Chapter 2
Participatory Approaches and Plant Diseases in Less Developed Countries

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2.1 Introduction

Globalisation and increasing demand for safe food, for example free from pesticide residues, and sustainable production practices, is increasing the need for farmers across the world to acquire new knowledge continually on crop production practices. Farmers on small holdings, particularly women, in resource-poor countries and communities often do not have ready access to information specific to their requirements for crop management and protection. They generally receive information through informal sources, such as neighbours, family and friends, and the agricultural industries. In many cases, staff from commercial organisations are more regular conveyors of information than the government extension service.

Following reductionist principles, scientific research on pest management tends to focus on single pests in isolated systems, even if done using integrated pest management (IPM) concepts. Old-style extension relies on the over-simplified theory that scientists are those who the sources of new knowledge, that extension workers are those who transfer the knowledge and that farmers are those who adopt/reject new knowledge.

The Green Revolution in Asia in the early 1970s came about when higher yielding cereal cultivars were introduced as a major problem-solving technology. A dramatic success in terms of increased yields resulted in reduced food shortages, but the newer cultivars needed increased inputs such as water, pesticides and fertilisers.

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N.V. Hardwick and M.L. Gullino (eds.), *Knowledge and Technology Transfer for Plant Pathology*, Plant Pathology in the 21st Century 4,
DOI 10.1007/978-1-4020-8934-3_2, © Springer Science+Business Media B.V. 2010

The use of pesticides caused risks to farmers, farm workers as well as consumers and the centralised approach (including state-managed procurement of inputs) became increasingly criticised, leading to a demand for a new paradigm of feeding the world through *sustainable* food production (Schillhorn van Veen 2003).

Nowadays, farmers have to deal with increasingly competitive markets that demand high quality produce at a low price. At the same time more pressing production problems such as decline in soil fertility and water shortages are emerging in many areas of the world. Contributing to the problem, pests (including diseases and weeds) are adapting to break through (low-cost) single technology-style crop protection. Holistic approaches to knowledge generation and dissemination are therefore required.

The agricultural scientific community has an important role and duty to contribute to knowledge transfer and rural development. Stiglitz (2007) states:

> we recognize that knowledge is not only a public good, but a *global* or *international* public good. We have also come to recognize that knowledge is central to successful development. The international community … has a collective responsibility for the creation and dissemination of one global public good – knowledge for development.

Today, extension workers have to collaborate with multiple sectors, each with their personal and institutional histories, norms, values and interests (after Van Mele et al. 2005a).

2.2 Complex Messages

The transfer of pest management technologies is complex, because it needs to contribute to an overall sustainable solution to a crop production problem and fit into a sustainable production system.

There is an ongoing debate about what can actually be classified as ‘sustainable’. Marketing schemes, such as organic certifications, would represent ecologically sound practices, but there is less emphasis on the cultural and/or social equity. In the system of fair trade, those same cultural and social aspects are well managed, but these schemes may pay less attention to the stability of the agro-ecosystem. However, in general there is agreement that the implementation of sustainable agricultural practices should contribute to:

- Economic development
- Food security
- Human development/people empowerment
- Stable environment

… and be characterised as:

- Ecologically sound
- Based on a systems approach (location specific and continuously evolving)
- Economically viable
- Culturally appropriate
- Socially just and equitable

It is evident that single-message transfer style extension will not work for complex subjects such as sustainable agricultural production. One of the recognised shortcomings of traditional, top-down methods of extension, as practiced during the days of the green revolution, has been that blanket recommendations were conveyed without sufficient reference to local conditions (both agro-ecologically and socio-economically), or to local knowledge.

Agricultural knowledge generation and transfer is a complex interaction of various elements (Fig. 2.1)

To achieve what is called 'Putting Knowledge to Work' (Holderness 2003), knowledge established externally through formal science and that derived locally through a community's own experiences are necessary for successful innovation. It is argued that both types of knowledge have value, with scientific knowledge obtained and trusted through scientific process or other external validation, while indigenous knowledge is validated and trusted by the experiences of the community itself.

