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92a. LINKAGES BETWEEN FARMER-ORIENTED AND FORMAL RESEARCH AND DEVELOPMENT APPROACHES

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92b. WHEN IS QUANTITATIVE DATA COLLECTION APPROPRIATE IN FARMER PARTICIPATORY RESEARCH AND DEVELOPMENT? WHO SHOULD ANALYSE THE DATA AND HOW?

Sian Floyd

92c. THE APPROPRIATE USE OF QUALITATIVE INFORMATION IN PARTICIPATORY RESEARCH AND DEVELOPMENT. WHAT ARE THE ISSUES FOR FARMERS AND RESEARCHERS?

Barry Pound

Abstract

These three papers deal with some of the methodological questions facing practitioners involved in farmer participatory research and development.

The first paper (92a) outlines the different expectations that those involved—researchers, farmers, donors and NGOs—have from the research process. Using practical field examples, it highlights projects that have successfully combined farmer-led and more formal research approaches. It analyses the factors influencing choices over methodology and approach, focusing on the need to find a means of experimentation that all major stakeholders can subscribe to. It emphasises how stakeholder relationships are mediated by various influences including organisational cultures, values, disciplinary perspectives and personal relationships. A successful outcome will often involve a compromise to satisfy the ideas and interests of all those involved in the research process.

The next two papers focus on data collection in farmer participatory research, specifically on the choice between quantitative and qualitative research methods. Paper 92b emphasises the importance of understanding the relationship between research objectives and the types of trials that will ensure these objectives are met. It outlines the advantages of well-planned and appropriate quantitative data collection, stressing that great efforts have often been expended on obtaining data that are not needed. The paper also emphasises the usefulness of statistical analysis and modelling in understanding variations in outcomes.

Paper 92c analyses the role of qualitative methods and their articulation with quantitative methods. It emphasises how the collection, interpretation and utilisation of information can be a powerful tool for strengthening the involvement and confidence of those involved in the research process. It outlines the complimentarity of qualitative and quantitative methods, particularly in complex natural resource management situations where a mixture of stakeholders, disciplines and often conflicting agendas are involved.

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CONTENTS

Page

Abstract i

Acknowledgement i

Acronyms iv

92a. Linkages between farmer-oriented and formal research and development approaches — Alistair Sutherland

1 A CONCEPTUAL FRAMEWORK FOR LINKAGES 1

2 FARMER PARTICIPATORY RESEARCH 1

3 POTENTIAL DIFFICULTIES IN LINKING FARMERS' AND FORMAL RESEARCH PARADIGMS 1

Different knowledge systems
Knowledge systems that interface?
Respectful 'collegiate' dialogue

4 LINKING FARMER-LED AND FORMAL RESEARCH APPROACHES 2

Dryland Applied Research and Extension Project
Perennial crops in Zanzibar
Conservation tillage in Zimbabwe

5 FARMER-LED AND FORMAL RESEARCH APPROACHES—KEY QUESTIONS 4

Why not scrap form experimental methods when doing location specific work?
Which research methods yield more 'generic' technical results?
How important is geographical mandate?
What is the underlying rationale for the research?

6 HOW IMPORTANT ARE ORGANISATIONAL CULTURE AND INDIVIDUALS' BACKGROUNDS? 5

Organisational influences
Values
Disciplinary influences

7 WHAT KIND OF LINKAGES CAN BE MADE? 6

Mutual operational understanding
Personal relationships
Interdependence of organisations
Can everyone be satisfied?

8 CONCLUSION 6

REFERENCES 7

Boxes

Box 1 DAREP: Rainwater harvesting for field crops 2
Box 2 DAREP: Intervention in animal health 3
Box 3 DAREP: Soil fertility in dryland Kenya 3
Box 4 World Neighbours in Bolivia 4

92b. When is quantitative data collection appropriate in farmer participatory research and development? Who should analyse the data and how? — Sian Floyd

1 INTRODUCTION 9

What is meant by 'participatory'?

2 STUDY OBJECTIVES—A SUGGESTED DIVISION INTO THREE MAIN GROUPS 9

3 WHAT IS QUANTITATIVE DATA? 10

4 WHEN SHOULD QUANTITATIVE DATA BE COLLECTED IN FPR/FPD? 10

5 STATISTICAL ANALYSIS OF QUANTITATIVE DATA 11

6 WHAT QUANTITATIVE DATA SHOULD BE COLLECTED? 11
Detailed biological assessments
Objective assessment of outcome
Frequency of assessment of outcome data
Quantitative farmer assessment
Socio-economic data
Baseline data

7 TYPES OF QUANTITATIVE DATA FOR PARTICULAR OBJECTIVES/ TRIAL TYPES 13
Type 1 trials
Type 2 trials
Type 3 trials

8 TWO GENERAL ISSUES WHICH AFFECT THE USEFULNESS OF DATA 14
Conflicting objectives
Sample size, time and resources

9 WHO SHOULD ANALYSE THE DATA AND HOW? 14

10 CONCLUSION 14

REFERENCES 14

Boxes and tables

Box 1 The value of quantitative data 11
Box 2 The value of quantitative monitoring data 13
Box 3 Sustainable agriculture in the forest margins 13

Table 1 Research objectives and trial types 10

92c. The appropriate use of qualitative information in participatory research and development. What are the issues for farmers and researchers? — Barry Pound

1 INTRODUCTION 16

2 WHAT IS MEANT BY QUALITATIVE INFORMATION? 16

3 WHAT DOES QUALITATIVE INFORMATION HAVE TO OFFER? 16
Sharing knowledge
Understanding complex natural resource management issues

4 CHALLENGES INVOLVED IN DEVELOPING AND USING QUALITATIVE METHODS 17
Ensuring inclusivity in the collection and interpretation of information
Documenting the successes and problems encountered in the use of qualitative methods by researchers and farmers
Identifying how different qualitative methods complement one another and how qualitative and quantitative methods and information can be used together
What implications does the increased use of qualitative methods in FPR/PTD have for formal institutions?

5 CONCLUSION 19

REFERENCES 19

Acronyms

CIAL	Comité de Investigación Agricola Local
DAREP	Dryland Applied Research and Extension Project
FPD	farmer participatory development
FPR	farmer participatory research
NARS	National Agricultural Research Systems
NRM	natural resources management
PRA	participatory rural appraisal
PTD	participatory technology development

92a. LINKAGES BETWEEN FARMER-ORIENTED AND FORMAL RESEARCH AND DEVELOPMENT APPROACHES

Alistair Sutherland

1 A CONCEPTUAL FRAMEWORK FOR LINKAGES

The typology of farmer participation developed by Biggs (1989) has become the accepted dogma for recent discussions about farmer participatory research (FPR). Biggs identifies four modes of participation through which farmers and researchers (i.e. paid professional scientists) are linked. In the first mode, contractual, the researcher is all-powerful and the linkage is mainly based on an exchange of immediate 'material' benefits: the farmer gets inputs and produce while the researcher gets data. In the contract mode, there is minimal emphasis on linking the two parties through knowledge exchange and joint planning. The consultative mode keeps most of the key decisions with the researcher, but puts additional emphasis on farmer consultation in problem identification and priority setting. The collaborative mode puts the researcher and farmer on a more equal footing, emphasising linkage through an exchange of knowledge and a sharing of decision- making during experimental design, implementation and evaluation. The collegiate mode places the farmer in the position of greatest power, with the researcher responding to farmer requests (it is assumed that farmers have influence on research budgets and ability to 'buy-in' support).

In reality, most donor funded farmer-oriented natural resource research projects operate on the interface between the consultative and collaborative modes. Operating in this way can create tensions, particularly for the researchers involved, who are often caught in between conflicting sets of expectations. The research community expects 'good science' and validation of existing knowledge. There are expectations (at least in some quarters of the research community such as variety release committees) that research results will be 'generalisable' for particular environmental zones. Farmers expect new and useful knowledge, attention from prestigious outsiders and material benefits. A third set of expectations may come from extension workers, agricultural credit agencies, agribusiness and local NGOs who are looking for 'new messages, packages or products' to take to their client group. Finally, donors often expect new 'sexy' sounding outputs to support their corporate image of being at the cutting edge of development approaches that address core issues (e.g. sustainability, livelihoods, gender and poverty), or 'evidence of impact' to justify further expenditure on research. This array of expectations influences what researchers do and how they present and write up their results.

