Participatory Development of Agricultural Innovations

Procedures and Methods of On-Farm Research

J. Werner

Schriftenreihe der GTZ, No. 234

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Technische Zusammenarbeit
(GTZ) GmbH

Technical Cooperation –
Federal Republic of Germany

Eschborn 1993

Die Deutsche Bibliothek – Cataloguing-in-Publication Data

Werner, Jürgen:
Participatory development of agricultural innovations: procedures and methods of on-farm research / Jürgen Werner.
[Publ. by: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH and SDC, Swiss Development Cooperation. Drawings: Ueli Scheuermeier]. – Roßdorf: TZ-Verl.-Ges., 1993
(Schriftenreihe der GTZ; No. 234)
ISBN 3-88085-492-0 (GTZ)
NE: Deutsche Gesellschaft für Technische Zusammenarbeit <Eschborn>: Schriftenreihe der GTZ

Publisher:	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Postfach 5180, 65726 Eschborn, Federal Republic of Germany
and	SDC Swiss Development Cooperation, CH-3003 Bern, Switzerland
Drawings:	Ueli Scheuermeier
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Typesetting by:	rdw Typowerkstätte
Cover-design:	Manfred Sehring
Cover-photo:	CIAT, Centro Internacional de Agricultura Tropical
Printed by:	Typo-Druck-Roßdorf
Distribution:	TZ-Verlagsgesellschaft mbH, Postfach 1164, 64373 Roßdorf, Federal Republic of Germany

ISBN 3-88085-492-0
ISSN 0723-9637

I/0993/2,5

Preface

Agricultural innovations have to overcome farm level constraints, not only regarding farmers' and their families perception but also with regard to the ecological, economic and socio-cultural environment farmers operate in. The understanding, that only working together with farmers guarantees the adaptability of innovations led GTZ already in the early eighties to prepare a guide on On-Farm-Research procedures to be used in rural development projects, the "On-Farm Experimentation Handbook" by Kurt G. Steiner. The book found a worldwide appreciation and became a valuable tool for researchers and extensionists in developing "client oriented" innovations.

"The Steiner" - as the book became to be known - ran out of print quickly. At the same time, methodologies, especially in the field of farmer's participation, developed further and a revision of the guide proved necessary. The person who took up this task, Jürgen Werner, can draw on a vast personal experience with on-farm experimentation. In addition, he evaluated most recent experiences of projects of the German Technical Cooperation and the Swiss Development Cooperation (SDC) in various parts of the world. The outcome is a completely revised book, although essential elements of Steiner's handbook of 1986 have been integrated.

The book is to give a practical guide for On-Farm-Research to all those who have at their hearts the improvement of the living conditions of rural people in developing countries.

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Acknowledgements

Many people where involved in the development of this book:

I am particularly grateful to Willi Graf, who significantly influenced the work in many hours of discussion and brought in his own ideas and experiences. Gerhard Schweizer was always available when the work stagnated and help was needed to clarify or structure ideas.

Without the support and confidence of GTZ, namely M. Bosch, and SDC (Swiss Development Cooperation), namely W.Graf, it would not have been possible to write this book or to accumulate the experience on which it is based.

H.G. Schön prepared drafts on statistical issues and computer software and made valuable suggestions concerning trial design and analysis.

Many colleagues read drafts and provided important comments. Among them were J.Ashby, G. Hollenbach, A. Jäckle, M. Menzi, T. Schwederski, K.G. Steiner, H. Waibel, F.J. Wang'ati, ...

Thanks is due to CIAT and J. Ashby for permission to use part of the handbook "Evaluating Technology with Farmers". The mechanisms of communicating with farmers in on-farm research could not have been clarified better than in J. Ashby's text.

Many issues raised here are based on discussions and observations made in development programmes in East and West Africa which I had the opportunity to visit in 1990 and 1991. Thanks is due to the colleagues in these programmes for their hospitality and support.

Most obliged I am to farmers and colleagues in Liwonde, Malawi and Lamu, Kenya who I had the pleasure to work and to live with. The ideas presented here would not have been developed without their cooperation.

February 1993 Jürgen Werner

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Chapter 1 Introduction

Chapter 1 Introduction

1.1 The subject of the book

This book deals with procedures, tools and methods of on-farm research ("OFR"). Its **aim** is to assist in the development of innovations which

- correspond with farmers' goals, preferences and resources;
- are environmentally sound and
- economically viable.

Important **elements** of on-farm research are
- farmers' participation in drawing up a research agenda;
- experimentation by farmers in the farmers' environment;
- farmers' and researchers' joint assessment of options.

On-farm research is related to and uses pragmatically elements of approaches such as *farming systems research, farmer participatory research, participatory technology development, recherche développement, recherche action* and others. All these approaches have a **common goal:** increasing farmer participation in the development of agricultural innovations. They were all, however, developed at different times, at different places or by different groups and therefore vary from one other to a greater or lesser extent.

On-farm research also uses elements of *rapid rural appraisal, participatory rural appraisal* and related diagnostic instruments for assessing the demand for innovation and the options for experimentation.

1.2 The structure of the book

The book comprises two parts in addition to the introduction:

Part I, "Principles and procedures", is the heart of the book. It contains, so to speak, a basic construction plan with some advice on how to adapt it to different requirements. A sufficient understanding of this is a precondition for a satisfactory application of on-farm research tools and methods.

Part II, "The Tools", describes how to make a reasonable choice of the tools and methods which can be applied in on-farm research. Emphasis is laid on a brief presentation with enough detail to facilitate an easy practical application.

Annexes to some chapters of the book contain practical examples which foster the understanding of the research process or show how tools and methods work in practice.

1.3 The users of the book

1. The book is written mainly for **people actively involved in the planning and implementation of OFR-programmes**. This group includes :
- **professionals** working in research programmes or research components of rural development projects and
- **extension workers** who devote part of their time to the development of innovations, often not even considering this activity to be research.

For those belonging to one of these groups, Part I of the book is an opportunity to refresh or improve their understanding of OFR principles and procedures.
For researchers, the set of tools and methods provided can assist them to **achieve farmer participation** in the research process while obtaining reproducible data. The tools and methods will help **extension workers** to define appropriate extension contents in a **systematic** process.

2. **Development professionals** concerned with the design of development projects involving OFR-programmes may find the principles and procedure described in Part I of the book useful as a conceptual base.

1.4 How to use the book

The structure of the book facilitates the study of different chapters and subchapters independently and selectively.

Nevertheless, it is recommended that Part I of the book be read completely before dealing with the tools and methods of Part II in order to acquire a sufficient understanding of the principles and procedures which form the basis.

Relevance of the tools and methods to a particular project approach

Not all the tools and methods presented here will be really relevant to every kind of programme.

Table 1.1 shows some examples of how different tools and methods are relevant to various project approaches:

All the described tools and methods are relevant to **on-farm research programmes** aiming to **develop "prototype technologies"** adapted to the ecological and socio-economical conditions of the research area. A relatively small selection of farmers will usually participate in the research. Considering the heterogeneity of farm conditions and of farmers' goals and preferences, the result of the research can therefore not be one "message" for all farmers in the area, but rather a basket of options from which farmers can select and develop their own solution with the help of extension workers.

Extension programmes should mainly use participatory methods -informal, such as the dialogue on innovation, as well as formal ones, like the adoption survey. The aim can be to select potentially appropriate innovations from a given basket of choices and to test and assess them jointly with farmers. In extension programmes with a **community development focus** the informal methods can help to strengthen farmers' own ability to analyze their problems or potentials and to identify and test potential innovations by themselves.

The choice of technologies is largely predetermined in **commodity oriented** programmes. Emphasis will be on methods for the identification of potential clients and the assessment (before and after experimentation) of which technologies meet the demand of potential clients and comply with their conditions. In a **broad approach** without limitations concerning the choice of technologies, the whole set of tools and methods is relevant to explore demand for innovation, identify potential options, experiment and eventually assess tested options.

Application of tools and methods to the problems facing a particular programme

If the programme has already commenced, not all the potential tools and methods will be applied, nor the "research process" started afresh. The tools and methods to apply depend on the task to be carried out or the problem actually encountered.

Table 1.2 lists some problems commonly encountered by people working in on-farm research programmes and refers to the chapters of this book which can help to solve a particular problem.

Tools and methods need to be adapted to a specific situation

Those inexperienced in carrying out on-farm research are well advised to stick to the "operating instructions" given for the different tools and methods. Every situation will, however, require its own specific tools and the creative adaptation of their "operating instructions". After researchers have gained some experience, a touch of courage to develop approaches which are appropriate to a particular situation will be rewarded with better results.

1.5 Some notes on terminology

The term "research" as it is frequently used in this book refers to an activity rather than to an institution. In the context of this book "research" is broadly defined as an investigation into the demand for or the appropriateness of an innovation. This activity is carried out by research institutions as well as by extension organizations. The term "researcher", as it is used here, includes the extension worker searching for or developing appropriate extension contents as well as the staff of a research institution.

The terms "extension worker" or "researcher" are not gender specific. Both women and men can carry out extension as well as research functions equally well. Likewise, the term "farmer" applies to both male as well as female "farmers" and includes the male or female head of the farm household as well as his or her spouse.

Table 1.1: Relevant tools for different project approaches

Distinguishing feature	Project approach	Relevant tools and methods
Project function	Research project	The whole set of tools and methods to explore demand, identify options, experiment and assess trial innovations, in order to **develop technology**
	Extension oriented project	Emphasis on farmer participation in exploring demand for and assessing trial innovations, in order to **adapt technology to farmers own conditions**
	Community development oriented project	Emphasis on participatory tools and methods in order to **strengthen farmers innovative capacities**
Scope and type of field of work	Broad "system oriented" approach (choice of technology is open, direction to be determined by project)	The whole set of tools and methods to explore demand, identify options, experiment and assess technology
	"Commodity-oriented" approach (choice of technology is predetermined)	Emphasis on identification of potential clients and assessment of given technology

Table 1.2: How the book can help if different problems are encountered (I)

The problem	Recommended chapters of the book
You are not sure how to get the programme started.	2
You do not know how you will benefit from on-farm research.	2
You do not know which problems farmers in your research area have.	2.4.1, 4.2.2, 6.1.4
You are not sure whether you are working on the right problems and potentials.	2.4.1, 4.2.2, 6.1.3
You do not know which farming practices farmers in your area apply.	4.2.1, 4.2.2, 6.1
You have received a lot of survey results from the socio-economics department but do not know how to utilize them in the planning of the experimental programme.	2.4.1, 2.4.2
You do not know which type of technology to give priority to in your research.	2.4.1, 6.1.3, 6.1.5
You are not sure how to take "farmers' practice" into account in the experimental design.	5.1
You are not sure whether your technologies correspond with farmers preferences.	4.2.2, 6.1.6

Table 1.2: How the book can help if different problems are encountered (II)

The problem	Recommended chapters of the book
You do not know whether you are working with the most appropriate selection of farmers.	6.1.4
You feel you have a problem in communicating with farmers.	3
Farmers do not cooperate.	3, 2.4.1, 2.4.2
You do not have time to visit your trial farmers often enough.	5.3.1
Farmers apply experimental treatments incorrectly.	5.1, 5.3.2
Farmers management is not up to standard .	2.3, 5.1
There is not sufficient staff to supervise the trials properly.	5.3.1
You have too little money to run the programme as it was planned.	5.3.1
Your trial plots are always planted too late.	5.3.1
One or more farmers harvested trial before yield measurements were taken.	6.2.1
Records received from field staff are incomplete.	5.3.2

Table 1.2: How the book can help if different problems are encountered (III)

The problem	Recommended chapters of the book
Your data is difficult to analyze because some plots were destroyed by animals.	6.2.1
Trials were to be analyzed across sites but the number of farmers is not the same at all sites.	6.2.1
Trial results show high variability.	6.2.1
You are not sure whether or to what extent your technologies are adopted by farmers.	4.2.3, 6.2.2.4
You do not know why farmers do not adopt suggested technologies.	4.2.2
Extension officers do not utilize your results.	2.4.5

Part I The Approach

Chapter 2 Principles and procedures of on-farm research

Chapter 2 Principles and procedures of on-farm research

2.1 Evolution of an approach

The results of many rural development projects aiming to improve the living standards of the rural population in developing countries have often been disappointingly poor. This was largely because agricultural innovations propagated to increase agricultural productivity were not adopted by small resource-poor farmers as was expected. It is now more or less generally accepted that the reason for this is not farmers ignorance but the inappropriateness of the supposed innovations (see Table 2.1).

