motive for research. Participants learn to see their crop as an ecosystem, and are encouraged to ask questions and look for answers. Moreover, they learn to conduct simple studies and compare treatments, but the activities resemble demonstrations rather than original research.

Types of farmer field research

By enhancing knowledge and skills, the farmer field school often compels farmers to do further activities. To some extent the farmer field school encourages farmers to start their own field research spontaneously. For example, Mr Sujai in East Java, who during an attack of tungro disease to his rice crop observed that some plants remained unaffected while being surrounded by diseased plants. He selected those plants and were not effected by the disease either. This caused him to select his own resistant rice seed and, reportedly, his crop has not suffered from the disease ever since. The seed is currently being sold and used by many farmers in the district. Another example of a farmer who started his research spontaneously without any outside help, other than a field school education, is Mr Aep Saepudin from West Java. He made the observation that barnyard grass had more tillers and flowered earlier than rice. He imagined that barnyard grass grew from a single seed whereas rice had to compete with five to nine tillers planted per hole. Moreover, he saw that barnyard grass emerged near the soil surface whereas rice seedlings were normally planted in 6-cm deep holes. Thus he designed his first experiment. He planted rice in shallow holes, each with only one to three tillers and compared the crop with that in surrounding fields planted the usual way. He found that shallow-planted rice had more tillers, less problems with weeds, and a higher yield than deep-planted rice, while it matured earlier and more evenly. It also saved on the amount of seed used. After repeating the study for three seasons, the results were confirmed and other farmers in his village became interested in his experiments. Eventually, more than half of the farmers in the village were using this new method of planting.

However, the majority of field school graduates in Indonesia did not spontaneously embark on research. The field school education improved farmers' knowledge and skills to improve crop management but did not explicitly guide them to conduct their own field research. In response the IPM program introduced an element of experimentation into the curriculum of a follow-up activity in Indonesia. Between 1996 and 1999, soybean field schools were conducted for rice IPM graduates to learn about IPM in this rotation crop, grown after rice in paddy fields. Farmers learned to develop, conduct and analyse their own field experiments in soybean in order to deal with variable growing conditions for this crop in paddy fields. The curriculum was repeatedly improved based on feedback from the field. First, the topic for study was selected by the group. Then the ideas to be tested were formulated. A simple tool helped avoid the single hypothesis by adding alternative hypotheses. For example, apart from the effect on yield, urea might also influence the incidence of weeds and insects and the plant canopy. Observations were planned according to these ideas to be tested. Furthermore, farmers learned about the principles of natural variation, interference between treatments, and the importance of a simple design. Based on these principles they designed their experiments. Hence, to deal with uneven field conditions, farmers often planned several replications of each treatment. A simple statistical tool was developed to help farmers determining whether their results from replicated trials were convincing or not. Finally, an evaluation of results was conducted by revisiting the initial ideas to be tested and by filling in newly acquired knowledge. A full description of the methods used are given by van den Berg et al. (2001).

A more intensive and long-term guidance of farmer field research was conducted at several selected locations in Indonesia on the basis of specific field problems in order to have farmers develop appropriate solutions. These so-called ‘action research facilities’ were sponsored by the IPM program for a period of two to three years. A facilitator was stationed at the location, some land was rented for initial experimentation and a simple house served as 'laboratory' and meeting place. One such facility was in the onion belt in Brebes, Central Java, where farmers had depended on the use of insecticides to control the insect pest shallot armyworm, but found that a range of chemicals had lost their effectiveness. The pest had clearly developed resistance to insecticides. Formal research had yielded an effective strain of an insect virus (an NPV) from shallot armyworm. When a formulation of the virus was sprayed in test fields, it caused an epidemic which controlled larval populations. The virus proved to be specific to shallot armyworm without harmful effects to other organisms. It was mass-produced in the laboratory by infecting field-collected caterpillars with an inoculum. Rather than introducing the external technology of NPV to farmers in the area, an action research facility was set up to help a learning group of farmers to study and discover the mode of action of the insect virus.

A process of farmer field research was initiated, and only when the time was right the insect virus was introduced by the facilitator. Actually, the learning group started off by studying a pest of red pepper, followed by a problem of stunting in onion. Only later on they examined shallot armyworm, and studied its lifecycle. A common farming practice in between spraying operations was to hand-pick infested onion leaves which contained eggs or larvae. The picked leaves with eggs or larvae were normally discarded in the field. The learning group questioned whether discarded larvae would be able to re-infest onion plants. After observing larvae crawling out of the picked leaves the farmers concluded that picked leaves should not be discarded in the field. Instead, they developed an alternative method whereby the picked leaves were put inside plastic bags which were left in the sun until the eggs and larvae had died. Despite the improved method, however, shallot armyworm remained a problem.

