odi
Agricultural Research
& Extension Network

AgREN

Network Paper No.105

July 2000

FARMER FIELD SCHOOLS AND LOCAL AGRICULTURAL RESEARCH COMMITTEES: COMPLEMENTARY PLATFORMS FOR INTEGRATED DECISION-MAKING IN SUSTAINABLE AGRICULTURE

Ann R. Braun, Graham Thiele and María Fernández

Abstract

Farmer field schools (FFS) and local agricultural research committees (CIALs) are participatory platforms for improving decision-making capacity and stimulating local innovation for sustainable agriculture. FFS offer community-based, non-formal education to groups of 20–25 farmers. Discovery-based learning is related to agroecological principles in a participatory learning process throughout a crop cycle. CIALs are a permanent agricultural research service staffed by a team of four or more volunteer farmers elected by the community. The committees create a link between local and formal research. Although the FFS and CIALs were initiated for different reasons and have different objectives, they have various commonalities: both focus on identifying concrete solutions for local problems, but they apply different styles of experimentation and analysis; both increase the capacity of individuals and local groups for critical analysis and decision-making; and both stimulate local innovation and emphasise principles and processes rather than recipes or technology packages. FFS fill gaps in local knowledge, conduct holistic research on agroecosystems and increase awareness and understanding of phenomena that are not obvious or easily observable. Their strength lies in increasing farmers' skills as managers of agroecosystems. The strength of the CIALs lies in their systematic evaluation of technological alternatives and their ability to influence the research agendas of formal research and extension systems.

Acknowledgements

We would like to thank Peter Ooi, Bill Settle and Russ Dilts of the FAO technical team (who support the Indonesian national IPM programme) for information on FFS for IPM in rice. We are indebted to Kevin Gallagher, Jeff Bentley, Silvia Caicedo, Trudy Brekelbaum, Jorge Rubiano and Pamela Anderson for reading the preliminary manuscript and providing insights on how to improve it; and to Jacqueline Ashby, Carlos Arturo Quirós, Sally Humphries, Juan Almanza and Jorge Quiroga for discussions that led to the crystallisation of many ideas presented here. We acknowledge the World Bank for allowing us to include material from Braun (1997), a report of a technical audit conducted for the World Bank on the Indonesian Integrated Pest Management Training Project.

The ideas expressed in this paper are our own and do not necessarily reflect the views of those mentioned here.

Ann R. Braun can be contacted at CGIAR Systemwide Program on Participatory Research and Gender Analysis, PO Box 462, Nelson, NEW ZEALAND

Graham Thiele is an anthropologist by training. He helps support participatory technology development and planning in potato research organisations in Bolivia, Peru and Ecuador. He can be contacted at Papa Andina Project, International Potato Center (CIP), Cochabamba, BOLIVIA. *Tel*: 591 4 360800/360801 *Fax*: 591 4 360802 *Email*: g.thiele@cgiar.org

María Fernández coordinates the Natural Resource Management working group of the CGIAR Systemwide Programme on Participatory Research and Gender Analysis. She can be contacted at CGIAR Systemwide Program on Participatory Research and Gender Analysis, Centro Internacional de Agricultura Tropical (CIAT), Casilla R18–067, Lima 18, PERU. *Tel*: 51 1 3494057 *Email*: m.fernandez@cgiar.org

The Agricultural Research and Extension Network is sponsored by the UK Department for International Development (DFID)
The opinions expressed in this paper do not necessarily reflect those of DFID.
We are happy for this material to be reproduced on a not-for-profit basis. The Network Coordinator would appreciate receiving details of any use of this material in training, research or programme design, implementation or evaluation.

Network Coordinator: Catherine Longley Assistant Editor: Helen Suich Administrator: Alana Coyle

ISBN 085003 487 6

CONTENTS

Page

Abstract i

Acknowledgements i

Acronyms iv

1 INTRODUCTION 1

2 FARMER FIELD SCHOOLS 1
Historical context and objectives
Actors
Principles
Key processes
Financing
Maturity and evolution

3 LOCAL AGRICULTURAL RESEARCH COMMITTEES (CIALs) 5
Historical context and objectives
Actors
Principles
Key processes
Costs
Maturity and evolution

4 DIFFERENCES, SIMILARITIES AND COMPLEMENTARITIES BETWEEN FFS AND CIALs 11
Similarities
Differences
Convergence of the platforms

5 FUTURE POTENTIAL 14

REFERENCES 14

ENDNOTES 16

Tables, boxes and figures

Table 1	Objectives, actors and processes of FFS for rice IPM and local agricultural research committees	10
Table 2	Key differences between research processes in FFS for rice IPM and local agricultural research committees	12
Box 1	Profile of a FFS session for IPM in rice	4
Figure 1	Average institutional costs of facilitating a CIAL	8
Figure 2	The per cent of CIALs in Cauca, Colombia (n=53) that could clearly explain basic concepts of controlled experimentation, 1998	9

Acronyms

AEA	agroecosystem analysis
ARF	action research facility (FAO)
ASOCIAL	*Asociación de los CIAL*/CIAL Association (Honduras)
CGIAR	Consultative Group on International Agricultural Research
CIAL	*Comité de investigación agricola local*/local agricultural research committee
CIAT	*Centro Internacional de Agricultura Tropical*/International Centre for Tropical Agriculture (Colombia)
CIP	*Centro Internacional de la Papa*/International Potato Centre (Peru)
CORFOCIAL	*Corporación para el Fomento de los CIAL* (Colombia)
CORPOICA	*Corporación Colombiana de Investigación Agropecuaria*/Colombian Agricultural Research Corporation
FAO	Food and Agriculture Organisation of the United Nations (Italy)
FFS	farmer field schools
IPM	integrated pest management
IPRA	*Investigación Participativa con Agricultores*/Participatory Research with Farmers *(*CIAT)
NGO	non-governmental organisation
PROINPA	*Fundación para la Promoción e Investigación de Productos Andinos* (Bolivia)
R&D	research and development
UPWARD	Users' Perspective With Agricultural Research and Development
USAID	United States Agency for International Development
WE	World Education

FARMER FIELD SCHOOLS AND LOCAL AGRICULTURAL RESEARCH COMMITTEES: COMPLEMENTARY PLATFORMS FOR INTEGRATED DECISION-MAKING IN SUSTAINABLE AGRICULTURE

Ann R. Braun, Graham Thiele and María Fernández

1 INTRODUCTION

Farmer field schools (FFS) and local agricultural research committees (CIALs) constitute two platforms[1] for promoting integrated decision-making and innovation for sustainable agriculture by farmers. Recently, there has been some convergence between the two platforms, but the main objectives underlying each differ. The first platform is oriented towards providing agroecological education through participatory learning, whereas the second is intended to build a permanent local research service that links farmer experimentation with formal research. Outcomes common to both approaches include:

- increased farmers' capacity for research, innovation and informed decision-making (Ashby et al., 2000; Aizen, 1998; Settle et al., 1998; Nyambo et al., 1997; Schmidt et al., 1997; van de Fliert, 1993; Humphries et al., this issue);
- development of farmers' capacity to define their own research agendas in the CIALs and as part of the FFS follow-up activities (Ashby et al., 2000; Ooi, 1998; Braun, 1997; Settle, 1997; Humphries et al., this issue);
- stimulation of farmers to become facilitators of their own research and learning processes (Ashby et al., 2000; Settle et al., 1998; Braun, 1997; Humphries et al., this issue; Schmidt et al., 1997; Winarto, 1995);
- increased responsiveness to farmer-clients' demands and needs by organisations in national research, extension and development systems (Ashby et al., 2000; Settle et al., 1998; van de Fliert, 1993).

The FFS and CIAL approaches have been replicated both inside and outside the countries where they originated (Ashby et al., 2000; Settle et al., 1998). FFS began in Indonesia in 1986. By 1998, two million small farmers in key rice production areas of 12 Asian countries had learnt through FFS how to become informed decision-makers with respect to crop management and protection (Settle et al., 1998). Untung (1996) estimates that the resulting reduction in pesticide use in Indonesia is around 50–60 per cent. FFS have already been established in several African countries and the first Latin American FFS are operating in Ecuador, Peru and Bolivia. CIALs began in Colombia in 1990, and by 1999 249 resource-poor communities in eight Latin American countries had active CIALs providing agricultural research services (Ashby et al., 2000). In addition to stimulating local experimentation on varieties, crop and soil management, and improving access to formal research products, the CIALs have contributed to increased food security, higher yields, greater biodiversity in cropping systems, the launching of rural microenterprises, and to increasing social status of women and other marginalised groups (Ashby et al., 2000; Humphries et al., this issue).

In Latin America both the FFS and CIAL platforms have begun to operate within the same geographic areas: in Ecuador and Bolivia both are supported by the same organisations. Farmers, researchers and extensionists are already asking how they relate to each other, and what are their comparative advantages. This paper compares their objectives, principles and processes as a basis for exploring their most appropriate use. We first compare the two platforms as they were originally conceived, then discuss the evolution of each and, finally, explore future directions. The basic questions addressed are:

- What are FFS and CIALs?
- What are their objectives and what type of problems do they address?
- Who are the actors and what are the fundamental principles and processes involved in each case?
- How have both approaches evolved and matured?
- What are their differences, similarities and complementarities?
- What is their future potential?