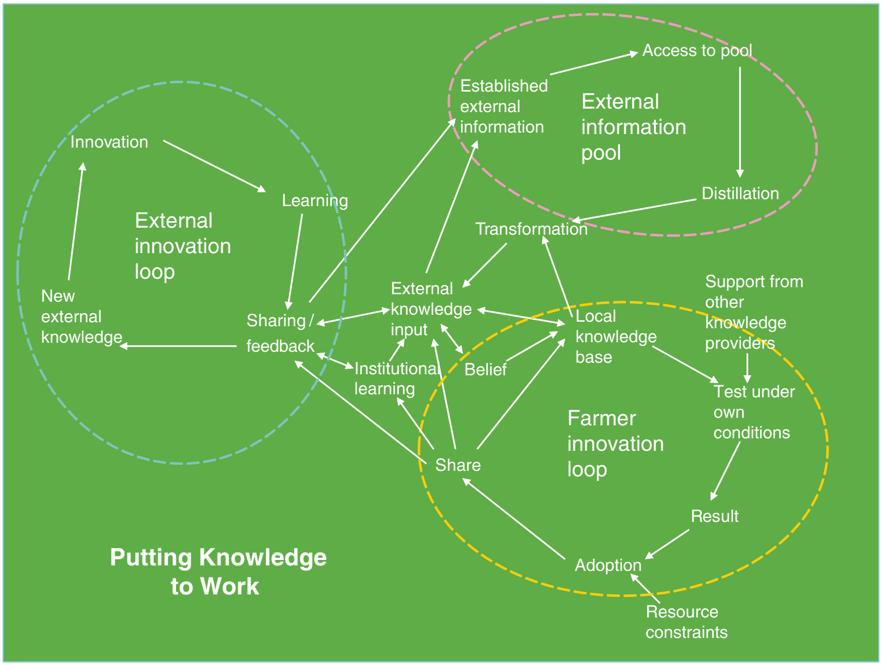

Fig. 2.1 The process of knowledge and information generation and transfer (After Holderness 2003). This diagram pictures three sources of knowledge and information and how these should interlink for appropriate distribution of knowledge. The External innovation loop is generated through off-farm research by specialised scientists in the public and private domain. The External information pool consists of documentation (incl grey material) of research findings and others, generally stored in libraries at institutions and universities. The Farmer innovation loop is generated through on-farm research activities by farmers

2.3 Participatory Approaches

Participatory methods are currently widely used and there is a variety (and confusion) of terms and acronyms to name numerous different applications. The common denominators amongst all are the focus on active participation of the target/end-user groups in discovering new knowledge and the focus on the facilitating role of trainers. Hence, participatory approaches are learner-centred and enhance ownership of findings, thereby improving the understanding of underlying principles of, for example pest management. It is important to distinguish the situations appropriate for participatory training and those where participatory research would be more appropriate (Fig. 2.2)

2.3.1 Participatory Training

Participatory training is applicable when knowledge is available, either at the farmer level (indigenous knowledge) or at the research level. Such knowledge can be offered by training in problem solving through facilitating a discovery learning process by which the problem diagnosis or identification is followed by understanding the biology and/or ecology in the case of crop pests and finally the experimentation with various management options (Box 2.1).

Adopting participatory training means moving away from the traditional teaching terminology. Instead of trainees or students, we refer to participants. Instead of teachers or trainers, we refer to facilitators. Instead of researchers, we refer to resource persons. This reflects the fact that valuable knowledge can also be sourced from within the farming communities. It has been found that farmers take on roles of facilitator as well as resource person. It also means moving away from thinking of extension workers as the only stakeholder disseminating knowledge and of researchers as the only stakeholder inventing new knowledge.