2 FARMER PARTICIPATORY RESEARCH

The term farmer participatory research has been used to describe the efforts of various projects and individuals to more fully involve farmers in the agricultural research process. Perhaps one of the most useful definitions comes from Okali *et al*, "in principle, FPR aims to operate at the interface between knowledge systems: it can be described as a people-centred process of purposeful and creative interplay between local individuals and communities on the one hand, with formal agricultural and research knowledge on the other—the collegiate interface" (1994: 15-16). This definition relies on several assumptions regarding effective linkages and communication between researchers and farmers. The first is that there are different knowledge systems relating to agriculture—farmers' (local) knowledge on the one hand and formal research (generic) knowledge on the other. Secondly, that it is possible to interface these knowledge systems (through 'creative interplay') involving dialogue between different groups (local farmers and researchers). Finally, this dialogue will be respectful and serve to draw the two parties together in partnership ('collegiate interface'). While most of these assumptions may hold in optimal situations, projects often face difficulties in linking ideas and actors in order to exemplify good practice.

3 POTENTIAL DIFFICULTIES IN LINKING FARMERS' AND FORMAL RESEARCH PARADIGMS

Each of these assumptions has been either questioned or qualified by both academics and practitioners.

Different knowledge systems

Academics have debated the differences between researchers' and farmers' knowledge systems. One position is that these systems are qualitatively different and therefore not strictly comparable (Richards, 1979). Farmers' knowledge is often not verbally or numerically codified and is often inseparable from performance, while being affected by geography, culture and society. Researchers' knowledge is seen as more generic. In formal science, great efforts are made to systematically codify knowledge, quantify it and apply quality control (Farrington and Martin, 1988). Scoones and Thompson argue that these two types of knowledge should not be seen as 'systems' at all—at least not as 'hard' systems—but that 'productive engagement' (of farmers by researchers) should be pursued with the aim of 'exploring common ground and the opportunity for creative exchanges that it offers' (1994: 30). A more recent position in this debate is that farmers approach research in a similar way to researchers and, by inference have similar ways of looking at experimentation (Sumberg and Okali, 1997). While knowledge systems may differ, most on-farm practitioners would agree that researchers and farmers need to try and learn from each other. But can they, and how?

Knowledge systems that interface?

On-farm research practitioners have found that an effective interface between local farmers and researchers—particularly with regard to experimentation—is not easy to achieve (Sutherland *et al*, 1998). While the 'participatory rural appraisal revolution' may have been important in providing professional researchers with a more sympathetic understanding of farmers' perspectives, many challenges remain. Cultural barriers and differences relating to language, including different mother tongues and different scientific concepts, are still apparent. Differences between the main actors including social status (occupation, gender and wealth), perspectives, interests and expectations all tend to negatively affect the interface and strongly influence the way that knowledge is generated and shared.

Formal research, through the transfer of technology paradigm, presumes that the best technology for a particular commodity or factor should be identified, multiplied and disseminated through agribusiness and/or national extension services as either products and/or printed information packages. Farmer-led research often seeks to identify a range of useful technology options to be shared with other interested farmers, who may continue to experiment and share new knowledge informally through conversation and practise. At least at the level of rhetoric, it is all about providing farmers with choices and options, and empowering them to access these.

Respectful 'collegiate' dialogue

In most projects, differences in knowledge, interest, status and power hinder the development of a truly 'collaborative' or equal relationship, not to mention a collegiate one. Effort is required on both sides to establish common ground, minimise differences and develop methods for balanced and respectful dialogue. Practitioners have found that this is not something one starts with, but rather aims for during the life of a project. In this process, if linkages with farmers are to be sustained and improved, a bargaining process and trading of interests takes place. If dialogue is honest and respectful (rather than respectfully deceptive and polite which it often is), farmers may have the courage to say things like: 'you have been wasting our time', 'haven't you got anything new to show us', 'can't you just give us the inputs we need' or 'why do I need a control plot, why don't you do it this way?' As researchers become busier and the novelty of fieldwork wears thin, dialogue is often delegated to supporting field staff. These staff have been subject to top-down communication styles, which they often replicate in the field. For most developing country National Agricultural Research Systems (NARS), a sustainable institutional framework for a truly collegiate, or even collaborative research mode for resource poor farmers remains distant. However, cultivating an environment for respectful dialogue between researchers and farmers is still a worthy aim.

4 LINKING FARMER-LED AND FORMAL RESEARCH APPROACHES

A large number of projects, both in the public and NGO sectors, have combined farmer-led and more formal research approaches within a project framework based on consultative or collaborative modes of research. (e.g. van Veldhuizen *et al*, 1997; Sutherland *et al*, 1997). The examples below cover different aspects of natural resource management and a range of approaches of implementing research with farmers.

Box 1 DAREP: Rainwater harvesting for field crops

Water management trials had been conducted by previous projects in sites representing a range of soil types under controlled experimental conditions over six seasons from 1990 to 1993. Local farmers had seen the trials, discussed them with researchers and been invited to try the technologies as part of an on-farm research trial programme. After more than three years of exposure, there was no significant uptake by farmers of any of the technologies. The lack of farmer uptake was not because farmers did not perceive soil moisture to be a problem, but because of the way solutions were presented to them.

In 1993, participatory diagnosis confirmed that water availability during the growing season was perceived as an important crop production constraint. In late 1993, farmer research groups were formed in two localities and began to explore ways of addressing this constraint. The groups rejected the technologies which had been used in the above experiments. The researchers used diagrams and photographs to present different options for in-situ rainwater harvesting. The majority of farmers were not sufficiently convinced by any of these techniques.

During 1994, the researcher came to hear about another project some 350 km away which had introduced a range of water-harvesting methods with good results. She arranged a study tour for some of the research group farmers. Farmers were enthusiastic about what they saw and made a request to a member from the other project to come and teach them about water-harvesting. He came and helped the groups to lay out a number of different structures on their individual farms. The group monitored the performance of the structures over several seasons, making modifications to them as they felt necessary. There were regular meetings between farmers, the researcher and collaborating extension staff, to discuss the performance of the various structures. On most farms there was a control area for comparisons with normal farmer practice, and yield data was collected. After a season, the performance of the structures was reviewed and with encouragement from a workshop of senior researchers, the more promising ones were included in a replicated on-station experiment.

After four seasons, in early 1996, the farmer research groups were ready to make their recommendations about the usefulness of the various structures, including suitability for different soil types, topography and tillage systems. A workshop was held in June 1996 to review and share the research results. Research and extension staff from various institutions in Kenya reviewed the formal research results and visited the farmers to see the structures in operation. As a result, the professionals recommended that all of the techniques being tested should be documented in leaflets and used in the national extension system's soil and water conservation programme.

Source: Mellis, 1996.

Dryland Applied Research and Extension Project

The aim of the Dryland Applied Research and Extension Project (DAREP) was to develop sustainable agricultural technologies for dryland areas of Kenya, using participatory research methodologies within a farming systems research framework. DAREP covered approximately 70,000 smallholder farming families, living in semi-arid areas of three districts east of Mount Kenya, through a decentralised infrastructure of ten local research and demonstration sites. Activities were implemented through an interdisciplinary team comprised of an agronomist, a livestock specialist, an agro-forester, an agricultural engineer, an agricultural economist, a social anthropologist and most recently an entomologist. The project area is remote, with poor infrastructure and a limited agricultural extension service capacity. Due to population pressure, there is increasing pressure on arable land. Grazing land is being encroached for cultivation, and shifting cultivation systems are rapidly giving way to semi-permanent cultivation. As livestock becomes less important, farmers are paying more attention to seasonal rainfed crops and to tree planting where conditions allow.

Box 2 DAREP: Intervention in animal health

Constraints to livestock production, identified and prioritised by farmers in 1993 and 1994, put animal health as a priority. Researchers selected goats as the primary target, because ownership of goats was more widespread than for cattle. An area of intervention that looked promising was mange (*Sarcoptes* and *Psoroptes spp.*). This wasting skin disease was particularly feared as, once it got into the herd, it usually wiped out most of the animals. Most farmers found commercial solutions, including dipping, too expensive in the newly liberalised economy. In 1994, focus group discussions and visits to local herbalists came up with a list of over eight local concoctions which farmers were using. After further discussions with farmers, the list was narrowed to four promising treatments, to be compared with two recommended commercial medicines. A mange control trial was conducted over one year on herds of animals belonging to local farmers which became infected between April 1995 and May 1996.

