Development and linkages of farmer field school and other platforms for participatory research and learning[1]

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Abstract

The International Potato Center employed the farmer field school (FFS) model in several of its research and development activities relating to potato and sweetpotato integrated pest, disease and crop management as a platform for participatory research and/or farmer learning. Four approached can roughly be distinguished in how the FFS was used, differentiated primarily by the function that participatory research served in the FFS. The PR-FFS approach fully integrated PR and learning activities. The FFS-with-some-PR focused on farmer learning but introduced several adaptive research activities, mainly to allow farmers to be involved in variety selection. The FFS-after-PR approach designed FFS based on participatory research outputs conducted through the farmer researcher team platform, and limited experimentation in FFS to learning and adaptive research purposes. The FFS-with-community-led-research approach builds FFS programs based on off-the-shelf technical information available but mainly aims at establishing active farmer networks that will continue to generate and fine-tune information by themselves. Each of the approaches has its own strengths and weaknesses which are analyzed in this paper. The major lesson learned is that careful analysis of project objectives, partner expectations, available capacities and resources, and existing platforms to link up with is necessary to determine the appropriateness of employing the FFS model in general, and in one of the four described capacities in particular.

Introduction

The concept of the farmer field school was born in 1989 when the FAO Inter-Country IPM Program[8] designed this innovative model for farmer training on integrated pest management (IPM) in rice-based cropping systems in Indonesia (Kenmore 1991). This model was different from conventional agricultural extension on IPM conducted thus far, in that it recognized the characteristics of sustainable agricultural development being people centered, knowledge intensive and location specific. It attempted to tackle the specific needs for change towards

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[8] In full: Inter-country Program for the Development and Application of Integrated Pest Control in Rice in South and South-east Asia, Food and Agriculture Organization of the United Nations. The fourth phase of this program was conducted until 2002 as the Program for Community IPM in Asia (http://www.communityIPM.org).

agricultural sustainability by applying the principles of non-formal education (Van de Fliert, 1993). Non-formal education defined as "the fostering of quality-of-life enhancing learning outside the formal school system" (Dilts, 1983), explicitly recognizes human values as a prerequisite for learning. It is based on Paulo Freire's (1972) perspective on education as a problem-solving, consciousness raising strategy for empowerment. Education as an empowering process places importance on how educational processes and relationships affect the learners, not only on the contents (Kindervatter, 1979). Therefore, experience-based learning is linked to living problems. It seeks to empower people to actively solve those problems by fostering participation, self-confidence, dialogue, joint decision making and self-determination.

Translating these underlying principles to IPM learning, farmer field schools (FFS) are designed to capacitate farmers by enhancing their agro-ecological, science-based knowledge and develop skills needed for informed decision making and problem solving, such as field observation, agro-ecosystem analysis, experimentation and farm economic analysis. An IPM FFS lasts for a whole growing season and ideally involves a group of around 25 farmers in weekly, half-day sessions. The trainer's role is to facilitate the experiential learning process, which implies organizing adequate learning activities and providing crucial information where needed. To be able to fulfill this role, trainers need to undergo thorough technical and methodological training themselves, and similar to FFS learning, training of trainers is preferably season-long and experiential.

Successful IPM field schools have often become platforms for follow-up activities, spontaneously organized, and funded, by the field school graduates; an example is the IPM clubs in Vietnam (Eveleens *et al*,. 1996). During these follow-up activities, farmer groups study new cultivation problems, organize collective control measures, and set up experiments to further fine-tune technological guidelines to local conditions. Even wider aspects of community development have been initiated by FFS groups, including rice–fish culture, collective marketing of produce, and advocacy for fair share cropping agreements (Van de Fliert and Wiyanto, 1996). People-centered extension methodologies enhanced farmers' ability to put in practice what they had learned, but also taught them how to create and exploit opportunities for further learning. Over time, after FFS groups showed interest and capacity to move from conducting experiments mainly for learning purposes to experiments for adaptive research purposes, research organizations and NGO networks began to consider the FFS an appropriate platform for participatory research (Van de Fliert *et al*., 2002).

The International Potato Center[9] (CIP) has applied the farmer field school approach for several of the above-mentioned purposes. Farmer field schools were first introduced at CIP in 1995 as a farmer learning platform for sweetpotato integrated crop management (ICM) in Indonesia, which was later expanded to Vietnam, Philippines, China, Uganda and Kenya. In 1998, efforts were initiated at CIP headquarters in Peru to adapt the FFS model to include participatory research activities on late blight management, which was expanded to Bolivia, China, Bangladesh, Uganda and Ethiopia in 1999, and over time included more aspects of potato disease and pest management. In Ecuador, collaboration with the FAO Global IPM Facility as of 1999 got CIP

[9] The International Potato Center is a Future Harvest center supported by the Consultative Group on International Agricultural Research (CGIAR). With its headquarters based in Lima, Peru, CIP's research mandate focuses on potato, sweetpotato and Andean root and tuber crops systems and on natural resources management in high mountain areas.

involved in community development oriented activities through potato FFS. FFS models for potato IPM learning also began to be developed in Nepal (1998) and in Indonesia and Vietnam (2001).

FFS activities in the various locations were often conducted simultaneously with other conventional and participatory research activities using other platforms, such as the farmer researcher committees (CIALs) in Latin America. The confrontation between platforms led to extensive debates about which was the most effective and how they should be linked (Braun *et al.*, 2001). After a wide range of field-based experiences with FFS we are better placed to provide some more informed conclusions. In this paper we will describe the various experiences, attempt to assess what worked and what didn't, and how in practice platforms fitted together or perhaps didn't. Our intention is that this assessment will be helpful to others as they select or develop platforms for participatory research and training activities. After outlining the rationale for integrating the FFS model in the research program of an international agricultural research center, a detailed description of five approaches to using the FFS in CIP's research program, grouped according to the role of PR in the FFS, is presented. This is followed by a comparison of the different uses and an analysis of the linkages and complementarities of the FFS with other research and development platforms, after which we draw some conclusions and present some lessons learned.