The facilitator considered the time ripe for the introduction of the insect virus. To let farmers discover the virus for themselves, he applied the virus secretly to the study field. After a few days, while conducting their regular observations, the learning group noticed armyworm larvae looking weak and yellowish, different from those killed by chemicals. They reasoned that the larvae were sick because their bodies were filled with of the bad-smelling liquid which the farmers suspected contained germs of a disease. During discussions which the facilitator occasionally directed with questions, the idea arose to test if this liquid was infectious to healthy larvae. The contents of five sick larvae were squeezed into a glass of water and the emulsion was sprayed onto a potted plant. Several healthy larvae were added. The larvae died after a few days with the same symptoms as those observed earlier. After this test, the virus was applied to the field and caused an epidemic in the armyworm population. These initial findings gave rise to a process of experimentation. Farmers used the hand-picked larvae to stock their multiplication of the virus, and began spraying the virus solution over larger fields. The virus was found to provide better control at a lower price than chemical insecticides. But large numbers of moths originating from chemically-treated fields continued to invade their fields. The learning group concluded that neighboring farmers had to be involved to implement the improved management of shallot armyworm over a wider area to have more effect. Posters and leaflets were prepared, and a a large meetings were held for onion farmers in several villages. Many of them agreed to join the improved practice of hand-picking. And farmers were encouraged to begin their own virus culture.

Other action research facilities were set up in locations with problems of white stemborer in rice and rice tungro virus. In each case, there was a gradual learning process that resulted in the development of locally appropriate and sustainable methods of crop management. And because the results had been obtained through genuine farmer effort, they were readily accepted by fellow farmers and received local government support.

The perpetual learning cycle

Field research starts with a question or idea, which may originate from past experiences or observations, or from creative, unexpected connections in thought. Through a combination of experience and creativity, Mr Aep connected the observation on barnyard grass to his rice crop, which caused him to develop an improved planting method for rice. The farmer field school, by letting farmers figure out what is best for their crops, stimulates this creativity. It is crucial that the ideas originate from farmers, not from the facilitator or from a resource person. At the action research facility in Dukuhwringin the facilitator introduced the concept of the insect virus without disturbing the learning process of the farmer group. The introduction of the virus literally remained a secret. Farmers may need to be stimulated to form new ideas, especially when they have accepted the field conditions as their fate. For example, a learning group in West Java was not inclined to study their problem of white stemborer in rice, until their facilitator encouraged them to ask questions about the phenomena in the field. The facilitator started the learning process but soon the group came up with their own ideas to be tested. The role of the facilitator waned as the farmers grew more confident and skilled in doing their own research.

Once started, a learning group usually enters into a mode of asking and testing. This 'learning cycle' (Fig. 1) starts with a question (or with an observation that produces a question). An idea is formulated and tested, and results are analysed and interpreted. The curriculum on experimentation in soybean field schools guided farmers through a single learning cycle, but at action research facilities more cycles were made. This process of asking and testing was repeated several times as the results or accidental observations of each test gave rise to new questions. This active process of research gradually brought farmers closer to understanding their object. There was no shortcut for this process. The learning cycle is a self-enforcing mechanism because questions are rewarded with answers while generating new questions. In other words, curiosity grows when fed with new observations or experiences. Hence, by doing research farmers are motivated to do more research. This process starts at the farmer field school and continues in field research. There are certain limitations of farmer field research. For example, farmers in Central Java intended to study whether synchronous planting reduces pests populations; this is an example of a complex problem requiring a sophisticated design and analysis.

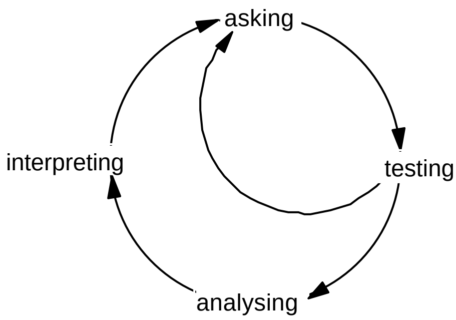

Fig. 1. The learning process of farmer field research.

Facilitation: Walking the tightrope

Even though the farmer field school caused some farmers to start their own research, most graduated farmers felt inconfident or insufficiently equipped to experiment in their fields. Therefore, a training curriculum on experimentation was incorporated in soybean field schools which covered single seasons and which were conducted at a large number of sites, whereas action research facilities were established at a few key locations which covered several seasons. The two approaches yielded valuable experiences in facilitating farmer field research.

Trainers initially lacked confidence to facilitate farmer field research. Their own research experience was limited to standard trials conducted during their own training. Hence, there was a tendency to instruct farmers to do the same studies using the same methods. In return, the farmers considered the study not their own and lacked interest in observations and results. To solve this problem, the IPM program provided some opportunities for trainers to gain experience in field research, and gave trainers additional training on how to facilitate farmer field research. Furthermore, the curriculum on experimentation was improved to ensure the prominent role of farmers at all stages of the research. As a result, the role of farmers increased while the role of the facilitator decreased. Thus, the first steps of the learning process appears are the most crucial in determining the level of farmer ownership. By identifying the options and by formulating ideas to be tested, farmers ensure that the study is their own.