To maintain experimental standards, the local concoctions were supplied and prepared under the researchers' supervision. Data collected included body condition, weight change, farmers' opinions and photographs before and after the treatment. As soon as one farmer found the local concoctions effective, word spread quickly to neighbours, who requested inclusion in the experiment. In this way it was possible to cover enough farmers to allow statistical analysis. However, visual results were so impressive and farmers so enthusiastic, that it was not necessary to wait for statistical analysis before disseminating the technology. In July 1995, a mange outbreak occurred in a locality some 100km away. The researcher organised a farmers' tour, where farmers with infected animals visited the experimenting farmers who showed them how to use the local concoctions. While farmers did not require statistical data to be convinced about the value of the local concoctions, the researcher was able to use this data to interest his colleagues in research and extension within Kenya and neighbouring countries.

Source: Kang'ara *et al*, 1997.

Within the project there is no set formula for experimental research. Boxes one, two and three outline examples of DAREPs experience with linking farmer-led and formal research approaches.

Box 3 DAREP: Soil fertility in dryland Kenya

Soil fertility, as an area of research, proved more challenging than other technical areas in terms of farmer-led experimentation and farmer-researcher dialogue. One reason was farmer perceptions: while farmers in all seven locations covered by diagnostic surveys acknowledged that soil fertility did decline after continuous cultivation, only in one location-with lighter soils-did farmers report that soil fertility was significantly limiting to crop production. During the diagnostic participatory rural appraisal (PRA) exercises, soil samples were taken from farmers' fields, one from an area of poor soil and another from an area of good soil. Analysis of results showed a high correlation between farmers' and researchers' evaluation of soil quality. However, this exercise did not point to an obvious line of applied or adaptive research.

Controlled experimentation on manure application rates, conducted from 1989 to 1993, clearly illustrated the benefits of manure application in most soil types for a range of drought tolerant crops. However, only a few farmers requested on-farm manure trials. Efforts to monitor these on-farm trials met with limited success and after a couple of seasons they were abandoned. Meanwhile, basic experimentation with soil organic matter, including a study of the residual effects of manure proceeded on-station. Farmers visited these controlled experiments but there was no obvious or measurable uptake of ideas comparable to the uptake of new crops and varieties also displayed at the research sites.

In early 1995, a formal research planning workshop was held to discuss soil fertility, but it failed to identify clear lines of adaptive research. Researchers felt that more basic research was needed to enable a better understanding of soil fertility dynamics in semi-arid areas. A member of the team implemented academic research on the interaction between nitrogen and phosphorous under farmers' conditions. This involved the establishment of controlled experimental sites in farmers' fields, a formal survey of farmers' organic matter management practices and informal discussions with farmers. The controlled experiments yielded good data. Impressed by the results of inorganic fertiliser use in the controlled experiment, some collaborating farmers (from the area with sandy soils) began their own experiments.

Meanwhile, other farmer-oriented and farmer-led activities were taking place. Some of the farmers from the water harvesting research group with access to manure started to combine manure application with water harvesting structures. This generally produced good results, particularly for maize, which had not been included in the on-station experiments; new on-station experiments comparing alternative water-harvesting structures were then planted with maize. A further development came when new varieties were tested in on-station observation plots under different fertility levels. For example, four new maize varieties were compared in an on-station observation that combined water harvesting with manure application. About 40 pearl millet and sorghum varieties were also screened, under high and low fertility levels using a combination of inorganic fertiliser and residual manure to provide a high fertility environment. Farmers came to the station at key times during the growing season to evaluate the performance of these new varieties under different fertility conditions. Statistical data was not collected due to the small plot size and lack of replication. In parallel to the research programme, a popular new pearl millet variety chosen by farmers was tested on-farm under high and low fertility conditions. This trial did not use manure or inorganic fertiliser to alter the growing environment, but farmers' own classification of parts of their fields as more and less fertile. In this trial, farmers chose whether or not to plant a control using a local variety, and more than half of them did.

Source: Irungu *et al*,1997a, 1997b; Sutherland *et al*, 1997.

Perennial crops in Zanzibar

Perennial crops present different types of research challenges and require different approaches to combining traditional experimental methods with farmer-led experimentation. Research is often long-term and expensive, while research projects are typically funded on a short-term basis. Faced with the impossibility of doing long-term trials on trees, the Zanzibar Cash Crop Farming Systems Project tried to harness farmers' knowledge to simulate experimental conditions (de Villiers, 1996). Local expert farmers used matrix ranking to simulate the results of a trial plot. The results of several matrix-ranking exercises were then analysed in much the same way as a field trial. This exercise allowed researchers to reach a conclusion about a particular technology before recommending it. The same project also established a network of farmers with an interest in agro-forestry issues, which served as means of exchanging ideas and knowledge about trees.

Conservation tillage in Zimbabwe

Hagmann *et al*, (1997) describe how researchers invited farmers to view and discuss conservation tillage technologies on display at the research station. Farmers promised to test the technologies on-farm, using standard on-farm trial designs. The dialogue which developed however was not an open one, with farmers always wanting to please. Only after training of both field staff and farmers (the latter through a process of 'training for transformation'—concientisation through participatory education to build farmers' confidence) was a point reached were honest dialogue with researchers was achieved and real progress made. Farmers were taught the differences between demonstrations and trials, how to manage a control plot for purposes of comparison and how to collect data. Researchers also monitored farmer-managed experiments, and data which could satisfy 'scientific standards' was collected. The research station became an 'options think-tank', which could be visited by interested farmer groups. Blending farmers' judgement with researchers' analysis enabled the classification of technologies as either 'on the market', 'promotable' or 'under testing'.

While the approach placed value on the collection of quantifiable on-farm data and the use of a research station for more controlled experimentation, the main direction taken was to disseminate the approach, rather than the technologies *per se*. This conclusion does raise questions over what the data was collected for: did it help in convincing key stakeholders in the value of farmer-led approaches, or was it an expensive show-piece appendage to the process?

Box 4 World Neighbours in Bolivia

After years of encouraging and empowering farmers to conduct simple experiments and demonstrations on a mass scale, World Neighbours decided to invest resources in training farmers to conduct more complex experiments using formal methods. Why was this done? The use of more formal research methods by farmers not only attracted more interest from government researchers in what had been a neglected area, but also made farmers feel better about themselves. In a culture where rural people are made to feel inferior to their urban and more educated counterparts, the widespread training in formal experimental methods was linked to a drive for literacy. More educational resources were invested in the area and technical pamphlets on how to conduct experiments were used in adult literacy classes and in curriculum development for rural schools.

Source: Ruddell, 1997.

5 FARMER-LED AND FORMAL RESEARCH APPROACHES—KEY QUESTIONS

The above examples raise a number of questions regarding the relevance of formal and farmer-led approaches and the extent to which methods can be used in a complementary fashion.

Why not scrap formal experimental methods when doing location specific research?

With the exception of the soil fertility example, a common feature of all the cases is that the visual results of trials and the testimonies of farmers were sufficient to convince farmers of the value of technologies. Yet formal experimental designs were used and quantitative data was collected and analysed. The question therefore arises as to why researchers did not drop the use of formal research methods. This appears to be a legitimate question—particularly in a situation where the organisation, for instance an NGO, does not have a strong attachment and vested interest in formal research approaches. It is interesting however, that an organisation which might have done this, actually took the opposite line of action (Box 4).

The above case illustrates that agricultural research, whether formal or informal, researcher directed or participatory, is not purely a technical activity but has political and social dimensions. The choice of methodology is likely to be mediated by other factors. Particularly important is the need to find a means of experimentation that all the major stakeholders can subscribe to and accept as legitimate. In the Zimbabwean tillage example, the use of formal experimentation methods was used as a tactic to engage government research capacity. In a future where interdisciplinary and multi-institutional approaches to research are increasingly promoted, choices over methodology are likely to involve a compromise between methods and approaches. Over time, as stakeholders understand each other better, there may be scope for further development and refinement of research methods that will be acceptable to all, and in the process, improve research efficiency.

Which research methods yield more 'generic' technical results?