The farmer field school at an international agricultural research center

The integration of FFS approaches into CIP's research program has been driven by the felt need to link research with development. CIP has a highly decentralized research program whereby a significant proportion of its scientists are posted in regional or country offices. This enables CIP scientists to work more closely with NARES[10] organizations and implement activities directly with farmer groups. International agricultural research centers (IARCs) have forever struggled to get their research outputs utilized by large numbers of farmers. Certain improved varieties ignite a spark and spread like wildfire, but generally these success stories are more the exception than the rule. More complex, knowledge-intensive and location-specific approaches to production constraints, such as integrated pest and disease management, typically lack the "silver bullet" solutions that easily sell themselves. Several strategies can be observed on how IARC scientists have dealt with this issue:

- *The "this-is-not-my-business" strategy:* Scientists believe that their job is to do high quality, cutting-edge research to move science forward, and after publishing the results in refereed journals their job is done. It is considered the task of the national research and extension system to pick up those results, adapt them to local conditions and applications, and translate them into extension messages. Most of the more basic and strategic research is done with this conviction. At most, collaboration with national research organizations is established and expected to facilitate the link to eventual outreach activities.
- *The "targeting-and-linkages" strategy:* By applying farmer participatory research approaches, scientists anticipate that research agenda and direction will better address farmers' needs, opportunities and conditions. This is expected to result in research outputs

[10] National agricultural research and extension system, which in our understanding includes government, non-government and farmer organizations

that are relevant and applicable to farmers' conditions and readily taken up by participating farmers. Wider dissemination from the specific participatory research sites to larger farmer communities, however, has proven difficult and requires involvement of some sort of extension mechanism (Connell, 2000; Van de Fliert *et al.*, 2000). The link to large-scale extension mechanisms does not automatically exist,

- *The "let's-do-it-ourselves" strategy:* Only in few occasions have (national) researchers been observed to reach substantial numbers of farmers through training, for instance in Cuba where researchers also fulfill extension tasks (Cisneros and Alcazar, 2001). Generally, however, to ensure large-scale promotion of research outputs, the do-it-yourself effort of a research organization is limited to the development of an effective outreach model, and establishment of an appropriate implementation mechanism. This implies, firstly, a translation of the technological content (the research output) into promotional or learning messages and methods for farmers. Secondly, organizations and a sufficient number of individuals capable of facilitating the dissemination efforts at the desired scale need to be identified, motivated, and adequately trained. Resources for large-scale implementation need to be identified and made available.

When aiming to achieve impact in farmers' fields, with impact implying both qualitative improvement of conditions and quantitative coverage, complementary application of the three strategies in partly overlapping and iterative phases and cross-disciplinary collaboration may provide the best results. Good participatory research should improve the relevance of conventional research but is not likely to be effective without the latter to back up. Likewise, suitable options developed with farmers may never reach a broader population if dissemination and implementation beyond research sites is not anticipated. Complementary application of the three research and development strategies would require holistic and collective planning and implementation of a center's overall research program. More commonly, however, we see that participatory research and development activities are localized initiatives of committed individuals (Thiele *et al.*, 2002).

The farmer field school has been used at CIP as a platform for both the second and third strategy, and in some cases serving both purposes at the same time. Because of its perceived origins in IPM, the FFS platform has primarily been applied at CIP for research or farmer education on integrated pest, diseases or crop management (IPM/IDM/ICM), although currently initiatives for integration of livestock and marketing issues in field school initiatives are being developed. Particularly in countries where strong national FFS programs had been established for farmer training on IPM, such as Indonesia, Vietnam, Philippines, Uganda and Kenya, the FFS seemed the most logical model to adopt and adapt for farmer training on potato and sweetpotato IPM. Minimum investment would then be needed to establish national cadres of trainers simply by widening the skills of existing FFS facilitators to include the specific requirements of the crop and the FFS learning activities adapted to a new cropping system. Moreover, national governments or nongovernmental organizations already applying FFS programs were expected to be more readily willing to invest in large-scale sweetpotato and potato FFS programs in areas where the crops have major economic importance. This has so far proven true particularly for Vietnam and the Philippines, and on a smaller scale also for Indonesia, where researchers could progressively transfer responsibilities for implementation to national extension organizations.

However, to introduce FFS in countries with limited experience and capacity in the approach, a considerable investment is required to train trainers.

Where FFS was used as a platform for simultaneous participatory research and farmer learning, the various levels of research and extension objectives needed to be accommodated by one and the same platform. These multi-purpose FFS activities were particularly challenging because they were conducted in countries where FFS had not covered much ground yet and with partners who initially had little experience with the approach. Additionally, they focused on disease rather than insect management, which required creative adaptation of the original model. The various uses of the FFS at CIP are discussed in detail in the following four sections, clustered according to similarities in the main objective applied to the use of the field school as a platform and the role of research in the FFS. These four approaches coincide with the grouping of activities by four (groups of) scientists who each held a different conviction on what purposes the FFS should serve as a platform in research and development.

The PR-FFS approach for potato integrated disease management (IDM)

Under tropical highland conditions diseases present major constraints to potato production: late blight, bacterial wilt and viruses. Late blight, in particular has been one of CIP's most important research priorities. There are two main components that account for most of the efficiency in controlling late blight, i.e. genetic resistance and optimization of fungicide use. Farmers' perceptions of the two differ. Resistance is easier to observe and is less dependent on management decisions (and prior knowledge generation), so farmers' perceptions tend to be more uniform. Efficient fungicide use depends on farmers' management decisions at local level (which in turn depends on their knowledge), and the agro-ecological conditions. Hence farmers' perceptions of the role of fungicide use tend to be much more varied. A special project to work on these issues with farmers in an FFS setting was designed and financed by the International Fund for Agricultural Development (IFAD) in Peru, Bolivia, Uganda, Ethiopia, Bangladesh and China. These fields schools served the purpose of both farmer learning on integrated late blight management as well as participatory evaluation of late blight resistant varieties and clones, and of fungicide management schemes. Because of the emphasis on participatory research, the approach was called PR-FFS. The variety evaluation trials facilitated farmers' access to new potato materials and in some cases, farmers began to have access to materials that had been on the shelf for many years. They also provided researchers with information about the performance of the varieties under these fungicide treatments over a wide range of ecological conditions (Nelson *et al.*, 2001).

