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Case Study

Human and Technical Dimensions of Potato Integrated Pest Management Using Farmer Field Schools: International Potato Center and Partners' Experience With Potato Late Blight Management

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Abstract

In the 1990s, the integrated pest management (IPM) team for potato late blight (IPM-late blight) at the International Potato Center (CIP) began to address the management of this complex potato disease by combining crop protection with social and behavioral sciences. Since the early 2000s, the team has worked with research and development organizations in countries in Asia, sub-Saharan Africa, and South America to develop farmer discovery-based learning methods using farmer field schools (FFS). The principles of late blight control were more visible and understood by farmers when they could test options for managing late blight, particularly new potato clones with resistance to the disease, for themselves. CIP and partners have since adapted an approach combining FFS and participatory research to facilitate farmers' access to information, knowledge, and technologies. Several manuals to implement FFS-IPM-late blight with farmers were subsequently developed. Results indicated that farmers using this approach learned new knowledge, assessed new potato clones, and changed crop management practices. Hence farmers realized a 32% average increase in potato productivity and income in Peru; similar changes occurred in other countries. The participatory research and training approach had a significant impact beyond IPM-late blight. In Peru and Bolivia, for example, more than 2,000 FFS were implemented between 2005 and 2012 on IPM for potato, other crops (coffee, cocoa, fruit trees), and livestock. In Uganda and Ethiopia, the experience expanded to potato seed management with the formation of seed cooperatives. Lessons have been drawn from this experience.

Key words: FFS, scaling-up, mainstreaming, potato, learning activity

In the early 1990s, integrated pest management (IPM) came to be understood as a knowledge-intensive technology, requiring farmers to strengthen their knowledge and skills in order to make appropriate decisions (Jacobsen 1997, Matson et al. 1997, Ortiz et al. 1997). At the International Potato Center (CIP), IPM efforts to control mainly insect pests also started in the early 1990s, using the 'IPM pilot areas' approach (Cisneros et al. 1995) and reached a similar conclusion.

In the late 1990s, CIP ran a priority-setting exercise and identified potato late blight management as the main production constraint in most potato agro-ecosystems. To tackle this challenge, CIP conducted research that considered the problem from different angles. These included breeding for resistance to the disease, epidemiological studies of the pathogen, and development of late blight control practices, particularly optimization of fungicide use for different levels of varietal resistance. It was evident that late blight management required a more knowledge-intensive approach, and that farmers needed to make appropriate choices if they were to succeed in the face of the late blight pandemic. But such an approach would require farmers to have specific knowledge of the

disease, the crop, and the control methods available for possible technology adaptation, adoption, or both. Therefore, a method was needed that would facilitate farmer-learning of complex concepts. The farmer field school (FFS) approach emerged as an appropriate option.

The FFS approach was modeled after the system of nonformal education based on the principles of adult learning first developed in the 1960s (Freire 1970, Braun and Duveskog 2008). The aim was to facilitate farmers' understanding of complex issues, such as the biophysical principles involved in IPM, in what was called discovery-based learning. For this approach to be successful, farmers needed to be engaged directly in learning by both observing field activities first-hand and asking questions about those activities. With the knowledge gained from these observations and responses to questions, farmers would improve their capacity to make critical decisions about crop management options (Conway and McCauley 1983, Braun et al. 1999, Gallagher 2003).

Through the exchange of experiences and participatory learning (Braun et al. 1999), FFS should help farmers to develop their analytical abilities, critical thinking, and creativity. By learning how to make better decisions and improve the management of their crops with knowledge based on personal experiences, they will become IPM experts (Kenmore 2002), as measured by an increase in their knowledge and in farmer-facilitated capacity building (Aguilar et al. 2010, Gutiérrez-Montes and Siles 2011). In that sense, FFS appeared as a new paradigm of extension, adaptation, adjustment, and even development of new technologies (Gottret and Córdoba 2004).

Since the first FFS were implemented, many projects have used this concept. Results have revealed two significant outcomes. First, FFS facilitated immediate change in participating farmers' knowledge, attitudes, and practices. Second, it empowered farmers to seek and access agricultural information and technology so that they became experts in the management of crops or livestock production (Nelson et al. 2001). Worldwide, different institutions have implemented FFS in more than 87 countries. A global survey estimated that by 2008, some 10–20 million farmers had graduated and benefited from FFS (Okoth et al. 2010).