The slow progress in the development of smallholder agriculture in most developing countries contrasts sharply with the rapid development of agriculture, in the industrialized countries. Many explanations for this are given in the extensive and ever-growing literature on farmers' role in and their benefits from agricultural research and extension. Some explanations cite the high diversity of ecological conditions, the complexity of production systems and the high risks caused in particular by unstable climatic conditions (Chambers et al., 1989). Simple, high-input, systems that were successful with "industrial" or "green revolution" agriculture do not succeed well under such conditions.

Better adapted technologies were expected from "on-farm research" methods developed in the early 1980s. Smallholder production conditions and systems were systematically analyzed and production constraints defined by researchers as far as possible from the farmers point of view. Potential solutions were subsequently tested in farmers fields, i.e. under farmers' own environmental conditions. Economic considerations became as important in the trial evaluation as the agronomic analysis.

The results achieved were, nevertheless, still unsatisfactory. Researchers had difficulty in considering the production goals and decision criteria of smallholder farmers in the development of agricultural innovations. The complex goals and decision criteria of smallholder farmers are often beyond the understanding of agricultural researchers. Quantifying the value of an innovation in monetary terms, which was considered appropriate for judging the effect of an innovation, is often meaningless to a small farmer in a developing country. Not understanding farmers' goals and decision criteria increases the likelihood

of addressing the wrong problem or of valuing an innovation incorrectly. Obviously (in the words of J. Ashby, 1990) "no one specialist knows as intimately as the farmer all the many different problems and needs of the small farm household. Therefore, no other specialist is better equipped to visualize how to put a technology to work on the farm to meet those needs".

Table 2.1: Failure of farmers to adopt new technologies: how this was explained and favored remedies over the past 40 years (adapted from Chambers and Ghildyal, 1985)

Stage	Period when dominant	Explanation of non-adoption	Prescription
1	1950s 1960s	Ignorance of farmers	Agricultural extension to teach farmers the right technology
2	1970s 1980s	Farm-level constraints	Ease constraints to enable farmers to adopt (e.g.credit for inputs or implements)
3	early 1980s	Technology does not fit RPF conditions	Researchers to understand conditions and generate technologies which fit
4	late 1980s 1990s	Technology does not match with RPF goals	Farmers participate in planning and evaluation of research programs

RPF = Resource-poor farmers

The current trend is therefore towards increasing the involvement of farmers not only in the physical implementation of trials but also in the definition of research needs and the design and evaluation of programmes in order to utilize their specialist knowledge. This kind of **participatory approach** to the development of innovations, called "on-farm research", is the subject of this book.

2.2 Researchers, extension workers and innovation

Researchers and extension workers both play their role in the development and dissemination of innovation. But are extension workers and researchers really required to initiate an innovation process?

So-called "traditional agriculture" can be seen as the long-term result of a continuous innovation process carried out by farmers for generations. Traditional agriculture is not static. It does not have the same face as 100 years ago. Farmers themselves conducted their own type of "trial and error" experimentation to continuously adapt their farming practises to changing circumstances or to incorporate new ideas they picked up.

Example:
The literature shows many examples of successful innovations developed by farmers. An example is that of a group of Kenyan farmers who were compelled by increasing land scarcity in the highlands to settle at the coast, in a completely strange environment. Forced by natural circumstances, they developed a new intercropping system within 10 years without the support of extension workers or researchers. This intercropping system, consisting of cotton, maize and cowpeas, is now the core of their farming practice. Subsequent research efforts to optimize the system failed: it was apparently well developed already.

As innovation takes place anyway, the primary function of extension workers and researchers can not be to initiate innovation. They can, however, stimulate the ongoing process and give it new dimensions. New ideas produced and tested with the help of researchers can help to lift farming to a new technological level; extension workers in the function of "facilitators" accelerate the ongoing innovation process by spreading new ideas among farmers and between researchers and farmers and by encouraging farmers to try out by themselves.

2.3 Principles of on-farm research

The success of an agricultural innovation is always to some extent a matter of chance. No rules can guarantee success, but one can give chance a helping hand by observing a few simple principles:

Try first to understand farmers and their circumstances

Farmers' decision as to production and consumption are determined by their goals and preferences as well as by natural and socio-economic circumstances. These factors also determine farmers' attitude towards a new technology, and should therefore guide the researcher in the development of an innovation.

Researchers require a basic comprehension of farmers' goals and circumstances if they want to help farmers to articulate their needs or to assess options tested. Any attempt to comprehend farmers' goals and circumstances to the last detail is, however, expensive, time consuming and unlikely to succeed. More promising and less tiresome is, therefore, an approach which ensures that:

Farmers play a role in determining the course of action

Nobody has a better understanding of his different needs and the opportunities his farm offers than the farmer himself. Nobody is better able to judge which kind of technology would be required and how to get it to work on the farm. The complex decision criteria of small farmers are well beyond the comprehension of researchers. New technologies are therefore more likely to succeed, the earlier the specialized "farming systems know-how" of farmers is utilized and combined with the technical knowledge of researchers.

As farmers are the center of attention, they should also play a key role in determining the subject of research and the choice of appropriate technologies. The role of researchers is more:

- to help farmers to articulate their demand for innovation, to offer a choice of options to satisfy this demand and
- to provide the principles and methods for testing these rather than deciding what farmers need.

Options are tested in farmers' fields, under farmers management and using farmers own practice as a control

The purpose of on-farm experimentation is not so much to show the potential productivity of an innovation (this should be known already from station research) but rather to prove its feasibility under actual farm conditions. **Experimentation in farmers' fields** provides data regarding the feasibility of an innovation under the diverse ecological conditions which farmers face. Such trials **under farmers' management** show whether the technology is compatible with practices applied by farmers and works given existing resources. Experimentation which **use farmers' own practices** as the control provides an appropriate basis for comparison.

The response of farmers is a primary evaluation criterion

Early attempts to carry out on-farm research often met with failure. An important cause was that innovations were primary evaluated according to agronomic and economic criteria laid down by researchers. Eventually the "best" option (according to these criteria) was presented to farmers for their judgement – and failed more often than not to achieve acceptance. Meanwhile many "second best" options, better corresponding with farmers' goals, were already lost on the way.

Experience has shown the importance of considering farmers' goals as evaluation criterion right from the beginning of the research process. "It should not be the (final) packages of technology that are provided to farmers but (a choice of) genetic materials, principles, practices and methods for them to test and use" (Chambers, 1990). It is eventually farmers judgement which determines whether a new technology will be adopted or not. Farmers' judgement therefore also deserves to be a key criterion in the evaluation of different technical options compared in a trial programme.

The innovation must be technically sound, economically viable and warrant sustainability

The conventional agronomic and economic evaluation criteria are, nevertheless, still of importance. Costly measures to facilitate and promote new agricultural technologies are certainly not economically justified if the new technology does not prove to be superior to existing technology in agronomic and economic terms. Current approval by farmers can also not substitute for the sustainability of an innovation.

The success of an innovation is measured by its adoption

A successful technology is the one which is adopted by its target group. The research process is not finished with the publications of results showing the superior performance of a developed technology in terms of agronomic or economic criteria, but with the proof that it is applied by farmers.

A systems perspective is applied

No activity in a farm exists in isolation. They are interrelated through competition for scarce resources or when products of one farm activity are used as the basis for another. The optimization of one component or production technique of the "farming system" may require that specific characteristics of other components and production techniques be taken into consideration.

On-farm research is a step-by-step procedure

An important precondition for adoption is that farmers are able to comprehend the effects of a change of technology. The meaning of "systems perspective" should, therefore, not be misinterpreted. New "systems" or complex new technologies are very seldom adopted by farmers at once as an integral whole. Farmers adopt technological components one at a time, and not as complete package. On-farm research should, therefore, strive for a step-by-step change, bearing the systems perspective in mind.

On-farm and station-based research are complementary

On-farm research does not have the means to and should therefore not strive for the development of "new" agricultural technologies. It is rather complementary to station-based research. Its role is to explore existing and future needs for new technology and to identify technologies which satisfy these needs from the already available alternatives developed by research stations or innovative farmers.

In an efficient research system station-based and on-farm research are carried out in close cooperation. Station-based researchers consider the need for technology identified by on-farm researchers to steer their own activities. On-farm researchers in turn, draw material from the technological alternatives developed at the research stations.

Involve extension workers from the beginning

It would be desirable that every extension worker was active as an on-farm researcher himself, helping his farmers to articulate needs for innovation, to gather ideas about innovation from within the farming community and from outside and to test these ideas. This is, however, not the case in many research and extension systems.

Where on-farm research and extension functions are not carried out by the same persons or institutions, extension workers must nevertheless be involved in the research process right from the beginning.

It is often not possible that extension workers are actively involved in the actual field implementation of the research. Their participation in planning programmes and in the assessment of tested technologies is necessary, however, to improve and accelerate the dissemination of results, because:

- extension workers views concerning agricultural problems and potential solutions can be considered in the research planning,
- the feasibility of promoting results through extension can already be considered during the research process,
- continuous involvement of extension workers in the research process improves their comprehension of results eventually achieved,
- the time lag between the conclusion of an experiment and the application of its results through extension is reduced.

Table 2.2: Characteristics of on-farm research

Objectives:
- to develop innovations consistent with **farmers circumstances**, compatible with **actual farming systems** and corresponding with **farmers' goals and preferences.**

Primary location:
- farmers' fields.

Roles of farmers:
- to discover needs for agricultural innovation;
- to select from a choice of technology;
- to determine conditions and management of testing;
- to test and evaluate whether chosen technology meets demand;
- to transfer knowledge in farmer-to-farmer extension.

Roles of extension workers:
- to point out their own need for information about innovation;
- to mobilize farmers indigenous knowledge;
- to help farmers to articulate their demand for innovation;
- to evaluate feasibility of innovation within the frame of the extension system;
- to spread knowledge about innovation;
- to transfer knowledge about how to test and evaluate innovations.

Roles of researchers:
- to help farmers to articulate their demand for innovation;
- to demonstrate choice of possible technology to satisfy needs;
- to explore and use indigenous knowledge;
- to provide principles and methods to test chosen technology;
- to evaluate productivity and sustainability.

Primary criteria for assessment of technology:
- correspondence with farmers' circumstances, goals and preferences and sustainability are as important as productivity.

Primary criterion for successful technology:
- ITS ADOPTION

2.4 On-farm research: process and procedures

The development of appropriate agricultural innovations involves a number of equally important activities. The testing of production alternatives, which is often central consideration is one important stage in the process, but not the only one. More often than not, experimentation is actually the sifting out of technologies for which there is no demand, because the preparatory steps were insufficiently executed. That some technologies are inappropriate is frequently discovered too late (if at all) because the final evaluation stage is reduced to a mere application of statistical procedures on agronomic data. Better results are often achieved by reducing the emphasis on experimentation and favouring a proper preparation and evaluation.