In Peru, there were two types of experiments. The first aimed at identifying and showing to farmers the interaction between genetic resistance of a number of potato varieties (susceptible, moderately resistant and resistant) and different fungicide regimes (low, medium and high frequency of application). The experimental design of this trial was simplified after feedback from farmers indicated it was too complex for some of them to understand. The second experiment included the evaluation of 10-15 new resistant clones from CIP's breeding program and some other varieties that were managed only with the low fungicide regime. FFS farmers were able to select the best ten clones that fulfill their expectations out of fifty that were initially introduced in just three cropping seasons. Most of the learning activities on late blight management were based on observing these two experiments, where farmers could draw their own conclusions about the role of resistance and what fungicide regime would be better for each level of varietal resistance. Farmers considered the level of resistance, the weather conditions, and their newly gained knowledge about types of products, doses and ways of spraying to draw up their conclusions. They learned how to manage resistant varieties or clones with less fungicides, and susceptible varieties with more fungicides in relation to weather conditions.

A significant outcome of this process was that at the same time that farmers select, they start to multiply the materials that they like, so that initiation of the adoption curve of new clones occurs earlier than if the materials would have been passed to the national program for conventional evaluation. It is estimated that adoption could begin five years earlier, which generates additional benefits for farmers and an increase of at least 20% of internal rate of return when estimating impact (Ortiz *et al.*, 2002). Other evaluation results indicated that FFS participants tend to use less fungicide than non-participants (Ortiz *et al.*, 2002), particularly in years with higher disease pressure, which indicates that they are tending to optimize fungicide use. Similar results were achieved in Uganda and Ethiopia, in that during three cropping seasons farmers' knowledge has been enhanced regarding the existence of resistance, types of fungicides, doses and ways of spraying, which in turn significantly improved late blight management in their fields.

After several seasons, farmers who participated in PR-FFS on potato late blight management in Peru began to request learning activities on other cultivation constraints. Hence a more comprehensive curriculum was developed in collaboration with the IPM group at headquarters. Large-scale implementation of potato IPM FFS in Peru have now taken off under the responsibility of a project coordinated by FAO. CIP contributed to this process by training field staff and providing published guidelines for potato IPM FFS facilitation.

In Uganda and Ethiopia, PR-FFS were conducted in 1999, 2000 and 2001 with a similar focus as in Peru on potato variety evaluation and fungicide management. Farmers' input in clonal selection was valuable and used as additional criteria for potato variety release. Main field selection criteria established by farmers included tuber yield, resistance to late blight or bacterial wilt, tuber shape, maturity period, seed availability, lack of storage rots, sprouting duration from harvest, palatability and consumer acceptability. The fungicide management trials involved treatments of various fungicide regimes in combination with potato clones/varieties arranged in factorial experiments and with various field sites as replications. Results of these experiments indicated that certain practices such as disease monitoring prior to fungicide applications were quite effective for late blight management compared to other measures. In addition to the participatory trials, the FFS concentrated on farmer learning related to late blight and bacterial wilt management, such as seed quality and selection, pest diagnosis, use of resistant varieties, fungicide management, decision support systems, safe use of pesticides, and harvest considerations. Farmers requested a series of topics to be dealt with in the FFS, and hence heavily influenced the direction of the learning process (Olanya *et al.*, 2000). Several experiments on bacterial wilt management were conducted serving a learning purpose, such as disease transmission through infected seed, and a comparison of infected and clean soil on potted plant development. Particularly in Uganda, the seed-plot system as a strategy for small-scale potato seed production systems, involving the separation of ware and seed tubers, was tested with farmers. In addition to learning in the FFS, farmers were invited to visit experimental plots at the research station. The output of the above activities were the production and dissemination of information on potato IDM, leading to optimum promotion and utilization of components of bacterial wilt management in FFS curriculum, enhancement of seed quality, and application of integrated management practices. Eventually, bacterial wilt incidence in FFS farmers' fields decreased and potato yield increased.

The FFS-with-some-PR approach for potato production research and learning

In Bolivia, the PROINPA Foundation, which carries out potato research and breeding activities, together with an NGO, ASAR, have promoted FFS in the Cochabamba department of Bolivia. FFS have tested new late blight resistant varieties and a small number of advanced clones using simple trial designs (two replications and a local control), with one or two fungicide sprays on small study plots (Thiele *et al*., 2001). Farmers in the FFS assess late blight incidence, carefully follow the plant growth, measure yields, evaluate tuber shape and color and cook and taste the harvested tubers. FFS farmers have been multiplying the two preferred varieties to emerge from their trials. These varieties combine good resistance with market acceptability. Farmers learn about how these new materials are affected by late blight under differing fungicide treatments on their main learning field where one of the best adapted new varieties is grown using IPM practices including the decision support system discussed below compared with local management. Participatory variety selection on the study parcel and the IPM using a resistant variety are complementary in the way they build farmer knowledge about the interaction between varieties, the late blight pathogen and fungicide use.

Researchers in PROINPA had developed a strategy for fungicide application with multi-locational researcher managed trials over several years. The strategy includes the use of a systemic fungicide before symptoms of late blight appear, alternating with a contact fungicide and shorter intervals between fungicide applications in rainy and damp weather. The strategy proved very effective in field trials with very high rates of return. It was incorporated as a central element of IPM for late blight in the FFS (Torrez *et al*., 1999). Farmers typically applied fungicide after symptoms appear and a key part of the discovery-based learning was to help farmers learn that the disease grows invisibly within the plant. In the case of susceptible varieties this means that the first spray should be made before symptoms appear, whereas with resistant varieties spraying should begin when the first symptoms appear. Farmers also needed to improve their understanding of different fungicide types, dosage rates and application methods to make effective use of the strategy.

The potato FFS were developed from the beginning as a platform that could test a small set (less than three or four) of the most advanced materials emerging from PROINPA's existing decentralized and participatory breeding processes. Local groups of farmers were involved since the early 1990s in testing quite large sets of breeding materials, with around 30 becoming accepted as the norm (Thiele *et al*., 1997). The potential of FFS in linking varietal development with the existing platform for participatory variety selection, which included both groups of farmer evaluators and CIALs, was clear from the beginning and the same individuals in PROINPA were involved with both.