This article describes the pioneering process of adapting the FFS approach to conduct participatory research and training for integrated management of potato late blight (IPM-late blight), from its introduction and adaptation in the late 1990s, through a phase of contextualized scaling between 2000 and 2004, and FFS mainstreaming in institutions after 2005 (Fig. 1). In Peru,

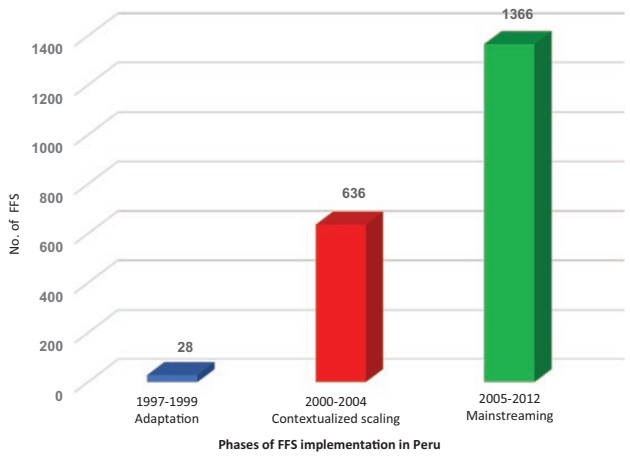

Fig. 1. Phases of implementation of farmer field schools in Peru from 1997 to 2012.

information about FFS institutionalization was gathered by CIP staff in 2012 through two types of surveys conducted with 37 representatives of organizations implementing FFS in the previous 10 yr. One survey targeted the managers of the participating organizations via e-mail; the other was directed at FFS facilitators or trainers as a self-filled questionnaire and completed in a face-to-face interview. Organizations were first identified, then contacted. A presentation of the study and two questionnaires were sent via e-mail to obtain information about the institutions and quantify implementation of FFS. Additionally, secondary information, such as strategic plans and annual reports, were used to verify how organizations were mainstreaming FFS into their extension activities. A picture of the evolution of the potato-related FFS in other countries such as Bolivia, Ethiopia, and Uganda emerged based on secondary information.

FFS and its Introduction to CIP: The Approach–Adaptation Phase (1997–1999)

Structural adjustment of economies and decentralization in several developing countries have dramatically decreased the availability of extension services during the last three decades. As a result, farmers' access to agricultural information and technologies was (and continues to be) severely limited (Farrington 1994). Moreover, the few services provided by public and private organizations relied on conventional extension methods in which information was presented in ways that limited its comprehensibility and transformation into knowledge and practice. Nor did these methods consider farmer-specific learning needs or the relevance of farmers' diverse contexts. Several organizations, including CIP, started to explore ideas to solve this problem and develop methods of participatory research and training.

Building on the organization's experience in the IPM pilot areas in the early 1990s (Cisneros et al. 1995), CIP continued with pest management of potato, especially IPM-late blight. Compared with insect pest management, IPM-late blight was more complex and required a method that would help farmers to understand it better. When a new leader of the late blight team joined CIP, there was interest in adapting this method for the management of potato disease (Nelson et al. 2001). This meant bringing to CIP the team leader's earlier experience with FFS through a collaboration with the Food and Agriculture Organization of the United Nations (FAO), the Vietnamese national program, and the International Rice Research Institute. The challenge was to adapt FFS to facilitate farmers' learning of complex concepts involved in the control of potato late blight.

The FFS approach used in Asia, particularly for the management of insect pests of rice, focused on reducing the indiscriminate use of insecticides so as to allow natural enemies to control the pests. The management recommendation that was tested aimed at reducing insecticide sprays and was thus a relatively simple one. But not spraying as a means of encouraging natural control was not an option for dealing with the potato late blight pathogen, as the microbe lacks known natural enemies and can rapidly destroy entire crops. This underscored clearly that the FFS approach needed substantial methodological adaptation to deal with this potato disease.