The DAREP results on soil and water were accepted for wider dissemination through the extension service. In Zimbabwe, a similar research approach in a similar technical area resulted in a rather different conclusion regarding wider applicability. Here conservation tillage research provided a means by which participatory extension approaches were developed and demonstrated. The underlying assumption was that there was limited scope for the more generic application of the technical results of the on-farm tillage research, through a top-down extension approach. How can we account for these different outcomes? Was it differences in the institutional environment, the project objectives, the stakeholders' interests, research methods or the farming systems and biophysical conditions? It is likely that project objectives and institutional environment account for most of the differences (in fact farming systems and biophysical environments for soil and water management are more homogenous in Zimbabwe than in Kenya and so—other things being equal—one might have anticipated the reverse conclusion). The implication is that acceptance of technical results from on-farm research is likely to depend more on the attitudes and institutional cultures of professionals, than on the results themselves.

How important is geographical mandate?

Participatory research initiated within the framework of a community development initiative (as in the Zimbabwe project) is not likely to be concerned initially with research impact beyond the project area. However, national research centres with regional mandates, such as the one accommodating DAREP, are concerned that technical research results from one locality—both constraint and opportunity diagnosis and technology testing and development—are more widely applicable.

What is the underlying rationale for the research?

Standard experimental designs (and also some participatory evaluation methods such as ranking) have a reductionist orientation. They are designed to help select the best or better, from a wider range of options. In the cases cited above, both the DAREP animal health and the Zanzibar cases tended to have a reductionist orientation. By contrast, the DAREP rainwater harvesting and soil fertility and Zimbabwe cases had a more adaptive or 'pluralist' orientation. In these cases, the emphasis was more on 'what, and whatever, will work in your particular situation', rather than 'what is the best technology?'. In the DAREP soil fertility case, more attention was put on understanding biophysical processes and making observations on the potential performance of externally imposed technologies. Thus the rationale and expected outcome of the research has an important influence on the methods selected.

6 HOW IMPORTANT ARE ORGANISATIONAL CULTURE AND INDIVIDUALS' BACKGROUNDS?

Linkages between farmer-led and formal experimentation are mediated by various cultural influences including organisational culture, values, disciplinary perspective and personal relationships.

Organisational influence

Mobilising expertise to address a particular research problem or theme often requires the input of more than one organisation. The cases clearly show that the type of organisations involved will influence the combination of research methods used. The most rigorously scientific methods were used in the case of DAREP soil fertility, when a university research programme was involved. Less formal experimentation methods prevailed where a local NGO had a strong influence on the on-farm research programme, as in Zimbabwe.

Values

Organisational cultures are influenced by the underlying values to which their members subscribe. Formal agricultural research often requires that for an activity to be meaningful, the 'science' must be visible. Skills required to obtain clear data which show significant differences are highly valued. By contrast, rural communities hold agricultural productivity and skill in high regard. A research approach which allows researchers to demonstrate this skill, to both other community members and to interested outsiders, is likely to be well received. Large experimental plots, that are well managed and show clear differences between treatments are often appropriate because they are a means through which the agricultural skills of researchers and collaborating farmers can be displayed.

Disciplinary influence

In the case studies where a technical scientist led the on-farm research process, the methods used were more formal. The researcher introducing informal methods for on-farm research on water harvesting in Kenya had an anthropological background.

7 WHAT KIND OF LINKAGES CAN BE MADE?

Mutual operational understanding

At the conceptual level it is difficult, especially at the start of a project, to link formal research with farmer-led experimentation. Generally, little is known about how farmers in a particular location experiment and how they perceive the experimental process. This is clearly illustrated by the early difficulties of the conservation tillage project in Zimbabwe—significant progress was made when a local word *kuturaya* (to describe experimentation) was discovered by researchers. The meaning of *kuturaya* actually changed over time, as the methodology and emphasis of the project evolved (Hagman *et al*, 1997). Embarking on a protracted discussion of definitions of formal research on the one hand and farmer-led research on the other, may be less important than the two parties developing operational understanding of each others' needs and ways of doing things.

Personal relationships

The process by which researchers and farmers come to understand each other better is likely to result in an identity change: 'researchers must accept to be changed by the process of their research' (Edwards, 1994). Researchers engaged in participatory research projects are often regarded as somewhat strange (fashion and jargon followers, not proper researchers, 'sucking up' to donors) by their colleagues who are still happily and comfortably experimenting under controlled conditions on research stations. Farmers engaged in extensive experimentation may also be seen as different (boastful, conceited, time wasting, outside recognition seekers) by their neighbours. Farmers learn a new vocabulary through interaction with researchers and become exposed to a wider range of ideas and social situations (e.g. through visits to research stations and other farming areas). In time relationships develop. The question of linkage between two approaches becomes subsumed by the development of personal relationships which try to minimise differences. In the Bolivian and Zimbabwean case, this led to efforts to train and educate both field staff and farmers, so that they could communicate and collaborate more effectively.

Interdependence of organisations

Organisations operating at different levels in research generate interdependencies that encourage blending of farmer-led and conventional research approaches. For example, in the DAREP project, the crop research programme depended on strong linkages with international and national research programmes to source germplasm for new crops and varieties. Such research programmes may request certain data in return, as they are also under pressure to demonstrate impact, and may find the data useful in their own screening and breeding programmes.

Can everyone be satisfied?

All of the examples illustrate that effective on-farm research—blending formal and farmer-led approaches—requires a cross section of expertise. The end result is likely to be a compromise of methods and approaches to satisfy the ideas and interests of all stakeholders. Over time, there maybe iteration from formal to informal and back again. As the level of understanding improves, there may be scope for the further development of methods to improve research efficiency.

8 CONCLUSION

This paper has attempted to stimulate ideas on how the links between formal and farmer-led research can be developed. From a researchers' perspective, several conclusions can be drawn.

In terms of the benefits of linking farmer-led and formal approaches, researchers in international and national agricultural research systems will spend less time conducting academic repetitive and redundant research. They will also—through searching locally, nationally and internationally for technologies—be able to target priority problems and opportunities and pass on ideas more quickly to farmers. However, there are also risks involved. Dialogue with influential and unrepresentative farmer researchers may mean that the researcher becomes side tracked from more widely applicable research. NARS researchers who get drawn into full-time farmer-oriented research may also lose their credibility in more academic-oriented institutions.

Better linkages could be achieved by developing a priority setting mechanism, which allows categorisation of which research requires formal methods and which can be done more efficiently with a farmer-led approach. Resources also need to be invested in the experimentation process itself, to allow time for critical reflection of the results of different methods. This may involve diversion of funds from 'repetitive' research into more 'reflective' research, so that there is less emphasis on technical knowledge validation and more on development of appropriate research skills and approaches. Finally, success will depend on the creation of sustainable dialogue between all stakeholders regarding their expectations, roles and responsibilities in the research process.

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92b. WHEN IS QUANTITATIVE DATA COLLECTION APPROPRIATE IN FARMER PARTICIPATORY RESEARCH AND DEVELOPMENT? WHO SHOULD ANALYSE THE DATA AND HOW?

Sian Floyd

1 INTRODUCTION

The range of projects encompassed by farmer participatory research and development (FPR/FPD) is vast, and so correspondingly are their specific objectives. The type of data collection that is appropriate follows directly from these objectives and so, any discussion of when quantitative data are appropriate requires broad groupings of study aims to be distinguished. It is also essential to be clear about what is meant by 'participatory' and what is meant by 'quantitative' data. This paper considers quantitative data collection for the monitoring and evaluation of research and development work, but does not consider data collection for problem diagnosis since the latter is less controversial.

What is meant by 'participatory'?

Biggs (1987) distinguishes four different modes of farmer involvement in agricultural research, determined by researchers' and farmers' relative degree of control over the research agenda:

- Contract—researchers set the agenda, farmers' only involvement is that researchers carry out trials on their land;
- Consultative—researchers consult farmers in order to diagnose problems and modify research plans, but retain control over decision-making;
- Collaborative—researchers and farmers work as equal partners and decisions over what research should be done, and how, are made jointly;
- Collegiate—the research agenda is farmer-driven, with farmers having the final say in all decisions.

All except the first are participatory, in the sense that the research process takes some account of farmers' opinions and priorities.

Coe (1997), meanwhile, distinguishes three categories of on-farm trial:

- Type 1—researcher designed and managed;
- Type 2—researcher designed and farmer managed;
- Type 3—farmer designed and managed.