In this book the development of agricultural innovations is broken down into five stages:

(1) exploring the demand for innovations;
(2) identifying alternatives to satisfy the demand;
(3) testing the identified alternatives;
(4) assessing the identified alternatives, and
(5) disseminating results.

The first four stages concern the **actual development** of appropriate innovations. Their **purpose** is to explore the demand for innovations and to identify, test and assess various alternatives which may satisfy the demands using appropriate **tools and methods** according to **defined criteria** (see Table 2.3).

The fifth stage -the **dissemination** of results- is important in order to ensure that innovations are not only developed but also reach the intended target groups.

A balanced execution of all of these stages of the development process is the precondition for successful results and for a satisfactory impact on the target group.

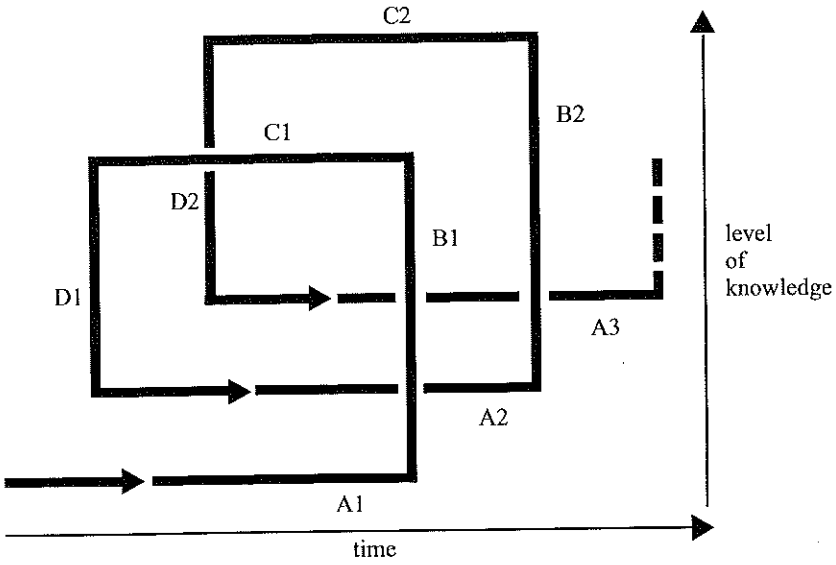
Table 2.3: The development of agricultural innovations: purposes, criteria and methods at different stages

Stage	Purpose	Criteria	Tools/Methods
Exploring demand	Explore: – Who demands innovation? – What is demanded? – Where is it demanded?	Farmers' perceived needs Present and expected problems Non-utilized opportunities	Secondary information Exploratory survey Dialogue on innovation Approp. analytic. tools
Identifying options	Identify: – Which available technologies can satisfy the demand?	Correspondence with farmers goals and preferences Ecological compatibility Economic viability Feasibility	Secondary information Dialogue on innovation Approp. analytic. tools
Testing alternatives	Collect information to examine how far alternatives comply with defined criteria	Correspondence with farmers goals and preferences Ecological compatibility Economic viability Feasibility	Experiment Observation Dialogue on innovation Farmer assessment
Assessing alternatives	Analyze, interpret and decide which of the tested alternatives comply with criteria	Correspondence with farmers goals and preferences Ecological compatibility Economic viability Feasibility Adoption	Organizing data Scaling and rating Statistical analysis Economical analysis Analysis of farmer assessment

The development of innovations is an **iterative and dynamic** process.

It is "iterative" in that the four stages of actual technology development (exploring demand through to assessing alternatives) occur in recurrent succession (see Figure 2.1). The process is "dynamic" as it is constantly readjusted on the basis of new information, reaching a higher level after every cycle of the development spiral.

Figure 2.1: The spiral of technology development in on-farm research



A = Exploring demand B = Identifying alternatives
C = Testing alternatives D = Assessing alternatives

Ideally, every new cycle of the process will be initiated with a review of the demand for innovation. The actual demand may have changed due to a change of circumstances. Or the researchers perception of demand may alter in the light of additional information gained. The modified view of demand and/or new technologies available may also change the set of potential alternatives to satisfy the demand which was identified as the basis for the testing stage.

2.4.1 Exploring the demand for innovations

The exploration of demand for innovations sets the course for all subsequent steps. Care should be taken that the on-farm research process is steered off to the right direction here. Unsatisfactory results in the development of innovations are often the result of a one-sided, superficial or incomplete approach at this early stage.

Purpose

The exploration of the demand for innovations determines the subsequent development stages in terms of

- location;
- target group and
- problems and potentials to be addressed.

It must answer questions such as:

- **Who is making demands?**
  i.e. for which group of people is the matter relevant?
- **What is demanded?**
  i.e. what problem is to be addressed by the subsequent research?
- **Where is it demanded?**
  i.e. are these problems relevant to the whole programme area, or only for part of it?

"What could we try out?" Farmers needs determine the course of action

Who is the target group ?

The obvious answer to this question is that it is **farmers** who are to benefit from the innovations to be developed.

Often **"farmers"** are mistakenly "lumped together" by programme planners as a homogeneous undifferentiated mass. Every farmer has got his own goals and is working under different conditions from his neighbor. **Target grouping** helps to strike a balance between two extreme alternatives:

(a) the impossible task of developing recommendations for each farmer and
(b) the inappropriate one of developing one recommendation for the whole farming community despite differences in farming systems, determining goals and circumstances.

"Target grouping", as it is described in Chapter 6.1.3, considers both the questions of **"where"** the innovation is demanded and **"who"** is demanding. Target grouping divides the heterogeneous farming population into more homogeneous subgroups on the basis of those factors which determine farming systems (i.e. to natural and socio-economic circumstances, goals and preferences, etc).

The target group "extension workers"

Researchers' immediate "target group" is usually **extension workers** where extension and research is not carried out by the same person or institution. The results eventually achieved are transferred first to extension workers, who in turn are expected to disseminate these results or to help farmers adjusting them to their own specific conditions.

Extension workers' and farmers' perception of the demand for technology are not always identical. The question whose perception of demand should carry more weight -that of farmers or that of extension workers- is a controversial one. To create a good working relationship between extension workers and researchers, which is required for an efficient dissemination of innovations, it may help if the demands expressed by extension workers is seriously taken into account. Though it may not improve farmers' practices immediately, it is necessary at times to address extension workers demands in order to create favourable conditions for the introduction of innovations.

What is demanded ?

This question forms the contents of practice-oriented research.

The term "demand", as it is applied here, refers to **problems** which are to be solved as well as to **opportunities** which could be utilized.

The most important **criterion** for the demand for innovation is that the **need is felt by the target group**. Farmers however may often not mention all the needs they feel due to social barriers between themselves and researchers – for prestige reasons or simply because of the strange interview situation. Particularly at the beginning of the research process farmers may only mention those matters which in their view correspond with researchers' expectations. Or farmers may expect researcher's interventions according to previous experience with development institutions.

Furthermore, **the target group itself may not beware of its demand for innovation** because they lack the necessary experience or knowledge. This applies to actual production problems, where perhaps **existence without a certain problem is beyond the farmer's experience** (for example, pest or disease problems, the absence of which is virtually unknown). It also applies to problems which **slowly develop** and are not yet really felt (i.e. environmental pollution in industrialized countries had a long time to develop before people started to consider it a problem; the same can usually be said of slow developing soil fertility problems). Awareness of demand requires, furthermore, a knowledge of the possible supply (you

would not know, for example, that you need a stereo music system if you are unaware that such a system exists). Many opportunities are just not utilized, because they are not known (like the possibility of improving production with a new variety or a new crop).

Because the aim is for farmers to eventually express their demands themselves, researchers will have to assist them in the formation and articulation of their needs. Researchers' role at this stage will be:

- to clarify expectations with regard to the possible results of on-farm experimentation;
- to identify and show cases where the demand is already obvious;
- to show or develop examples (pilot technologies) which reveal the potential of those opportunities which are not yet utilized.

In order to achieve this, the researcher will have to develop his **own hypotheses** as to demands which are not yet perceived or experienced by the target group.

Where is the innovation demanded ?

This question focuses on the geographical distribution of the demand for innovations. It is important where the programme area is heterogeneous in terms of natural or socio-economical conditions and farming systems. Differences with regard to factors like soil, rainfall or marketing facilities can considerably influence the demand for innovation. On-farm research programmes should be actually run in those areas where the demand was identified.

Tools and methods

Where problem consciousness of farmers is not well developed yet, the exploration of demand may be initially based more on researchers' perception. As confidence between farmers and researchers improves and farmers' problem consciousness develops, the exploration of demand will be guided more by farmers' own opinions.

An useful procedure for the researcher to develop a hypothesis as to existing demand is shown in Figure 2.2. The analysis of **secondary information** is utilized to develop an working hypothesis. This is the basis for a

subsequent exploratory survey (a combination of individual interviews and group discussions with farmers, and field observations made by the researcher) and for the dialogue on innovation.

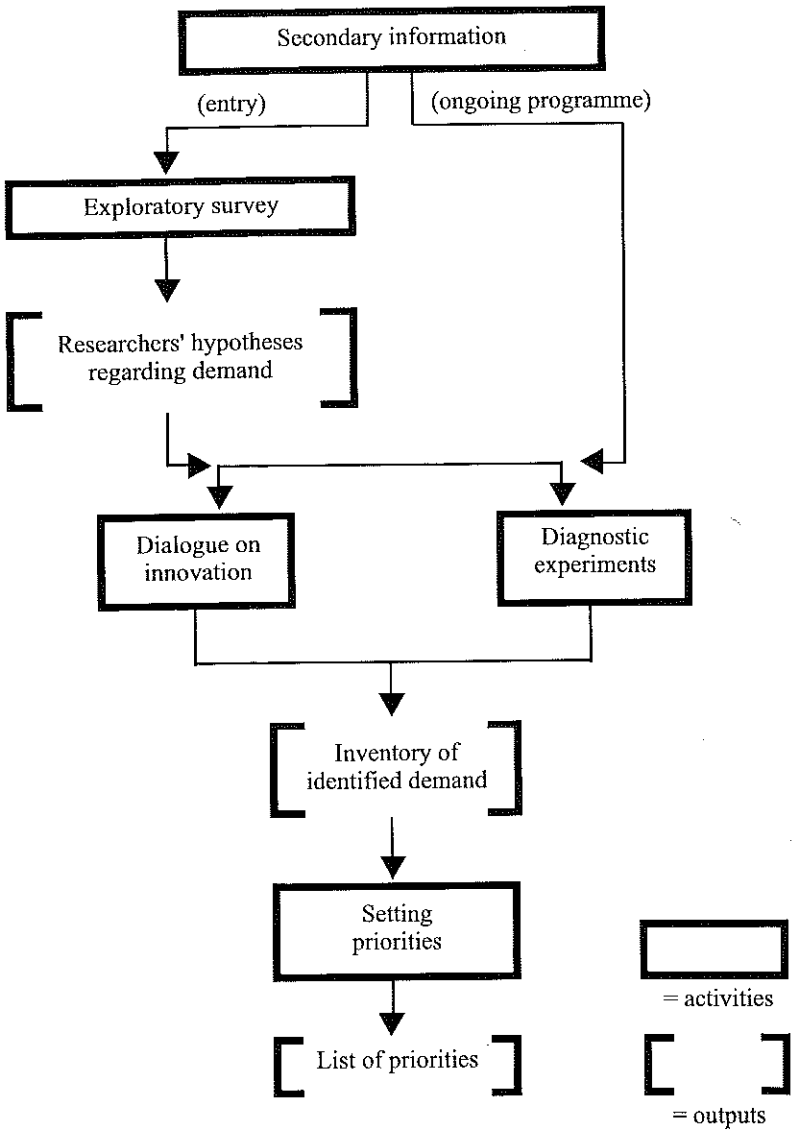
The **exploratory survey** is not a must. It can be, however, helpful at the beginning of a research process where problem consciousness and problem solving capacity of the target population is not well developed yet. The exploratory survey (see Chapter 4.2.1) allows the researcher to develop his preliminary hypotheses with regard to the demand for technology. These hypotheses can in turn form the basis for more exploratory work (for example diagnostic experiments if interrelationships between production factors and productivity need to be clarified), for confirmatory studies (for example, a formal survey if decisions as to subsequent steps require quantitative validation of the hypothesis) or for a dialogue on innovation.

