STRENGTHENING FARMER PARTICIPATION THROUGH GROUPS:

EXPERIENCES AND LESSONS FROM BOTSWANA

by

Geoffrey M. Heinrich

International Service for National Agricultural Research

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This is the last publication in ISNAR's Special Series on the Organization and Management of On-Farm Client-Oriented Research (OFCOR). Any other papers resulting from the OFCOR study will be published under ISNAR's regular series or elsewhere.

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CABI Descriptors:

agricultural research; Botswana; farming systems; management; participatory research programs

INTRODUCTION TO THE ISNAR STUDY ON ORGANIZATION AND MANAGEMENT OF ON-FARM CLIENT-ORIENTED RESEARCH (OFCOR)

Deborah Merrill-Sands
Study Leader

Introduction

In 1986, ISNAR initiated a major study on the organization and management of on-farm, client-oriented research (OFCOR) in national agricultural research systems (NARS). The study was developed in response to requests from NARS leaders for advice in this area and was carried out with the support of the Government of Italy and the Rockefeller Foundation. The objective was to analyze the critical organizational and managerial factors that influence the way national research institutes can develop and sustain OFCOR programs to realize their specific policies and goals.

What is OFCOR?

OFCOR is a research approach designed to help research meet the needs of specific clients, most commonly resource poor farmers. It complements, and is dependent upon, experiment station research. It involves a client-oriented philosophy, a specific research approach and methods, and a series of operational activities carried out at the farm level. These activities range from diagnosing and ranking problems through to the design, development, adaptation, and evaluation of appropriate technological solutions. Farmers are directly involved at various stages in the process.

In this study, OFCOR programs are analyzed in terms of the functions OFCOR can perform within the larger research and extension process. We have identified the following seven potential functions as a framework for analyzing the organization and management of a range of on-farm research programs in nine national agricultural research systems. The functions are the following:

1) to support within research a problem-solving approach, which is fundamentally oriented toward farmers as the primary clients of research;

2) to contribute to the application of an interdisciplinary, systems perspective within research;

3) to characterize major farming systems and client groups, using agroecological and socioeconomic criteria, in order to diagnose priority production problems as well as identify key opportunities for research with the objective of improving the productivity and/or stability of those systems;

4) to adapt existing technologies and/or contribute to the development of alternative technologies for targeted groups of farmers sharing common production problems by conducting experiments under farmers' conditions;

5) to promote farmer participation in research as collaborators, experimenters, testers, and evaluators of alternative technologies;

6) to provide feedback to the research priority setting, planning, and programming processes so that experiment station and on-farm research are integrated into a coherent program focused on farmers' needs;

7) to promote collaboration with extension and development agencies in order to improve the efficiency of the processes of technology generation and diffusion.

The designation *OFCOR* has been used as distinct from *farming systems research (FSR)* because the latter has come to have very different meanings for different people.

Why Are the Organization and Management of OFCOR Important?

Over the last 15 years, many NARS have set up OFCOR programs of varying scope and intensity to strengthen the link between research and farmers, particularly resource poor farmers. While significant attention has been given to developing methods for OFCOR, provisions for fully integrating this approach within the research process have been inadequate and the institutional challenge underestimated. With the accumulation of experience, it is clear that NARS have confronted significant problems in implementing and effectively integrating OFCOR into their organizations. In many cases, OFCOR programs have become marginalized and have not had the intended impact on the research process.

Improved organization and management are crucial to overcoming these problems. Effectively integrating OFCOR within a research system implies forging a new research approach which complements and builds on existing research efforts. This is no small task. It involves establishing new communication links between researchers from diverse disciplines, extension agents, and farmers. It requires hiring people with the right skills or systematically training existing staff. It requires changes in planning, programming, review, and supervisory procedures. It creates increased demands for operating funds and logistical support for researchers working away from headquarters. And it often involves working with one or more donor agencies. All of these make the management of OFCOR more demanding than that of traditional experiment station research.

This study focuses directly on these issues of implementation and institutionalization. We have analyzed and synthesized the experiences of diverse NARS in which OFCOR programs have been established for at least five years. The intention is to provide a body of practical experience upon which research managers can draw as they strive to strengthen OFCOR as an integral part of their research systems.

Operational Strategy and Products

Our approach has been to learn from the experiences of research managers in NARS. We have built the analysis around case studies of nine countries whose NARS have had sufficient time to experiment with and develop diverse organizational arrangements and management systems for implementing OFCOR. By region, the countries are as follows:

Latin America:	Ecuador, Guatemala, Panama
Africa:	Senegal, Zambia, Zimbabwe
Asia:	Bangladesh, Indonesia, Nepal

The study has generated four different types of reports: country case studies, discussion papers, comparative study papers, and synthesis papers. These are briefly described below and a complete list of the study's publications follows.