Types 2 and 3 are clearly participatory in the sense that farmers are involved in implementing the research. Type 1 may also be seen as participatory, if farmers and researchers have decided together that such a trial would be useful (research mode is collaborative or collegiate), or if farmers are involved in assessing the outcome of the trial.

2 STUDY OBJECTIVES—A SUGGESTED DIVISION INTO THREE MAIN GROUPS

The importance of a clear definition of objectives prior to undertaking any research or development project cannot be overstated and is absolutely essential if data collection is to be planned and implemented appropriately. Mosse (1996) and Farrington and Nelson (1997) discuss three broad objectives of FPR/FPD: (i) improving agricultural and natural resources productivity; (ii) human resource development; and (iii) institutional development. Issues of data collection arise mainly, if not exclusively, with objective (i), although collecting data that farmers can share in analysing will contribute to objective (ii). This paper considers data collection to meet objective (i).

Coe (*op cit.*) defines three main groups of objectives of FPR/FPD:

1. The study of whether new technologies—'treatments' in the terminology of experimentation—that have worked in other settings, are useful in the project region;
2. The study of what farm and farmer characteristics affect the performance of technologies, and to obtain realistic economic data where there is good evidence that a technology is beneficial in the project area;
3. The study of how farmers adopt and adapt technology.

Where the objective is to meet group three, the research is clearly farmer-managed in the sense that farmers manage the technology as they wish. It may also be farmer-designed, in that farmers choose from a range of options, which technologies they wish to experiment with. This is equivalent to a Type 3 trial. Such a trial may be done at any stage of the research process, with the emphasis being on adaptation in the early stages of research.

To meet the second objective, research is also farmer-managed. It is assumed that the new technologies themselves (but not necessarily any other aspect of management) are to be applied according to a fixed protocol in order to compare a small range of alternatives. This is a Type 2 trial if designed by researchers and a Type 3 trial if designed by farmers. For simplicity, and to match Coe's division of trial types and objectives, such trials will from now on be referred to as Type 2 trials and those with objective three as Type 3 trials.

To meet objective one, there may be a case for a researcher-managed trial—a Type 1 trial. This may be appropriate when there is risk attached to the new technology. For example, if the study is investigating methods of pest control, then taking trials straight to farmers' fields may be risky, because if an intervention goes wrong a whole crop may be lost (Compton, 1997). An alternative case might be when there are a large number of potential interventions to be screened, as it is generally recommended that the treatment number is small in farmer-managed trials (Mutsaers and Walker, 1991; Coe, *op cit.*). A researcher-managed trial is also appropriate because it is desirable to minimise variability in order to maximise the chance of demonstrating differences between treatments.

It is worth reiterating that Type 1 trials can be termed participatory, for two main reasons. First, farmers themselves can determined the problem to be investigated and agree that researchers are best placed to carry out the experiment. Second, even if the impetus for the research comes from researchers, farmers may be involved in evaluating the research. Sherington and Okali (1996) note the problems with conducting livestock research with farmers' animals and stress that farmers can be involved through visits to research stations.

Table 1 summarises the relationship between research objectives and trial types.

3 WHAT IS QUANTITATIVE DATA?

The terms quantitative data and qualitative data are frequently referred to in the debate about what types of data should be collected in different kinds of FPR/FPD, but it is often unclear whether there is a common understanding about what these terms really mean.

A textbook definition might be: data in the form of numbers are quantitative, while data that cannot be expressed in numerical form are qualitative. However, this definition is too simplistic. For instance, so called qualitative data can fall into one of a few clearly-defined categories—for example good; intermediate; bad; or yes/no. Such data are easily quantified. For instance, the percentage of observations in each category is easily calculated. A better definition therefore might be that *any data which can readily be summarised in numerical form can be considered quantitative.*

In the context of FPR/FPD, the term quantitative often seems to be equated to data that are objective, in the sense that their value is independent of the person collecting the data, while the term qualitative is equated to subjective assessments. This also causes problems. Objective data are obtained through measurement (e.g. plant yield, percentage incidence of disease, weed level above or below a given threshold, count of pests, percentage adoption) and so are readily quantified. But scores and ranks assigned by farmers to different technologies are generally subjective, unless the scoring/ranking is being done against very precisely defined criteria. These data are numerical so *subjective data can also be quantified*.

It is common to encounter difficulties in distilling people's views and opinions into a numerical summary without losing important information. Grouping views and opinions expressed during interviews or group discussions into a number of categories can be attempted, and if this is done it further blurs the distinction between quantitative and qualitative data.

The debate over quantitative versus qualitative data in FPR/FPD seems largely to centre on objective assessment through measurement, versus subjective farmer assessment. The assumption seems to be that there is a tendency for the natural scientist to want to measure things, while the social scientist emphasises farmer assessment. It is less clear what view farmers have of the value of measuring outcomes. Sumberg and Okali (1988) stress the overriding importance of one of the few objective measures of farmer assessment, percentage adoption of a technology, but this can only be used for a Type 3 trial.

For the purposes of this paper, quantitative data will be taken to mean any data that are numerical or are easily quantifiable, including the subjective data that comes from scoring and ranking and categorical data such as yes/no, but excluding detailed farmer comments.

4 WHEN SHOULD QUANTITATIVE DATA BE COLLECTED IN FPR/FPD?

Different kinds of quantitative data will be appropriate depending on the objectives (shown in Table 1) and there is an obvious division between farmer assessment data and measurement data. However, it is possible to make some general comments about the value of quantitative data (Box 1).

It is worth noting that time and expense are often cited as reasons for not collecting quantitative data. However, often far more data are collected than is necessary. Also, the speed of collecting data can often be substantially increased without compromising

Table 1 Research objectives and trial types

Objective of research	Category of on-farm trial
To determine the usefulness of technology in an area, especially where there is risk attached	Type 1-researcher-designed and researcher-managed
To investigate what factors affect the performance of a technology, where there is evidence that it is beneficial in the project region	Type 2-researcher-designed and farmer-managed
To study how farmers adapt and adopt technologies *Also:* To investigate what factors affect the performance of a technology	Type 3-farmer-designed and farmer-managed

accuracy. Sampling has great potential to reduce effort, while still obtaining acceptable precision. Alternative methods for measurement may also be valuable. Compton (1997) discusses how rapid participatory assessment methods were used successfully to obtain an objective assessment of pest damage in farmers' stores. She observes that, 'slow and overly precise methods slow down research, limit farmer participation and can keep researchers away from the farm'. Further, that 'the development of rapid participatory field-based methods in many technical subjects has not kept pace with the development of rapid participatory rural appraisal (PRA) and other methods designed for the socio-economic component of on-farm research work'.

5 STATISTICAL ANALYSIS OF QUANTITATIVE DATA

Since one of the advantages of quantitative data is that it can be analysed statistically, and since many have been sceptical of the value of such analysis in FPR/FPD, it is worth elaborating briefly on what such analyses can achieve. Analysis in this context means going beyond calculating simple means, or the percentage of times something was found/said, to try to model data in order to extract more from it (for a fuller discussion, see Martin and Sherington (1997)). In general, the value of statistical analysis is that it can:

- Indicate the extent to which findings are replicable. For instance, it can provide an indication of the probability that differences among treatments are real and have not arisen by chance.
- Show how accurately parameters of interest (e.g. average yield) have been estimated, through calculating measures of precision such as standard errors and confidence intervals.
- Quantify the variability in outcomes.
- Separate the individual effects of different factors on the outcome of interest, through a modelling approach—observed values often need adjustment so fair comparisons can be made, and using raw means as a basis for interpreting results can be misleading. Further there are often interactions between different factors—the effect of an intervention may vary depending on soil type, or how well a farmer controls weeds—and these are difficult to investigate properly without modelling the data.

It is also worth noting that many people are unaware that categorical data—such as farmer scores, yes/no answers—can be analysed with standard statistical software, using approaches that were previously available only for continuous data. There are also few restrictions on the analysis. There is no requirement for each treatment to be tested the same number of times, or for every farmer to test all treatments—although it is important to note that good study design is still very important. Methods for analysing ranking data are still relatively basic, but do enable the strength of evidence for differences between treatments to be calculated.