A **dialogue on innovation** (see Chapter 4.2.2) is the crucial element in the exploration of demand. It is the first really participatory element in the research process. Farmers are the "subjects" of the research. They determine the course of action through their analysis of demand and their setting of priorities, whereas their role was more that of the "object" and informant of the researcher during the exploratory survey.

Reference is made to:

- Chapter 4.2.1 for the exploratory survey;
- Chapter 4.2.2 for the dialogue on innovation;
- Chapters 6.1.1 – 6.1.4 for analytical methods which are useful in the dialogue on innovation and can help to analyze information from exploratory surveys.

Figure 2.2: Tools and methods for the exploration of demand



2.4.2 Identifying alternatives

At this point the focus of subsequent experimentation should be determined. To simply hope for a lucky hit, as which researchers sometimes do, reduces the likelihood that the direction chosen for experimentation really contains the technology which could best meet the demands of the target group. The following, therefore, outlines a systematic approach to the identification of potential options so as to improve the chances of success.

"What's a good banana?" Farmers criteria play an important role in the identification of trial options

Purpose

"Identification of options" means to select according to **defined criteria** a set of **available technologies** which appear to be **appropriate to satisfy the identified demand**.

This stage defines the subject of the subsequent experimentation. As a basis for this, **criteria** are first to be determined which are used to assess which technology potentially meets the identified demand. The same criteria determined here are used later on throughout the subsequent stages to assess whether the selected technologies really met the demand.

The identification of **options** is an important interface with station-based research. Ideally it is expected that station-based research makes available required technologies as far as they are developed already, or develops these technologies if they are not yet available.

Activities and methods

The identification of potential options consists mainly of listing and screening available technologies. A possible procedure for this is shown in Figure 2.3.

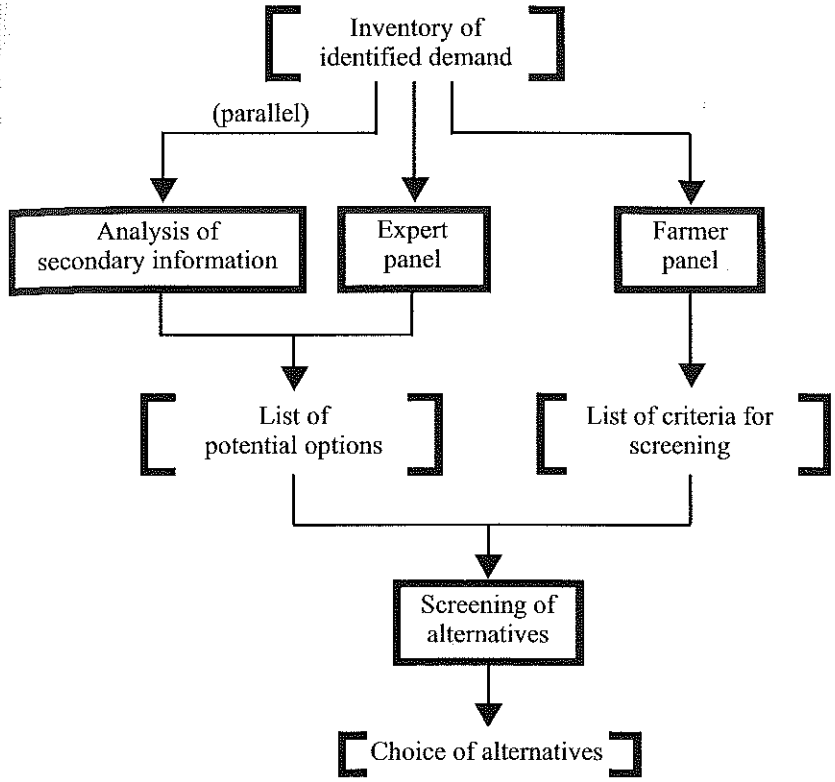
An essential step in the preparation stage is to analyze secondary information on the subjects determined by the exploration of demand. This can be written documentation of results from research stations within the area or research institutions working in a similar environment. Also direct communication with relevant station based researchers is absolutely necessary because not all the information available is documented.

In this context it is also important not to forget options already independently developed by farmers. Such information may already be available from the dialogue on innovation or the exploratory survey and researchers should be on the lookout for it.

Based on the information available, a list is made of options which potentially satisfy the identified demand. This list should be as broad as possible to ensure that no alternative what so ever is left out. The feasibility of the alternatives does not need to be considered now. It is, however, helpful to formulate the alternatives as precisely as possible in order to facilitate the logical deduction of treatments for the testing stage later on.

The list of alternatives can be drawn by the team conducting the on-farm research. Better results are achieved if an "expert panel" is employed, comprising the on-farm research team, appropriate farmers, relevant station-based researchers and extension workers.

Figure 2.3: Proposed procedure for identifying options



The same panel can also draw up criteria for screening the alternatives. However, a more appropriate team of experts to define criteria for screening would be a discussion panel consisting purely of farmers.

Criteria for screening

The listed alternatives are systematically screened through a set of defined criteria in order to avoid an arbitrary selection of technologies for testing.

These criteria describe a number of essential qualities an innovation should have in order to meet the identified demand.

Table 2.4 gives an example of possible criteria for screening categorized under five subheadings:

- feasibility under given socio-economic circumstances;
- correspondence with farmer' goals and preferences;
- feasibility under given natural conditions;
- ecological viability;
- economic viability.

Table 2.4: List of criteria for screening of alternative technologies

(1) Feasibility under given socio-economic circumstances
- correspondence with farmers' skills;
- availability of input and produce markets;
- sufficiency of farmers' resources;
- sufficiency of research resources.

(2) Correspondence with farmers' goals and preferences
- correspondence with food/taste preferences;
- compatibility with cropping pattern/cropping calendar;
- interaction crop / livestock.

(3) Feasibility under given natural conditions
- expected production as compared to present situation;
- expected stability of production;
- expected production risks.

(4) Ecological viability
- expected effects on the natural environment;
- expected effects on the long term productivity;
- expected effects on diversity of agro-ecosystems.

(5) Economic viability
- profitability as compared to present situation;
- expected effects on produce markets.

(6) Further criteria

Though these subheadings may be universally applicable, the individual criteria and their significance will depend on the respective subject. For every subject determined in the "exploration of demand", a new list of screening criteria will have to be developed.

Reference is made to:

- Chapter 6.1.5 for analytical approaches to screening

2.4.3 Testing alternatives

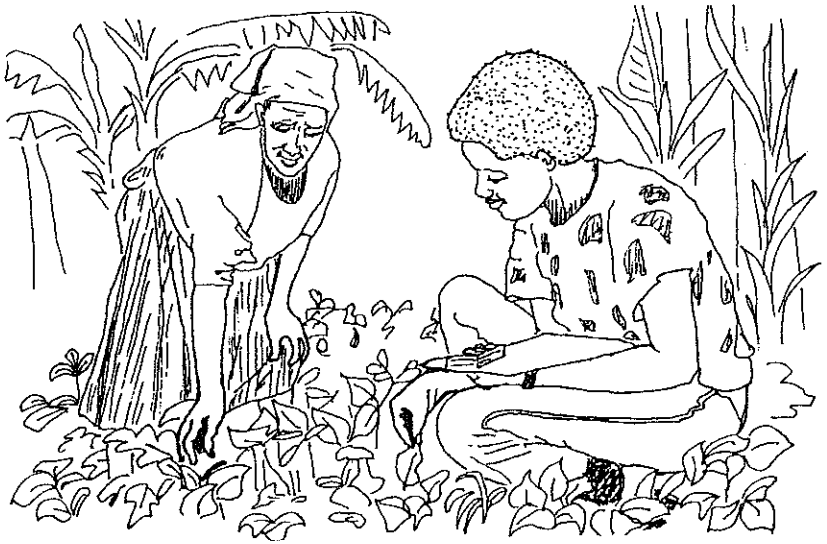
The testing of alternatives is one, but not the only important component for the development of appropriate innovations. The most excellent experimentation will not cover up a superficial preparation or analysis. The testing of alternatives is also not implemented as an end in itself but as a basis for the collection of information. This information is of agronomic as well as of socio-economic nature, as it will be shown in the following.

Purpose

The purpose of this stage is to
- **plan and execute experiments** which are used as a basis for
- **collecting the data** required to examine how far the tested technologies comply with the criteria defined earlier.

The nature of the data to be collected should have basically been determined already when the criteria for the identification of appropriate alternatives were defined.

They cover:
- the feasibility of a tested technology under the given socio-economic circumstances;
- the correspondence with farmers' goals and preferences;
- the feasibility in to the local environment;
- the ecological viability, and
- the economic viability.



"What's happening in our trial?" There is a lot researchers can learn from farmers during experimentation

Agronomic data, which are often the center of attention, are important for assessing the suitability of a technology to the local environment. They are also an important basis for determining economic viability. Agronomic data are not, however, the only important data. **Equally important is also socio-economic** data on how feasible an innovation is likely to be under the given circumstances and on its correspondence with farmers' goals and preferences. Gathering socio-economic data sometimes requires even more effort if agronomic data are available already from station research.

Furthermore, it is also helpful to examine how far the tested technologies are taken over by participating farmers. Farmers themselves are in the best position to judge whether a new technology really meets actual demand. Nevertheless it has often been observed that shortcomings of a technology do not come to light through dialogue with farmers. The examination of adoption by farmers is, therefore, a valuable indicator of the appropriateness of an innovation and, where necessary, a good starting point for a dialogue about its shortcomings.