		What Farmers	
		Know	Don't Know
What Scientists	Know	Common Knowledge	Participatory Training
	Don't Know	Indigenous Knowledge	Participatory Research

Fig. 2.2 'Johari window' representing knowledge between scientists and farmers

Box 2.1 Managing bacterial wilt in tomato, Vietnam

Farmers used to recognise wilting tomato plants in their fields, but did not practice roguing as they lacked the understanding that wilting plants in the field become sources of infection for other plants.

The classic exercise of cutting wilting plants at the stem base and inserting a piece of stem in a glass of water to see the bacterial white milky ooze come out was practised with farmers in a field training session.

(continued)

Box 2.1 (continued)

Farmers were excited at the discovery but queried whether this was the disease that was killing their plants. A follow-up experiment was done using two recently potted healthy young plants. The glass with the water and bacterial ooze was emptied on the soil of one potted plant and a glass with clean tap water was emptied on the soil of the other potted plant. The two plants were monitored and after 9 days the results were clearly visible: the infected plant showed the wilt whereas the control plant remained healthy.

This simple exercise opened the minds of the farmers. First and foremost, farmers started to understand the spread of the disease in water as well as the fact that wilted plants were sources of infection. Facilitators steered the discussion so that farmers came to the conclusion by themselves that such wilting plants should be removed from the field as soon as symptoms became apparent.

The *training process* is the methodology used in knowledge transfer, based on adult learning principles:

- Adults are voluntary learners
- Adults are motivated to learn only when the subject is of interest to them
- Adults exchange good experiences
- Adults learn best when actively involved and discover by themselves
- Adults need a real-world approach

There are social dimensions to group versus individual training. The impact of the farmer-field school process is specifically high in cultures where farmers like to work together. In other situations, farmer exchange visits or other forms of group meetings appear to have more appeal, depending on costs.

The *training content* is the actual message that needs transferring. In the ‘spray dye’ exercise (Box 2.2) the message is that one can save on pesticide use while increasing efficacy with adaptations to the spraying equipment.

It is our experience that participatory training leads to a high level of enthusiasm with participants and the desire to learn more. It is also our experience that one-off training does not necessarily build sufficient confidence for farmers to continue with the discovery learning process beyond the training programme. Following up with related activities is more likely to encourage continued innovation and help farmers see new opportunities for change (Box 2.3).

The follow-up can range from establishing a network of trained farmers, organising regular meetings to stimulate continued information exchange. Marketing activities, literacy classes and beekeeping are all examples of further activities seen in the field. One particularly interesting development is where farmers start doing research in their own fields on unresolved problems. Facilitators and resource persons should continue to be key here in supporting the process of selecting comparable treatments as well as the process of trial design, trial monitoring and trial evaluation.

Box 2.2 Rational pesticide use in a perennial crop

In Cameroon, smallholder cocoa farmers regularly apply fungicides to control cocoa black pod, caused by *Phytophthora*. When farmers use pesticides in cocoa, the tendency is to spray until run-off, which is inefficient and ineffective. In addition, because of the tropical conditions, they don't use protective clothing to avoid contamination with the spray and poisoning.

(continued)

Box 2.2 (continued)

A spray dye exercise was done: farmers were wrapped in white paper (tissue paper or flipcharts) and their sprayers (preferably of a variety of type and age) filled with water coloured with red food dye. Some farmers were asked to spray by their usual method and some were asked to spot apply only as if they were spraying to control pod rot. After 10 min, all farmers who had used the sprayers were gathered together and the contamination by the red dye on their white outfits were studied and discussed.

Old sprayers generally leaked and the red dye on the sprayers' hands was apparent when they adjusted their nozzles while spraying. In addition, they also measured the amount of 'pesticide' that had been used over the 10 min exercise. Farmers then realised that they were at risk when using old and leaking knapsack sprayers. They also discovered that they could save on costly pesticides through targeted applications and by using well-maintained spray equipment.