Case studies: The case studies are stand alone products. Each is a comprehensive analysis developed by a team of national researchers with personal experience in the individual OFCOR programs. The cases provide useful insights and lessons on the general issues, as well as specific guidance for research policy and the organization and management of on farm research in their countries.

Discussion papers: The discussion papers derive from the cases and are written specifically for research managers. They are short, analytic pieces which highlight important experiences, lessons, or practical solutions to common problems encountered in the organization and management of on farm research in national research systems.

Comparative study papers: The comparative study papers provide a systematic analysis across the case studies. Synthesizing the experience of the case study NARS, these papers provide practical advice for research managers on organizational and managerial issues central to the effective integration of on farm client oriented research within their research systems.

Synthesis papers: These are short papers designed to highlight the principal findings and conclusions of the study.

LIST OF PUBLICATIONS FROM THE STUDY ON THE ORGANIZATION AND MANAGEMENT OF ON-FARM CLIENT-ORIENTED RESEARCH

OFCOR Country Case Studies

No 1 Zambia: Organization and Management of the Adaptive Research Planning Team (ARPT), Research Branch, Ministry of Agriculture and Water Development. S.A. Kean and L.P. Singogo

No 2 Guatemala: Organizacion y Manejo de la Investigacion en Finca en el Instituto de Ciencia y Tecnologia Agricolas (ICTA). S. Ruano and A. Damasallo

No 3 Bangladesh: The Evolution and Significance of On-Farm Farming Systems Research in the Bangladesh Research Institute. M.A. Jabbar and M.Z. Abedin

No 4 Nepal: Organization and Management of On-Farm Research in the National Agricultural Research System. B.N. Kayastha, S.B. Mathema and P. Rood

No 5 Zimbabwe: Organization and Management of On-Farm Research in the Department of Research and Specialist Services, Ministry of Lands, Agriculture and Rural Settlement. M. Avila, E.E. Whingwiri, and B.G. Mombeshora

No 6 Senegal: Organisation et Gestion de la Recherche sur les Systemes de Production. L. Laye and R.J. Bingen

No 7 Ecuador: Organizacion y Manejo de la Investigacion en Finca en el Instituto Nacional de Investigaciones Agropecuarias (INIAP). R. Soliz V., P. Espinoza, and V.H. Cardoso

No 8 Panama: Organizacion y Manejo de Programas de Investigacion Agropecuaria de Panama (IDIAP). M. Cuellar M.

No 9 Indonesia: Organization and Management of On-Farm Research in the Agencies for Agricultural Research and Development. I. Budianto, I.G. Ismail, Sudodo, P. Sitorus, D.D. Tarigans, A. Mulyadi (mimeo)

OFCOR Discussion Papers

No 1 Research Extension Liaison Officers in Zambia: Bridging the Gap between Research and Extension. S.A. Kean and L.P. Singogo

No 2 Closing the Gap between Research and Resource Poor Farmers: A New Model for Technology Transfer Developed in Guatemala. R. Ortiz, S. Ruano, H. Juarez, E. Olivet, and V. Meneses

No 3 Strengthening Farmer Participation through Groups: Experiences and Lessons from Botswana. G.M. Heinrich

OFCOR Comparative Study Papers

No 1 Strengthening the Integration of On-Farm Client-Oriented Research and Experiment Station Research in National Agricultural Research Systems: Management Lessons from Nine Country Case Studies. D. Merrill-Sands and J. McAllister

No.2 Organization and Management of Field Activities in On-Farm Research: A Review of Experiences in Nine Countries. P.T. Ewell.

No.3 Resource-Poor Farmer Participation in Research: A Synthesis of Experiences from Nine National Agricultural Research Systems. S.D. Biggs.

No.4 Linkages between On-Farm Research and Extension in Nine Countries. P.T. Ewell.

No.5 Staff Management Issues in On-Farm Client-Oriented Research: Lessons for Managers. R.J. Bingen and S.V. Poats.

No.6 Financial Resources and Management for On-Farm Research: A Review of Experiences in Nine Countries. E.H. Gilbert. (mimeo)

OFCOR Synthesis Papers

D. Merrill-Sands, P. Ewell, S. Biggs, and J. McAllister. 1989. "Issues in Institutionalizing On-Farm Client-Oriented Research: A Review of Experiences from Nine National Agricultural Research Systems." *Quarterly Journal of International Agriculture*, vol. 28, nos. 3/4, July-December 1989.

D. Merrill-Sands, S. Biggs, R.J. Bingen, P. Ewell, J. McAllister, and S. Poats. 1991. "Institutional Considerations in Strengthening On-Farm Client-Oriented Research in National Agricultural Research Systems: Lessons from a Nine Country Study." *Experimental Agriculture*, vol. 27, pp. 343-357.