2 FARMER FIELD SCHOOLS

Historical context and objectives

Originally the FFS were developed in Asia, where there are some 200 million rice farmers. Food security was endangered and political stability threatened in several countries as a result of severe losses in rice production caused by the brown plant hopper (*Nilaparvata lugens* Stål) (Winarto, 1995; van de Fliert et al., 1995; Conway and McCauley, 1983). This initial classical FFS for integrated pest management (IPM) on rice was subsequently broadened in a second generation of FFS to address other crops and topics.

Research carried out in the Philippines (Litsinger, 1989; Gallagher, 1988; Kenmore, 1980) and confirmed in Indonesia (Untung, 1996) demonstrated that indiscriminate pesticide use in rice crops not only induced resistance in *N. Lugens* but also eliminated its natural enemies, resulting in severe outbreaks. In Indonesia these processes were accelerated by frequent aerial applications of pesticides during the 1970s (Schmidt et al., 1997). The first serious outbreaks of *N. lugens* in Indonesia in 1975 and 1977 caused estimated losses of US$1 billion. The plant hopper reappeared in the mid-1980s because of continued heavy insecticide

use and the rapid breakdown of resistance in new rice varieties (Schmidt et al., 1997; Untung, 1996). Indonesia's goal of self-sufficiency in rice production, reached in 1984, was reversed in 1985–6 when *N. lugens* destroyed 275,000ha of rice (Röling and van de Fliert, 1998).

For the FAO Intercountry IPM Programme[2] – the innovators of the FFS – the plant hopper outbreak was symptomatic of a major problem in modern agriculture: pesticide dependency (Matteson et al., 1992). Moreover, the technical recommendations made by the formal research system had limited applicability in farmers' fields, and concepts such as economic thresholds proved irrelevant as decision-making criteria. Some research products (e.g. resistant varieties) had the potential for managing pests but were not fully exploited because farmers opted for the less risky option of pesticides (Matteson et al., 1992).

The FFS were designed to address these problems and to empower farmers in the longer-term so that they could influence policy makers. The main objectives were to improve farmers' analytical and decision-making skills, develop expertise in IPM, and end dependency on pesticides as the main or exclusive pest-control measure. To accomplish this, farmers had to gain an understanding of the ecological principles and processes governing pest population dynamics.

The FFS provide an opportunity for learning-by-doing, based on principles of non-formal education. Extension workers or trained farmers facilitate the learning process, encouraging farmers to discover key agroecological concepts and develop IPM skills through self-discovery activities practised in the field (Ooi, 1996).

Actors

Although NGOs play an important complementary role within national extension strategies, the FAO team felt that the limited scope of their projects prevented them from being the main channel for diffusing IPM extensively (Matteson et al., 1992). The only way to reach a significant number of farmers and ensure continuity and quality of IPM training and extension was to integrate these processes within a national programme agenda for each country. In Indonesia, for example, field leaders and pest observers were trained for 15 months in IPM and facilitation skills in regional IPM training centres (van de Fliert et al., 1995). The programme's strategy was not to train individual farmers but to establish an IPM capacity in each community and then support its horizontal diffusion (Settle et al., 1998; van de Fliert et al., 1995).

FFS for rice IPM are designed for 20–25 participants from one community. This number is intended to develop a critical mass, around which collective action and follow-up activities can be consolidated after the FFS activities end. Interested farmers are invited to a community meeting at which FFS objectives and processes are explained, as well as the importance of attendance at weekly meetings throughout the crop cycle.

Principles

FFS emphasise four principles of IPM:

- to grow a healthy crop;
- to conserve natural enemies of insect pests;
- to monitor the fields regularly;
- to become IPM experts through participation in FFS.

Key processes

Planning

FFS require significant institutional commitment and support, usually provided by the national extension service, although other mechanisms are possible where this is lacking. Several weeks before planting the facilitating organisation should begin to:

- consult and coordinate with other programmes working in the region;
- identify communities that fulfil the criteria for establishing FFS;
- identify participants and make plans with them for conducting FFS.

The community leader and interested farmers attend a preparatory meeting, where they:

- characterise and map the village, identify main problems faced by farmers, and select the meeting site and fields for trials;
- analyse the participation of women and men in rice production activities and identify individuals who can benefit from attending the field school;
- motivate the community by explaining FFS objectives and processes, select participants and formalise commitment by signing a learning contract.

The learning cycle – observation, analysis and action

FFS for rice hold weekly meetings throughout the crop cycle (three months). The first session usually begins one to three weeks after transplanting so that field observations cover all critical phases of crop growth.

Improved decision-making emerges from an iterative process of analysing a situation from multiple viewpoints, synthesising the analyses, making decisions accordingly, implementing the decisions, observing the outcome, and then evaluating the overall impact. New knowledge and insights at each stage require revision of earlier stages and modification of initial assumptions. This process is conducted within the framework of an agroecosystem analysis (AEA), originally developed by Conway (1985 and 1987) with Thai colleagues.

To discover key agroecological principles, each FFS plants a rice field (about 1000m^2) that is divided into two plots. Local crop management practices on the non-IPM plot are compared with those based on the participants' AEA on the IPM plot. The control (non-IPM plot) is based on farmers' conventional management, where the application of insecticide eliminates natural enemies of insect pests. Participants learn about the agroecosystem and insect population dynamics during the process of making observations in the two plots throughout the crop cycle.

Small groups of four to five farmers carry out an AEA. The groups observe 10 rice plants in each plot, noting the insects (types, numbers, location, etc.) and number of tillers per plant. Afterwards, farmers draw what they have observed on large sheets of paper. The drawings (see Mangan, 1997) show the development stage of the rice plants and the pests and natural enemies observed, as well as other information considered relevant to crop management by the participants (e.g. soil moisture, weeds, climate, etc.). Based on their AEA, the farmers reach a consensus on the management practices that should be carried out in the IPM plot the following week. Each group presents its analysis and proposed actions in a plenary session, followed by questions and discussion. Drawings from previous sessions are available as reference material to enrich the discussion. Yields and profitability are compared at harvest.

Developing agroecological knowledge

Agroecological systems – even complex ones – are structured by a few key processes. When managing an agroecosystem, it is important to understand not only its components but also the patterns and processes defining the relationships among them. Scientists use quantitative techniques to study ecosystem components, while patterns and processes are studied qualitatively, making it possible to map interrelationships.

In the case of irrigated rice in the tropics, the key relationships include the following (Settle, 1997):

1. Energy is stored as organic matter and enters the system through the action of micro-organisms and detritivores.
2. The micro-organisms and detritivores sustain filter-feeding insects such as mosquito larvae.
3. In turn, the filter feeders provide a consistent alternative food supply for generalist arthropod predators that consume rice pests.

The key to understanding outbreaks of the brown plant hopper lies in comprehending these relationships and how they are disrupted by the application of pesticides. Since these relationships are generally unknown to farmers, mechanisms for identifying and filling such knowledge gaps are critical (Bentley, 1994a). FFS include special topic field activities designed to uncover unknown agroecosystems relationships.

A classic example of such a field activity is the insect zoo which consists of placing an insect in a cage with a rice plant covered by muslin netting that allows the farmers to observe the insect in order to determine whether it is neutral (a detritivore or plankton feeder), plant-feeding or beneficial (predatory). Other activities include (Settle et al., 1998):

- taking samples of aquatic plankton for observation and discussion;
- diagramming food chains and energy flows as the basis for discussing the structure and stability of the rice ecosystem;
- conducting discovery exercises to show that the effects of insecticides on natural enemies are poisonous not medicinal (the term used by farmers);
- defoliation or elimination of tillers to determine the capacity of the rice plant to compensate for insect damage;
- studying the impact of plant spacing, water control, fertilisers, varieties and soil characteristics on the rice plant and its pests.

The most important concepts discovered by farmers through these special topic field activities are that:

- most insects found in the IPM plot are either neutral or beneficial;
- the rice plant can tolerate fairly high levels of damage without suffering reduced yields; and
- insecticides are toxic to natural enemies and most other animals, including human beings (Settle et al., 1998).

Once these concepts are internalised by farmers the stage is set for better management decisions.

Special topics also develop farmer research capacity by stimulating comparison of IPM and non-IPM (control) plots and by providing regular opportunities for data gathering and analysis. Once the facilitator has introduced a special topic and explained the steps to follow, participants assume active management of the activities.

Another key concept of the FFS approach is the *indicator*. Because successful agroecosystem management depends upon system health, the FFS emphasise the importance of health indicators and develop the capacity to formulate them. The less tangible and concrete a property, the greater the importance of indicators as management tools. An example of an agroecosystem health indicator, discovered by a FFS farmer-facilitator, is the population level of the dragonfly, an insect that is highly sensitive to pesticides. Their absence indicates that the environment is contaminated (Ooi, 1998).

Developing the capacity for collective action

Each FFS meeting includes a group dynamics exercise to strengthen teamwork and problem-solving skills, promote creativity and create awareness of the importance and role of collective action. The facilitator suggests a problem or a challenge for the group to solve. These exercises usually involve physical activity but sometimes take the form of mental puzzles or brain-teasers – they should be fun while offering an opportunity to work together towards solving a specific problem.