It was also clear that the FFS needed to link with seed systems. PROINPA have promoted FFS in higher areas which are more suited to seed production but where late blight is less of a problem and in lower areas which are unsuitable for seed production but where late blight is a major problem. FFS farmers in the two areas have been encouraged to share information about their needs so that higher altitude farmers can produce seed for those at lower altitudes.

FFS were developed as part of CIP's IFAD project. Some of the FFS facilitators returned from their training course with a belief that the FFS advanced on and replaced existing platforms. As a result, initially FFS were seen as an alternative to farmer research committees (CIALs) which had been established earlier with support from CIAT's IPRA program. This perception subsequently changed. Firstly, over time once a number of FFS had been conducted it became more obvious that forming a CIAL could be a good follow up activity to maintain some institutional links. Secondly, CIALs were becoming more favorably viewed in PROINPA as a mechanism for linking with local municipalities and giving voice to farmers demands. Thirdly, after many heated discussions, facilitators moved away from the notion of FFS as a hybrid with participatory research, which had been developed in Peru, to see it as more of a training platform with a limited participatory research component.

PROINPA has also begun participatory plant breeding (PPB), with large amounts of genetic material, where farmers themselves make crosses (Gabriel *et al.*, 2000). At the outset there was confusion about which platform should be used for this. Initially PPB was fully incorporated within one of the FFS that was underway. Subsequently after reflecting that PPB only gives benefits in the long term as the development of a variety takes several years it was decided to separate the PPB group from the FFS. Nevertheless the PPB was developed using discovery based learning methods. Farmers made crosses using different methods to understand and see which worked best. The organization of meetings and the development of a curriculum drew heavily on the ideas being developed with the FFS. PROINPA has been concerned to achieve wider impact; most FFS to date have been within pilot sites. To scale up FFS implementation, PROINPA is negotiating a project proposal with the FAO for training of facilitators and linking FFS implementation to municipalities.

A special theme in FFS activities with some PR in some areas of Bolivia, Ecuador, Uganda and Ethiopia was post-harvest and the linkages with markets and industries. In those places, farmers showed high interested in entering rapidly growing markets for processed potato, which command higher and more stable prices. Typically it is larger farmers who are making use of these new opportunities which are more demanding on quality with minimum levels of damage and other criteria such as size and quantity with the delivery of agreed volumes to meet factory and restaurant deadlines. FFS can use integrated management to deliver a better quality product and because FFS organizes farmers in groups it could potentially help them compete more effectively on quantity and negotiate with agro-industrial groups.

With these ideas in mind PROINPA began working in 2001 with existing FFS in Bolivia, which had been set up to improve integrated management of the potato crop. Special sessions were included in the existing FFS curriculum on: calculating profits, marketing, the potato industry, industry and restaurant preferences for potato types, how to produce potatoes for industrial uses and selection and storage of potatoes for sale (Mamani, 2001). FFS farmers were helped to build special silos to prolong the period potatoes could be stored and lengthen the period over which potatoes could be sold to industrial users. Farmers are helping researchers with trials to develop optimum management in the silos. A business meeting was held between the 30 FFS graduates and representatives of local potato industry. Farmers and industry were divided into separate groups. Farmers answered the question "What varieties do we want to grow and why?" and "How much potato do we produce?" The industry group answered the question "What varieties interest us, and why?" and "How much potatoes do we need?". Each group presented their questions in plenary and so came to understand the perspectives and needs of the other. Subsequently to the meeting farmers representatives and some of the industrial groups established specific agreements to supply potatoes for processing. As a result of the FFS farmers have learned to meet industrial requirements on size and quality of potatoes. Prior to the training only 20% of farmers could do this properly, afterwards 90% were able to do so. As a result of the training and subsequent meetings, FFS farmers are currently supplying a local manufacturer of potato chips. PROINPA is looking at ways to scale up this experience.

In Ecuador, where the farmer field schools are a relatively new initiative, formal linkages to the agro-food industry are being explored. A number of organizations, in particular INIAP, CESA, a national NGO, and individual farmers belonging to field schools have interacted directly with the food industry. These established ties provide a number of opportunities for the future, particularly for the production of safer produce for both domestic (supermarkets, Frito-Lay) and international markets (Agrofrio) as well as better prices for farmers.

Post-harvest and marketing activities have also been included in the FFS curriculum in Uganda and Ethiopia. This followed a needs assessment and the realization by farmers that knowledge on farm accountability, marketing and industry trends are essential for financial sustainability. The success of the FFS program in Uganda and Ethiopia have facilitated the expansion of seed growers association in Uganda and informal farmer-based seed growers in Ethiopia. In the case of Uganda, at least six farmers who graduated from FFS have been admitted into the Uganda National Seed Potato Growers Association (UNSPA) on the basis of their knowledge acquired from FFS and competence in potato seed production. The potato seed growers association have benefited tremendously from the seed trade in the country. The linkage of the seed growers association and the farmer field school is also based on the fact that potato seed from the association is sold to members of the farmer field schools and neighboring communities thereby developing good agro-industry linkages. Similarly, produce from the field schools and seed plot members are also being targeted for open markets and being purchased by Africare, an NGO, for further use in their food security initiative and other marketing intermediaries.