D. Merrill-Sands, S. Biggs, R.J. Bingen, P. Ewell, J. McAllister, and S. Poats. 1991. "Integrating On-Farm Research into National Agricultural Research Systems: Lessons for Research Policy, Organization, and Management." In: R. Tripp (ed.) *Planned Change in Farming Systems: Progress in On-Farm Research*. Chichester and New York: John Wiley & Sons. Chapter 15.

D. Merrill-Sands, P. Ewell, S. Biggs, R.J. Bingen, J. McAllister, and S. Poats. 1992. "Management of Key Institutional Linkages in On-Farm Client-Oriented Research." In: H. Moock and R. Rhoades (eds.) *Diversity, Farmer Knowledge, and Sustainability*. Ithaca, NY: Cornell University Press. Chapter 7.

Co-published with the ISNAR Study on Research-Technology Transfer Linkages

D. Merrill-Sands and D. Kaimowitz (with Kay Sayce and Simon Chater). 1990. *The Technology Triangle: Linking Farmers, Technology Transfer Agents, and Agricultural Researchers*. The Hague: International Service for National Agricultural Research (ISNAR).

FOREWORD

ISNAR's studies on ways of strengthening the links between research and technology users—farmers and technology transfer agents—concluded that research organizations need direct links with farmers to ensure the relevance of research and technology development. Input from technology transfer workers alone, although important, is not enough.

Recognizing the importance of direct links with farmers to ensure quality feedback, many research managers in developing countries have experimented with different approaches to on-farm research, involving various degrees of farmer participation. However, the ISNAR comparative study on organizing and managing on-farm client-oriented research in national research systems showed that organizing and sustaining active farmer participation was often more difficult than managers had expected. Moreover, the more intensive modes of participation, in which farmers are actively involved in both experimentation and the planning and review of research, have proved the most difficult to institutionalize. Problems have often derived from management and resource constraints, as well as researchers' reluctance to relinquish control of the research agenda.

Working with groups of farmers, rather than individuals, is potentially a highly effective way of sustaining farmer participation while reducing costs. Experience has shown that working with groups often stimulates better discussions and increases farmers' commitment. It also provides a more formal mechanism enabling researchers to discuss results and potential new technologies with farmers and systematically obtain their feedback. And, perhaps most importantly, groups give farmers more power to influence the research agenda.

Organizing farmer participation through groups can also improve efficiency of resource use—a key concern for managers and a common obstacle to effective on-farm research. As this paper shows, farmer groups can help to increase the scale of on-farm research operations, lower operating costs, reduce the time burden collaboration places on both researchers and farmers and—most important—increase impact in terms of delivering technologies that are well suited to farmers' conditions.

Although there is growing interest in working with farmer groups, there is little documented experience. In this paper, Heinrich draws on 7 years of experience in working with farmer groups in the Botswana national research system to provide research managers with practical advice. The paper confirms the advantages of working with groups, and outlines some of the management lessons learned.

Thanks to the group approach, on-farm research in Botswana has been innovative, productive and economical. National researchers and managers will be able to draw useful conclusions from this experience, which they can adapt and apply in their own research systems.

Deborah Merrill-Sands
Study Leader

ABSTRACT

The need for farmers to participate more directly in the process of agricultural technology development is becoming widely accepted. This is particularly true for research programs targeted on resource-poor farmers in environments that are diverse, complex and risk-prone. The next step is to develop efficient and effective participatory models that can be institutionalized in national agricultural research and extension systems. This paper presents the experience of a research program in the Francistown Region of Botswana that has worked with one participatory method (farmer groups) for the past 7 years. The program is part of the Department of Agricultural Research, within Botswana's Ministry of Agriculture.

The paper discusses the need for farmer participation, the use of groups of farmers, the magnitude of and output from this activity, the benefits obtained, the issues that arose during the development of the method, and conclusions from the experience.

Farmer participation in the research program was through research-oriented groups. These groups provided a forum for the joint design, testing and evaluation of a wide range of technology options by both researchers and farmers. Local extension personnel also participated. Eventually, over 120 farmers (from three villages) participated in the program. The farmers implemented up to 140 trials annually, involving up to 14 different technology options. Farmers' problems and evaluations of technology options were discussed at monthly meetings and quantified in an end-of-season survey. Simultaneously, researchers were able to evaluate the technical performance of these innovations at diverse sites across the region.

Though the groups were only one part of the total regional research program, they contributed a great deal. The benefits included expanded research capacity; increased efficiency in the research program;and stronger links between the on-farm research program and farmers, extension personnel and station-based research programs.