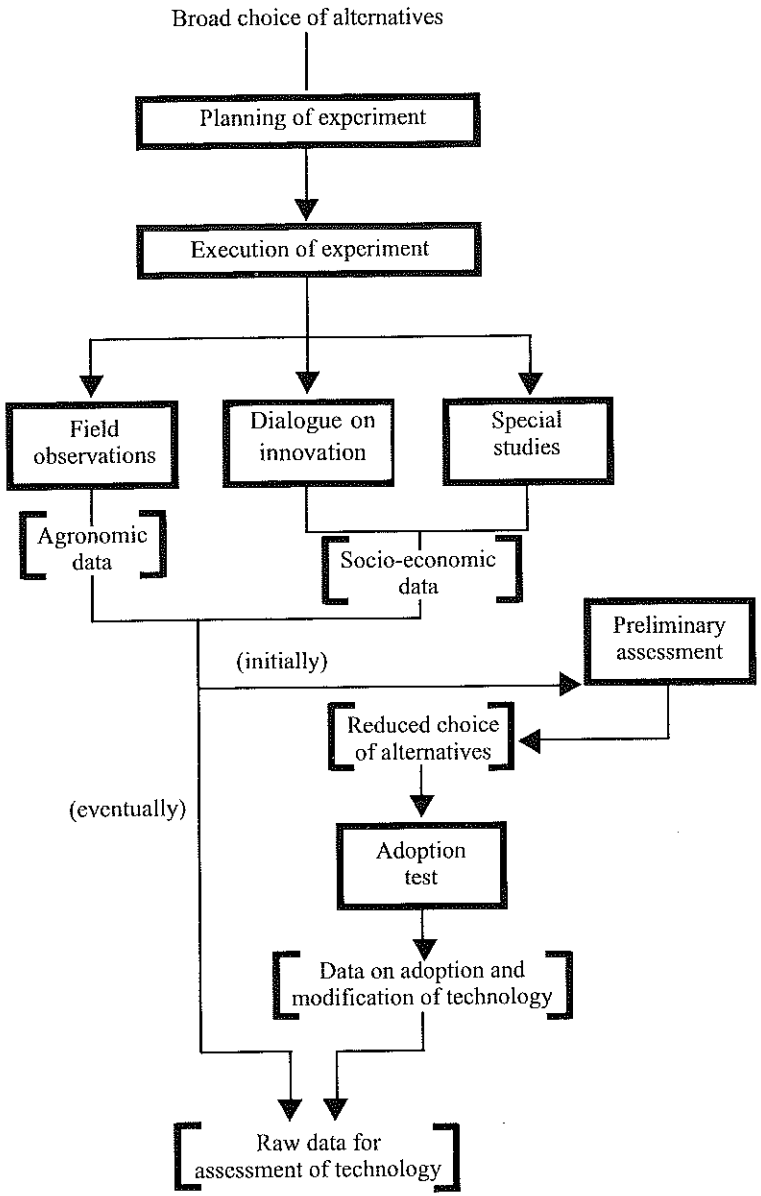
Procedures and methods

What has been stated concerning the overall process of on-farm research applies in particular to the testing stage: there are no "strict rules" which are universally applicable. Instead, the guiding principles given here rather need to be adapted to the specific situation of a project and the question to be answered by the experiment.

In any case, the testing stage should start with the **planning of experiments**. This includes the definition of **objectives** and, closely related, of relevant **data to be collected**. This process is, by and large, a translation of the screening criteria which were drawn up during the identification of options. Furthermore, the alternatives identified are transformed into experimental **treatments**. Also decisions are made at this stage concerning the **arrangement of treatments** (or the trial design), **suitable experimental sites** and **appropriate management**.

Experiments executed in the field form the basis for collecting data needed to confirm whether the alternatives being tested comply with the defined criteria. Different criteria require different **types of data** and, accordingly, different **methods of data collection**.

Figure 2.4: Possible sequence of data collection



Assessing a technology's suitability to the local environment and its economic viability mainly requires agronomic data. This information comprises measurements and observations collected in the trial field.

The correspondence of a technology with farmers' goals and preferences is largely assessed by farmers themselves. Relevant information is collected in a "dialogue on innovation" with farmers. Farmers' participation in the assessment of a trial technology takes place at this stage. Specific studies or secondary information analysis may be required if further socio-economic data is needed (for example on price fluctuations, market structures etc) .

The **adoption or non-adoption** of an innovation by participating farmers gives the ultimate answer to the question of whether a trial technology complies with the required conditions in the view of farmers. Relevant data can be, for example, collected in a formal survey combining interviews with farmers and field observations in the season after the trial. The survey may also tackle the question of whether farmers modified the trial technologies in order to better adapt them to their specific situation.

Not all experiments will require the collection of all **types of data**. The data to be collected and the **sequence of activities** largely depends on the objectives of the experiment and the information already available. A possible sequence of activities is proposed in Figure 2.4.

Sequence of data collection

The early literature on on-farm research commonly suggested a defined **sequence of data collection**: agronomic data were the focus of attention in the first seasons of an experiment. Agronomic criteria were used to narrow down the choice of alternatives. Farmers' responses and other socio-economic factors were analyzed only with regard to a limited choice of alternatives.

Experience has shown, however, that agronomic criteria applied by researchers frequently deviate from those criteria important to farmers. As a result, the agronomically "best" technologies are often rejected by farmers. "Second best" alternatives however, corresponding better with farmers' goals and preferences, had already been dropped from experiments by the time farmers were asked for their opinions.

A widespread conviction among on-farm research practitioners is, therefore, that **farmers should participate in the assessment of the trial technologies as early as possible**. Instead of following a fixed sequence with

regard to the types of data collected, the data collection should be guided by the actual requirements of the experiment. This means, the data collection procedures should be individually tailored for every experiment (and, in fact, the design of an experiment may require adaptations to the data to be collected in the course of the experimentation). The **guiding principle** could be the question for the **most critical factor**(s) determining the adoption of a specific technology by farmers. Depending on the answer, the focus of data collection can either be first on socio-economic or on agronomic data or both can be collected simultaneously on a similar scale.

The only logical order of procedure is to first collect in-depth socio-economic and agronomic information for a larger choice of alternatives on a limited scale. Thereafter more superficial data on adoption are collected for a narrower choice of the most promising alternatives on a broader scale. Good socio-economic data, in particular information related to farmers perception, require as much attention as the collection of agronomic data. Experiments in this respect can be made, therefore, only on a relatively few farms. On the other hand, a relatively large number of representative farmers is eventually required to asses adoption or to monitor which modifications to the technology are made by farmers.

Reference is made to

- Chapters 5.1. and 5.2 for planning of experiments;
- Chapter 5.3 for the implementation of experiments;
- Chapter 4.2.2 for the dialogue on innovation;
- Chapter 4.2.3 for the implementation of surveys to analyze adoption.

2.4.4 Assessing tested alternatives

A new technology is often judged to be appropriate based exclusively on its productivity as determined in the experiment. As a consequence, many new technologies are not taken over by farmers because they do not comply with their goals and preferences or the circumstances they face. In the following, therefore, a more comprehensive approach to the assessment of a new technology will be described.

Purpose

The assessment of options is basically a desk job for the on-farm research personnel. It synthesizes all the collected data and the opinions already collected from farmers in the previous step in order to determine which of the tested alternatives are most appropriate for the given set of conditions, with reference to the following criteria:

- feasibility under the given socio-economic circumstances;
- correspondence with farmers' goals and preferences;
- feasibility in the local environment;
- ecological viability;
- economic viability and
- adoption by the target group (this is the ultimate indicator, i.e. that the farmers themselves consider a technology to meet the actual demand.

"What is the best – and why?" Farmer's assesment decides about the success

The results of the assessment determines further action:

Only a technology which complies with all the defined conditions is ready for dissemination.

The research cycle is re-initiated,

- if none of the options tested meets all the conditions,
- if the required data are not complete or
- if there are still doubts with regard to the appropriateness of the options.

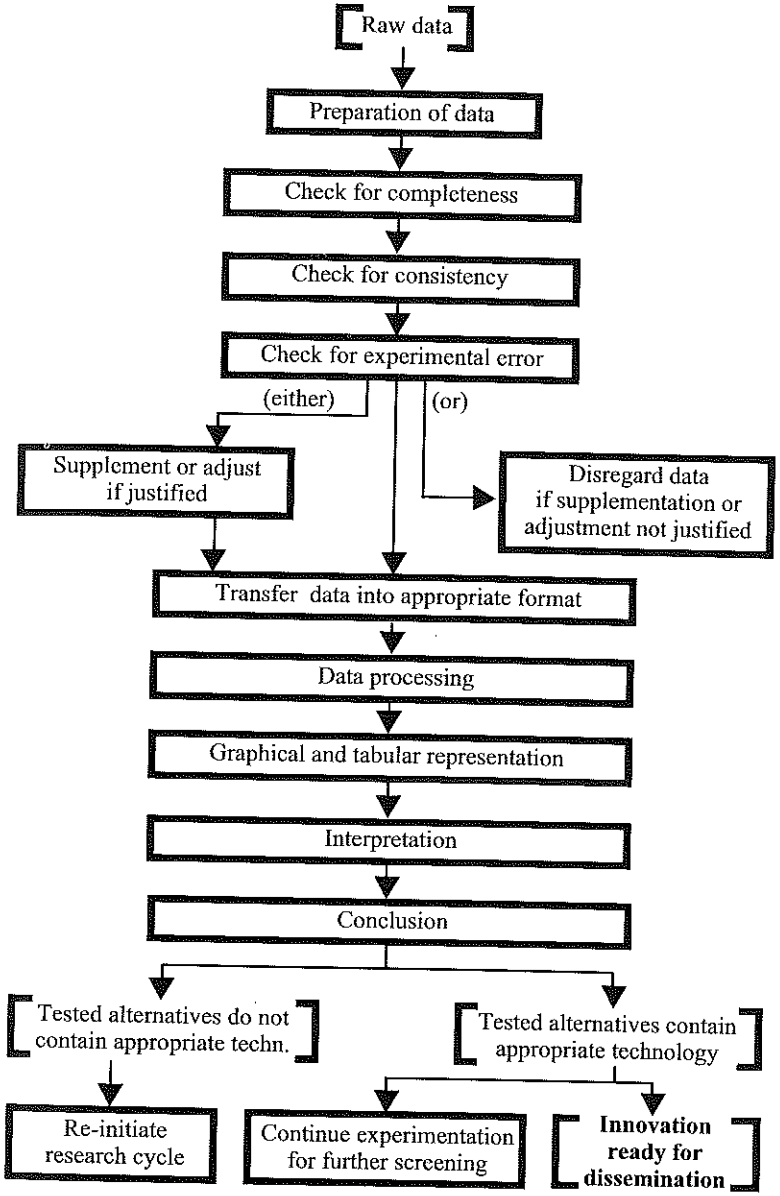
Procedure and methods

A suggested procedure for assessing the trial technologies is shown in Figure 2.5.

Preparation of the raw data for analysis is the first and often most time consuming step. To a large extent it determines the quality of the final result. It involves checking for completeness, for experimental errors and for data consistency as well as transforming of data into a format appropriate for processing.

Incomplete data must be supplemented and incorrect or inconsistent data adjusted as far as it is possible and justified. Data sets where supplementing or adjusting is not possible or practical, are disregarded from further processing. The remaining data sets should be arranged in a format appropriate for further processing. This is important in particular where computer facilities are utilized for data processing.

Figure 2.5: Proposed procedure for analyzing on-farm trials



The data are processed using appropriate statistical procedures. **Tabular and graphical representation** of the results simplifies their **interpretation**. **Conclusions** are to be drawn regarding whether any of the trial technologies complies with the defined conditions. The conclusions determine further action, for example whether

- to **continue the experimentation** to collect further data. This can be the case if the available data do not appear to be conclusive. As was mentioned earlier, not all data considered necessary may be collected simultaneously but stepwise, the most critical ones first. In this case the decision to be taken is whether the data already available justify a continuation of the experiment;
- to **re-initiate the research cycle** if none of the tested alternatives meet all the defined criteria;
- to **disseminate the results** if one or more of the trial technologies meet all the defined criteria. If more than one technology tested in an experiment meet all the set conditions it would be worthwhile to not only promote what is considered the best technology by the researchers but a choice of alternatives to submit to farmers' own judgement.

Reference is made to

- Chapter 6.1.6 for the qualitative assessment of treatments by farmers;
- Chapter 6.2.1 for preparation, supplementation and adjustment of data;
- Chapters 6.2.2.1 for the statistical and 6.2.2.2 for the economic analysis of experimental data;
- Chapter 6.2.2.3 for the analysis of farmers assessment.