The FFS-after-PR approach for (sweet)potato IPM/ICM

CIP's sweetpotato IPM work in Asia was initiated in 1993 in Indonesia with a strong focus on sweetpotato weevil management. After a participatory assessment of needs and opportunities in 1994/95, the course of the activities was broadened on farmers' request to integrated crop management (ICM). Farmer researcher teams conducted five seasons of participatory trials on a variety of crop management practices, and were complemented by researchers who managed specific trials on-station. Farmer researcher teams consisted of two farmers in each of the four research sites, who were selected during the needs and opportunity assessment sessions and intensively involved in further research planning, implementation and analysis (Van de Fliert *et al.*, 2002). While the technical content of sweetpotato ICM was being developed, the group of collaborating researchers and farmers began to think about how to scale up dissemination and what additional skill development would benefit sweetpotato farmers. As the predominant IPM training model in Indonesia, the FFS was selected and piloted for the sweetpotato crop, after which specific sweetpotato ICM modules were developed with support from CIP's Users' Perspectives With Agricultural Research and Development (UPWARD) Network. In comparison with the rice model that focused on analysis of the balance of pests and natural enemies, the sweetpotato curriculum centered more on ecosystem health and farm management. It specifically taught farmers experimental methodology in order to encourage them to conduct adaptive research in their own fields. Nationwide training for trainers for government and NGO staff was conducted to support large-scale dissemination of the information developed. Evaluations studies showed that participation of farmers in research had had a positive impact on the relevance of the training program and, as a result, significantly contributed to trained farmers' increased income from sweetpotato (Johnson *et al.*, 2001).

The sweetpotato ICM FFS model developed for Indonesia seemed applicable to other Asian countries where CIP was working on improvement of sweetpotato production systems and where field schools had already been widely established: Vietnam, Philippines, China, Uganda and Kenya. Specific adaptations were made through participatory field studies and plot FFS and adapted manuals were produced in the local languages. In the Philippines, the FFS took healthy seed production as an entry point, considering the importance of the virus disease in major sweetpotato growing areas. In Vietnam, the curriculum expanded to post-harvest issues, including the use of sweetpotato for animal feed, storage and marketing. In Uganda and Kenya, sweetpotato production and post-harvest was integrated into the cash crops FFS to contribute to a more comprehensive model for farming systems field school.

To establish cadres of FFS facilitators through training of trainers has proven not to be enough to ensure large-scale implementation of sweetpotato FFS programs, despite efforts to develop follow-up implementation programs during the training. The major stumbling block has been to find funds for implementation. In Indonesia, after a first round of sweetpotato field schools in six provinces, implemented and funded by the National IPM Program, expected follow-up with local government funds did not materialize as a result of the economic crisis that hit Indonesia as of 1997 (Van de Fliert *et al.*, 2001). A new initiative will be needed to re-ignite interest now that the economic situation is slowly improving. NGO programs, however, have continued to implement activities, but coverage is limited. In the Philippines, local governments in major sweetpotato growing provinces took a keen interest in expansion of pilot activities, and made available funds and personnel (i.e. over $60,000 to date). Similarly, in Vietnam the government has allocated part of its annual FFS budget to sweetpotato FFS training of trainers and implementation. Facilitation of linkage mechanisms with government and NGO programs at an early stage in the FFS development process has been the key to successful follow-up later, socio-economic conditions allowing.

In the case of potato IPM, work in the Asian region did not commence until 1998 when a participatory needs assessment was conducted in Indonesia, and the year after in Vietnam. Potato production constraints in the tropical highlands in Indonesia are plenty, including leafminer fly, bacterial wilt and late blight, and no easy solutions exist. Similarly to the sweetpotato IPM work in Asia, participatory research on IPM components was conducted through the farmer researcher team platform. Only where ready-made technologies for bacterial wilt management needed validation of integrated application under field conditions, and simultaneous learning activities needed to be developed, was an FFS type platform chosen. It was not until three years later that the team felt ready to begin developing an adapted FFS model for potato IPM farmer learning.

The bacterial wilt activities were preceded by many years of conventional research on biological processes and control of bacterial wilt disease in potato production, caused by the bacterium *Ralstonia solanacearum*, resulted in a set of management practices that were considered to all contribute to prevention of disease outbreak, but none would be able to do the job alone. Participatory needs and opportunity assessment studies had shown that potato farmers in both Indonesia and Vietnam ranked bacterial wilt as one of their major problems. The cause of the problem, however, differed. In Indonesia a crop typically gets infected through seed and soil. In the Red River Delta in Vietnam soils are generally clean of the disease after two seasons of inundated rice, but in addition to using infected seed it was suspected that farmers bring the disease to the field through uncomposted manure. Participatory evaluation of the existing integrated package of management practices to combat bacterial wilt therefore needed to be complemented by research to detect the level of *R. solanacearum* inoculum in farm manure and to assess the efficacy of simple composting methods to eliminate the inoculum.

The methodology chosen to validate and adapt the integrated set of measures, which mainly boil down to various good crop management and seed selection, was based on the idea that farmers can only evaluate practices and will try them out in their own fields if they have enough knowledge about the reasons why the practices could possibly work. In three different villages in Vietnam and three in Indonesia, 10-15 potato farmers per village became involved in a series of six sessions throughout the season containing both learning and research activities. In Vietnam, the activities were led by a researcher but with intensive involvement of some farmer researchers. In Indonesia, teams consisting of a farmer researcher and an NGO staff in two locations, and a researcher and an FFS facilitator in the third village, were in charge after having received prior training. Learning activities were very much FFS-like: hands-on, discovery based and participatory. Each group managed a learning plot where all the integrated management components were implemented. On an additional plot they conducted experiments of their choice. Throughout the season, farmers' practices in their own fields were recorded, to see whether the learning activities could convince them to implement the management components and measure their effects. After harvest, the outputs of the learning and experimental plots were compared with those on farmers' own fields.

Despite the similarities with an FFS setting, albeit with fewer farmers, fewer sessions and focused on bacterial wilt only, it was agreed with the participating farmers that we were not sure of the outcome of the experiments and were learning together, hence we would not call it an FFS yet. As a result of FFS history in Indonesia and Vietnam, farmers' expectations of an FFS would be a training event that would not leave any doubt of what works and what not. The activities served to develop collaboratively both the technical content for a locally acceptable integrated bacterial wilt management approach and learning activities to be integrated later into a more comprehensive potato IPM FFS curriculum. These curricula are currently under development.