Farmers' interest in the group activities was evident from the rapid early growth of the groups and sustained farmer participation over the years. The group approach has recently been modified for use as an extension tool and adopted by the extension service in Botswana at the pilot program level.

Farmer participation has had an impact on the direction of the research program and the relevance of research output. The experience indicates that it is possible to develop effective, cost-efficient methods for farmer participation in the technology development process within a national agricultural research system.

Table of Contents

List of Tables

List of Boxes

Acknowledgments

Many people were involved in the development of the research-oriented farmer groups in the Francistown Region of Botswana. They included administrative personnel in the Agricultural Technology Improvement Project (ATIP) and the Department of Agricultural Research (DAR), who not only permitted but encouraged the experimental activity, as well as the scientists, technical officers and other staff who implemented the ATIP project. The participating farmers made vital contributions, not only to the development of the method but also to its implementation. It is impossible to mention by name all those who contributed. However, the role of local Batswana staff—and particularly, Mr. S. Masikara, Mr. B. Bagai, and Mr. C. Sibanda—in developing specific technical operating procedures that were both practical and culturally acceptable deserves special mention.

This paper was conceived by Dr. D. Merrill-Sands of ISNAR, and both Dr. D. Norman and Dr. Merrill-Sands made constructive comments. The paper was reviewed by Mr. E. Modiakgotla, leader of the Production Systems Program in Botswana, and edited by Mr. S. Chater. I am most grateful for the contributions made by all four. However, I accept full responsibility for the content of the paper. The opinions expressed are my own and do not necessarily reflect those of the DAR, Botswana.

The Author

Geoffrey Heinrich spent 7 years in Botswana as agronomist in a farming systems research team, and then 2 years as advisor to the leader of the national Production Systems Program (PSP). During the latter period he also served as the PSP team leader for the Francistown Region. He has been directly involved in the development of both research-oriented and extension-oriented farmer groups in Botswana since their inception in 1985-86.

Acronyms

ATIP	Agriculture Technology Improvement Project (Botswana)
DAR	Department of Agricultural Research (Botswana)
FAO	Food and Agriculture Organization
GTZ	Gesellschaft für Technische Zussamenarbeit (Germany)
IITA	International Institute of Tropical Agriculture
MIAC	Mid-American International Agricultural Consortium
OFCOR	On-farm client-oriented research
NGO	Non-governmental organization
PSP	Production Systems Program (Botswana)
SIDA	Swedish International Development Authority
USAID	United States Agency for International Development
ZBDT	Zwenshambe Brigade Development Trust (Botswana)

Vital Statistics on Botswana

Country

Area: 581 730 km^2
Population (1989 estimate): 1.2 million
Population density: 2.1 persons/km^2
GDP per capita (1990): US$ 2240
Agricultural GDP as % of GDP (1989): 3
% economically active population employed in agriculture (1980): 70.3

Agriculture

Average rainfall in cropping areas: 400-450 mm per year
Livestock: 80% of the population have links with the cattle industry. Goats are also kept by the majority of rural households
Crops: Major crops are sorghum, millet, maize, cowpea and watermelon

National Research System

Number of researchers: 51
Number of technicians: 103
% researchers with advanced degrees: 63
% researcher person-years allocated to OFCOR: 18

Sources: Nkarabang and Mpaphadzi (1990); and World Development Reports (World Bank, Washington, D.C.)

INTRODUCTION

Purpose of the Paper

Farmer groups have the potential to greatly increase the capacity, efficiency and relevance of on-farm client-oriented research (OFCOR) programs. At little extra cost they can add farmers' energies, resources, ideas and indigenous technical knowledge to those of on-farm researchers. Farmer groups are particularly useful for OFCOR efforts constrained by limited resources.

Although the potential of farmer groups for research purposes is now being recognized, the use of groups is still not common practice. At the same time, there are many different ways in which farmer groups can be organized and incorporated into OFCOR programs, depending on the needs and interests of the farming community, local cultural norms and the objectives of the research program (Biggs, 1989). Because of their advantages, the use of farmer groups in OFCOR is likely to grow in the future. The purpose of this paper, therefore, is to synthesize the experience and insights gained in working with farmer groups in Botswana over a 7-year period, and to present them for use by other OFCOR programs. The paper emphasizes the lessons for research managers.

The work in Botswana is particularly relevant because it illustrates an attempt to increase farmer input and participation in a small national agricultural research system. Small systems, which are more prone to resource constraints than large ones, experience special difficulty in meeting the many and diverse demands placed on them. In such systems, approaches that improve the efficiency and effectiveness of the research program are especially welcome.