Box 2.3 Cotton grading in Zimbabwe

Organic cotton farmers in Zimbabwe had participated in farmer field schools in order to learn about non-chemical pest control and the need to grade their harvest before transporting it to market. The farmers were only convinced of the need to grade the cotton once they had visited the local cotton gin (industry to separate cotton from its seeds) and spoken to the manager (Page 2000).

2.3.2 *Participatory Research*

Participatory research is applicable in areas where there are no known solutions for farmers' problems or when scientific recommendations conflict with traditional practises. Many definitions are available, but generally farmers set the agenda, evaluate and develop technologies under their own conditions with assistance from facilitators and resource persons.

The process in participatory research doesn't differ much from participatory training. However, the outcome is uncertain and farmers need to be leading and/or play a more proactive role in the field activities. Particularly important in participatory research is the trial design, choice of parameters to observe as well as the evaluation. It is suggested therefore that these activities become joint activities between resource persons and farmers. Resource persons need to provide support to make sure that, for example a proper control is included as one of the treatments (even scientists sometimes forget to do so!) and that the trial design allows for proper analysis on completion.

Careful consideration should be given to the number and kind of parameters that are chosen. Farmers may wish to observe only those parameters that they have learnt to observe before, for example those they were trained to monitor during a farmer-field school, such as number of infected plants. Resource persons on the other hand may wish to observe many more and different parameters such as infection severity. A compromise should be reached, with practical and 'hands-on' observations that are likely to answer the farmers' research question at the end of the trial.

The observations should be done by farmers, but resource persons will want to assist with the analysis. A good compromise is for the resource persons to analyse the data using appropriate statistics and then repeating the exercise with farmers following a simplified statistics method. Subsequently, farmers need to be asked whether they agree with the outcome and why they think the outcome is as such. This will lead to a good debate and to further understanding of the problem as well as potential ideas for follow-up research, by farmers, resource persons or both (Boxes 2.4 and 2.5).

Box 2.4 Discovering about vegetable nematode management in Ghana

Vegetable production in Ghana is suffering from root-knot nematodes in many areas. Discussions with farmers and extension workers showed that local knowledge included the use of chicken manure to reduce root-knot nematode problems.

To verify this and clarify that properly matured compost is free from plant-parasitic nematodes, a field study was done with treatments of organic (chicken) manure and inorganic fertilisers compared to planting in compost and in soil without fertiliser (control). Trainees monitored tomato growth and

(continued)

Box 2.4 (continued)

production and found that the treatments with inorganic fertilisers and the control didn't grow well and hardly produced. The treatment with chicken manure produced well, as did the treatment where tomato seedlings were planted in compost.

The real discovery came, however after the end of the season, when the plants were uprooted and trainees saw the difference in the root systems between the different treatments. They discovered that where tomato roots grew in compost, they were healthy, thus giving the plants a good start. They also found that in the chicken manure treated plot the roots were infected but not as badly as in the inorganic fertilised or control plot.

This discovery led to a change in thinking about soils and crop nutrition in relation to crop health.

Box 2.5 Integrating old and new ideas to manage frosty pod rot on cocoa in Central America

In Costa Rica, cocoa growers loose 80% of their cocoa pods to frosty pod rot (caused by *Moniliophthora roreri*). Traditionally, the disease is managed by phytosanitation, that is the regular removal of infected pods. Researchers have repeatedly recommended increasing the phytosanitation frequency from monthly to weekly intervals. However, this recommendation contradicted the growers' intuition, who did not see this labour investment as being economically viable.

Box 2.5 (continued)

In a participatory evaluation of cultural and biological control in organic smallholdings, weekly and fortnightly phytosanitation and seven biological treatments, using a range of *Clonostachys* and *Trichoderma* species, were tested. Weekly phytosanitation reduced frosty pod rot significantly, probably via a reduction in sporulation of the fungal pathogen. Both regimes increased yields but only weekly phytosanitation augmented the percentage of healthy pods. Four of the biological treatments (including combinations of the biocontrol species) reduced moniliasis, with yield improvements of up to 50%.