One of the first actions that the CIP IPM team took was to assess farmers' knowledge and practices about potato late blight. Findings indicated that, although they knew a lot about different subjects, there were also significant gaps in their knowledge and misconceptions about the disease were common. An assessment of farmers' knowledge in Peru, Bolivia, Ecuador, and Uganda determined that most did not know that the real cause of late blight

was a microorganism, and that they (correctly) associated the disease with environmental factors such as rainfall, fog, and cold weather (Ortiz et al. 1999). During the study, about 88% of the interviewed farmers confused late blight symptoms with other physiological or pathological disorders. Most farmers used fungicides to control for late blight, but did not understand the differences in the mode of actions of contact and systemic products. In many cases, the concepts of resistance to fungicide use were not well understood. The evidence indicated that farmers should learn these basic concepts if they were to apply IPM-late blight in potato and effectively control the disease more cost-effectively (ibid.).

Therefore a process of adapting the FFS approach to potato late blight was initiated in the countries where the assessment was carried out. In Ecuador, a 3-mo residential training (a full cycle of growing potatoes), supported by the FAO, was conducted in 1999 with a highly experienced FFS facilitator from Cambodia and with FFS facilitators from Bolivia, Ecuador, and Peru. On the basis of this training, the CIP team and a range of extension and development-oriented partners—e.g., CARE–Peru, a nongovernmental organization (NGO)—initiated the design, assessment, and adjustment of a curriculum of learning sessions. The curriculum allowed farmers to learn about IPM-late blight through the potato cycle, from planting to harvesting. As a result, CIP and partners published FFS guidelines that described the entire process of implementing and assessing FFS for IPM-late blight. The field guide (published first in Spanish then in English) was validated in 28 FFS in the pilot area of the CIP-CARE project implemented in northern Peru from 1997 to 2001 (Bazán et al. 2002, Nelson et al. 2002).

One of the main changes from the original FFS concept was the explicit inclusion of farmer participatory research (Thiele et al. 2001). This adaptation was required because options to manage late blight needed to be adjusted to different levels of varietal resistance and to the local agro-ecological conditions. The learning plot, which is a normal feature of FFS whereby farmers compare fields with and without IPM, was modified into a full experimental design with replications. It now also included treatments that compared different options for late blight management, including a cultivar's resistant levels, combined with contact and systemic fungicide applications. Another adaptation of FFS to strengthen the experimental elements was the design of learning sessions for farmers and the participatory technology assessment method. This also went beyond IPM-late blight to include integrated crop management in general, in response to specific demands from farmers (Nelson et al. 2002; Ortiz et al. 2004, 2008). In some FFS in Uganda, participants even suggested a 1-h adult literacy session per meeting day–week (in addition to the normal FFS activity) so as to improve the capacity of farmers who could not read or write. This was seen as an urgent need to help farmers read fungicide labels, for example (Olanya et al. 2010).

Taking into account the lessons learned in Peru, the FFS approach to potato management was similarly adapted in other countries and with the participation of organizations involved in research and development (R&D). These included the Ethiopian Institute of Agricultural Research and the NGO Self Help Development International in Ethiopia; the National Agricultural Research Organization (NARO) and the NGO AFRICARE in Uganda; the Tuber Crop Research Institute and CARE in Bangladesh; CIP and the Chongqing Plant Protection Institute in China; and in Bolivia the PROINPA Foundation and Association for Rural Agricultural Services, a local NGO. But the participation of additional partners added complexity to the method. It became apparent that the participatory research component should be an integral part of the process of FFS for potato IPM-late blight due to the need for assessing new technologies according to local contexts, particularly to control the disease.

The adaptation phase had its challenges, however. Foremost was to provide appropriate training involving the method itself, including participatory research. Another was in the planning and monitoring of the results with staff of participating organizations, as critical elements for the further implementation of FFS.

Contextualized Scaling-up of the FFS (2000–2004)