Institutionalizing Farmer Participation

In recent years there has been increasing recognition of the importance of farmer participation in the research process, particularly for resource-poor farmers in complex, diverse and risk-prone environments (Ashby et al., 1989; Biggs, 1989; Farrington and Martin, 1987; Chambers, 1988; Norman and Modiakgotla, 1990). Farmers know a great deal about their complex physical and social environment, and can contribute this knowledge to the technology development process. Moreover, since farmers are the end users of technology, it is vital to have their input during the technology development phase of research. Numerous approaches to farmer participation are being tried, but organizational and managerial constraints have often inhibited their full adoption or effective implementation (Biggs, 1989; Merrill-Sands et al., 1991). Many of these approaches were developed by "specific research projects of limited duration with no apparent commitment to their eventual incorporation into an institutional framework" (Farrington and Martin, 1987, p.64).

Such incorporation is, however, essential. In many developing countries the government is the primary instrument of agricultural research and development targeted on resource-poor farmers. Its efforts are often supported by non-governmental organizations (NGOs) and through external funding, but government institutions control development policy and the types of technologies made available to resource-poor farmers. In addition, many governments have an extensive network of technology transfer agents in place to bring new technological innovations to farming communities. Thus, it is within the national research and extension system that farmer participation can have its greatest impact.

Conversely, the lack of farmer participation may make this large, expensive system ineffectual and largely irrelevant for the very people it is meant to serve.

Institutional Setting of OFCOR in Botswana

Botswana is a large country in Southern Africa with a relatively small population. The Department of Agricultural Research (DAR), which forms part of the Ministry of Agriculture, is likewise relatively small.

The DAR is separate from the national extension department and from the Botswana College of Agriculture, both of which also come under the Ministry of Agriculture. The DAR has two divisions, one for arable crops and one for livestock. Its headquarters are at the main national research station near the capital, Gaborone. There is also a smaller research station at Maun (Western Region) and three sub-stations. Table 1 summarizes the research staff numbers and qualifications. The operating budget for OFCOR activities in the 1991-92 season was approximately US$ 176 000 (provided by the Botswana Government). An additional US$ 40 000 was obtained as grants from donor agencies, including the United States Agency for International Development (USAID), the Gesellschaft für Technische Zusammenarbeit (GTZ), the Farming Systems Support Project of the Swedish International Development Authority (SIDA) and the Food and Agriculture Organization of the United Nations (FAO).

When OFCOR began in Botswana in the late 1970s it was largely through donor-funded farming systems research projects staffed by expatriate technicians and Batswana counterparts. By the mid-1980s there were four such projects funded by four separate donors. Two of the projects were based in the extension department, and two in the research department.

By 1991, most donor funding for OFCOR had been withdrawn. In that year the DAR was restructured into multidisciplinary, problem-oriented research programs. One of the new research programs was the Production Systems Program (PSP). All OFCOR projects were brought into the DAR and placed within the PSP, under a single program leader. The PSP developed aims and objectives for OFCOR on a national basis, and these were approved by the department. As a result of these changes the role of OFCOR in Botswana was formalized, and a channel provided for formal links between on-farm research, station-based research and extension (Modiakgotla et al., 1991).

At present the DAR maintains OFCOR teams at four locations: Pelotshetlha, Mahalapye, Francistown and Maun. Three of the teams are headed by officers at the M.Sc. level or above, and one by a B.Sc. graduate. The majority of staff involved in OFCOR are agronomists, and in the short term there is a critical shortage of expertise in other disciplines. This problem should be solved in the medium term, as staff return from training.

The Research Program in the Francistown Region and the Role of Farmer Groups

The OFCOR program in the Francistown Region began as part of the Agricultural Technology Improvement Project (ATIP). This project, which was jointly funded by the Government of Botswana and USAID, and administered by the Mid-American International Agricultural Consortium (MIAC)

Table 1. Staff Allocations in the Department of Agricultural Research, Botswana, September 1992[1]

Position/program	Level of training			
	Ph. D. [2]	M. Sc.	B. Sc.	Dip./cert.
	No. of staff			
Administration				
Director	1			
Deputy Director	1			
Head, Crops	1			
Head, Livestock	1			
Station Head, Maun		1		
Animal Production and Range Research	1	9	6	45
Crops Research				
Cereal improvement	1	1	2	3
Grain legumes	0	1	1	2
Horticulture	0	2	0	4
Oilseeds	1	0	0	5
Plant genetic resources	0	1	0	2
Production systems				20
Pelotshetlha	0	0	1	-
Mahalapye	0	1	1	-
Francistown	1	0	1	-
Maun	1	1	1	-
In training	-	1	-	-
Soil/water engineering	0	2	2	4
Seed multiplication	0	1	0	4
Station management	0	0	0	6
Support programs [3]	0	2	4	8
Totals	9	23	19	103

1. Subject to changes due to transfers, staff returning from training, retirements, etc.
2. Ph.Ds are expatriate staff who departed at the end of 1992.
3. Support programs include Biometrics, Economics, Pathology, Entomology, Weed Science, etc.

through Kansas State University, conducted farming systems research in two regions of Botswana, the Mahalapye and Francistown Regions, between 1982 and 1990. ATIP personnel came under the Ministry of Agriculture.