Box 1 The value of quantitative data

Advantages

- Collection does not require high levels of skill. Trained technicians and farmers themselves can take objective measurements. Obtaining ranking and scoring data from farmers is also not difficult.
- The data are readily analysed using statistical techniques such as analysis of variance and regression (for continuous data) and generalised linear modelling (for categorical data such as farmer scores, or measurements such as yes/no, or scores for disease severity). Non-parametric methods or an ad hoc approach using ideas from the analysis of categorical data are useful for ranking data (Poole, 1997 and Martin and Sherington, 1997, respectively).
- Quantitative data that arise from measurement provide an objective assessment of results and a record of what has happened during the research/development.
- It is relatively easy to present concise summaries of quantitative data.

Disadvantages

- Collecting measurement data can be time consuming and expensive.
- Data does not have the 'richness' of qualitative data and may be insufficient when an in-depth assessment of experiences or results is required.
- Data maybe difficult to collect. For example, it may be difficult to predict when a farmer will need to harvest, while measuring animal feed intake is known to be difficult in a farmer managed trial. Accurate labour data are notoriously difficult to obtain.

6 WHAT QUANTITATIVE DATA SHOULD BE COLLECTED?

A common fault with FPR/FPD has been to approach data collection for farmer-managed trials in the same way as for researcher-managed trials. This has led to important omissions in data collection, while great effort has been expended on obtaining data that are not needed.

Detailed biological assessments

Researcher-managed trials have often paid considerable attention to obtaining a detailed understanding of the biological systems they are working with, for example being interested in height and girth of plants, number of leaves, time to flowering etc. There has been tendency for this to be carried over into farmer-managed work. Farmers are, however, unlikely to view such data as a priority. If researchers want detailed biological data then they should collect it in their own trials.

Objective assessment of outcomes

Some trials have chosen to rely solely on farmer assessments for ascertaining outcomes. While some form of farmer assessment is crucial in FPR/FPD, an objective assessment is also always valuable, either in its own right or to support/complement subjective data. It is therefore sensible to collect data on important indicators the trial is hoping to improve.

Objective data also have the advantage of often being continuous measurements. As a general rule, statistical analysis of continuous data is more powerful than for discrete data, so there is more likelihood of demonstrating differences than there is with farmer assessment data.

Yield is the most obvious example of objective outcome data. Depending on the trial, data such as length of time it is possible to store food, or reduction in labour requirements may be key indicators of the performance of a technology. Such data are useful also in Type 3 trials where the main interest is in how farmers adapt and adopt technologies—since it is useful to have some objective measure of the success of the adoption or adaptation of a technology.

A Type 2 agroforestry trial in Kenya demonstrates the usefulness of objective assessments (Swinkels and Franzel, 1997); here measurements made by researchers did not clearly match farmer assessments. It was not clear whether farmers' overall assessments took into account aspects not measured by researchers, or whether farmers' higher assessment was partly because they sought to please researchers. Regardless of the reason, the fact that both types of data were collected revealed important information that would have been missed had objective measurements not been made.

A further reason to collect such measurements is that they are likely to be important for farmers not involved in the trials. It is logical to assume that these farmers would value both subjective assessments by project farmers and measurement data.

Frequency of assessment of outcome data

Data from farmer-managed trials have often been collected far more frequently than is necessary. A common situation where this occurs is when plant growth is a key variable (notwithstanding the comments made above). For example, in long-term work with perennials, the time taken for plants to become productive is often of key importance; a proxy measure for this in the early stages of a trial is plant height or girth. There have been instances when such data have been collected monthly when, for a slowly developing plant, measurement at six monthly or yearly intervals is likely to be sufficient.

Quantitative farmer assessment

Some form of quantitative farmer assessment—in the form of ranks and scores, or yes/no responses—will generally be useful. It enables key findings to be simply presented (for instance percentage of farmers adopting a technology, percentage of farmers scoring a technology highly for a specific criteria). It also means that the data may be used for statistical analysis. With Type 1 trials, the data may be used to describe how farmers perceive alternative technologies, while with Type 2 trials it allows the reasons for differences between farmer assessments to be investigated through modelling.

With Type 3 trials, such data means that differences in adaptation and adoption behaviour, and how alternative technologies are rated among sub-groups of farmers, can be investigated. A Type 3 trial formed part of a DFID-funded project on 'participatory indicators for farming systems change: Matrices for learning in farmer managed trials in Bolivia and Laos'. It was found that quantitative farmer assessment, based on scoring a number of key indicators, was valuable for both researchers and farmers. For researchers it facilitated comparisons between farmers, and for farmers it helped them 'to examine the results more critically and perhaps modify the technology further, or clarify their own ideas when passing on concepts to other farmers' (Lawrence *et al*, 1997). The project also noted the need for farmers to make individual rather than group assessments, because 'in group interviews all the participants tend to agree with each other'.

More powerful modelling approaches are available for data in the form of scores than in the form of ranks. Scores can also provide a better summary of the differences between alternative technologies because: (i) scoring can be done on a scale that is easily interpreted (e.g. 1-5: meaning very poor to very good); and (ii) the difference between the top and bottom-ranked technology may be relatively small or relatively large; ranking says nothing about whether or not differences between technologies are important. On the other hand, ranking is easier to carry out.

Socio-economic data

A major objective of Type 2 trials is to obtain realistic economic data (this is clearly impossible in a researcher managed trial and is not an objective of Type 3 trials). Economic data are quantitative—amounts of labour, material inputs and total output all convert to monetary values. It is possible to analyse this data in the same way as biological data. It is also possible to study the relationship between final output—such as yield—and levels of labour and material inputs in the same way as the effects of particular management practices on final output may be investigated.

Baseline data

Baseline data on farm characteristics are often essential, e.g. soil type, in order to understand the performance of alternative technologies. Farm characteristics that may change over time and may be affected by the technologies being studied, must be collected before the trial begins, in order to know how initial values affect outcomes and to investigate the extent to which the interventions have resulted in change.

7 TYPES OF QUANTITATIVE DATA FOR PARTICULAR OBJECTIVES/TRIAL TYPES

Type 1 trials

These trials are fairly straightforward from the point of view of data collection, since they are the type of experiments that have been carried out for decades on research stations. Non-treatment related occurrences that occur during the trial and which may affect outcomes—such as pest incidence and waterlogging—need to be recorded, as do baseline data on plot characteristics that are expected to affect outcomes but which are difficult to control for in the experimental design. Outcome data are expected to include an objective quantitative assessment of key indicators and some form of farmer assessment of individual plots. Individual farmer or group assessments are possible. Individual assessments will allow investigation of whether there is evidence that different types of farmer (e.g. men/women) rate treatments differently.

Type 2 trials

As with Type 1 trials, it is expected that both an objective and a quantitative farmer assessment of final outcomes will be useful. Baseline data on farm characteristics needs to be collected before trials start and careful thought given to how meaningful economic data can be obtained.

The main distinguishing feature of Type 2 trials is the need for careful monitoring.

The major objective of a Type 2 trial is to understand what factors affect the performance of new technologies—they may be very helpful in some circumstances, but of no benefit in others. Farm characteristics such as soil type, management practices, and variables directly related to these management practices (e.g. frequency of weeding and weed levels respectively) therefore need to be monitored.

Monitoring might consist only of farmer comments about trial progress, which may enable differences in outcomes to be attributed to particular causes. This is problematic for two reasons—the data are subjective and they are not quantitative. Measuring important indicators (such as weed, pest or disease levels) at key times, and management practices (e.g. frequency of weeding) will always be helpful in understanding final outcomes.

Box 2 The value of quantitative monitoring data

The DFID funded *Imperata* control project provides an example of the use of monitoring data for understanding differences in outcomes. There was no intervention in the project: the aim was to study how farmers were using the herbicide that was known to control *Imperata* and to quantify the impact that this weed had when rubber was grown under farmer management. Farm characteristic data including farming system (four types), land origin (three types) and type of rubber (clonal/seedling) was collected. Monitoring data, including percentage *Imperata* cover, was measured fortnightly. Regression analysis suggested that *Imperata* level had a very large effect on rubber growth, as did rubber type and farming system. There was no evidence that the effect on growth of *Imperata* varied depending on rubber type or farming system.

Quantitative outcome and monitoring data can be modelled to disentangle the effects of multiple factors. Mutsaers and Walker (1991) stress that ‘by measuring uncontrolled site and plot variables it is possible, by use of a combination of standard statistical techniques, to separate treatment effects from environmental variables and more importantly, show how these variables may influence treatment effect’.