Motivating and sustaining interest

To stimulate interest in FFS beyond the immediate participants, the field school invites the whole village and farmers from neighbouring villages to attend the harvesting of its plots and participate in analysis of results. The Indonesian national IPM programme and many local governments have sponsored facilitator meetings and the attendance of FFS alumni at technical workshops and planning meetings. The resulting farmer-trainer networks develop strategies for training other farmers and influencing local agricultural policies.

Facilitation

The facilitator's role and attitude are key factors in determining the success of an FFS. His or her duties include serving as catalyst, encouraging analysis, setting standards, posing questions and concerns, paying attention to group dynamics, serving as mediator and encouraging participants to ask questions and come to their own conclusions. A facilitator who provides answers instead of raising new questions will fail in an FFS environment. For example, if someone asks, 'What's this insect? Is it a pest?' a good facilitator would answer with another question: 'What can we do to find out?'

Extension workers who serve as facilitators have completed a training programme that lasts an entire crop cycle and provides them with first-hand experience in rice cultivation, while developing facilitation, leadership and administrative skills. Each facilitator is expected to guide at least three FFS per year. Today, the trend is to strengthen the role of farmers as facilitators (Braun, 1997). This occurred spontaneously in Indonesia: in 1990 former alumni of one district organised field schools for their neighbours, and by 1993 formal training of farmers as facilitators had begun (Settle et al., 1998).

Candidates for the role of farmer-facilitator are identified during FFS, where participants' capacities and potential as facilitators are easily observed. They are given one week of training and are supported in their tasks by an extensionist-facilitator. Farmer-facilitators have proven to be motivated and sometimes more effective than their professional counterparts because farmers appreciate learning from peers with similar experience who speak their local language (van de Fliert et al., 1995).

Financing

In 1989, Indonesia launched its national IPM programme based on FFS, with technical assistance from FAO and three years' funding from USAID. This programme was backed by presidential decree, which formalised the adoption of IPM as the national crop-protection strategy, prohibiting the use of 57 broad-spectrum pesticides for rice and eliminating pesticide subsidies. From 1994 to 1998, a World Bank bilateral loan sustained the programme (Braun, 1997). During the 1996–7 fiscal year, the average cost of a field school facilitated by a professional extension worker was US$532. The budget covered the honorarium of the facilitator; preparation and coordination expenses; the facilitator's transport; materials; refreshments; compensation for the farmer providing the experimental field; stipends for participant farmers; and field day expenses incurred for the field day. Stipends for participants amounted to US$0.43 per person per session and consumed a quarter of the budget. Farmer-directed FFS have slightly higher budgets (US$586) because two farmers are responsible for facilitating the process (Braun, 1997).

Box 1 Profile of a FFS session for IPM in rice

Field observations: 7:30–8:30a.m. Farmers form small groups, make observations of the whole field, and then examine 10 plants per plot, recording the number of tillers per plant, the type and number of insects, and any other relevant details.

Agroecosystem analysis: 8:30–9:15a.m. Each group prepares drawings of their field observations including information on the condition of the plants, pests and diseases; natural enemies of insect pests; weather, soil and water conditions.

Presentation and discussion: 9:15–10:00a.m. Each group presents their drawings and discusses their observations and conclusions. The whole group reaches consensus about the crop management practices that they will carry out during the coming week.

Break: 10:00–10:15a.m. Refreshments.

Group dynamics exercise: 10:15–10:30a.m. This activity aims to stimulate attention and participation, as well as strengthen group communication and increase solidarity.

Special topic: 10:30–12:00a.m. The facilitator guides the group in experiments, lessons, exercises and discussions on special topics related to what is actually occurring in the field.

Maturity and evolution

The profile of a classical rice IPM field school session is given in Box 1. The field school ends at the harvest, but participants are expected to continue the learning process and collective actions that began at the school. Since 1991, various follow-up activities have been conducted to support the continuity of the process. Demands for follow-up emerged spontaneously among alumni who wanted to seek solutions to specific problems they faced with other crops. In areas with particularly difficult or persisting rice production problems, the FAO team developed action research facilities or ARFs (Ooi, 1998 and 1996). Like field schools, the ARFs are not permanent, but they may last for several crop cycles. They are designed to increase farmers' understanding of basic ecological principles within a larger agroecosystem, investigate serious problems and develop community-level action plans. Studies are conceived and carried out by former FFS students with the support of a scientist-facilitator. Farmers begin by making a list of ideas, both exogenous and endogenous, on how to manage the targeted problem. Then they systematically study each idea. An ARF in Java spent two years studying the management of the white stemborer in rice (Settle, 1997; Winarto, 1995). After the facilitator leaves, farmers are expected to continue studying on their own to broaden their understanding of the agroecological basis of agriculture and to maintain a community IPM programme (Settle, 1997).

In some cases, more permanent ties have been established between formal research services and communities participating in FFS. These arose mainly in areas where other crops – especially vegetables – were important. In some cases the approach used for rice required modification because the pest and disease problems were more complex than in rice, which is part of an ancient agroecological system in Asia. Given that vegetables are often exotic species with limited beneficial fauna, in many cases the underlying agroecological principles were not sufficiently well

understood to permit development of an effective field school curriculum.

World Education (WE) – an international NGO that had developed FFS for vegetables such as potatoes, green onions and cabbage – had to suspend the FFS for potatoes because of poor attendance resulting from insufficient technical content. WE sought the support of universities and agricultural research centres, proposing the formation of an integrated college between researchers and farmers trained in the FFS approach. Formal and local researchers worked together to characterise and understand production problems, as well as identify research topics and decide how to execute them. Clemson University in the US (see Shepard et al., 1998), the International Potato Centre (CIP), and national universities and research centres participated in the process.

CIP developed FFS for sweet potato, a crop that is rotated with rice in areas where irrigation is not available throughout the year. The FFS for sweet potatoes were incorporated as a follow-up activity offered by the Indonesian National IPM Programme to farmers participating in FFS for rice. Whilst the objective was to complement and enrich existing FFS processes, it introduced several innovations. First, it was developed through a participatory process involving a network of communities where sweet potatoes play a key role in the family economy. The approach used was based on integrated crop management from production to marketing (Braun et al., 1995). In addition to developing agroecological knowledge, the sweet potato field school sought to strengthen farmer capacity to design and conduct research oriented towards the generation and/or adaptation of solutions to problems prioritised by the participants (Braun et al., 1995; Braun and van de Fliert, 1997; van de Fliert et al., 1996).

The FAO team that developed the FFS approach recognises four stages that have evolved spontaneously. According to Settle et al. (1998), these stages are:

1. farmer field schools;
2. follow-up studies and action research facilities implemented by farmer-researchers;
3. farmer-to-farmer training; and
4. community IPM involving networks of farmers, farmer-facilitators and researchers.

The best indicator of the local establishment and institutionalisation of community IPM is increased local economic and logistic support for FFS and their follow-up activities. In analysing key factors affecting the quality of FFS, Braun (1997) found the following examples of local support for community IPM:

- local leaders request FFS for their communities;
- local leaders attend FFS inauguration and closing ceremonies;
- FFS organised by farmer-facilitators or by associations of former FFS students arise spontaneously;
- FFS are supported financially by local governments;
- FFS and IPM are promoted in community meetings by participating farmers and facilitators;
- spontaneous research is carried out by farmers who have completed FFS courses;
- insecticide-free areas are established voluntarily by communities;
- farmer-facilitators have been elected to local positions and then promote IPM within their villages;
- traditional fish-breeding systems are re-established within rice fields when a community suspends pesticide use;
- associations are established to market pesticide-free rice and vegetables;
- IPM is adopted by administrative entities as an official policy of sustainable agriculture.

3 LOCAL AGRICULTURAL RESEARCH COMMITTEES (CIALs)

Historical context and objectives

A CIAL is a research service that belongs to and is managed by a rural community. The research team is made up of volunteer farmers, chosen for their interest in, and aptitude for, experimentation. The CIAL links farmer-researchers with formal research systems, thereby increasing local capacity, not only to exert demand on the formal system but also to access potentially useful skills, information and research products.

The Participatory Research with Farmers (IPRA) team that developed the CIALs launched this platform in response to the limited impact of formal research systems among poor farmers in environments which are characterised as complex, diverse, and risk-prone (Chambers et al., 1989), and were not reached by the Green Revolution. As a project of the International Centre for Tropical Agriculture (CIAT), IPRA operated in an environment that was associated with Green Revolution varieties and technological packages. Initially, the project's main concerns were the low adoption of improved varieties and the rejection of recommendations for fertiliser use in Andean hillside areas where the problems of soil deterioration were notable (Ashby et al., 2000).

Working in the Colombian province of Cauca, IPRA began by testing the hypothesis that increasing farmers' participation in the diagnosis of problems and in subsequent research design would result in different conclusions and recommendations. The findings were clear: research that did not involve farmers as active members in the early phases ran the risk of developing technologies of little relevance and of low probability of adoption (Ashby, 1987). Farmers who experimented alone obtained lower yields and reached different conclusions regarding use of inputs than those working with researchers. Results also showed that early participation of farmers led to the selection of potentially useful options that had been rejected by researchers working alone (Ashby, 1987).