ATIP began with the classical interdisciplinary farming systems perspective. During the first 2 years the emphasis was on descriptive and diagnostic activities, but some promising technology that was already on the shelf was also tested during this period. The emphasis shifted to technology design and testing once key production constraints had been defined. These constraints included, *inter alia*, low rainfall, variability in rainfall distribution, and shortages of draft power and labor.

Initially, trials focussed on what was seen as one of the major constraints—the inadequate soil moisture available for plant growth. They were largely researcher-managed and either researcher- or farmer-implemented. However, it rapidly became clear that farmers faced many other production constraints for which potentially useful technologies already existed. For example, they required short-duration crop cultivars for late-season planting, or they had insect attacks on cowpea that could be dealt with by using pesticides. It also became clear that farmer input into the technology development process was very limited, formal surveys and researcher-managed trials being the primary research tools.

To address these issues, a program of farmer-managed, farmer-implemented trials was initiated, and the approach of working with farmer groups was selected for management purposes. Thus, the research program that has evolved in Francistown now has three major components:

- researcher-managed trials, in which the research agenda and trials are controlled by researchers;
- research-oriented farmer groups, in which farmers have considerable control over the research agenda; and
- extension-oriented farmer groups, which are responsible for the adaptation and dissemination of promising technology options.

This paper focuses on the role of research-oriented farmer groups in on-farm research, and the related management issues.

Researcher-managed trials

This component of the program comprises both researcher-managed, researcher-implemented trials and researcher-managed, farmer-implemented trials (Norman and Modiakgotla, 1990). It is used mainly for diagnostic and design purposes, or during the early stage of technology testing, when hard data are required or cause-and-effect relationships need to be examined. Given its high requirement for input from researchers, only a limited number of research topics can be examined using this type of trial. For this reason this component is narrowly focused on high-priority research areas. It consumes roughly 60 percent of researchers' time, but only about 40 percent of other program resources.

Research-oriented farmer groups

This component involves monthly discussion meetings between researchers and farmer groups to review technology options, and farmer testing of options which they themselves select. Thus it is used mainly for the evaluation and adaptation of new technologies. It is also used to ensure that research directly addresses farmers' concerns, to create a strong channel for communication between farmers and researchers, and to provide a vehicle for greater farmer input into the research agenda.

About 30 percent of researcher time is allocated to this component, which consumes an estimated 50 percent of research resources. The amount of information obtained per unit of researcher time is high, because farmers conduct most of the research and feed back the information derived from it

Extension-oriented farmer groups

This component, led by extension personnel, deals primarily with the dissemination of research results, but provides a forum for continued interaction between research and extension as technologies move

into the extension domain. Activities under this component absorb roughly 10 percent of researcher time, and a very minor percentage of research resources. The extension department provides most of the resources required (equipment prototypes, seeds of new forage species, etc).

Chapter 1

GROUP OPERATIONS AND OUTPUTS

Operations

Introduction

Research with farmer groups in the Francistown Region began in 1985-86. By 1987 it had expanded to include over 120 farmers in three villages. The villages were selected initially through an informal, region-wide survey to represent different types of communities in the region.

Roles of farmers and researchers

To understand the specifics of group operations, it is helpful to understand the roles of both researchers and farmers.

Researchers and farmers bring different but complementary types of knowledge to bear when developing technologies to improve the productivity and sustainability of farming systems. Farmers have a strong comparative advantage in understanding the complexities and constraints of their farming systems, in applying knowledge of their farm environment to the design and assessment of technologies, and in determining the "goodness of fit" and overall usefulness of a new technology. Researchers, on the other hand, have a comparative advantage in identifying constraints from a scientific and technical perspective (such as micronutrient deficiencies), in accessing world knowledge on potential technological solutions to constraints, and in systematically testing technologies and synthesizing results over a wide range of diverse environments.

Thus, within the Francistown groups the role of the researchers is to act as a resource for the farmers. They fulfill the "search" function to find useful technology options, provide small amounts of necessary inputs (equipment prototypes, seeds of new crop varieties, etc), help design trials to enhance their usefulness (to farmers) and their experimental rigor (for researchers), and assist with the synthesis of findings by analyzing results across farms and villages.

The role of the farmers is to express their needs and interests and to work with the researchers to develop potentially useful options, to select and test technology options that might benefit their own production systems, and to share the results of these trials, and their own observations, with other members of the group.