An example of the value of monitoring data in the form of quantitative measurements is illustrated in Box 2.

Type 3 trials

The main aim of Type 3 trials is to study the adaptation and adoption of technologies. They therefore require less intensive monitoring than Type 2 trials (although with any FPR/FPD, regular visits by the researchers are important) and certainly far fewer quantitative measurements. Some farmer assessment data is relatively straightforward, e.g. the percentage of farmers adopting the technology and percentage of farmers adapting the technology in particular ways. Other quantitative farmer assessment data that will be useful are scores and ranks for each technology. It may be possible to model this data in order to investigate whether there are important differences among groups of farmers (because each farmer is likely to manage and modify a given technology in a unique way, comparisons between alternatives are likely to be difficult, if not impossible, and are better suited to Type 2 trials).

Objective assessments of key indicators (e.g. yield) will again be useful so that where a technology appears to have been adapted in a particularly useful way, some objective measure of its merits is obtained.

Box 3 Sustainable agriculture in the forest margins

This on-farm trial programme begun by CIAT in the mid-nineties, with subsequent technical support from DFID, clearly illustrates the kind of data problems that can arise if study aims are not transparent at the outset. The project aimed to investigate the agronomic performance of a large number of novel crops, compare alternative systems and study how farmers adapted and adopted these systems. All this was attempted within the same trial. Objectives suited to each of trial types one, two and three were therefore present in a single trial.

Relatively little data were actually collected on how and why farmers adapted systems, compromising the objective of studying adaptation (a detailed study of adoption was done). Meanwhile, because farmers had some flexibility in modifying the systems, most farmers were unique in what they grew, the envisaged comparison of system A versus system B could not therefore be made. On the other hand, farmers were constrained in some ways, so the objective of assessing adaptation could not properly be met. Very detailed agronomic data on crop growth were collected, which allowed investigation of what factors affect growth, but it seems with hindsight that a basic understanding of what factors affect performance might have been more efficiently obtained through more controlled trials.

Source: CIAT, 1997.

8 TWO GENERAL ISSUES WHICH AFFECT THE USEFULNESS OF DATA

Conflicting objectives

Conflicting objectives have been a recurrent problem in FPR/FPD trials and have major implications for how any data can be used (Box 3).

Sample size, time and resources

The benefits of modelling quantitative data in order to understand variation was noted earlier. It is crucial to bear in mind that for Type 2 and Type 3 trials, such modelling is only likely to reveal any interesting differences when sample sizes are relatively large, unless differences due to a particular factor are big. This is because of the great variability characteristic in farmer-managed trials (Sherington and Okali, 1996; Compton, 1997). Any amount of data collection on individual farmers cannot compensate for involving too few farmers in the first place.

This clearly has implications for the time and resources that are required for Type 2 and Type 3 trials, if they are to produce findings that are more than indicative. It is important to note that the most expensive component of a Type 2 or Type 3 trial is likely to be monitoring, rather than assessment of the final outcome, so this issue is not of overriding importance when deciding what quantitative outcome data should be collected.

9 WHO SHOULD ANALYSE THE DATA AND HOW?

The value of modelling in order to understand variation in outcomes has already been discussed. Modelling simultaneously provides information on the strength of evidence for differences among technologies and on how accurately mean values have been estimated. This analysis will need to be done by researchers, but the logic behind the approach should be explained to farmers, and results interpreted jointly.

Simple summaries of data (means, minima, maxima, percentages) provide a starting point for more complex analysis and can indicate broad trends. Such analyses can be done jointly by researchers and farmers and can serve to highlight unusual values which may be interesting and provide ideas for future research. It is also worth noting that all quantitative data that are collected can be very usefully used, together with qualitative data, to build up an individual case study of each farmer's experiences.

10 CONCLUSION

The value of quantitative data are that they are easy to summarise, complement qualitative data by providing an objective assessment, and facilitate modelling in order to understand variation in outcomes. The type of quantitative data that are useful is dependent on the objectives of FPR/FPD. Three broad groupings of study aims may be distinguished and guidelines provided for each one. However, with farmer-managed trials it is important to recognise that modelling data is only likely to be useful if the number of farmers involved in the FPR/FPD is relatively large, and for Type 2 trials if the time and resources available allow for fairly intensive monitoring.

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92c. THE APPROPRIATE USE OF QUALITATIVE INFORMATION IN PARTICIPATORY RESEARCH AND DEVELOPMENT. WHAT ARE THE ISSUES FOR FARMERS AND RESEARCHERS?

Barry Pound

1 INTRODUCTION

This paper analyses the role of qualitative methods in farmer participatory research (FPR) and participatory technology development (PTD) and their articulation with quantitative methods. This is in response to difficulties experienced in selecting and using the most appropriate mix of qualitative and quantitative participatory and conventional research methods that serve the interests of donors, collaborating institutions and local communities. The paper first aims to identify the most widespread and serious methodological challenges facing FPR/PTD practitioners; then to compile evidence of a variety of appropriate methods, to describe their strengths and weaknesses and to characterise their complementarity with other methods. The challenge for methodologies is particularly acute for the more complex natural resources management (NRM) situations, where several disciplines and perhaps conflicting agendas are involved. The emphasis of the paper is on planning, implementation, monitoring, data analysis and evaluation stages of FPR/PTD, rather than the diagnosis stage, which is relatively well developed and documented.

2 WHAT IS MEANT BY QUALITATIVE INFORMATION?

For the purposes of this paper, qualitative information is taken to be that which is not collected in numerical form and which is not easily quantifiable. In general terms, quantitative data are the result of measurement, usually of a limited number of specific and discreet parameters (e.g. grain yield or live weight gain). Qualitative information on the other hand provides an assessment, often based on a large number of criteria, and drawing on experience of different circumstances over time and space. An example might be the degree to which a technology would 'fit' into the farming system. Different responses might be expected from men and women in the same family, or from richer and poorer members of the same community.

In many cases, quantitative data are *objective*, and qualitative information is *subjective*. However, while scores and ranks assigned by farmers to different treatments might be subjective, it might also be possible to quantify and statistically analyse the information given. This information would then be classified as quantitative, rather than qualitative. It is likely that as further advances are made in the application of biometrics to on-farm and participatory research, more information, previously considered descriptive and subjective, will be amenable to statistical analysis.

Much progress has already been made towards legitimising and refining qualitative methods. Computer software is now available to assist with the interpretation of non-numerical information. Such advances are now enabling the characterisation of local knowledge systems, the development of farmer decision-support systems and the involvement of farmers in complex natural resource investigations, such as the development of soil nutrient flow models. At the same time, by refining qualitative methods, it is possible to strengthen farmer's own research, giving confidence and motivation to the process of local research empowerment.

Qualitative information can be obtained in informal ways (e.g. observation or unstructured conversation) or using structured, formal methods, such as semi-structured interviews of individuals or groups selected through careful sampling procedures. Such methods may be participatory (in the sense that all those involved learn from the process and results) but can also be extractive with—in the short-term at least—benefits accruing mainly to researchers.

Qualitative information helps to explain relationships in a way that quantitative data cannot (providing the why rather than the what). The challenge is to combine qualitative information with sufficient (and no more than that) quantitative data of the type that is useful to decision-makers—including farmers (Waters-Bayer, pers. comm.).

3 WHAT DOES QUALITATIVE INFORMATION HAVE TO OFFER?

Sharing knowledge

Formal natural sciences experimentation has relied heavily on quantitative methods for evaluating technologies and understanding processes. In contrast, the evaluation of potential modifications by farming families is dominated by multi-criteria subjective judgement, often in the absence of any recorded quantitative data. It is now accepted that there are sound reasons for farmers to be involved as equal partners in technology development and dissemination in complex, diverse and risk-prone situations. This implies a two-way sharing, not only of knowledge, but also of the planning, evaluation, analysis and monitoring methods and criteria used by farmers and researchers. In this way, the interpretation and utilisation of information can be strengthened for both farming families and researchers, and planning and implementation can proceed with increased involvement and confidence.

Understanding complex natural resource management issues

Qualitative methods, such as the construction of models or maps and carefully collected comments from family members and key informants (individually or in group discussions), can contribute to the understanding of joint decision-making processes in complex NRM situations, such as watershed management.