UPWARD-led activities in Nepal (Hidalgo *et al.*, 2001) and the Philippines (Campilan *et al.*, 2001) also used FFS essentially as a versatile learning platform, but bringing in a new use as a vehicle for community-based propagation and maintenance of clean planting materials. The use of healthy seed is a central message conveyed to farmers in IPM FFS, but farmers do not always have access to healthy planting material. Since 1998, potato and sweetpotato FFS that focus on production of healthy planting materials have been pilot-tested in Nepal (potatoes) and the Philippines (sweetpotatoes). The underlying goal of these efforts was to use the learning plots to set up farmer experiments on healthy seed production and to propagate planting materials. In the case of Nepal, farmers set aside a portion of the learning plot where seed multiplication was undertaken using pathogen-tested tubers and/or true potato seed (TPS) obtained from the Potato Development Program of the Department of Agriculture (DoA). In the case of the Philippines, farmers set up net houses, using locally available materials, where planting materials of sweetpotato are multiplied using tissue-cultured mother plants obtained from the nearby Tarlac College of Agriculture (TCA). The FFS curriculum for seed propagation needed some major adaptations, including 1) adjusting the timing and frequency of sessions to coincide with the critical growth stages and appearance of disease symptoms, 2) conducting a series of FFS (2-3 subsequent seasons) with the same group to encompass the full cycle of seed propagation and on-farm maintenance, and 3) planting potato in learning plots not only for experimentation and observation, but with the goal of multiplying the seed and distributing these to farmer participants at the end of the season. For sweetpotato seed FFS, adaptations to the curriculum included 1) the use of "learning net houses" in addition to the experimental and observation plots in the open field, 2) a focus on vine production for multiplying planting materials instead of root production as in a typical sweetpotato ICM FFS, and 3) learning methods and tools to help farmers visualize concepts such as vector, pathogen and hosts.

A major lesson derived from the Nepal experience is that where FFS is widened to seed production, social and institutional arrangements need to be put in place, in order to ensure a more equitable access to and sharing of the seed produced (Campilan, 2002). In subsequent FFS, the facilitators and farmer participants have made sure that this is a key negotiation point during the preparatory meeting for an FFS. Meanwhile in the Philippines, the cost of setting up net houses was a major issue during the FFS. To meet the technical requirements set by the scientists while recognizing the resource limitations of farmers, a low-cost net house design has evolved after experimenting with various local construction materials and simplified designs. It was also realized that an FFS for producing healthy planting materials is a necessary but not sufficient step toward successful management of sweetpotato diseases. Planting materials obtained from the FFS net houses were observed to have become virus-infected as early as the first season of planting in the field. A follow-up FFS on ICM has since then been developed in order for farmers, who were earlier trained in planting materials production, to subsequently learn practices for maintaining crop health so that the sweetpotato fields could serve as source of healthy planting materials for subsequent seasons.

The FFS-for-community-led-research approach for potato systems

CIP – FAO IPM Global IPM Facility collaboration in Ecuador have emphasized multi-institutional and collaborative modalities. Both FFS and CIAL methodologies have been used as means to enabling development practitioners and their organizations to progress from instrumental modalities to more interactive approaches to community development. More recently, partners have been working with the FFS to develop linkages with the agrifood chain and to influence public policy. Similarly, sweetpotato field schools in Asia and Africa are touching on many of these issues (marketing mechanisms, sweetpotato in the livelihood system, self-financing mechanisms, sustained farmer experimentation), although they were less specifically organized only for that purpose, and therefore have been reported as part of the previous approach.

A central theme for Latin America is rapid economic liberalization, which in practical terms has come to mean government restructuring (decentralization) and privatization of resource ownership and management. This process commonly has been referred to as economic and political ‘modernization’. Beginning in the 1980’s, international development agencies encouraged economic stabilization, privatization, and liberalization throughout Latin America to promote commodity exports and economic globalization. In the early 1990’s, the Andean countries responded with new laws with names that included an arrangement of the following constructs: structural adjustment, decentralization, agricultural and forestry modernization and strengthening municipalities. Bolivia was able to shape this around the concept of ‘popular participation’, though the original economic mechanisms of decentralization and privatization remained unchanged.

In response, efforts to establish and maintain national IPM programs, for example, must be compatible with the new and emerging institutional framework. The theoretical implications, in terms of knowledge systems and their outcomes as well as changing roles of key actors, such as governments (municipalities, MAG), action agencies (NGOs, CBOs), research institutions (NARs, universities, CGIARs) and increasingly private industry, are profound. FFS has helped to shape this re-institutionalization towards community-based structures, but the challenges are many and the work has only begun.

FFS in Ecuador have relied largely on off-the-shelf technologies rather than technology development, and further built on the foundation of existing farming practice and worked with farmers to develop opportunities for the future. One very relevant example is the recent work with *wachu rozado* (in Quichua and Spanish, literally "cut furrow"), a pre-Colombian tillage system where potato is grown under folded grass sod. Initial research on the system has shown that it is both highly productive and resource conserving – a rare combination.

About 20 percent of FFS participants in Northern Ecuador continue to use *wachu rozado* and produce about 21 T/ha, which is the present average in Carchi and about three times the average in other parts of the country. During the design of FFS, farmers stated that *wachu rozado* required about one third less fertilizers and pesticides than potato under conventional tillage. Furthermore, farmers said that the system prevented soil erosion, which was agreed to by soil scientists. Nevertheless, despite much promise, the system is in sharp decline.

Even though FFS have determined that *wachu rozado* requires about one third less work than doing total tillage by hand, recent access to tractors coupled with total tillage mentality have literally plowed under this promising system. Field Schools are working with farmers to improve *wachu rozado*, through combining past know-how with modern technologies. For example, FFS have been testing animal traction and tractor implements to fold sod and decrease both mechanized and hand labor requirements (the system only requires one pass with a tractor, rather than three or four as with total tillage). Farmers are also looking at more efficient ways to apply synthetic fertilizers and pesticides, taking advantage of the unique mulching environment. In early plots, FFS have been able to maintain production with 50 percent less external inputs. Scientists from INIAP, the national research service, recently began a project to deepen understanding of the *wachu rozado* system and to build on the empirical results of the FFS.