The groups thus function in close agreement with the guidelines regarded by Chambers as important for resource-poor farmers in difficult environments: "They need, it is now realized, not messages but methods, not precepts but principles, not a package of practices but a basket of choices, not a fixed menu, table d'hôte, but a choice, à la carte; not instruction on what to adopt, but ideas on what to try, with support for their own trials and experimentation" (Chambers, 1988, p.10).

Operating system

The basic approach to working with farmer groups is as follows:

- **Participation is open to all interested farmers** within a village. Besides researchers and farmers, the local extension agent generally attends all group activities. Field activities are conducted on an individual basis; the groups are used for organization and discussion.

- **Researchers present a wide range of technology options for farmers' consideration** at the beginning of the season. The list of options is developed according to problems identified through on-farm diagnostic research. It also includes new technologies, such as improved crop varieties, emerging from station-based research. In addition, farmers are encouraged to suggest areas in which other options are needed. When this occurs, more options are sought, discussed with farmers, and added to the list.

- **Farmers individually select options** to address their problems and fit their resource constraints. For example, those with soil fertility problems can select a fertilizer trial, while those possessing their own draft power can select trials on intensified tillage systems for water conservation, and so on.

- **Sub-groups of farmers who have selected the same options then conduct trials** according to a standard, mutually agreed upon trial design. The design is discussed by both farmers and researchers, to ensure that it meets the needs of both parties. The adoption of a standard design allows comparisons across farms and some simple statistical analyses of yield results.

- **The research teams supply small amounts of inputs** where necessary (for example, 1 kg of seed of each of four cowpea genotypes in a variety trial). The research field staff also assist in pegging trial plots where necessary, in monitoring the dates of all field operations in each trial, and in weighing plot grain yields once farmers have completed harvesting and threshing.

- **Groups meet monthly** so that farmers, researchers and extensionists can discuss progress and observations, and deal with any problems that arise in conducting the trials. These monthly meetings have several important functions. They provide a regular forum for reviewing trial management and they facilitate the ongoing assessment of the technologies being tested. They also provide an important channel for communication between researchers and farmers on a range of related topics, including more precise problem identification, adaptations of the technologies being tested, and the identification of new technology options. The monthly meetings ensure a continuing dialogue between farmers and researchers throughout the technology development process.

- **Senior researchers visit each trial site** during slack periods in the growing season (generally between weeding and harvesting) to check on implementation procedures and assess the validity of the trial for inclusion in the comparative yield analysis. This is done in the field, through observation and discussion with the farmers and with junior research staff. The field visits occupy two researchers for about 2 weeks.

- **Field days are held** towards harvest to share interesting results with farmers outside the group, with extension personnel and with other researchers.

- **An end-of-season survey is conducted with each farmer participant** for each technology option tested. The objective is to quantify farmers' opinions and perceptions of the technology and to solicit suggestions for further improvement. This information supplements the regular monthly discussions on the same subject.

Organization of group meetings

Meetings between researchers and farmers may be organized in many ways, depending on specific objectives, local cultural norms and personal preferences (Biggs, 1989). The approach used in the case of the Francistown groups works well to meet program objectives.

At the first meeting of the season researchers present and discuss the results of previous years' trials, and all the various technology options they have assembled for farmer appraisal in the current year. The options include new equipment, crop varieties, and so on. Discussion occurs after the presentation of each option, and farmers are given the opportunity to request and discuss options not on the original list. Farmers then identify the options they wish to test. This initial meeting can last for 4 to 5 hours.

Trial designs are discussed at subsequent meetings, once farmers have made their selections. Subsequent meetings are shorter and, once the trials are under way, follow a standard format. Their purpose is to maintain a dialogue throughout the season on what is happening in farmers' trials. Problems encountered with the application of technology options, queries regarding implementation procedures, observations on technology performance and general field problems are all discussed. For an average group of 15 to 20 farmers, these meetings may last 2 to 2.5 hours, depending on the issues that arise.

These meetings are chaired by the local research supervisor (a technical level research officer based in the village). At the start each farmer is given an opportunity to describe his or her progress with the trial(s) and to make observations. Allowing each farmer to speak in turn in this way avoids dominance of the meetings by a specific individual or sub-group. Notes are kept on each report by the village research staff. Once all farmers have had a chance to speak, a general discussion is held on items common to several farmers. For example, if 7 out of 15 farmers report aphid problems on their cowpeas, aphid control options are discussed. These meetings are open-ended, and finish when all queries and discussion topics have been addressed. Meetings end with the setting of a date and time for the next meeting.

Group size

Table 2 shows the growth of group activities over time. It demonstrates that the group approach has attracted and sustained farmer interest. That the activities have been continued by researchers shows that they too find them practical and useful.