2.4.5 Disseminating innovations

The on-farm research process described is not implemented for the sake of publishing results but in order to make better agricultural technology available to farmers. The mere publication of an annual report will usually not suffice to achieve this goal. The dissemination of results requires as much attention as the other stages in order to ensure that developed technology really reaches its target group.

"What's new?" Creating awareness is an important task of extension workers

Different approaches to research require different procedures with regard to the dissemination of research results. Two principal approaches are differentiated:

I Research and extension are carried out by different persons or organizations

The immediate target group of researchers for the dissemination of results is extension workers, **where extension and on-farm research are not done by the same persons or institutions**. In this case it is the responsibility of the researcher to spread knowledge about innovation amongst extension workers.

It is recommended that decisions about which innovation to be disseminated to farmers should be made by extension workers rather than by researchers. This increases the chance that chosen innovations are promoted with conviction. The role of researchers at this stage should rather be

- to ensure that the results of research are made available to the extension workers concerned,
- to make the results understandable to extension workers and
- to advise extension workers with regard to their decision about the appropriate choice of technology.

Extension workers should be involved in the development of new technologies as early as possible to ensure that they promote the final choice of innovations with conviction. Suggestions for achieving an effective dissemination of results include:

- the participation of extension workers in exploring the demand for innovation, the identification of available options and the assessment of tested options;
- field days or field tours to familiarize extension workers with the ongoing programme and to keep them informed on progress;
- regular meetings and/or workshops to present and discuss results and, if possible, to draw conclusions with regard to their impact on the extension contents;
- distribution of written results; a presentation in bite-sized pieces, for example in the form of a regular newsletter or subject-specific paper is more easily digested than a comprehensive annual report;
- initiation of or participation in the preparation of extension materials.

II On-farm research is part and parcel of the extension work

In many extension and rural development programmes the development of innovations through on-farm research is part and parcel of the extension workers job. **On-farm research and extension are carried out by the same person.**

In this case one task can be the dissemination of locally realized outcomes of experimentation from those farmers participating in the on-farm research to those not actively involved. Another important task can be to spread ideas and experiences about how farmers can experiment with potential innovations by themselves.

Possible activities at this stage include (adapted from ILEIA, 1992):

- field days or field tours including farmers not participating in on-farm research to spread ideas within a village;
- cross visits from village to village in order to share ideas and experiences;
- field workshops with farmers;
- "farmer-to-farmer-learning-by-doing-training";
- developing written or audiovisual materials for farmers.

Reference is made to

- Chapter 3 for principles of communication with target groups.

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Part II The Tools

Chapter 3 Communication with farmers*

* This chapter is adapted from **Ashby, J. A. 1990.**: Evaluating technology with farmers. IPRA/CIAT, Cali, Colombia

Chapter 3 Communication with farmers

3.1 Factors determining the relationship between farmers and researchers

It requires more than technical skills if a researcher wants to involve farmers effectively in the development of innovations. Good collaboration requires mutual trust which stands or falls with the communicational skills of the researcher. These are to some extent a matter of natural gift, but some important techniques can be learned. In the following, a few tips and hints for getting in touch and communicating with farmers in a dialogue on innovation will be given.

Talking to researchers – a special situation for farmers

When farmers are talking to researchers or extension agents, they are often acutely conscious of being in a very special social situation. The researcher will usually be more educated than the farmer and often uses different words or scientific terms which the farmer is unfamiliar with. Differences will be visible in dress. Often farmer and researcher are from different cultural or ethnic groups and may even speak different languages. All these differences are obvious to farmers, making them aware of being in a social situation they are unaccustomed to, and putting them on their guard about what they say or do. As a result, it is rather common that farmers do not express what they really feel or think in the conversation with the researcher.

Farmers are guided by

- **expectations:** researchers (or extension workers) are often seen as people who have access to knowledge, techniques or inputs which can be valuable to farmers. They may, therefore, be in the position to bring improvements from outside. While such expectations may create a healthy motivation for farmers to participate in on-farm research, they can also create reserve, because the farmer does not want to offend the visitor.
- **suspicion**: farmers are often suspicious of the researchers real motives. Why should a stranger be interested in helping farmers?

Bad experience with outsiders in the past can intensify suspicion. Suspicion can be particularly intense when farmers and researchers are from different ethnic, religious or social groups that have been in conflict in the past.
- **deference**: farmers may perceive researchers as socially superior, because of their status as a government official, their better education, etc. This feeling will be the stronger the more rigid the social or political order. Subconsciously researchers may share and even reinforce the deferential relationship. In such a situation farmers have the tendency to look for clues about what the researcher is thinking and to defer to what they believe to be the views of the researcher.
- **courtesy**: even if farmers are not guided by their expectations, by suspicion or deference, farmers may be reluctant to disappoint the researcher by pointing out a flaw in the technology.

Researchers' tasks

The goal is not achieved if farmers express their approval of a potential innovation because of fear or suspicion, deference, or politeness, but only if the innovation really meets farmers needs. One of the most difficult tasks of the researcher is to **encourage farmers to express frankly their own views**.

It is therefore necessary to **clarify expectations** and to **reduce suspicion** or fear. It also means **not imposing own views** on farmers, consciously or unconsciously.

The necessary trust of farmers does not occur spontaneously. It needs **careful nurturing** throughout the entire research process and often takes years to develop.

3.2 Establishing a collegiate working relationship with farmers

Successful on-farm research requires that farmers frankly express their opinions about the technology which researchers and farmers are testing together, and are willing to discuss the reasoning behind those opinions. The essential ingredient of success is a high degree of trust and confidence between the researcher and farmer. This means that each party feels sure he understands the other's motives, what the other stands to gain from cooperating, and what the other expects (and does not expect) from him.

Establishing such mutual understanding involves a social interaction between the researcher and the farmer in which many spoken and unspoken signals are exchanged, as in any face-to-face communication between people. The researcher's awareness of these signals, and his skills in consciously managing them, will determine the success of the evaluation. In this section, we review the techniques which researchers need to exercise in order to achieve successful communication with farmers.

"Entry" or managing first impressions

The term "entry" refers to the procedures used for gaining acceptance in the farming community for the initial presence of the on-farm research team, and for establishing an understanding among community members of what the research is about. Even when farmers are totally accustomed to the frequent presence of outsiders whose main activity is to ask them questions, the initial activities of the on-farm researcher create first impressions which may be beneficial or prejudicial to the success of interaction with farmers later on.

When the on-farm researcher or team begins field work in a farm community, their actions will stimulate curiosity and speculation ranging from mild to intense. Farmers will ask themselves questions such as:

"What do they really want to find out from us?"
"How might they bring harm to or benefit us?"

It is important to be aware that first impressions and the way in which farmers discuss and answer such questions among themselves can influence the ease or difficulty with which relationships of mutual trust and confidence are established. Therefore, the presentation of the researchers' objectives needs to be carefully structured from the very start.

As discussed in the preceding section, the researcher is likely to encounter several possible expectations on the part of farmers involved in the research. The farmer may define the social situation in which he is being asked to take part in some or all of the ways illustrated in Table 3.1.

Table 3.1.: Conventional expectations of farmer-researcher relations

Definition of researcher's role	Definition of farmer's role
Researcher is the expert.	Farmer is the layman.
Researcher is a social superior.	Farmer is a social inferior.
Researcher represents modern agriculture.	Farmer represents backward traditional agriculture.
Researcher merits deference from farmers.	Farmer should show deference to researcher.
Researcher asks questions.	Farmer gives answers.
Researcher makes decisions.	Farmer complies with researcher's decisions.
Researcher controls strategic resources, may harm farmer, i.e. act counter to farmer's interests.	Farmer lacks control, is powerless to influence researcher's behaviour, is dependent on researcher's goodwill.
Researcher is supposed to teach and convince the farmer that the new technology is better than existing practices.	Farmer is supposed to learn from received wisdom of researcher.

These expectations are possible sources of bias which are likely to discourage farmers from giving researchers frank opinions. They may also motivate farmers to distort the information they give to researchers. The researchers basic objective must be therefore the elimination of these expectations. He must recast them and try instead to build the expectations summarized in Table 3.2.

Table 3.2: Key expectations for successful farmer evaluation

- Researchers and farmers are experts in their own knowledge and experience.
- Both types of knowledge merit mutual respect.
- The farmer's agricultural practices and whole way of life are respected and esteemed by the researcher.
- The farmer needs to understand the technology that is being tested and therefore has the right to ask questions; he is entitled to explanations and justification of the research.
- The researcher is motivated to learn from the farmer who therefore teaches as well as learns.
- The farmer will be responsible for decisions that can make or break the success of the research.

This brings us to an important principle for achieving successful on-farm research: it is essential **not to think of farmers as passive informants** in the research process. The farmer who is treated as passive informant is not very likely to take an active interest in the research, or to make an effort to formulate opinions about the technology. He is very likely, though, to give answers that he guesses are what the person asking questions wants to hear. The success of an evaluation depends, therefore, on creating a social relationship in which **the researcher and the farmer are both active participants** in research, questioning, studying, and arriving at conclusions together. The first step in creating this type of understanding is at the point of entry, when it is critical to explain thoroughly the objectives of the research, and to entertain questions and discussion about these objectives and what they imply in terms of farmer participation.

Clarifying expectations

A good social understanding between farmers and researchers is not enough to ensure effective participation of farmers in the on-farm research. Farmers must also understand well what is being studied. If farmers don't know or understand the research objectives, their assessment will be superficial and misleading. To prevent this from happening, it is useful to arrive at the field site for the first time prepared to volunteer the following types of information:

- Your name.
- Your professional role (a simple job description).
- Your institutional affiliation (explain what the organization is called and what its main activities are).
- Reasons why researchers want to work on farms.
- Reasons why researchers need to talk with farmers.
- An explanation of what an experiment is, what is done, and for what purposes.
- An explanation of the role farmers will play in the research.
- Reasons why the farmer's role is important (how research will succeed or fail depending on whether farmers take part).
- An explanation of what farmers can hope to gain (and cannot expect to gain) from taking part.
- An explanation of what researchers cannot do (provide rural electrification, install schools, etc.).
- An explanation of your special interests and expertise (related to specific crops, disease, etc.), and of these types of information you are interested in.

Figure 3.1 summarizes these topics in the form of a flowchart. The development of a flowchart is a useful technique for planning and carrying out an open-end dialogue with farmers on any number of topics. Use of a flowchart helps to structure communication with farmers on any number of topics. Use of a flowchart helps to structure communication with farmers towards a particular objective without imposing the rigidity of a questionnaire. Researchers can refer to a flowchart during discussion with individuals or groups of farmers to check that essential topics have been covered, and that particular points of importance have not been forgotten.

In the example in Figure 3.1 the dialogue is divided into three stages: warm-up, development, and the closure.

In the opening stage, the **warm-up**, the key expectations summarized earlier in Table 3.2 are defined by the researcher's presentation of him or herself.