These findings led IPRA to ask whether it was feasible to establish a sustainable, community-based participatory research service that was directed by its members (Ashby

et al., 2000). At the same time, the communities involved in comparing research results with and without farmer participation posed their own questions, such as what would happen when IPRA left. The farmers involved wanted to continue developing their own research in small groups and sharing their results within the community. They wanted the support of a facilitator (i.e. an agronomist) to catalyse the process: thus the concept of a farmer-operated local research service was born.

Actors

In Colombia, each CIAL has a facilitator and four elected members. In Honduras, many CIALs have more than four elected members, plus several non-elected volunteers (Humphries et al., this issue). The facilitator may be a trained agronomist from a supportive formal research centre, university, NGO or an extension service. Alternatively, he or she may be a trained farmer who has served on a CIAL. The facilitator plays a key role in developing the CIAL's competence in the research process and is responsible for providing feedback on farmers' priorities and research results to formal research and extension services.

Principles

Ashby et al., (2000) identified five principles underlying successful CIALs:

- knowledge is generated by building on experiences and 'learning-by-doing';
- relationships among the CIAL, the community and external actors are based on mutual respect, accountability and shared decision-making;
- partners in the research process share the risks;
- research products are public goods;
- the farming system is improved by a systematic and participatory process of comparing technological alternatives.

Key processes

The CIAL process is iterative and consists of a number of steps which are all supported by facilitation, monitoring and evaluation, as described in following paragraphs.

Facilitation

The farmers providing the research service have a formal link with a research centre mediated by a trained facilitator. The facilitator initiates the CIAL process by convening a motivational meeting in the community.

Training in CIAL processes is provided in the community through regular visits by the facilitator. This equips the farmer research team to conduct experiments that compare alternatives with a control treatment and that employ replication in time and space. The training familiarises the farmer-researchers with terminology that will give their results credibility with the formal research system, but that is communicable to local people. The training also builds skills related to planning, management, meeting facilitation, monitoring and evaluation, record-keeping and basic accounting.

Facilitators are expected to respect the research priorities established by the community and the decisions made by the farmer research team in defining experimental treatments and evaluation criteria, generating recommendations and managing research funds. The facilitator is expected to respect local knowledge, to understand that risk is inherent in experimentation, and that learning to manage risk is part of the process of becoming a farmer-researcher.

Facilitation of a CIAL requires profound changes in the attitudes of and relationships among farmers, rural communities and agricultural professionals. Training of facilitators includes a sensitisation process and practice in new communication skills. The first lesson is to avoid the leading questions that so often characterise researchers' interactions with farmers. Instead, facilitators learn how to ask open questions that permit true two-way communication. Another change that facilitators must make is to cease promoting their organisation's agenda.

A facilitator begins with a two-week course and continues in-service training during the formation of his or her first CIAL. During the first year, s/he has the support of a trainer who has several years of experience as a facilitator. The trainer visits the CIAL at key moments (diagnosis, planning and evaluation – see below); monitors processes and provides feedback to the committee and its facilitator; and points out strengths and weaknesses. After the first year, as the CIAL evolves, follow-ups ensure that the facilitator and the CIAL have access to an expert with experience in the subsequent phases of the process.

Motivation

The facilitator invites the entire community to a meeting where the nature and purpose of the CIAL are discussed. The farmers are invited to analyse what it means to experiment with a new agricultural technology. Local experiences and experimental results are discussed. The possibility of having access to new technologies from outside the community is also mentioned. If the community decides to form a CIAL, it then elects four farmers to staff the committee.

Managing risk

A CIAL fund is established to help absorb research risks. The fund is initiated from seed money, which may take the form of a one-off donation from the facilitating organisation. Alternatively, it may be provided from a rotating fund managed by an association of CIALs (Ashby et al., 2000; Humphries et al., this issue). The farmer research team uses the fund to procure inputs needed for their experiments and to compensate members for the incurred losses. The fund is owned by and established in the name of the community. The CIAL and the community are jointly responsible for assuring that decapitalisation does not occur, and they are expected to contribute to building the fund through collective efforts.

When a technology proves successful, the CIAL should be able to reimburse the fund for the research costs when the harvest is sold. The amount needed to begin operations typically varies from US$30–120. As the fund grows, the CIAL can expand its research, share some of its earnings with participants, or invest in new equipment or services. Some CIALs launch small enterprises. Research products such as seed of different varieties can be multiplied and sold by the farmer-researcher team, individually or collectively. However, a small part of the earnings should be allocated to the CIAL fund and/or community fund for loans or credit.

Electing CIAL members

A key selection criterion for elected members is that the farmers are experimenting on their own and are willing and able to provide a service to the rest of the community. CIAL members agree to serve for a minimum of one year. The elected members each have a specific role as leader, treasurer, secretary or communicator and are often assisted by several additional volunteers. The elected members agree to take part in a regular training and capacity-building process over at least one year.

Diagnosis

The research topic is determined through a group diagnosis in an open meeting of the community. The opening question is: 'What do we want to know about?' or 'What do we want to investigate?' The objective is to identify researchable questions of priority to the community. The topics generated by the discussion are prioritised by asking questions on the likelihood of success, who and how many would benefit, and the estimated cost of the research.

Research cycle

The iterative research process includes the following steps:

Planning: The experiments carried out by the farmer-researcher team aim to generate information on technology options – either of local or external origin – of interest to the community. The experiments are not for demonstrating technologies or teaching principles. Technologies from outside the community need not be finished products: offering access to a technology while it is under development and making adjustments based on the feedback obtained from the CIAL is a powerful mechanism for research organisations to respond to farmer needs and priorities.

The facilitator helps the farmer-researcher team obtain the information required to plan the experiment. Other farmers and staff of formal research and extension services are often consulted. If the information gathered indicates that the selected topic should be modified, this decision is discussed with the community.

The facilitator helps the CIAL to formulate a clear objective for each experiment. The objective should guide the CIAL in all the decisions it makes from design to evaluation. Based on the experiment's objective, the CIAL decides what, how and when to evaluate the trial. It also determines experimental variables, criteria for evaluating results, comparisons to be made, data to be collected, and the measurement units to be used.

Establishment and management of the experiment: The CIAL carries out the trial as planned. The cost of the inputs is covered by the CIAL fund.

Evaluation: The farmer-researcher team meets with the facilitator to evaluate the treatments and control, and to record the data. The timing of the evaluations and types of data collected should agree with the objectives of the experiment.

Analysis and feedback: The farmer-researcher team draws conclusions and presents their results to the community. The analysis includes the question: 'What have we learned?' Analysis of the process is especially important when an innovation is unsuccessful or when unexpected results are obtained.

Iteration of processes

The facilitator guides the CIAL through three successive experiments. In the first experiment, known as the exploratory or preliminary trial, the CIAL tests innovations on small plots. These may have several treatments, such as different crop varieties, fertiliser amounts or types, sowing dates or plant densities, etc. The exploratory trial is a mechanism for eliminating options that are unlikely to succeed under local conditions. If the objective of the first experiment is to compare the performance of different crop varieties, eight to ten materials may be planted including at least one local control. The area planted would be in the order of three to four replications of eight to ten rows, each five metres long. The treatments selected as the most promising are then tested on larger plots in a second experiment. In a comparison of varieties the second experiment might consist of five materials planted in ten rows, each ten metres long. Finally, two or three top-performing choices are planted over a still larger area in the third experiment, often called the production plot. A production plot for top-choice varieties might consist of three or more replications of 20–30 rows of between 20–30 metres. After this, the CIAL may continue with commercial production if it wishes to do so, or switch to a new research topic.

To begin on a small scale is fundamental to the CIAL approach. Small plots provide the CIAL with the experience of applying new concepts such as replication and control, and they allow it to gain confidence before moving to larger and therefore riskier plots. Small-scale experiments also allow the CIAL to screen out options that have little likelihood of success.

As the CIAL becomes proficient in managing the process, the facilitator reduces the frequency of visits from two visits per month for new CIALs to one visit every three or four months in mature CIALs (for a contrasting case see Humphries et al., this issue). The main purposes of visits to mature CIALs are to acquire feedback on research priorities and results, and to

provide the CIAL with access to technology under development by formal research services.

Providing feedback
Open meetings are held with the community on a regular basis. The CIAL presents its activities, reports on progress and makes recommendations based on its experiments. It also reports regularly on the state of its finances. This is essential when creating a climate of accountability and ensuring that research products become public goods. In turn, the facilitators are responsible for ensuring that research priorities and results reach the formal research system.

Monitoring and evaluation
Monitoring and evaluation is a mechanism for building mutual accountability among partners in the CIAL process. The community evaluates the performance of the farmer-researcher team and may decide to replace any member. The farmer-researcher team keeps records of its experiments: these records belong to the community and are available to community members or others authorised by the community to consult them. The farmer-researcher team is also responsible for the appropriate use of the CIAL fund. It should inform the community on financial decisions, expenditures and cash inflow.

The CIAL formally evaluates the support received from the facilitator and shares these results with the community and with the facilitating organisation. Experienced trainer-facilitators visit CIALs formed by new facilitators to monitor the evolution of the CIAL process and provide timely feedback to both the facilitator and the CIAL members. They assess the CIAL's understanding of the research process and degree of self-management.