Farmers opted to combine cultural and biological control for best results. Even then, weekly phytosanitation proved necessary, that is biocontrol provided no single solution. But with effective biocontrol, pod sporulation is inhibited and the phytosanitary operation itself becomes gradually less labour-intensive. Farmers needed to experience this for themselves in their own crops, in order to counter their instinct.

The experiential learning circle of Kolb (1984) is relevant here, which should lead to continuous problem-solving, in which (1) immediate or concrete experiences provide a basis for (2) observations and reflections. These 'observations and reflections' are assimilated and distilled into (3) abstract concepts producing new implications for action that are (4) actively tested in turn, creating new experiences (Fig. 2.3).

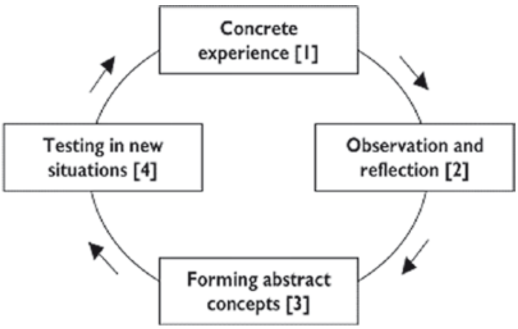

Fig. 2.3 The experimental learning circle (Kolb 1984)

2.4 Regarding Impact

Impact assessment can also be a participatory exercise with farmers and scientists. In order to help this process, farmers should be encouraged to keep their own records. Key indicators of success can initially be selected by farmers during group discussions and facilitators should then prepare short (1–2 page) forms that can be filled in using numbers and a few simple words. Scientists may prepare outlines. However, farmers and facilitators need to 'translate' these into their own forms. Completed forms can be photocopied so that both farmers and researchers can use the data to monitor progress and assess impact. In addition to this, the recording of planting and harvesting dates, pest out-breaks, input, transport and marketing costs, will enable farmers to calculate whether or not they are profiting from their chosen input strategy. Once farmers realise the value of record-keeping they will be eager to continue the process in their own exercise books.

FPR has been criticised for its limited scale of coverage (Farrington 1998). This is because participatory processes work well on pilot scales but time and again human and financial resources prove to be too limited for scaling-up. Conroy and Sutherland (2004) suggest using the 'recommendation domain' which defines the target population as a tool for developing a strategy for scaling-up the benefits from farmer-participatory activities. The size of the recommendation domain will depend on the following:

1. How widespread is the production constraint or opportunity.
2. The number of households involved in producing the relevant commodity or with a similar problem.
3. The resources (land, labour and money) available to the household producing the commodity.
4. The likely availability of the inputs needed.

Project reports, survey and census data can provide most of the information needed to determine the number of households to include in the domain.

Searching for cost-effective methods to ensure impact beyond pilot sites have led to some good examples of innovative approaches to disseminating successful results of participatory training/research. These include using farmer networks, excursions, documentation such as fact-sheets and manuals, and use of media, such as video (Box 2.6) and newspapers (Box 2.7).

Box 2.6 Participatory video

Through participatory research with scientists, women farmers in Bangladesh developed new rice seed management methods that gave consistent yield increases for minimal cost. They then shared their knowledge through participatory video production, using local languages and practical illustrations directly relevant to other women. These methods enabled messages to quickly reach thousands of women (Van Mele et al. 2005b). The programme was awarded an International Visual Communications Award for its innovative approach.

Impact assessment amongst 115 women who had watched the video twice or more at village venues revealed that these women had been able to implement the new methods and thus gained an average increase of 20 additional food secure days at no extra cost (Page et al. 2008).

Box 2.6 (continued)

Currently six videos on rice seed and rice post-harvest management, have already reached over 500,000 farmers in four Asian and 10 African countries, and to over 40 million people via television in Bangladesh and The Gambia (Van Mele P, personal communication, Africa Rice Center).