In the second or **development stage** of the interview, the researcher develops two general themes:

1) The general purpose of the contacts being made with farmers;

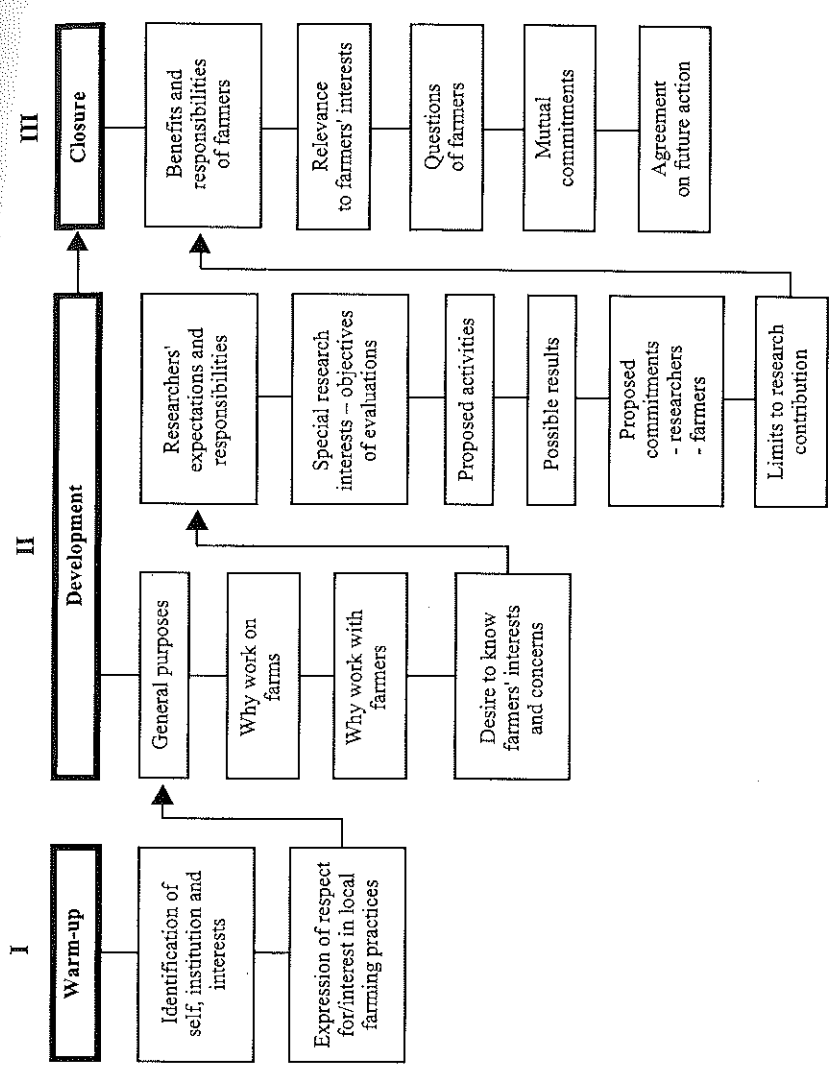
2) The expectations the researcher brings to the proposed relationship with the farmer, and the responsibilities of both sides involved in taking part in the proposed activities.

Finally in the **closure stage**, the researcher aims to verify that effective communication has been achieved concerning:

1) What the farmer can hope to gain from taking part in the programme (inviting questions to clarify the farmer's perceptions);

2) Agreement on mutual commitments and future action.

Figure 3.1: A flowchart of a dialogue with farmers for explaining the purpose of farmer evaluation



Several techniques for managing this open-ended style of communication with farmers will be treated in detail in the later section on face-to-face communication skills. Others are basic principles of conduct which influence first impressions and the effectiveness of dialogue with farmers. These are briefly discussed below.

Treating the farmer as an expert

Farmers are asked to participate in on-farm research to mobilize their farming systems expertise. While it goes without saying that not all farmers have the same level of competence in local farming practises, the researcher must treat each farmer as an expert. This is an important principle for laying the basis for a good working relationship with farmers. Therefore, it is extremely worthwhile for on-farm workers to communicate in initial contacts their intent to learn from the farmers.

A verbal explanation of why researchers want to learn from farmers is important, but not always convincing to a farmer who is accustomed to feeling deferential or suspicious towards official visitors. Therefore, the researcher should **communicate non-verbally** the value he places on a farmer's experience and wisdom, by asking the farmers to teach and explain some local practice or techniques which will be relevant to the proposed activities.

Such teaching can be done by individual farmers or by a group of farmers. It can focus on the use of traditional tools, planting methods, management practices (such as weeding), or harvesting methods, depending on the stage in the local crop season in which contacts with farmers are being initiated. For example, researchers who have never practiced farming as small farmers might ask for instruction on the use of traditional tools. Upon receiving such instruction, they will probably be surprised at how difficult it can be to manipulate the local tools expertly. Yet showing incompetence in such a situation, where the farmer is the expert, is constructive rather than damaging to the working relationship needed for conducting effective on-farm research: it will reinforce the message made verbally by the researcher, that local farmers will bring unique expertise to bear on development of innovation. The researcher, by getting his hands dirty in such a situation, sends the non-verbal message that local farming practices are worthy of respect, a message which is especially important in cultures where low status is associated with manual work.

Treating the farmer as an expert also involves **showing respect for the farmers time**, for local hospitality and social customs. Effective interaction will not be achieved if the farmer is in a hurry to get on to some other pressing task while the on-farm worker is trying to explain a proposed trial or conduct an assessment interview. Therefore, at any of the points of contact with farmers discussed in this handbook, it is essential to ask the farmer if he has time for the proposed activity. The appropriate response to any sign of hesitation on the part of the farmer is to request the farmer to suggest another more convenient time.

Equally, time spent in accepting hospitality and chatting on topics unrelated to evaluations is time well spent because it communicates non-verbally a respect for, and interest in, the farmer as a person, which is indispensable to a good working relationship.

Although these principles of field work are usually well-known and appreciated by experienced field staff, it is essential for researchers managing a large number of evaluations to plan to allocate tasks with such considerations in mind, especially in the early stages of contact with farmers. The benefits of doing this are unquestionable. Placing the farmer in a teaching role is an extremely powerful technique for restructuring the conventional expectations of researcher-farmer relationships outlined in Table 3.1, and for subsequently working towards achieving those expectations essential for successful farmer evaluations. And it is especially useful for the dialogue on innovation, because it provides the researcher with the local agricultural terminology, which is indispensable for understanding farmer's concepts. In addition, it communicates the on-farm worker's respect for, and intent to learn from a farmer's knowledge. It also gives researchers the opportunity to assess how articulate different farmers are, as they explain how and why local practices are followed. This is an important criterion for selecting the farmers in some stages of the on-farm experimentation (see Chapter 5.3.1).

3.3 Communicational skills for assessing technologies through dialogue with farmers

Nothing seems more natural or straightforward than for an agricultural researcher or extension agent to talk with a farmer, especially because the topic of conversation is likely to be of profound interest to both. Yet because of the social dynamics of a dialogue on innovation between researchers and farmers in developing countries discussed earlier, the skills required for effective communication with farmers are quite different from those

which come naturally in everyday conversation. For this reason, a dialogue for assessing potential innovations is different from a conversation with farmers.

The open-ended farmer interview in the dialogue on innovation is also a different mode of communication from a survey interview. The survey questionnaire might seek opinions which researchers should be able to predict. In contrast the open-ended dialogue explores what farmers think about the technology being tested. The answers are spontaneous, and not readily predictable. The information researchers will obtain from farmers in the dialogue on innovation is not known until a number of interviews have been completed. This is precisely the purpose of the dialogue: to bring to light the farmers' criteria, which would otherwise be unknown. Some of the most valuable information from dialogue on innovation with farmers can best be obtained trough the proper use of open-ended questions, a technique quite different from the closed questions that are typical of a formal questionnaire. For this reasons, knowledge of how to manage the skills of face-to-face communication is invaluable for an effective dialogue with farmers.

We can divide the face-to-face communication skills useful for the dialogue on innovation into two types of techniques: those for listening, and those for asking questions. **How you listen** to what the farmer says is as important as **what you ask** the farmer. In a well-conducted dialogue with farmers, the researcher should listen more than he or she talks. This by no means implies that the researcher is passive. On the contrary, the researcher must constantly be alert of the need and opportunity to be directive, steering the flow of farmers' comments so that reasoning is clarified and information is gathered which makes sense to the researcher, and can be made intelligible to his or her colleagues. The communication skills discussed here are unobtrusive methods for directing open-ended interviews with farmers so as to achieve an effective dialogue on innovation.

How to listen in a dialogue on innovation

If you could take ten or fifteen minutes to eavesdrop on a conversation between researcher or extension agent (R) and a farmer (F) in the culture in which you plan to conduct farmer evaluations, you might see and hear any of the following:

R agrees with F and interrupts him to give an example of something that supports his point of view.

R contradicts F.

R shows disapproval by vigorously shaking his head, by facial expression or by moving away from F.

R is bored by F, stares into the distance, fiddles with his clothing, picks his fingernails.

F shows R how to do something and R gives F advice on how to do it differently.

R loses interest in what F is saying and introduces a new, unrelated topic of conversation.

R expands on a theme F and overrides F's attempts to speak.

In a discussion about agriculture between a researcher or extension agent and a farmer, these everyday events are very likely to occur because researchers and extension workers have been trained to give farmers advice to improve on what they normally do. Yet each of these normal conversational behaviors is inadmissible and counterproductive to a dialogue on innovation. In contrast to a conversation, the dialogue on innovation requires the researcher or extension agent to be receptive to whatever the farmer says, however contrary to received wisdom this may seem to be. It requires him to use **listening skills** to help the farmer articulate the reasoning that underlies the point of view that he or she is expressing.

Basic skills for listening to farmers will help the researcher to communicate verbally and non-verbally to the farmer that the researcher has a sympathetic and lively interest in the farmer's comments about the technology they are testing together. A useful exercise in this respect is to jot down on a piece of paper, for yourself, the culturally appropriate signals that you can make in a face-to-face conversation to express interest in what the speaker is saying. These might be for example:

- Nodding your head.
- Interpolating grunts that express interest ("uh-huh" and "umm" in English).
- Interpolating "I understand" or "very interesting".
- Leaning forward intently.
- Making eye contact.
- Smiling.
- Taking a relaxed body position.

The important "dont's" in effective listening are therefore:

- Don't get impatient or interrupt the farmer.
- Don't contradict the farmer.
- Don't show disapproval of the farmer's statements, even if you disagree.
- Don't express judgements about the correctness or incorrectness of what the farmer says.
- Don't give the farmer advice during an evaluation, even if your other professional responsibilities or activities involve giving farmers advice.
- Don't convey either verbally or non-verbally that you are bored by what the farmer is saying, even if his comments wander away from topics that are of interest to you.

Body language

It should be clear from making a list of culturally appropriate signals used by an interested listener, that many involve body language. How you position yourself physically in a dialogue with farmers is an important technique for communicating respect, a serious intent to learn, and deference to the farmer's opinions. With practice, such techniques become second nature to the interviewer.

For example, it is quite usual for the researcher, because of his social and cultural origins, to physically tower over the farmer. This, however, implies a researcher's superiority. It is much more tactful for instance, when interviewing in a farmer's plot where a crop is being examined, for the researcher to stoop or kneel while the farmer remains standing, so that discussion can be carried on with the researcher looking up towards instead of down at the farmer. If the dialogue takes place in a setting where it is possible to sit, guide the farmer to a situation where both or all participants in the interview can talk sitting down. Often in a household setting, farmers invite the researcher to sit while the farmer remains standing. Again, it is important to communicate that it matters to the researcher that the farmer should feel comfortable in the interview situation by ensuring that both are sitting.

Very often in a field setting, researcher and farmer stand sweating in the hot sun throughout the interview; consideration for the farmer's comfort can be shown by moving into the shade when practical. This communicates that the farmer's well-being is of concern to the researcher.