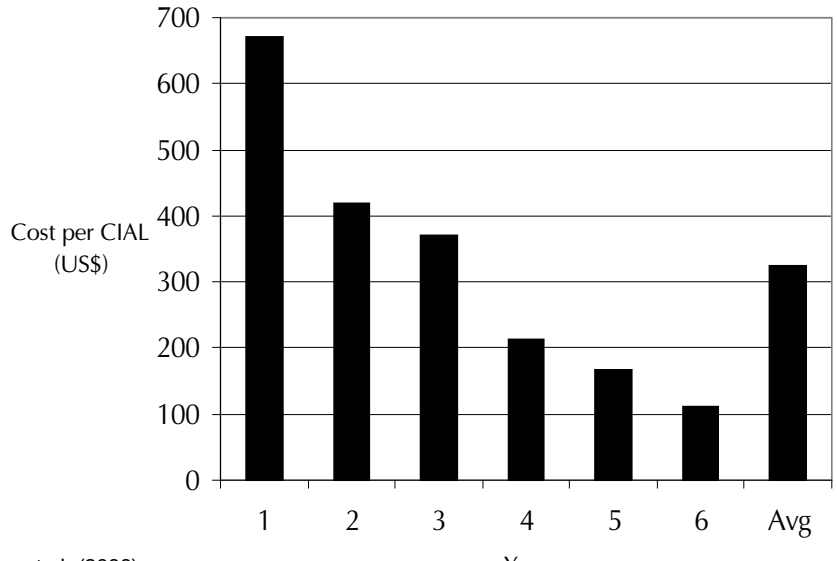
Costs

Institutional start-up costs for supporting CIALs are highest in the first year because of the investment in training the facilitator and the provision of seed money for the CIAL fund. The cost of facilitating a CIAL strongly depends on the number of CIALs served per facilitator and on the level of maturity of the CIALs. New CIALs requiring two visits per month imply more facilitator time and higher transportation costs than mature CIALs (Humphries et al., this issue). Drawing upon data from several different types of facilitating organisations (NGO, national research insititute and CIAL association), the average yearly cost of facilitating one CIAL has been estimated at US$486 over the first three years and $325 over the first six years (Figure 1).

Maturity and evolution

The maturation process
A successful CIAL provides an effective research service to its community. The CIAL's comprehension of the research process, capacity for self-management and the use of its research products by the community are important indicators of success. Monitoring and evaluation activities have revealed that comprehension of the research process follows a learning curve (Ashby et al., 2000; Humphries et al., this issue). For the CIALs in Cauca, Colombia that have conducted one or two experiments, 61 per cent were able to clearly explain the basic concepts of systematic experimentation[3], compared to 68 per cent that had conducted three or four experiments, and 90 per cent that had conducted more than four experiments. The majority of new CIALs, (i.e. those that had conducted one or two experiments) were able to explain some but not all key concepts related to their research. New CIALs quickly grasp the objective, design, and local relevance of their

Figure 1 Average institutional costs of facilitating a CIAL



Source: Ashby et al. (2000)

experiment, but most were not yet able to explain more difficult concepts such as treatments, replications and control plots. These concepts and the role of small-scale experiments as a risk-management mechanism are the most difficult of the research-related ideas for CIALs to grasp (Figure 2). This analysis, and a parallel evaluation of self-management capacity (Ashby et al., 2000) indicate that CIALs undergo a maturation process. In the case of the CIALs located in the Cauca province of Colombia, comprehension of the research process and the capacity to manage the whole CIAL process improved significantly once they had completed a minimum of four experiments (Ashby et al., 2000; for a contrasting case involving communities with lower levels of literacy see Humphries et al., this issue).

In addition to this qualitative leap in the understanding of the research process and the capacity for self-management there are other indicators of CIAL maturity (Ashby et al., 2000; Humphries et al., this issue). These include:

- an advance from research on relatively closed problems (e.g. the identification of varieties that are adapted to local conditions and preferences) towards more open and complex subjects (e.g. pest management, soil management and conservation);
- the launching of small agroenterprises based on research results and products;
- the delivery of other types of services to the community (e.g. preparation of proposals to access external resources, launching of micro-credit schemes, organisation and participation in educational or health campaigns);
- the participation of CIAL members in other community organisations or in public positions (e.g. elected as leader of the community council);
- the formation of second-order regional organisations involving several CIALs.

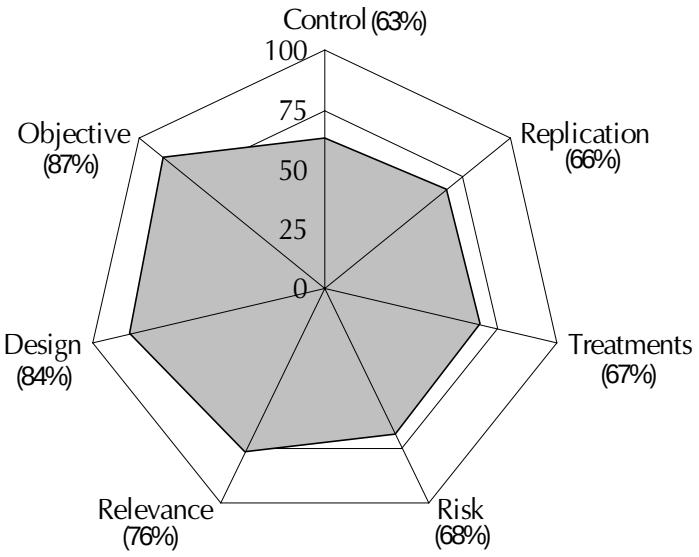
Second-order associations

The formation of second-order associations is particularly important because of the volatility of financial and human resources, the frequent reorganisation and the rapidly changing missions of public sector entities. Although an institution may be convinced of the benefits of farmer participation in research, this may not always translate into the successful channelling of sufficient resources to support the CIALs that it has formed. The formation of second-order associations provides experienced members of CIALs with opportunities to serve as paraprofessional facilitators and to assume responsibility for forming and facilitating new CIALs. CIALs in Colombia and Honduras were the first to form second-order organisations (CORFOCIAL in Cauca, Colombia and ASOCIAL in Yoro, Honduras) (Ashby et al., 2000; Humphries et al., this issue). Important functions performed by these associations include:

- forming CIALs and facilitating their development;
- organising exchange visits to promote sharing of information and research products (e.g. improved seed);
- formulating and managing projects to obtain external resources for community projects;
- providing small credit to facilitate the formation of small enterprises;
- participating in local development projects and activities.

Although CIAL associations decrease the risk that CIALs will become inactive or fail because of discontinuities in support from formal R&D organisations, they need to maintain strong ties with these organisations to ensure that they have access to the products of formal

Figure 2 The per cent of CIALs in Cauca, Colombia (n=53) that could clearly explain basic concepts of controlled experimentation, 1998



Source: Ashby et al. (2000)

research and that their priorities are considered in the setting of institutional agendas.

Evolution of CIAL research themes

Five years ago most CIALs were experimenting with crop varieties. More recently, a number of new research areas have begun to emerge: five per cent are conducting research on small livestock; 19 per cent are studying ways to improve pest or disease management; and 12 per cent are researching soil, water and nutrient management practices. Case studies in Bolivia, Colombia and Honduras (Humphries et al., this issue) suggest that committees studying agroecosystems face challenges that differ from those faced by CIALs researching less complex topics. Issues related to extending the scope of research include:

- the limitations faced by the CIAL in conceptualising research questions and designing management options when basic knowledge about agroecosystem components and patterns of interrelationships is restricted;
- the importance of considering scale and related collective action issues when designing research on agroecosystems;
- the integration of multiple technological alternatives within overall farm management.

Crop diversification and microenterprises

Of the CIALs studying crop varieties or species in 1999, 68 per cent were conducting research on four crops: beans, maize, cassava, and potatoes – staple food crops in poor areas of Latin America (Ashby et al., 2000). Most CIALs working with these crops are trying to solve local problems of food security (see Humphries et al., this issue). An increasing number of CIALs are moving beyond food security issues into crop and livestock diversification, and 11 per cent have launched small businesses. These often involve the production and marketing of seed (Ashby et al., 2000), but several are selling fresh or processed food products. This can be the first step on the road out of poverty.