At the action research facilities there was no training curriculum. Instead, the process of research was developed by the learning group as they proceeded. The role of the facilitator was to get farmers into the ‘research mode’ by analysing their problems, reflecting on these problems, and asking questions. But once the farmers were guided through (part of) a learning cycle, the facilitator had to let farmers get on with it by assuming a role in the background. If not, he would have obstructed the learning process by claiming a part of ownership over the research. The key, it seems, is to accept that full ownership of the research is with the farmers. The facilitator can still influence the research process, but with questions rather than solutions to encourage farmers to reflect critically on issues. New ideas or options are occasionally introduced but not without being tested. A common problem with researchers visiting farmer groups is that researchers are inclined to introduce abrupt changes to the research since they do not understand the importance of the learning process for farmers. Also, facilitators who know the outcome of a learning cycle are tempted to provide a shortcut. This jeopardises farmer ownership and discourages experiential learning.

Thus, proper facilitation of farmer field research demands patience and a humble attitude. At the action research facilities, the role of facilitator was not bound to persons, but farmers gradually became facilitators themselves as they gained experience. Even though a resource person may enrich the technical content of farmer field research, the benefit depends largely on how new ideas or information are introduced. Occasionally, there is a need to interfere in the learning process of farmers in order to avoid reductionism, which occurs when the learning process halts at reaching a 'silver-bullet' solution. This has been observed in studies on botanical pesticides. Hence, there is a continuous need for backup support from, and interaction with, scientists, provided that the farmers keep the ownership over the research.

The curriculum to guide farmers through a learning cycle has proven to be valuable. Simple tools helped avoid common problems associated with farmer field research. A tool to analyse the farming situation and potential for improvement helped farmers take control of the planning process by identifying the topic of study of most relevance to them. A tool to formulate ideas to be tested helped farmers to avoid the problem of the single hypothesis and reductionist observations. The introduction of basic principles of experimentation helped farmers to design locally appropriate experiments. The curriculum was flexible by avoiding standards, but ensured that opportunities for learning were not being missed.

The importance of knowledge generation

Farmer field research is particularly important in projects on IPM and Agroecology. A project starts off from a “knowledge-base”, i.e. the ideas, experience and information that compel it to take action into a certain direction. In IPM projects, a knowledge-base may prescribe approaches to field problems or a pilot model of training on local decision-making. A knowledge-base alone, however, is rarely sufficient. New knowledge generated during implementation allows projects to advance in a methodological and technical sense.

Agroecosystems and the human interactions with those systems are both complex and variable. Their complexity demands universal knowledge into common functions, effects and trends of systems (e.g. what is the relationship between components; how do systems respond to changes or manipulations?). Conversely, their variability demands operational knowledge to make adaptations locally and timely (e.g. how much fertilizer to use, and when?).

Hence, projects need to incorporate knowledge generation into their framework (and to an extent this is done through ‘discovery learning’ in the farmer field school). A rough distinction can be made between farmer field research and ‘training-driven research’. Farmer field research deals with local issues or time- and location-specific adaptations. Training-driven research addresses more general issues and aims at developing curricula or guidelines for universal use; it involves organised studies on common functions, effects or trends.

Projects on IPM or Agroecology provide unique opportunities for both types of knowledge generation due to the number of actors and field locations involved and due to the holistic approach and the emphasis on ‘discovery learning’. By being implementation projects, however, knowledge generation is often given insufficient explicit attention. A related problem is that project actors are insufficiently skilled to explore new ecological or methodological approaches, or to fill important gaps in knowledge. Consequently, opportunities for generating new knowledge are being missed. The broadening scope of these projects make specialised consultant assistance relatively unattractive. Hence, there appears to be a need for implementation projects to strengthen their internal capacity to generate knowledge. This could be achieved through educational methods to be developed. These methods should help project actors to identify ecological issues or gaps in knowledge that require study, and to design and analyse organised actions. Meanwhile, there is a continued role for formal research which consists of providing backup information and guidance on issues selected by project actors.

Moreover, project actors need to become directly involved in the process of curriculum development. The experiences of FAO's IPM programme in Asia have demonstrated that there is no ready-made procedure for curriculum development. What matters are several concepts behind the process. First, the stakeholders need to participate from the research stage to the implementation of new curricula to ensure appropriate and relevant results. Second, the process should follow the learning cycle through several iterative rounds. Third, project actors need to stay with their objects until after the research stage in order to give advice on, or to suggest adjustments for, the process of curriculum development. Hence, the process of curriculum development, or technology development, needs to be both continuous and inclusive.

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