Methodological innovation requires significant adaptation to the local context, not only to the agro-ecological circumstances but to the institutional situations as well. Between 2000 and 2004, the FFS method for potato late blight was being implemented by more than 10 organizations in six different countries (Bangladesh, Bolivia, China, Ethiopia, Peru, and Uganda). In the case of Peru, and given the experience gained during the adaptation phase, CIP and CARE started to contextualize scaling-up: both organizations continued to make methodological changes in order to factor in local conditions with local resources. Similarly, scaling-up was also implemented by other partners and stakeholders. One step in this process happened as part of an FAO project on IPM-FFS in Peru, which broadened the work geographically and thematically. The project involved many of the staff from CARE who participated in IPM with CIP, and used that experience to continue adapting the method to different conditions on the ground. The FFS approach was replicated in potato IPM and integrated crop management, as well as in other crops (e.g., cotton, coffee, maize, citrus fruits, vegetables, beans, bananas, custard apple [chirimoya], quinoa, and soja) and in livestock. In other countries, too, adaptation and assessment were carried out within the organizational contexts and with respect to emergent production constraints specific to each country. Adaptation proceeded relatively rapidly in some countries. In Peru, Bolivia, Ethiopia, and Uganda, e.g., institutional alignment supported scaling of the approach. In Bangladesh and China, the institutional situation was different, and changes in organizational priorities prevented institutional uptake of the potato-related FFS method.

During the contextualized scaling-up phase by other organizations, CIP focused on assessing the impact of the FFS for potato IPM-late blight in the participating communities in northern Peru. It was critically important to determine changes in farmers' knowledge after being exposed to FFS. The results of the assessment indicated that farmers learned new information and practices through FFS, which included significant differences regarding knowledge on late blight biology, control practices (fungicide use), genetic resistance concepts, and influence of weather in disease development and progression (Nelson et al. 2001, Ortiz et al. 2004). Having additional knowledge was not enough, however, and a specific study was conducted to determine the influence of new knowledge on potato management and productivity. Godtland et al. (2004) determined that additional knowledge on potato IPM was associated with a 32% inferred increase in potato productivity. Zuger (2004) also assessed the impact of FFS by monitoring potato plots of FFS participants and nonparticipants and found rises in income of between $236/ha and $350/ha in the plots of the participant farmers. These results confirmed the impact of FFS for potato IPM-late blight in knowledge and productivity of potato farmers in Peru.

In the contextualized scaling phase, 636 FFS were implemented directly or indirectly in Peru under the influence of the FAO project mentioned above (2000–2004). A total of 207 professionals from 56 institutions were trained on FFS methodology and practice in the framework of this project, generating a space for learning and

exchange of experiences (Groeneweg et al. 2004). The main lessons of this phase were, first, that the staff in charge of implementing FFS required training in facilitation skills and enterprise technical aspects. Second, institutions required funds to cover the costs of implementing quality FFS (Malarín 2003), but sources of quality training were not always available. Yet some organizations did not consider FFS to be a central element of their structures and strategies for working with farmers. On the other hand, the organizations that participated in the FAO project contributed to a continual adaptation of the method to other issues and contexts.

Thirty-two FFS and 36 farmer research groups were organized in Ethiopia, where participatory potato-related research and training was conducted during the adaptation and contextualized scaling phases. Each FFS and farmer research group comprised an average of 25 and 15 participant farmers, respectively. They received access to new information, knowledge, late blight-resistant varieties, and other crop management options (Chindi et al. 2016).

These examples illustrate the flexibility of the method to deal not only with different types of knowledge-intensive technologies, such as IPM-late blight in potato, but also with other crops, constraints, and information delivery and dissemination mechanisms. The contextualized scaling by different participating organizations had challenges to overcome, most significantly the financial resources needed to cover the costs of implementing FFS. And although participating institutions were very interested in mainstreaming FFS in most of their work, they lacked sufficient funds or external resources to implement this approach fully. In many cases, funding organizations considered the FFS approach to be very expensive, with little consideration for its long-term benefits.

Another lesson was the need to have sound scientific evidence to support the information and technologies to be shared with farmers. This was clear for the case of potato late blight, but not necessarily for new topics that other organizations wanted to include.

FFS Mainstreaming at Institutional Level (2005–2012)

The process of mainstreaming FFS at institutional level was first started in Peru, where CIP devoted substantial efforts to train other organizations on FFS for IPM-late blight and potato-related production technologies (Orrego et al. 2009). In 2012, CIP surveyed government organizations and NGOs that used FFS methodology in their agricultural R&D interventions. Thirty-five NGOs and private organizations implemented 2,030 FFS in Peru up to that year. The thematic areas addressed in the FFS included potato and other crops such as cocoa, maize, quinoa as well as livestock management (Fig. 2). Other agricultural issues such as fruit fly, management of organic gardens, food security, nutrition, market linkages, and family health also were addressed.