In Latin America, support services for small agroenterprise development are generally lacking. The CIALs and CIAL associations are beginning to play a

Table 1 Objectives, actors and processes of FFS for rice IPM and local agricultural research committees

	Farmer field schools	Local agricultural research committees
Objectives	To develop among farmers and in the community an in-depth understanding of agroecological principles and processes that govern the population dynamics of pests. To strengthen farmer and community capacity as expert decision-makers in IPM through a new ecological orientation. To break the dependency on pesticides.	To strengthen the capacity of farmers and rural communities as decision-makers and innovators of agricultural solutions. To empower rural communities to exert pressure on the formal research system. To link local research with the formal system by providing access to new skills, information and research products that can be useful at the local level.
Actors	Communities in key rice-producing areas. 20–25 farmers from the same community. 1–2 facilitators (farmers or extension workers from government organisations and NGOs). National extension services. NGOs.	Communities with limited economic resources. Team of four or more volunteer farmers per community. One facilitator (farmer, agronomist or extension worker). National research and extension services. NGOs. Universities.
Duration	Ephemeral; lasts throughout a crop cycle with the possibility of follow-up activities and eventual emergence of a community-scale IPM process.	Permanent; establishes a research service that belongs to the community.
Financing	Initiated by the FAO Intercountry IPM Programme as national projects with co-financing (external funds) and evolved towards local financing from local governments.	Initiated by an international agricultural research center as a pilot project in Colombia with external financing in the form of seed money and then continued with replication of experiences by Latin American national programmes; evolved towards local financing through the establishment of regional associations of CIALs.
Key processes	Facilitation; planning (motivation, diagnosis, etc.); learning cycle (observe, analyse, act, etc.); in-depth development of knowledge; development of bases for collective action.	Facilitation; motivation; diagnosis; research (planning, experimentation, evaluation, analysis); feedback; monitoring and evaluation.
Evolution	Strengthening research skills through Action Research Facilities and in FFS for non-rice crops. Developing FFS for other crops and with approaches beyond IPM. Strengthening ties between local and formal research institutions. Establishing networks of farmers, facilitators and researchers Institutionalising IPM as a community process.	Forming regional associations of CIALs. Institutionalising participatory research within formal research and extension systems. Making adjustments to respond to farmer research interests in small livestock issues, agroenterprise development and crop health.

role in the development of local support services and have high potential for serving as a basic platform to develop research services within agroenterprises (Gottret and Ostertag, 1999). For example, in early 2000 CORFOCIAL obtained financing for and initiated a project that will systematise the experiences of 12 CIALs that have launched small enterprises. Each participating CIAL and CORFOCIAL itself will develop a business vision. The CIALs commonly evaluate the economic costs and benefits of different technological options as part of their research. Their emphasis on keeping records of experiments, and on simple financial accounting, associated with the management of petty cash, facilitates a business orientation.

4 DIFFERENCES, SIMILARITIES AND COMPLEMENTARITIES BETWEEN FFS AND CIALs

Similarities

Several principles underlying successful FFS and CIALs are common to both approaches. Both consider farmers as experts, stress respect for local values and knowledge, and build capacity based on practical experience. Both recognise the risk associated with learning and research, and have mechanisms to ensure that the risk is shared not borne individually. Both perceive the products of their processes as public goods.

Although the CIALs and FFS are organised differently, they share several processes (Table 1). For example, facilitation styles and the role of motivation are similar. Nevertheless, some apparently similar processes have different objectives. For example, the community participates in an initial diagnosis in both FFS and CIALs, but their purposes are different. The village diagnosis meeting held during the preparation for FFS seeks to determine whether the community fulfils the criteria for establishing a field school and to help the facilitator orient activities towards the local agroecosystem. The CIAL diagnosis aims to define the agricultural research topic that the community entrusts to the committee.

CIALs form networks with mechanisms for increasing the dissemination of research results and outcomes. Similarly, follow-up activities in the FFS include fora and networks to disseminate knowledge horizontally.

Differences

The approaches aim to strengthen farmer experimentation and innovation in different ways. Before considering these differences it is useful to reflect on what is known about farmer experimentation in general. Many studies claim that farmers experiment (Rhoades and Bebbington 1991): however, farmer experimentation differs from formal agricultural research in several respects.

Farmers sometimes evaluate the performance of different technological options in a similar environment by conducting controlled experiments that compare treatments. For example, they may plant small areas to different varieties, which Rhoades and Bebbington (1991) call 'adaptation experiments'. This type of experiment is similar to formal agricultural research practice (Ashby et al., 1995). Farmers also experiment on the interaction between one or more crops, pests and the environment, often on the whole plot. These 'problem-solving experiments' (Rhoades and Bebbington, 1991) help farmers understand how the agroecosystem functions. In Nigeria, some farmers have learnt how to control variegated grasshoppers – an important pest of cassava – through experiments which involve marking and digging up egg-laying sites (Richards, 1985). Another example of this type of experimentation is the long-term observation of the effect of changing crop rotations in the same field (IDS Workshop, 1989).

Normally, farmers' data collection methods are qualitative rather than quantitative, in the sense that they do not normally measure inputs and production systematically (Richards, 1985). For example, farmers rarely weigh the harvest to prove that a disease lowers yield, although they perceive these effects (Bentley, 1994b). Farmers do not usually control non-experimental variables nor do they use repetitions to control for the effect of spatial and temporal variation. Farmers evaluate differences contextually – rather than using blocking to control for differences in soil type, they evaluate how the variation of soil in a field affects plant development and yield (Stolzenbach, 1994). They also evaluate the performance of a new technology in different locations or in time (Prain et al., 1992; Ashby et al., 1995). Just as serendipity often plays a role in formal research, farmers' experiments are sometimes accidental or fortuitous discoveries (Richards, 1994). In general, farmers do not record their data, nor do they undertake formal analysis but they remember results and subject them to continuous comparison with new observations.

Farmer experimentation (like that of formal researchers) is limited by gaps in their knowledge (Bentley et al., 1994). They may not know, for example, how the different animals that comprise the stages in an insect life cycle are related to one another. They may draw the wrong conclusion about how a system functions, especially when the phenomena involved are difficult to observe and not of direct interest to them (Bentley, 1994b).

Finally, in terms of scale, farmer experimentation is local. Farmers are concerned with developing solutions that work under their particular conditions, and not with identifying options that can be adapted to other situations.

In the CIALs farmers learn to conduct relatively formal experiments (see Humphries et al., this issue). This approach helps to increase local capacity for research (Bunch, 1989) and to develop a common vocabulary among farmers and researchers that makes it easier for farmers to exert pressure on formal research and extension systems (Ashby et al., 1995). In addition, CIALs stimulate local experimentation by raising its status

through what has been called the prestige of popular acclaim (Bentley et al., 1994).

Although, as we have seen above, several types of farmer experiments make up what can be called 'native' experimentation (Ashby et al., 1995), in practice the great majority of CIAL experiments are controlled comparisons involving a range of technological options similar to farmers' adaptation experiments, as defined by Rhoades and Bebbington (1991). Evaluation methodologies have been adapted to local levels of literacy and numeracy, using symbols (e.g. faces for good (☺), fair (😐) and poor (☹)) and simple methods of classification and tabulation for data analyses (Table 2). Farmers establish their own evaluation criteria, avoiding, if possible, any influence from professional researchers. Because of this emphasis on respecting farmers' evaluation criteria, CIAL members prioritise, design and evaluate experiments based on their current knowledge. Facilitators may offer support in the form of training when research proposals are not feasible because of gaps in knowledge, but whether this occurs or not depends on the skills, knowledge and motivation of the facilitator.

In keeping with the emphasis on the systematic evaluation of technological options, the CIALs are made up of a small group of specialised farmer-researchers, chosen for their reputation as experimenters, and trained to further develop their research skills (Table 2).

The FFS approach, on the other hand, emphasises experimentation aimed at discovering how the agroecosystem operates, and translating this into the foundations for problem-solving and decision-making. This is similar to farmers' problem-solving experiments. This understanding of agroecosystem patterns, interrelationships and structure points the way to managing or manipulating the system to improve productivity. For example, Ooi (1998) reported the case of a farmer-facilitator who learned that dragonflies are predators of the brown plant hopper. The farmer observed that the bamboo markers that had been placed in the rice-field trials served as perches for the dragonflies. He placed more bamboo markers to see what would happen and found that plant hopper populations were lower in these areas. Observation and evaluation of the context is fundamental to experimentation in FFS (Table 2).

When intervening in ecological processes, it is critical to understand the interactions among different elements of the system. Farmers use drawings and other visual methods to represent what they see as a means of understanding the self-regulating feedback mechanisms that are key to these systems. The FFS approach assumes that farmer innovation is limited by the lack of this knowledge and/or the existence of misleading or erroneous information produced by poorly-focused extension programmes or agrochemical distributors wanting to sell their product (Gallagher, 1999). The

Table 2 Key differences between research processes in FFS for rice IPM and local agricultural research committees

Aspect	FFS	CIALs
Content	Ecological interactions; Experiments to demonstrate principles and solve problems.	Technological options; Adaptive research.
Type of experimentation	Analysis of agroecosystem structure, patterns and context.	Controlled comparison.
Data collection and analysis	Labelled drawings that show agroecosystem relationships and interactions.	Written records and symbols.
Gaps in knowledge	Addressed through experiential, discovery-based learning guided by a trained facilitator.	May be addressed through training organised by the facilitator.
Participants	Group of 25 heterogeneous farmers from one community.	Small group (≥4) of farmer-researchers from one community.
Continuity	Ephemeral; one crop cycle; forms core group of farmers capable of exerting influence on others to continue the process in the community.	Permanent; agricultural research service belonging to the community.
Link with formal research system	Not fundamental; increases demand for knowledge of the agroecosystem principles and structure.	Fundamental; increases demand for technological options (prototypes) that are evaluated through the local research process.
Scale	Local, but radius of influence expanded through networks and second-order organisations.	Local, but radius of influence expanded via networks and second-order organisations.

central focus of FFS is to develop exercises and activities that allow farmers themselves to make discoveries. According to Settle (1998), formal research should be directed towards developing general theories of the structure and dynamics of specific agroecosystems (Table 2) that provide the basis for effective FFS curricula.