An exclusive emphasis on pre-selected quantitative data sets can lead to vital elements of a technology being overlooked. For example, there may be exhaustive quantitative data on the labour requirements of a newly introduced crop, but it may be the way in which those requirements fit with the other labour needs over time and between family members that is more important. Qualitative calendars of activities (including off-farm activities), and family labour profiles would complement the quantitative data and identify conflicts and opportunities.

4 CHALLENGES INVOLVED IN DEVELOPING AND USING QUALITATIVE METHODS

Understanding the circumstances under which particular qualitative methods are appropriate, and the strengths and weaknesses of each method as seen from the point of view of different stakeholders is critical.

When selecting methods it is vital to ensure that they will contribute directly to meeting the objectives of the study: Who is the information for? What purpose will it serve? How and by whom will it be analysed? What criteria will be used in judging its legitimacy and by whom?

At present, there are some institutions (both in developing and developed countries) that don't recognise qualitative information unsupported by quantitative data. Some journals require conventional statistical tests on data before papers are accepted. Varietal release boards often require several years of quantitative data, and credit agencies may require quantitative proof that a technology is economically viable before supporting it.

Such strictures are unlikely to be important where the users of the information are farmers and farmer research groups. In this case, the challenge may be to identify methods for the presentation of information to their peers so that it represents reality as accurately as possible. This may be difficult if information has been collected in an unstructured way. Some participatory research methods in which farmers are the lead researchers, such as the Comité de Investigación Agricola Local (CIAL) developed by CIAT (Colombia), adopt a structured mix of qualitative and quantitative methods to overcome such problems.

Qualitative methods are thus becoming more powerful, but to some extent this is dependent on greater care being taken in their design and implementation. There may be a trade-off between the 'formalisation' of qualitative methods in pursuit of accuracy and the benefits of relaxed methods that promote confidence and open debate.

Where qualitative information is collected by 'outsiders', one needs to be aware of the potential for inaccuracy in the information volunteered. There are many reasons why this might be inaccurate, such as:

- Respondents might deliberately give wrong information;
- Respondents might give information that they believe to be correct, but is in fact incorrect;
- Poor understanding of the question by farmers;
- Poor interpretation of the response by researchers.

Improving accuracy depends on promoting confidence between the different parties involved in the evaluation and improving the skills of those eliciting the information. This implies a need for training in these areas. An analysis of likely sources of bias (on the part of researchers and farmers) can help reduce the distortions that preconceptions can bring to the interpretation of qualitative information. Often it is important to know the background of those providing the information in order to interpret it correctly, as this may vary between groups in the same way as local and indigenous knowledge does (i.e. between young and old, rich and poor, settled and recently arrived families, men and women, etc.). The use of recommendation domains based on social, as well as physical characteristics can be useful in categorising respondents. Stratification (for instance using wealth ranking) assists in systematising information into relatively homogenous groups.

Ensuring inclusivity in the collection and interpretation of information

Qualitative methods include a range of visualisation techniques—such as using maps and diagrams—that can be intelligible to all, including the illiterate who tend to be among the poorest. Conscious effort is required in order to ensure that disadvantaged groups (the poorest, women, low castes, those in remote areas, etc.) are included in information activities. The location, timing, composition and process of group activities or individual interviews need to be considered in order to preclude exclusiveness. In some, instances separate activities may be required to ensure all groups have a voice.

Options for engaging participants include: (a) volunteering; (b) delegation by the community; (c) probability sampling (using random or systematic sampling); and (d) guided purposive selection. Researchers have tended to take a somewhat ad hoc approach and/or favour options (a) or (b) on the basis that they are more participatory than (c) or (d) (Sutherland, 1999). However, approaches (a) and (b) tend to bias selection away from the poorest for a variety of reasons. A more guided approach is needed if the poorest constitute a target group of the project. The use of stratified sampling (e.g. by using wealth-ranking techniques) can help to guide the selection of participants appropriate to the objectives of the activity and reduce bias.

Documenting the successes and problems encountered in the use of qualitative methods by researchers and farmers

Some of the first widely accepted examples of local adaptation of technology are recounted in *Farmer First* (Chambers *et al*, 1989). Farmers' ability to evaluate technology—with or without the assistance of researchers, extension staff or community facilitators—is being increasingly acknowledged. However, there are still few studies designed to show how participatory methods in research and dissemination are more cost effective, or have a greater impact on livelihoods than top-down models. Consequently it can be difficult to convince more conventional institutions of the need for new approaches, such as a shift towards qualitative methods.

Identifying how different qualitative methods complement one another and how qualitative and quantitative methods and information can be used together

It is the potential to use a range of qualitative methods drawn from a dynamic and increasing repertoire that makes this area of research exciting. Participatory workshops and community meetings, field days and farmer's research groups can be extremely effective as communication vehicles between farmers and researchers, and between farmers. Participatory adoption studies and market surveys can similarly pick and choose, to get the appropriate combination of qualitative and quantitative methods. The design of surveys and on-farm trials calls for experience and skill in deciding what combination of methods will best achieve stated objectives.

There may be circumstances in which qualitative methods can be the main source of information. If the objective is to test a technology for use in a specific location, farmers may be able to base their selection on multi-criteria subjective judgement, which uses little or no recorded quantitative data. Qualitative information alone may also be sufficient for working with communities to describe the farming and institutional systems and in the identification of priorities and actions. On the other hand, if the objective is to gather information from multiple locations and analyse the robustness of a technology across circumstances, then a mix of qualitative and quantitative information might be more appropriate.

At different stages in the research and dissemination cycle, different mixes of qualitative and quantitative information are called for and for each stage, circumstance and purpose it would be possible to envisage an optimal combination. Generalisations are therefore difficult; requirements at any stage depend on factors such as:

- the objectives and expected outputs of the initiative;
- available secondary data;
- previous exposure of researchers and farming families to participatory methods;
- attitudes of the institutions involved;
- literacy and numeracy of community participants.

In some cases, the results from qualitative methods such as farmer interviews might contradict quantitative data based on agronomic or economic parameters. It will then be necessary to decide if the discrepancies are widespread or local and whether the differences are due to a different and/or important criterion that would override those used in the quantitative analysis. Sometimes the presentation of quantitative data in farmer's meetings can assist the process of evaluation, particularly if its level of precision and confidence can be explained and appreciated. It should not be allowed to dominate, but be seen as complementary to other sources of information and opinion brought by farmers.

What implications does the increased use of qualitative methods in FPR/PTD have for formal institutions?

While qualitative methods might be accepted as part of the repertoire of NGOs and developmental projects, the question remains as to whether qualitative data are adequate for the research community and policy makers. What are the expectations of researchers? Do research institutions feel threatened by research information that is subjective? Does the acceptance of an increased role for qualitative methods mean that it is necessary to change the criteria by which research and extension staff are evaluated?

In order to answer these questions it may be necessary to disaggregate the research and policy making communities, particularly with regard to scale. It may be that at the local level, qualitative information based on observation, debate and local knowledge is sufficient. For replication and extrapolation of an intervention, quantitative measures of robustness may be necessary. At a wider scale still (e.g. national level), qualitative information would again be important, such as in organisational analysis to understand how bureaucracies learn to adapt themselves to more participatory approaches to agricultural research and extension.

Qualitative approaches and methods go hand in hand with the adoption of participatory methodologies for research and dissemination. Greater use of qualitative methods implies the need for additional training of natural scientists in the philosophy of participation and its methods, and a change of attitude on the part of many research and extension staff. This change takes time; some estimate up to ten years (Jurgen Hagmann, pers. comm.).

A greater emphasis on qualitative methods also requires institutional budgets to be more responsive to field-led agendas, greater mobility of staff and better recognition of field work (indicators of performance related to the development of effective community-level research and development systems—rather than papers for the scientific community). Many National Agricultural Research Systems have great difficulty in providing these conditions, except where donor funds create special circumstances.

5 CONCLUSION

Methods for the collection, sharing and interpretation of qualitative information are developing rapidly. Qualitative information is complementary to quantitative data; the relative importance of each type of information depending on the objectives of the activity. Care must be taken with the methods used if the poorest or other disadvantaged groups are not to be excluded. The full adoption of qualitative approaches within participatory research and development institutions faces difficulties of attitude which will take time and enthusiasm to resolve.

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