After 2005, CIP began to investigate the factors that facilitated or limited institutionalization of FFS and other participatory methods. Ortiz et al. (2011) examined the incentives and disincentives for stakeholder involvement in participatory research, including the potato-related FFS method. The study was conducted by gathering

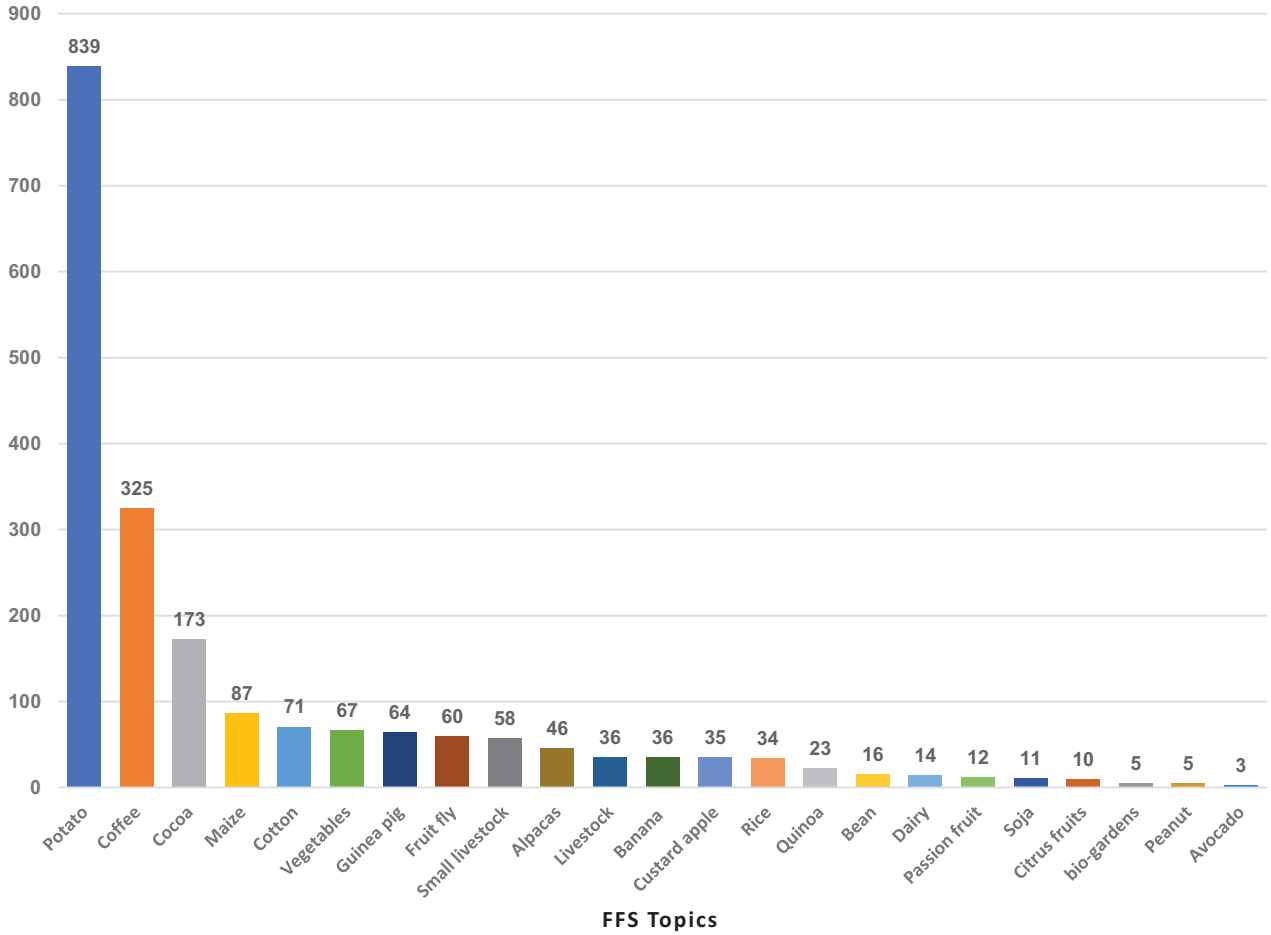

Fig. 2. Number of farmer field schools by farming activity in Peru from 1997 to 2012 (elaborated from CIPs survey).