The FFS do not focus on identifying a solution within a range of technological options as the CIALs do. They develop the capacity to manage ecological interrelationships efficiently within the farm and in cultivated areas belonging to and surrounding the community. Consequently, the FFS are not directed towards a specialised group of farmer-researchers, but towards a relatively large and heterogeneous group that should eventually form a core group within the community that promotes a permanent learning process (Table 2).

Convergence of the platforms

FFS have been effective in addressing pest problems in irrigated rice production systems in Asia. As farmers' understanding of ecological interrelationships grew, they realised that the reduced use of pesticides permitted the development of larger populations of beneficial species capable of controlling the pests. This is a relatively simple intervention in the agroecosystem: 'don't spray'. For other agroecosystem management issues, however, the understanding of system components and their interrelationships may not be sufficiently developed to identify system-level solutions (Settle, 1997). This is more likely to be the case in farming systems that include non-native species of crops, where these relationships have not had sufficient time to co-evolve and allow the system to develop self-regulation mechanisms. In these cases local capacity to evaluate different management options and to determine their advantages and disadvantages is important (Loevinsohn et al., 1998; Whitten, 1996), and controlled experimentation and relatively rigorous data collection are required (Torrez et al., 1999). The demand for technological options under these circumstances implies the need for a strong link with formal research – a comparative advantage of the CIALs.

The second generation of FFS, in farming systems that include vegetables and crops rotated with rice, together with the ARFs, have incorporated controlled experimentation and the evaluation of technological options and have established ties with the formal research system (Ooi, 1998; Settle et al., 1998; Shepard et al., 1998; van de Fliert et al., 1996; Whitten, 1996).

The CIALs are beginning to face gaps in knowledge that limit their experimentation (Humphries et al., this issue). A community in Bolivia prioritised the study of an important potato pest, but the farmers did not know that the larvae were a stage in the life cycle of a weevil. Thus, they were unable to plan and evaluate different control options successfully. Aware of this difficulty, the facilitator helped farmers discover the insect's life cycle. Nevertheless, guiding discovery-based learning is not an explicit part of CIAL facilitator training.

The trend towards convergence between FFS and CIALs poses important questions regarding the relationship between the two platforms. As they spread to new regions and begin to operate within the same geographic areas, farmers and research and extension institutions are beginning to question the relationship between the two, asking the following questions:

- Do FFS and CIALs differ sufficiently to justify the application of both within the same area?
- Are FFS and CIALs suitable for different conditions?
- Should we be looking for a hybrid between FFS and CIALs?

Because both FFS and CIALs are flexible platforms rather than rigid models, no definitive answers can be given to these questions. Institutions involved with both will ultimately have to resolve these issues for themselves. Nevertheless, we can suggest some guidelines based on the comparative advantages of FFS and CIALs.

Do FFS and CIALs differ sufficiently to justify the application of both within the same area?

Despite the trend towards convergence noted above, key differences remain. FFS are based on agroecological education; CIALs focus on establishing a community-based agricultural research service with links to the formal agricultural research system. FFS are limited in time to one or two cropping seasons; CIALs are permanent. Experimentation in FFS is usually of a holistic type that requires integrated contextual analysis of agroecosystem pattern, structure and relations. CIALs, in contrast, concentrate on experimentation through controlled comparisons.

FFS develop knowledge for decision-making with respect to managing the landscape of a farm or the local agricultural landscape of a community, recognising that some actions are individual and others collective. As a result of FFS activities, it is expected that more farmers will seek to cooperate in decision-making and coordination of agroecosystem management activities. FFS for rice IPM simulates this by involving a group in the collective management of an area of land, by establishing and using indicators to monitor the direction of changes and by the evolution of processes.

Farmers also face the challenge of managing the farm as an enterprise requiring decision-making about the efficient and profitable use of inputs, including human and financial resources. The CIAL approach is well suited to discriminating among farm enterprise management alternatives such as identifying the highest yielding variety, determining whether a new crop is profitable, deciding how much fertiliser to apply, or which kind of live barrier to plant. At the same time, the emphasis placed on the development of organisational and management skills strengthens the

capacity of farmers to engage the attention and services of formal R&D systems.

Although there is convergence, we conclude that the FFS and CIAL platforms are complementary and synergistic. FFS can build agroecological knowledge to make CIAL research more meaningful. CIALs can generate locally-adapted technological options to strengthen FFS. Both can therefore be established in the same area or even the same community, and a number of different pathways can be envisaged for their establishment. Assuming that institutions have the capacity to support both platforms, the most appropriate pathway depends mainly upon the existing level of agroecosystem knowledge. This leads us into the second question posed above.

Are FFS and CIALs suitable for different conditions?
Where there is sufficient local knowledge about the agroecosystem to support the development of the FFS curriculum by the facilitating organisation, then a field school could be established first. This helps build farmers' agroecological knowledge and provides an enhanced base for the subsequent establishment of a CIAL. The formation of a CIAL could be a post-FFS activity to deal with high-priority problems encountered by field school farmers. If the level of agroecosystem knowledge is too low to support the development of a field school, then a CIAL is probably more appropriate. Once the CIAL process has helped to develop knowledge about the local agroecosystem then FFS could begin. In this case, CIAL members could play an important role in helping to facilitate the FFS.

Should we be looking for a hybrid between FFS and CIAL?
Rather than looking for a hybrid FFS-CIAL, we can envisage the future development of a single unified platform encompassing both FFS and CIALs. One of the strengths of FFS compared to other extension approaches is that they are bounded in time; one of the strengths of CIALs is that they are permanent. A hybrid cannot have both characteristics. However, it could be possible to develop a unified FFS-CIAL platform which could support both FFS and CIALs as separate organisational forms. FFS and CIALs, or something similar (e.g. ARF), would therefore continue to exist as synergistic processes within this unified platform.

5 FUTURE POTENTIAL

Agricultural R&D systems at all levels across much of the developing world are in crisis. Many institutions perceive chronic funding difficulties as the cause of this crisis. However, underlying the problem of funding is a more pervasive questioning of the value of agricultural R&D and its relevance to the needs of society as a whole. Both the FFS and CIAL platforms described by this paper require and promote a much closer engagement of agricultural research and extension with rural society, building local institutional structures and processes for agricultural development. They also offer the chance of making R&D more relevant because they place farmers themselves at the centre of development processes. If widely implemented, FFS and CIALs open the possibility of a more fundamental transformation of agricultural R&D systems which could help alleviate the current crisis. Developing the capacity to support platforms like FFS and CIALs implies that agricultural R&D systems must: (a) construct general theories of the structure and dynamics of specific agroecosystems required for the development of FFS curricula; and (b) involve farmers in the testing and adaptation of technological options; while (c) simultaneously building the human resources required for facilitating farmer research and discovery-based learning. Growing interest in both FFS and CIALs by a wide range of financing and implementing organisations reflects an underlying perception that they form viable new alternatives. Under these circumstances we believe that there is good potential for applying both FFS and CIALs more widely. Both platforms will evolve further, and we believe that their future development should be carefully managed so as to draw on their underlying synergy.

REFERENCES

Aizen, H. (1998) *El Comité de Investigación Agrícola Local de San Bosco: Estudio de Caso*. Cali, Colombia: Centro Internacional de Agricultura Tropical.

Ashby, J.A. (1987) 'The effects of different types of farmer participation in the management of on-farm trials'. *Agricultural Administration and Extension* Vol. 25, pp. 235–252.

Ashby, J.A., Braun, A.R., Gracia, T., Guerrero, M. P., Hernández, L.A., Quirós, C.A. and Roa, J.I. (2000) *Investing in Farmers as Researchers: Experience with local agricultural research committees in Latin America*. Cali, Colombia: Centro Internacional de Agricultura Tropical.

Ashby, J.A., Gracia, T., Guerrero, M. P., Quirós, C.A. Roa, J.I. and Beltrán, J.A. (1995) 'Institutionalising farmer participation in adaptive technology testing with the CIAL'. *Agricultural Research and Extension Network Paper No. 57*. London: Overseas Development Institute.

Bentley, J.W. (1994a) 'Facts, fantasies and failures of farmer participatory research'. *Agriculture and Human Values* Vol. 11, No. 2–3, pp. 140–150.

Bentley, J.W. (1994b) 'Stimulating peasant farmer experiments in non-chemical pest control in Central America' in I. Scoones, and J. Thompson, (eds) *Beyond Farmer First: Rural people's knowledge, agricultural research and extension practice*. London: Intermediate Technology Publications.

Bentley, J., Rodríguez, G, and González, A. (1994). 'Science and people: Honduran campesinos and natural pest control inventions'. *Agriculture and Human Values* Vol. 11, No. 2–3, pp. 178–182.

Braun, A.R. (1997) 'An analysis of quality in the Indonesian integrated pest management training project.' Report of a technical audit conducted for the World Bank on the Indonesian Integrated Pest Management Training Project (Loan 3586-IND). Washington, D.C.: World Bank.

Braun, A.R. and van de Fliert, E. (1997) 'The farmer field school approach to IPM and ICM in Indonesia: user participation,' in Proc. Fifth Review and Planning Conference: 'Institutionalising Innovations in Root crop R&D', Clark Field, Pampanga, Philippines, 8–12 December 1996. Los Baños, Philippines: Users Perspective With Agricultural Research and Development (UPWARD).