Another aspect of body language that can influence how the researcher communicates in an interview is the physical space. Research shows that people position themselves physically in different relations to each other depending on the type of social interaction they are involved in, and common sense tells us this is so. Different degrees of physical proximity are acceptable among close friends, among acquaintances, or among business associates. **Physical distance is a non-verbal way of communicating how much we trust someone**, and the degree of equality between us. How closely we are placed in relation to another person affects our tone of voice, our ability to receive and interpret facial expressions, and many other qualitative aspects of human communication.

It is quite normal in interviews for farmers to position themselves at whatever is culturally defined by them as a formal distance from the researcher, implying deference on their part. Part of the process of establishing relations of mutual confidence in an evaluation interview involves communicating to the farmer that **you, the researcher, wish to close the distance**. For this purpose, there is a useful technique which is integral to the farmer evaluation: have the farmer show you something – a tool, a disease-damaged leaf, an insect, a handful of soil, or whatever is appropriate in the context of the ongoing discussion – and close the physical distance between you in order to examine whatever is being shown. Alternatively, the researcher can take the initiative by picking up some item of interest and, while holding it, invite the farmer to come closer so that both can observe and comment on some aspect. This simple act redefines what is acceptable physical and social space between farmer and researcher, and qualitatively changes the communication that can occur.

Note-taking during the dialogue with farmers can be an important part of the researcher's repertoire of non-verbal behaviors that affirm serious interest in what the farmer is saying. Farmer's acceptance of note taking varies culturally, and it can be perceived as threatening. However, if the techniques for communicating with farmers discussed in this chapter have been followed, by the time the researcher carries out an assessment interview with a farmer, note-taking should be seen by the farmer as evidence of the value the researcher places on the farmer's ideas and comments about the technology they are testing together. The physical act of note-taking by the researcher therefore becomes a signal to the farmer that what is being said is important. Energetic note-taking emphasizes unobtrusively to the farmer that it is a significant topic, and this can be used deliberately by the researcher to get the farmer to expand on a point or to direct the farmer's flow of ideas while the researcher listens.

Body language can be quite different in different cultures. The important body language skills for face-to-face communication with farmer, involve identifying and practicing value-neutral body language which does not selectively support the interviewers' personal values, but encourages the farmer to speak freely.

From listening to questioning: probing

Probing is a technique which combines being a good listener with asking questions which direct the flow of a farmer's spontaneous comment. Probing enables the researcher to direct the flow of the farmer's comments unobtrusively by rephrasing or repeating in the form of a question something of particular interest that the farmer has said. This technique can be used in several different ways:

- Restate what the farmer has just said (the mirror technique):"so it resists the drought..."
- Repeat a remark that has just been made in the form of a question. By doing this, you invite the farmer to expand on this particular theme:"It resists drought?"
- Go back to and repeat a comment made earlier. This can help to steer the farmer's flow of comments in a direction you think important.
- Ask the farmer to clarify: "Could you tell me a bit more about this?"
- Summarize in your own words what you understand the farmer to have said, and ask:"Do I understand correctly?"
- Be prepared to admit uncertainty with the statement:"I'm not sure I understand correctly; you seem to be saying the following..." and repeat the farmer's statement.
- Remain silent (the five-second pause), keeping eye contact. This encourages the speaker to keep talking.

The "key-word" probe is a useful technique for checking your understanding of the farmer's point of view. This involves repeating a key word from what the farmer has just said and asking for clarification: "In what way is it resistant?" Probing is also important if you suspect the farmer is pulling your leg for some reason. It also serves for checking the consistency of a farmer's remarks.

Table 3.3: Key word probes for checking interpretation of what farmers say

Farmers' Comments	Key Word Probe
It's difficult to weed.	In what way is it difficult?
The sprawling plant is an advantage.	What makes it an advantage?
The flavour is better.	What is it about the flavour?
This is easier to grow.	How can you tell its easier?
The variety is too tall.	How does its being tall make a difference? What is "too tall"! – what would be tall enough?

Open questions

There are three main types of questions that the researcher could ask a farmer: leading questions, direct questions and open questions.

- **Leading questions** are a normal feature on everyday conversation. They imply the kind of response that is expected: the speaker may be trying, consciously or unconsciously, to get the listener to agree with or support the speaker's point of view. While leading questions come naturally in ordinary conversation, they do not belong in farmer evaluations.
- **Direct questions** are usually aimed at obtaining specific points of information. For example "How often does this crop association need to be weeded?" The dialogue on innovation is not the appropriate opportunity for direct questions to obtain this type of informationr(which can best be handled with a formal questionnaire) except when specific information is needed to clarify a farmer's opinion or judgement. For example:

  Farmer: "I hate handling this type of straw."
  Interviewer: "What type of straw do you usually use? And how is this different?"

Questions asking for specific points of information from the respondent are usually framed with words like: how; what; when; how many; how often; which.

- Asking **open questions**, however, is a key technique in the dialogue on innovation. They give the farmer free rein of expression without explicitly directing farmer's response. The researcher must, therefore, consciously repress and restrain his natural inclination to ask leading questions based on his personal opinions. He must instead monitor carefully how questions are posed, so that farmers express their own opinions.

Consider the following dialogue between a researcher and farmer who have entered a bean variety trial planted in the farmer's field

Researcher: This looks very nice, some of these varieties appear to be doing really well, don't you think?
Farmer: Yes, well, these are all good varieties.
Researcher: What about this one, doesn't this look as if its standing up well against the mildew?
Farmer: Yes, this is a healthy variety, very resistant.
Researcher: What about the others, don't you think they are less resistant?
Farmer: Well, I think most have suffered from disease; they look pretty sick to me.
Researcher: Yes, this one in particular has problems, don't you agree?
Farmer: This plant is very bushy, it has a lot of disease.
Researcher: Don't you think some of these varieties are rather late flowering?
Farmer: Some, like this one here, have not formed any pods yet; this is definitely very late.
Researcher: Isn't this one rather stunted, maybe this variety needs more fertilizer.... What do you think?
Farmer: Well, we have a lot of problems here with fertilizer; it is very expensive.

This dialogue is loaded with leading questions posed by the researcher like those which begin with the phrase "Don't you think...," or which convey the researcher's own opinions and receive an answer that confirms these. The problem with this style of communication is that it is unlikely to produce valid information about the farmer's true opinions. The researcher in this dialogue has given the farmer no opportunity to take the initiative in identifying what he or she sees as significant criteria for evaluating the trial.

In a dialogue with farmers to assess an experiment, even a question like "Which of the treatments in the trial do you like best?" contains the assumption that the farmer must like something in the trial. The appropriate

open question is better phrased as "What do you think of the treatments in this trial?"

Open questions most useful for the dialogue on innovation are those which stimulate the respondent to express and explain ideas and opinions. Such questions use phrases like: do you think; do you see; why do you believe.

Table 3.4: Open questions to stimulate farmers' ideas

• Can you tell me more about this?
• What would be an example of that?
• What makes you see it this way?
• What are some reasons for that?
• Could you help me to understand this better?
• Have you any other ideas about this?
• How do you feel about that?
• How do you think other farmers would feel about this?
• How would you describe this?

At an exploratory stage of the on-farm research, use of open questions like those in Table 3.4 which invite the farmer to articulate opinions and explain them is especially important.

It is useful therefore, for researchers involved in farmers' assessment of technology to develop a repertoire of questions such as the following:

- What do you think of the trial?
- Are there any treatments which you think are especially interesting? Why?
- Why do you think this difference (among treatments) has occurred?
- What do you think of the appearance of the plants?
- How do you think this treatment compares with that?
- Have you noticed any difference in the management (weeding/irrigation/fumigation, etc.) requirements?

- Why do you think this (referring to an observation made by the farmer) is important?
- What sort of yields do you think we are going to obtain?
- Do you think they are any problems here we should look into?
- Do you see any advantages or disadvantages to this (referring to an observation made by the farmer)?
- How do you think this compares with your current practice?
- What do you think of the time at which weeding (or any other operation) was done?
- If we plant this trial again next season, would you like to do anything differently? Would you like to suggest any changes?

In sum, the technique of dialogue with open questions relies on posing questions with words like:

- Why?
- What?
- How?
- When?
- Do you think?
- Do you see?
- Do you believe?
- What is your opinion?

Questions phrased in this way are open because:

- The researcher does not state his or her opinion in the question.
- The researcher does not imply that there is a "correct" answer to the question.

Establishing neutrality: balanced questions

One purpose of open questions is to show that the researcher is neutral about the preferences the farmer may have for any of the different treatments which the farmer is being asked to assess. It is extremely important to establish this neutrality at the outset of an evaluation so that, far from feeling that he should say what the researcher wants to hear, the farmer

will feel confident that any positive or negative assessment is equally interesting to the researcher.

Often, at the beginning of a dialogue on innovation, the farmer may be noncommittal, aiming to be polite about the researchers' technology, and wondering about what he or she is expected to say. As a result, the open question "What do you think?" may at first elicit a polite response or vague generalities while the farmer stalls for time, hoping for leads which will indicate what opinions the researcher expects to hear. In this situation, the researcher can use the balanced question, which poses opposite points of view without indicating which one the researcher sympathizes with. For example:

Researcher: I've had several interesting discussions with local farmers about this planting system. Some say the plants are too close others say they could be planted even closer. What do you think?
or:
Researcher: I've heard a number of interesting opinions from farmers around here about this variety. Some say they like a bushy plant; others say the bushy plant is a problem. I'd like to understand this better. What's your opinion?

Even though the questions in these examples are presenting the farmer with opinions, they can be useful starter questions in a farmer evaluation because they communicate to the farmer that (a) critical comments are valid and interesting to the researcher, and (b) there is no one "right" answer to the researcher's question.

Other examples of balanced questions which can be used are:

- "Do you think this might require more or less labour/capital/fertilizer/irrigation etc. than what you presently use, or the same amount?"
- "How would you market this, or would you use the products mainly for home consumption?"
- "Would you recommend that we continue to test this, or had we better look for a different alternative?"

The disadvantage of the balanced question is that points for discussion are being introduced by the researcher. The farmer may not perceive planting distances or plant architecture, posed in the first two examples, as important. Therefore, questions which pose alternative opinions are primarily used to warm up the discussion, by reassuring the farmer that his or her

point of view, be it positive or negative, is being sought. Once the farmer is confident enough to take the initiative in an evaluation, listening skills and probing combined with open questions are the appropriate techniques to use.

Summary of communication skills for assessing technology through dialogue

The face-to-face communication involved in an effective dialogue on innovation is quite different from every day conversation or just talking to farmers. In contrast to conversation or formal questionnaire, the open-ended evaluation interview involves the researcher in an exchange of ideas which requires him:

- to communicate respect for and lively interest in farmers ideas;
- to create an opportunity for farmers to express honest opinions;
- to elicit and understand the reasoning behind these opinion.

To achieve valid information about farmers opinion, the person conducting a farmer evaluation needs to consciously use skills for managing COMMUNICATION which include:

- **Listening skills**
  - to communicate receptivity and respect;
  - to hear what the farmer is saying with an open mind.
- **Body language**
  - to communicate respect, trust, and a collegiate relationship, a partnership;
  - to qualitatively improve communication by redefining physical space dictated by cultural norms when the researcher is a social superior to the farmer.
- **Probing**
  - to combine receptive listening with questions which unobtrusively direct the flow of a farmer's comments;
  - to check understanding of the farmer's point of view, and consistency of the farmer's remarks.
- **Open questions**
  - to stimulate free expression of farmers opinion;
  - to avoid giving clues about the researcher's own opinions, which may bias farmers response.

- **Balanced questions**
  - to establish the researcher's neutrality with respect to positive or negative comments;
  - to kick off and warm up the discussion, by reassuring the farmer that different points of view are sought, and that there is no "correct" answer.