opinions from farmers, facilitators, and institutional representatives that implemented the participatory methods in Bolivia, Ethiopia, Peru, and Uganda from 2005 to 2007. Results indicated that the most important incentives for farmers were the access to new information and technologies as well as social capital (networking and better community organization). Farmers considered this to be essential for more sustainable results, although they claimed that limited time (farmers' time constraints) was an impediment to participation in all FFS sessions during the entire cropping season. Nevertheless, laying a foundation for FFS has provided a bedrock for developing innovative and unexpected enterprises such as, e.g., a goat-breeding village association and several village savings and credit organizations in Uganda.

For the facilitators (i.e., staff in charge of running FFS and other participatory methods), a number of operational and organizational factors prevented the full adoption of FFS. These included limited coordination between organizations and farmers, difficulties in accessing communities, multiple tasks in addition to FFS responsibilities, and job instability. At organizational level, both financial and operational factors presented incentives or disincentives, such as the higher cost of the participatory methods compared with other approaches, availability of skilled human resources, quality of technologies generated, and the sustainability of financial support. Organizations that intend to sustainably scale up FFS, as well as other participatory methods and derived technologies, need to consider these factors at both individual and organizational levels.

When mainstreaming knowledge-intensive participatory approaches at institutional level, different organizations began to implement FFS with their own funds in Peru. For example, CARE developed an FFS project to manage native fruit trees, incorporating marketing concepts (CARE–Peru 2006). In southwestern Uganda, NARO has consistently applied FFS concepts and approaches in most of its adaptive research and outreach activities with its partners. This has been achieved by retaining some of the pioneer FFS facilitators since 2001 and maintaining long-term collaborative linkages with some of its partners. Similarly, FFS approaches have been used in integrated sweet potato crop management in eastern and northern Uganda, where CIP has partnered with NARO and local governments to go beyond crop production to value addition and processing. The FFS approach has also been used in Uganda by NARO and local government district extension systems with FAO to effectively control banana bacterial wilt, which was declared a national disaster in 2009. On the whole, assessments by different authors have shown that FFS has helped to reduce pest-control substances or, in the case of banana bacterial wilt in Uganda, disease and pest control without the use of pesticides. This has led to improved crop or livestock performances in many countries (Godtland et al. 2004, Van den Berg 2004). Nonetheless, the FFS approach has been criticized for its relatively high cost (Ricker-Gilbert et al. 2008) compared with agricultural extension approaches, partly due to lack of long-term empirical data from controlled studies to demonstrate the sustainable benefits of the method.

In Ethiopia, an important component of the FFS training was on seed storage with diffused light stores. These low-input stores improved seed quality and reduced losses when compared with leaving potatoes on the ground, covered in the field, or stored in the home. This technology was adopted by farmers: FFS groups built at least 110 stores using their own resources (Woldegiorgis et al. 2013). In addition, training for different groups (farmers, development agents, field workers, technical assistants, and researchers) were also based on FFS, including diverse topics such as integrated disease (late blight) and crop management (Chindi et al. 2016), production of planting material of higher quality, postharvest management of seed and ware potato, and preparation of different food dishes using potato. Improved on-farm seed production has now become a common practice that helps farmers to both have high-quality planting material for the next cropping season and sell to others (Woldegiorgis et al. 2015, 2017). Most of the farmer groups that started as FFS evolved to become formal seed-producing cooperatives. Overall, the impact on potato production in the targeted communities was positive (Worku 2017).

In Bolivia, the continued evolution and use of FFS beyond potato have been extended to coffee, cocoa, fruit trees, and livestock management, as well as soil management and erosion control and other aspects related to climate change (Cuellar 2014, Helvetas 2014). Since 2007 the PROINPA Foundation has conducted FFS-related training and consultancy services for different public and private organizations, not only for potato management but also for management of crops such as fruit trees, pineapple, banana, wheat, and maize. This training involved several organizations and 175 field workers. A recent assessment indicated that these organizations have continued using FFS (or its principles) for participatory training of farmers; about 7,000 farmers have participated.