Braun, A.R. van de Fliert, E., Wheatley, C., Prain, G. and Widodo, Y. (1995) 'Improving profits from sweet potato by linking IPM with diversification of markets'. *CIP Circular* Vol. 21, No. 3, pp. 8–15.

Bunch, R. (1989) 'Encouraging farmers' experiments' in R. Chambers, A. Pacey and L.A. Thrupp (eds) *Farmer First: Farmer innovation and agricultural research*. London: Intermediate Technology Publications.

Chambers, R. Pacey, A. and Thrupp, L.A., (eds) (1989) *Farmer First: Farmer innovation and agricultural research*. London: Intermediate Technology Publications.

Conway, G.R. (1985) 'Agroecosystem analysis'. *Agricultural Administration* Vol. 20, pp. 31–55.

Conway, G.R. (1987) 'The properties of agroecosystems'. *Agricultural Systems* Vol. 24, pp. 95–117.

Conway, G.R. and McCauley, D.S. (1983). 'Intensifying tropical agriculture: the Indonesian experience'. *Nature* Vol. 302, pp. 288–289.

Gallagher, K. (1988) 'Effects of host resistance on the microevolution of the rice brown plant hopper Nilaparvata lugens (Stal.)'. PhD dissertation, University of California, Berkley, USA.

Gallagher, K. (1999) *Las escuelas de Campo para Agricultores (ECA): Un proceso de extension grupal basado en métodos de educación no formal para adultos*. Rome: Global IPM Facility.

Gottret, M.V. and Ostertag, C.F. (1999) 'Promoviendo el desarrollo empresarial rural: Proyectos productivos integrados y sistemas de apoyo'. Discussion document. Cali, Colombia: Centro Internacional de Agricultura Tropical.

Humphries, S., Gonzalez, J., Jimenez, J. and Sierra, F. (this issue) 'Searching for sustainable land use practices in Honduras: Lessons from a programme of participatory research with hillside farmers'. *Agricultural Research and Extension Network Paper* No. 104. London: Overseas Development Institute.

IDS Workshop (1989) 'Farmers' knowledge, innovations and relation to science' in R. Chambers, A. Pacey and L.A. Thrupp (eds) *Farmer First: Farmer innovation and agricultural research*. London: Intermediate Technology Publications.

Kenmore, P.E. (1980) 'Ecology and outbreaks of a tropical insect pest of the Green Revolution, the brown plant hopper Nilaparvata lugens (Stal.)'. PhD dissertation, University of California, Berkeley, USA.

Litsinger, J.A. (1989) 'Second generation insect pest problems on high yielding rices'. *Tropical Pest Management* Vol. 35, pp. 235–242.

Loevinsohn, M., Meijerink, G. and Salasya, B. (1998) 'Enhancing capacity to manage resources: assessing the farmer field school approach'. Paper presented at the Second Meeting of the Integrated Pest Management Network for the Caribbean, February 4–6, Kingston, Jamaica.

Mangan, J. (1997) 'Participatory pest analysis'. *PLA Notes* Vol. 28, pp. 84–86.

Matteson, P.C., Gallagher, K.D. and Kenmore, P.E. (1992) 'Extension of integrated pest management for plant hoppers in Asian irrigated rice: empowering the user' in R.F. Denno, and T.J. Perfect (eds) E*cology and Management of Planthoppers*. London: Chapman and Hall.

Nyambo, B.T., Kimemia, J.K. and Kimani, M. (1997) 'Farmer participatory IPM research and extension: experiences in Kenya'. Paper presented at 17th International Scientific Conference on Coffee, Nairobi, Kenya, 20–25 July.

Ooi, P.A.C. (1996) 'Experiences in educating rice farmers to understand biological control'. *Entomophaga* Vol. 41, pp. 375–385.

Ooi, P.A.C. (1998) 'Farmer participation in IPM action research'. Paper presented at the International Conference on IPM – Theory and Practice: Developing sustainable agriculture, 15–20 June 1998, Guangzhou, China.

Prain, G., Uribe, F. and Scheidegger, U. (1992) 'The friendly potato: farmer selection of potato varieties for multiple uses' in J.L. Moock and R.E. Rhoades (eds) *Diversity, Farmer Knowledge and Sustainability*. Ithaca: Cornell University Press.

Rhoades, R. and Bebbington, A. (1991) 'Farmers as experimenters' in B. Haverkort, J. van der Kamp and A. Waters-Bayer (eds) *Joining Farmers' Experiments: Experiences in participatory technology development*. London: Intermediate Technology Publications.

Richards, P. (1985) *Indigenous Agricultural Revolution. Ecology and food production in West Africa*. London: Hutchinson.

Richards, P. (1994) 'Local knowledge formation and validation: the case of rice in central Sierra Leone' in I. Scoones and J. Thompson (eds) *Beyond Farmer First. Rural people's knowledge, agricultural research and extension practice*. London: Intermediate Technology Publications.

Röling, N.G. and van de Fliert, E. (1998) 'Introducing integrated pest management in rice in Indonesia: a pioneering attempt to facilitate large-scale change' in N.G. Wagemakers and M.A.E. Röling (eds)

Facilitating Sustainable Agriculture. Cambridge: Cambridge University Press.

Röling, N.G. and Wagemakers, M.A.E. (eds) (1998) *Facilitating Sustainable Agriculture.* Cambridge: Cambridge University Press.

Schmidt, P., Stiefel, J. and Hürlimann, M. (1997) *Extension of Complex Issues: Success factors in integrated pest management*. St. Gallen, Switzerland: Swiss Centre for Development Cooperation in Technology and Management.

Settle, W.H. (1997) 'Science by farmers and science by researchers: challenges and opportunities'. Paper presented at the International Symposium on Integrated Pest Management in Rice-based Ecosystems, 20–24 October, 1997, Guangzhou, China.

Settle, W.H., Whitten, M., Dilts, R. and Ooi, P.A.C. (1998) 'Developments in community IPM for irrigated rice in Asia'. Paper presented at the Sixth Australasian Applied Entomological Research Conference, 29 September to the 6 October 1988, Brisbane, Australia.

Shepard, M., Samsudin, K. and Braun, A. R. (1998) 'Seasonal incidence of *Liriomyza huidobrensis* and its parasites on vegetables, weeds and ornamental crops in Indonesia'. *International Journal of Pest Management* Vol. 44, pp. 43–47.

Stolzenbach, A. (1994) 'Learning by improvization: farmer experimentation in Mali' in I. Scoones and J. Thompson (eds) *Beyond farmer first. Rural people's knowledge, agricultural research and extension practice*. London: Intermediate Technology Publications.

Torrez, R., Orrego, R., Ortiz, O., Tenorio, J., Valencia, C., Nelson, R. and Thiele, G. (1999) 'Implementing IPM for late blight in the Andes' in 'Impact on a Changing World'. Program Report, 1997–8. Lima, Peru: Centro Internacional de la Papa.

Untung, K. (1996) 'The role of pesticides in the implementation of integrated pest management in Indonesia'. *Journal of Pesticide Science* Vol. 21, pp. 129–131.

van de Fliert, E. (1993) 'Integrated pest management: farmer field schools generate sustainable practices'. Papers 93–3. Wageningen, Netherlands: Wageningen Agricultural University.

van de Fliert, E., Pontius, J., and Röling, N. (1995) 'Searching for strategies to replicate a successful extension approach: training of IPM trainers in Indonesia'. *European Journal of Agricultural Education and Extension* Vol. 1, No. 4, pp. 41–63.

van de Fliert, E., Asmunati, R., Wiyanto, F., Widodo, Y. and Braun, A.R. (1996) 'From basic approach to tailored curriculum: participatory development of a farmer field school model for sweet potato' in *Into Action Research: Partnership in Asian root crop research and development*. Los Baños, Philippines: Users Perspective With Agricultural Research and Development (UPWARD).

Whitten, M. (1996) 'The empowerment of vegetable farmers in the Philippines using IPM as an entry point: a four-way partnership between farmers, researchers, trainers and industry' in *Intercountry Programme for Vegetable IPM in Asia*. Makati, Philippines: FAO.

Winarto, Y.T. (1995) 'State intervention and farmer creativity integrated pest management among rice farmers in Subang, West Java'. *Agriculture and Human Values* Vol. 12, No. 4, pp. 47–57.

ENDNOTES

1 In this paper *platform* refers to an implemented, coherent set of principles and processes, tools and organisational forms. The concept of a *platform* was originally introduced to the literature of sustainable agriculture in Röling and Wagemakers (1998).

2 The full name is Intercountry Programme for the Development and Application of Integrated Pest Control in Rice in South and South East Asia, Food and Agriculture Organisation of the United Nations.

3 Comprehension of the research process was explored in a group interview where CIAL members were asked to explain the objectives of their experiment, its relevance to the situation in the community, its design, the treatments involved, replication, control, and the management of risk.

Network Papers cost £3.00 sterling each (plus postage & packing).
Please contact the Network Administrator at:
The Overseas Development Institute, 111 Westminster Bridge Road, London SE1 7HR, UK
Telephone: +44 (0)20 7922 0300 Fax: +44 (0)20 7922 0399 Email: agren@odi.org.uk

Information about ODI and its publications can be found on our World-Wide Web pages on the Internet at:
http://www.odi.org.uk/