Box 2.7 Cocoa farmers' newspaper in Ghana

The Ghanaian Cocoa Farmers Newspaper was developed to transfer knowledge to smallholder cocoa farmers all over Ghana, informing them about good agricultural practice in cocoa. For this bi-annual newspaper, articles are produced and edited in close collaboration with the Cocoa Research Institute Ghana, illustrated by an artist and printed by the Daily Graphic in Accra. The first edition came out in 2006, with 70,000 tabloid copies distributed through licensed cocoa buying companies who had agreed to assist with distribution to the farmers. Initial surveys have taken place to assess the impact and relevance to farmers and regular publication of such a newspaper is expected to be an effective communication tool, contributing to rural development and the future of Ghana's cocoa industry (Keith A Holmes, personal communication, CABI).

Notwithstanding these successful larger scale examples, more attention is still needed for documentation of processes and cost-benefit analysis as well as impact assessment. Lack of such impact studies and documentation is probably due to the limitation in funding sources, both in terms of time (project duration not sufficient to assess post-project impact) and scale (cost of measuring impact on knowledge dissemination to tens of thousands of farmers and more).

2.5 Discussion

The latest development paradigm places emphasis on local knowledge for development. It gives priority to partnerships and emphasises participation, not just by government agencies, but also by non-governmental organisations, and other parts of civil society, as the best way to achieve sustainable development. Adopting participatory design approaches means defying prescriptive methods and techniques, which makes successful implementation a complex challenge (Scarf and Hutchinson 2003). Due to the complexity of community dynamics as a human process there are no blueprints, nor ready made recipes of participatory processes that can be applied to promote participatory development (Botes and van Rensburg 2000).

Duraiappah et al. (2005) argue that:

> there is no doubt that the introduction of participatory approaches to development over the past three decades has effectively demonstrated the capacity of men and women from poor communities to participate actively in research, project design and policy analysis.… As in all research processes, the potential for researcher bias exists. Due to the power imbalances inherent in participatory development, and the often sensitive and critical nature of the issues being addressed through participatory research, care and attention must be taken to ensure that these processes provide benefits and enhance the capabilities and freedoms of the poor.

As advised by Bentley and Baker (2002), if the participatory approach is to become part of mainstream research, then it should be taught in universities and also in agricultural colleges.

Looking at improving extension, the Neuchatel Group (2006) argues for:

- Services to be driven by user demand
- Service providers to be accountable to the users
- Users to have a free choice of service providers

They conclude that preconditions for success are enabling policies and public sector commitment to the transition but also that the public sector must stop the free supply of extension services that can be delivered through the private sector (Neuchatel Group 2006).

These considerations are not confined to the developing world. A recent study in Europe concluded that sustainable rural development could be improved by paying more attention to the interaction between different types of knowledge, such as local, scientific and political (Bruckmeier and Tovey 2008). Their study shows four main ways of managing different types of knowledge in rural development in Europe:

- Resource renewal, for example, sustainable forest management, which uses scientific knowledge as a guide.
- Quality of life, for example, improving access to utilities, welfare, or aesthetics, which uses managerial or political knowledge (such as from planners).
- Improving local sustainable livelihoods, where local knowledge is used.
- Participatory resource management, whereby all stakeholders with an interest in the resource participate and no single form of knowledge dominates.

We conclude, therefore, that science has played and should play an important role in sustainable rural development and that this should continue using selected scientific knowledge in participatory processes. Key stakeholders in the knowledge transfer system need to change roles and attitudes and this includes both the public and private sector. This requires institutional change, which is being piloted across the world and described in some of the project examples that are highlighted in this chapter.

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http://www.springer.com/978-1-4020-8933-6

Knowledge and Technology Transfer for Plant Pathology
Hardwick, N.; Gullino, M.L. (Eds.)
2010, XI, 123 p., Hardcover
ISBN: 978-1-4020-8933-6