According to the 2012 survey in Peru, 95% of interviewed organizations reported FFS implementation. Yet at least 40% indicated that they had adopted the principles of FFS as part of their procedures and formal operational plans, thus providing evidence that the mainstreaming of the FFS methodology at institutional level had occurred in Peru after 2005. Information provided by the survey participants indicated that the FFS approach had adequate flexibility to be adapted to a number of needs, issues, and contexts, including a focus on income generation and market- or finance-oriented activities. As the number of organizations interested in FFS increased, however, there was also need for adequate training of trainers. But this was not always the case, and represented a main limitation to the use of FFS approach where it was considered essential.

CIP provided FFS training to different organizations, as many reported lack of formal training on the method. The analysis indicated that one of the challenges was continuation of an effective training process that guarantees quality facilitation of FFS. To contribute to this process, CIP shared its experience with several institutions (e.g., the National Agrarian University) and has jointly organized several workshops to train teachers and responsible extension service personnel. CIP has also continued to interact with other NGOs such as CESAL in Andahuaylas and FOVIDA in Junín. More recently in Peru, CIP has shared experiences with institutions of the high plateau of Puno, including governmental organizations and NGOs. The outcomes of these initiatives have yet to be assessed.

The approach also improved implementation of other activities that were not necessarily targeted by FFS in the absence of facilitators (Hakiza et al. 2004). For example, by mid-2009 more than 7,000 FFS had been implemented in Uganda, Kenya, and Tanzania; and the CIP-partner experience with FFS-IPM-late blight supported this process. The FFS approach helped to address critical problems in areas such as IPM, land and water management, disease management, the self-sufficiency of refugee communities, and the dissemination of new crop varieties. Yet another area addressed by FFS was the rehabilitation of livelihoods among communities that are resettled in a post-emergency context, a complex situation that required a mix of innovative measures (Okoth et al. 2010).

The limited access to quality training on FFS facilitation became more evident during the mainstreaming phase in which several organizations started to implement the approach. However, some

had no formal experiential training, which likely affected the quality of the FFS implemented.

FFS Gets a Fresh Lease on Life

By 2016 there was a renewed effort to accredit FFS facilitators formally. In Peru, the National System of Evaluation, Accreditation, and Certification of Educational Quality (SINEACE), attached to the Ministry of Education, started a process of certifying experienced professionals as formal evaluators of the FFS method, based on the competency standards developed for that purpose (SINEACE 2016). This approach would allow the performance of the facilitators to be evaluated and simultaneously the methodological quality of the training to be improved. The FFS approach has continued to evolve to the point that, e.g., with a business orientation it is called 'farmer business schools' (CIP 2017). This has grown from crop management to include aspects of business, marketing, savings and credit, climate change, and gender issues. At the same time, FAO is relaunching a global FFS platform, and CIP is designing new FFS-related projects in Malawi and Cameroon. In Uganda, the International Fertilizer Development Center, FAO, and NARO have been using the FFS methodology in interventions for improving agricultural production. These organizations have expanded efforts to strengthen farmer agribusiness capacity through the use of FFS approaches in a project that will run until 2020.

Lessons Learned about FFS Implementation for Late Blight Management

In this section, we present lessons learned for other organizations that may be interested in the FFS approach when dealing with IPM or similar technologies.

Sound Scientific Evidence for the FFS Curricula

CIPs experience with FFS in a number of countries demonstrated that unless sound scientific evidence is behind the content of the FFS sessions, results could be disappointing for participating farmers. Farmers' main interest is in resolving existing problems, as in the case of potato late blight, in which sound evidence supported management options for farmers. But that may not be the case for other topics included in FFS, such as those in Fig. 2 that were not directly related to CIP. This would be even more important for new challenges, such as those related to climate change. Here, new research would be required to feed into the FFS curriculum.

Need to Have Quality Facilitators to Use the Approach Properly

FFS facilitators are an essential element for implementing quality FFS, and learning how to implement the method requires relatively intensive training (in some cases a full cropping season). Not all organizations have the chance to access timely and quality training. At least in the countries included in the study, training sources about the FFS were sufficient during the adaptation and contextualized scaling phase, but became scarcer during the mainstreaming phase. This lack of training opportunities is a major limitation on scaling of the FFS approach.