FFS in Ecuador have also been involved in a research initiative to influence government policy on pesticides. FFS members and their families have been participated in a long-term study to understand pesticide effects on human health, farm productivity and the environment. Findings in one location have been alarming, with eighty percent of products used World Health Organization Hazard Category I agro-chemicals. Overuse and careless management of pesticides were found to contribute to severe human health effects, including poisonings (171/100,000), dermatitis (48% of applicators), pigmentation disorders (25% of applicators), and severe neuro-psychological effects (peripheral nerve damage, abnormal deep tendon reflexes and coordination). Between direct medication costs and recovery, farmers lost the equivalent of six days of work when recovering from a poisoning. Mortality due to pesticides was among the highest reported (21/100,000).

FFS helped to organize a series of community, provincial and national fora to inform public of the situation. This has included a national television program in which a FFS demonstrated its alternatives to decreasing pesticide use. The group is presently working the FAO and the Pesticide Action Network to eventually eliminate the sale and distribution of highly toxic products.

Rather than operate a single large project, the Ecuadorian initiative brings together funding from multiple sources to build a national program, including various projects focusing on potato systems as well as on-going project resources of NGO and CBO partners. The project has been progressing through a series of stages of maturity, achieving learning and organizational objectives, as it establishes a financial base. Each institution, in particular the NGOs, has invested at times significant human and material resources. As a result, progress may be slow, but it is built upon a broad and diverse institutional base. Motivation and organizational commitment appears to be increasing at exponential rates.

Presently, the program is testing self-financing mechanism, based on the model developed by the FAO Global IPM Facility in East Africa. Farmer facilitators have been paid by keeping a portion of the harvest from FFS learning plots. Nevertheless, this approach has caused problems, as facilitator and participants tend to be less interested in testing ideas that could potentially harm production. Partners are currently searching for alternative means to participant or community financing of the FFS process.

Table 1: Characterization of the different approaches in the use of the farmer field school at CIP

Approach	Focus of activities – Country*	Main objective of the FFS	Use of platforms by project phase				
			Platform led by CIP activity	Phase: Innovative technical research	Phase: Development of learning model	Phase: Farmer learning, adaptive research	*Platform led by others*
1. PR-FFS	Potato IDM – PE, BO, UG, ET, BD, CH	– Applied research on varieties and fungicide management – Development of FFS model – Farmer education	*PR-FFS*				*Conventional research*
							FFS
2. FFS with some PR	Potato production and post-harvest – BO, EC	– Development of FFS model – Adaptive research on varieties – Farmer education	*FFS*				*Conventional research*
			Farmer evaluation groups/CIAL				*Markets/ industries*
3. FFS after PR	Sweetpotato and potato IPM/ICM – IA, VN, PH, CH, UG, KE	– Farmer education, enhanced with skill and platform development for adaptive research	*PR with FRT**				*Conventional research*
			FFS				*FFS/Community IPM*
4. FFS for community-led research	Potato production and post-harvest – EC, BO	– Strengthen development intervention – Strengthen farmer-led, community based innovation	*FFS*				*Conventional research*
			CIAL				

* IA = Indonesia; VN = Vietnam; PH = Philippines; CH = China; NE = Nepal; UG = Uganda; KE = Kenya; BO = Bolivia; PE = Peru; ET = Ethiopia; BD = Bangladesh; EC = Ecuador; FRT = farmer researcher team

The four approaches: strengths and weaknesses

Although the choice for a certain approach of FFS utilization and the way it was operationalized has mostly been the result of decisions by individual coordinating scientists considering location-specific conditions, local team capacities and personal convictions, we will make an attempt here to compare the approaches and analyze their strengths and weaknesses. Table 1 provides an overview and characterization of the four approaches to FFS utilization applied at CIP. In addition to the main (although not always sole) purpose that the FFS was expected to serve, the table shows during what phases in the research and development cycle the FFS was applied and how that was complemented by processes or outputs of other platforms. A full research and development cycle, as applied by most CIP projects reported here, is roughly divided into five phases:

- A needs and opportunity assessment phase
- A research phase during which technological innovations are developed; this implies basic and applied research the outcomes of which are information and technology components (Innovative technical research phase in Table 1)
- A development phase during which learning models and mechanisms are developed, in these cases based on the FFS principles. This phase implies translation of technical guidelines into learning activities, preparation of modules and a curriculum, and field-testing of protocols (Development of learning model phase in Table 1)
- An extension and implementation phase during which farmers have access to learning opportunities and field-test, adapt and practice what they have learned in their own fields. This phase implies scaling up and out of CIP-led efforts (Farmer learning, adaptive research phase in Table 1)
- A monitoring and evaluation phase, both at the level of internal monitoring and evaluation of research and development efforts, as well as impact assessment of extension and implementation activities

Table 1 only relates to the second, third and fourth phases, which are those where FFS has been relevant as a major platform for conducting the activities. The platforms applied during or contributing to these three phases are distinguished between CIP-led platforms (listed on the left and represented by gray boxes), and platforms led by other projects or organizations that FFS have linked with or used outputs from (listed on the right and represented by black boxes). The shading of boxes across the research and development phases visualizes what objectives the various platforms under the five approaches fulfilled, and how these platforms were mutually linked within a set of activities.

The *PR-FFS approach* served three objectives reflecting the three research and development phases at the same time, while also tapping on outcomes of conventional research activities done elsewhere. Innovative research in the PR-FFS was limited to the development of new information about the interaction between resistance, environment and disease management, which proved useful for both researchers and farmers. The more straightforward variety evaluation and fungicide management trials done by farmers rather fulfilled learning and adaptive research purposes. Where over time FFS scaled up and implementation was taken over by extension programs, gradually a shift has taken place to FFS fully for farmer learning and adaptive research. Some initial PR-FFS groups in Peru, however, have specialized in research activities and continue to test control components for late blight. For CIP researchers this provides an interesting opportunity for collectively conducting trials with farmers on new late blight management components, such as simple decision support systems relating to combined resistance and fungicide use.

The *FFS-with-some-PR approach* mainly served the purpose of providing opportunities to farmers for adaptive research on varieties and learning. Learning content drew heavily on outcomes of research done elsewhere, and on links with CIALs. Whilst farmers learned a lot about late blight and its management on the learning field they did not apparently adapt the strategy which was proposed by the research institution to local conditions or improve on it in any meaningful way. Where FFS had a strong focus on post-harvest issues, they have mainly served to educate farmers and better link them to markets and industries. This involved some farmer research, for example on storage management, and links with CIALs have provided a complementary set of platforms for farmers to collectively work on improvement of their potato enterprise.