Resources Needed for Quality FFS Implementation: Staff Time, Logistics, Planning, and Monitoring and Evaluation

Several studies have compared costs and benefits of FFS (Feder et al. 2004, Braun and Duveskog 2008, Waddington and White 2014), and although evidence indicates that the approach pays off in terms of adoption of relatively complex technologies such as IPM, it is perceived as more costly than other extension approaches based on conventional methods or mass communication. The cost per farmer reached is one indicator that several donors and governments consider for making decisions regarding extension methods, which may have limited scaling of the approach. According to our experience, the cost per farmer participating in FFS averaged $50 per farmer participating in FFS, when the cost could be—nearly half that of other more conventional training methods (Ortiz et al. 2011). But this should not be the only factor to consider when making investment decisions. If the problem to be tackled with FFS requires famers' experiential learning, proper training of trainers, logistics, planning, and monitoring and evaluation (such as when dealing with IPM), FFS would be a choice because of higher chances of adoption. If, however, the problems do not require intensive training, alternative and cheaper methods could be considered.

Mobilizing Funding for Scaling FFS

CIPs experience showed that the process of adapting, scaling, and mainstreaming FFS was possible because there was institutional interest and initial investment to innovate with the approach, particularly during the phases of adaptation and contextualized scaling. However, funding limitations for scaling started to be evident during the mainstreaming phase. Evidence of financial challenges for sustainability of FFS has been provided by some studies (Feder et al. 2004, Waddington and White 2014). For the case of Peru, estimates indicate that about 2,030 FFS have been implemented between 1997 and 2012 (assuming 20 participants per FFS, this would result in 40,600 participants). Yet this number represents only about 1.8% of the total number of farmers. And if we consider potato producers, only about 0.5% would have benefited from FFS. In addition, other studies (Tripp et al. 2005) indicate that information and technologies are not easily shared from FFS participants to nonparticipants. Clearly, there is a need for public, NGO, and the private sector to invest and innovate in scaling the approach to reach more farmers with suitable information. This is particularly true when more complex needs are emerging, such as those related to adaptation to climate change, and for which innovative funding mechanisms related to the green economy are starting to be available, particularly to support the adaptation of small-scale family farming to emerging challenges.

Conclusions

Since it was first introduced into Peru and other countries about 20 yr ago, the FFS methodological innovation has proved to be resilient. It has been maintained in one way or another by different organizations to address not only IPM-late blight in potato but also a range of problems in other crops and farming activities. Clearly, an institutional innovation process that emerged from the FFS-IPM-late blight experience occurred in the case of Peru and selected countries, where FFS is still being implemented by different organizations.

This has been an interesting example of methodological research conducted by an international research organization (CIP) and partners, and how the documented experience became an international public good that has been replicated in different ways up to now. There is still a long way to go in order to increase the coverage of FFS or other methods that can make useful information available to farmers. For this to happen, there needs to be better interaction and coordination between the local, regional, and national government institutions with the NGO and private sector interested in this methodology and agriculture development in general (Ortiz et al. 2013).

The initial methodological results of the CIP-CARE experience have been translated into methodological innovations adopted by several organizations involved in R&D in Peru. Two particular challenges related to the scaling-up of this method in Peru are the need for more stable training of trainers and inadequate funding for FFS implementation. And although good experiences of implementing FFS at municipal and regional government levels have been reported, limited documentation and post-intervention assessments have constrained wider efficacy and application of FFS. FFS, however, represents only one methodological option for IPM and other issues. Most likely a combination of methods that take into account specific contexts and issues is needed to reach a larger number of farmers cost-effectively. Finally, despite the FFS approach being a more cost-effective way of promoting learning and innovation for the poor, to date, there is scant evidence to confirm empowerment impacts (Waddington and White 2014).

This article has described a process of methodological innovation, consistent with the arguments of Douthwaite (2002) and Douthwaite et al. (2009), as different actors learn and select improvements, thus highlighting the need to learn from the organizational experience to improve innovations. This is indeed what has happened in the evolution of FFS-IPM-late blight over three phases—from adaptation to contextualized scaling to institutional mainstreaming—in Peru and, likely, elsewhere. Finally, several lessons learned were identified, namely the need to 1) ensure that management options are grounded in scientific evidence, 2) focus on quality during implementation, and 3) seek new funding modalities for scaling FFS.

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