Although experimentation in these FFS did occur, in practice no significant participatory research could be said to have taken place. Why did this happen? The strategy is a complex composite technology regarded by the researchers who developed it as "finished" rather than a "prototype". On the IPM learning parcel farmers applied the whole strategy against local practice. There was no possibility to vary the strategy across the parcel or over time to understand the way in which any of its components affected the overall strategy. Furthermore the strategy had been developed in multiple locations over a number of cropping seasons. Significant farmer testing of the strategy would similarly require multiple locations and research over several seasons with different seasonal incidence of late blight. No significant PR took place because the single season single community FFS was too localized a platform to make it possible. Farmers had as much on their plate as they could manage simply to improve their understanding of late blight and the use of fungicides. Expecting them to engage in meaningful PR under these circumstances was never reasonable. PR in the case of more complex technology and difficult to understand problems requires prior training in the technology itself and research methodology. In the case of participatory variety selection the major variable across treatments, the varieties themselves, is much easier to understand. This explains the success of the FFS in PR with participatory variety selection and its limited progress with integrated management of late blight.

The *FFS-after-PR approach* has been part of projects that have a clearly phased structure, with development of technical content separated from, prior to, and facilitated through a different platform than FFS development. The farmer researcher teams in Indonesia made quick and focused research possible, which was needed because not many off-the shelf technologies were available to tackle the constraints in sweetpotato and potato under prevailing conditions. The other countries could benefit from the outcomes. Farmer researchers have been heavily involved in FFS development as well, and hence contributed strongly to connecting technology development and FFS development phases. For large-scale implementation of FFS, the project only established the mechanism and provided backstopping, monitoring and evaluation to pilot cycles, after which the project was phased over to extension organizations.

A strength of this approach is that the route that was taken through partly overlapping phases from needs assessment to phasing over to extension organization, has been clear to the whole team all the way, and as a result everyone's role was clear during the various phases. Additionally, the participatory research process has been of high quality and genuinely participatory, because farmers are trained on experimental methodologies, assisted throughout the research process, and heavily involved in agenda setting, planning, implementation and analysis. PR in the FFS is limited to adaptive research activities, and seldom contributes to generation of an innovation. A weakness of the approach has been that as soon as activities are phased over to extension organizations, one has no longer control over intensity, direction and quality of follow-up activities. Particularly the quality of experimental methodology taught to farmers has not always been good, leading to limited farmer experimentation in their own fields afterwards. To maintain quality and improve farmer experimentation, longer term guidance of trainers and FFS farmers would be needed.

The *FFS-with -community-led-research approach* mainly fulfills the purpose of farmer capacity building, with an initial, clear focus on a cropping system but serving much higher goals. When aiming at sustainable agr icultural development this should be the final goal for each intervention, however it may be asked who should preferably lead such an initiative. An IARC taking the lead in such work has the advantage of direct linkages with research activities and access to the latest research outputs. On the other hand, IARCs are not yet structured and geared towards the implementations of large development programs.

Conclusions

The previous sections have elaborated on how the FFS has been used in CIP-led research and development activities, and how these FFS were linked to other platforms. Four different approaches to the use of FFS were distinguished. Whereas all approaches have provided opportunities for farmers to learn, in an experiential way, about production and post-harvest issues in potato and sweetpotato systems, they mainly differed in the application and nature of participatory research in the field school. In addition to the experiential learning experiments contributing to farmer knowledge generation but not to the generation of new, public knowledge, in most FFS covered under the four approaches farmers have become engaged in adaptive research activities. These experiments served to field-test and fine-tune information or technologies made available to the farmers through the FFS. Only in some cases, where there has been substantial involvement of researchers, the FFS has provided a platform for research of a more applied, innovative nature. Intensive researcher involvement, however, tends to limit scaling up. Another differentiating characteristic of the four approaches is found in the extent to which linkages between FFS and other platforms for farmer research, such as CIALs and farmer researcher teams, were established and capitalized upon.

Each of the approaches has its merits and weaknesses and there is no single best approach. Choice of a platform for a certain activity should be done based on clearly stated objectives and analysis of the context to support that platform. As far as possible, not to raise false expectations, these objectives should be specified and agreed upon with the participating farmers and their expectations need to be made explicit. They should be clear about whether they are involved in an activity serving learning or research purposes, or both. Particularly for those activities mainly serving research objectives, the applicability of the research output for farmer practice needs to be clearly discussed with participating farmers, so as not to raise false expectations.

The various field experiences, and the opportunity to write this paper and do a more analytic comparison, provided several valuable insights. A major lesson we learned is that doing participatory research and organizing farmer learning activities is a chicken and egg situation. Good PR requires prior learning, whereas designing good learning activities requires prior PR to have a solid technical base. This dilemma was tackled in the FFS-after-PR approach through the phased project implementation and linkages with other PR platforms, whereas FFS primarily served a farmer training purpose. In the PR-FFS and FFS-with-some-PR approaches, the dilemma expressed itself in scale, in that FFS events with more PR were conducted on a smaller scale and at increasing scale PR began to be limited to adaptive research activities. The FFS-with-community-led-research approach mainly drew from existing, conventional research outcomes and encouraged farmers to further conduct adaptive research. When designing a project activity, it is critical to think about how learning activities and PR are brought together under the specific circumstances of the project area. Extracting from the CIP experiences, this could be within a single joint platform, across two platforms which exist simultaneously, or through two platforms which are developed one after the other. There may be more possible options. Whatever strategy is chosen, it would anyway be beneficial to look carefully at what other platforms already exist and think about linkage activities and mechanisms. It is also necessary to assess what the employment of a certain platform implies for both individual participating farmers and researchers and the organizations the various partners represents, with regard to capacity, commitments and expected outputs. More empirically based work on what works, what doesn't, and why or why not, with regard to platforms to employ for farmer participatory research and learning, objectives to fulfill, and linkages among platform to encourage, is needed and would provide an interesting area of research.

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