A single group was organized in each village. The size of the groups ranged from 30 to 50, but usually no more than 40 farmers attended any one meeting.

Group representativeness

As already noted, participation in group activities is open to any interested farmer in the village. Open participation of this kind has many advantages (*see* p. 22). However, it raises the question of whether

Table 2. Growth of Group Activities in the Francistown Region (1985-90)

Year	No. of villages	Total farmers	No. of valid comparisons [1]	No. of options tested
1985-86	1	12	12	1
1986-87	3	97	44 [2]	8
1987-88	3	143	152	6
1988-89	3	128	140	8
1989-90	3	145	130	10

1. Valid comparisons are trials that were properly implemented and in which at least one plot produced some grain yield. Trials not properly implemented, trials that produced no yield at all, and comparisons that were otherwise rendered invalid (e.g., a plot was eaten by cattle) were examined separately. Note that some farmers implemented more than one trial per season.

2. The low ratio of valid comparisons relative to the number of farmers in 1986-87 was a reflection both of farmers' lack of experience in implementing trials, and of the fact that rainfall ended early that season. Only trials planted early survived to produce a grain yield.

Source: Heinrich and Masikara (1992).

the group participants are representative of the population at large. The issue of representativeness is important because it can affect the capacity of the group approach to develop technologies appropriate for the majority of farmers in the region.

To answer this question, data on the household circumstances and resources of group participants were compared with similar data collected in a baseline survey conducted across the region. It was found that the group participants were indeed representative of the population in the region. For example:

- within the groups, about 60 percent of farmers owned fewer than 16 head of cattle, versus 65 percent district-wide (cattle ownership is a major indicator of wealth);
- within the groups, 40 percent of the participants were from female-headed households. District-wide the figure was 30 percent, with considerable variation across villages.

Types of technologies tested

The list of technology options made available for farmer testing is developed from several sources. It includes:

- technologies listed in response to constraints identified during diagnostic research;
- technologies listed in response to direct requests from participating farmers;
- technologies developed on-station, which the commodity research teams wish to test on-farm.

Whether technology options are new or are already on the shelf, as much of the testing as possible is done in collaboration with station-based research. Table 3 shows some of the options tested, together with the station-based research teams involved. Several options have been added only recently, including variety trials with sorghum, millet, sunflower and mung bean, a new light-weight cultivator, and a crop rotation.

Table 3. Technologies Tested by Farmer Groups in the Francistown Region (1985-89), and Collaborating Station-based Research Programs

Technology option		Station-based program
1.	Double plowing	Land and Water Management
2.	Rotary injection planter	Farm Machinery Development Unit
3.	"Maun" cultivator	Farm Machinery Development Unit
4.	Groundnut variety	Oilseed Improvement
5.	Groundnut seed treatment	Oilseed Improvement
6.	Groundnut planter	Oilseed Improvement
7.	Cowpea varieties	Cowpea Improvement
8.	Dutch hoe	Weed control
9.	Fodder production	ALDEP (extension program)
10.	Phosphate fertilizer	None
11.	Row planting	None
12.	Long- and short-duration crop mixes	None

Outputs

Group activities in the Francistown Region are integrated with other parts of the OFCOR program as well as with station-based research and extension. Hence the credit for any technological advances made must be shared equally among all the players in the process. With that in mind, the group activities have had an important role in the development and application of certain technologies and in achieving certain social benefits. These outputs are summarized in the two sections that follow.

Technologies

- **Double plowing:** this technology has become an official recommendation of the DAR;
- **"Maun" cultivator:** this light-weight cultivator is now sold through a government subsidy scheme;
- **"Kenya" donkey collar:** this is now produced in Botswana and is in a national pilot extension phase;
- **Rotary injection planter:** this is now produced in Botswana and is in a national pilot extension phase;
- **Cowpea variety screening:** the best varieties for specific environments and farmer circumstances within the Francistown Region have been identified and the information shared with local extension and with Agricultural Marketing Board personnel;
- **Row planter:** the many planters on the local market have been tested and the best ones for specific applications identified through feedback from farmers.

Social benefits

- **Higher adoption rates:** The group approach has been modified for extension purposes and is in a pilot phase in North East District. It is also being applied by an NGO in the same area. A study conducted by this NGO indicated that the use of improved practices was much higher in a group

that had been functioning for several years than in newly formed groups. For example, 50 percent of members of the older group used double plowing, compared with 15 percent in the two new groups. About 70 percent of farmers in the older group used row planting, thinning and gap-filling techniques, compared with 20 to 40 percent in the new groups.

- **Farmer access to knowledge:** An important aspect of the group approach, often undervalued, is that knowledge gained is regularly shared with farmers through group meetings and annual reviews of results. A study by the Rural Sociology Unit of the Ministry of Agriculture (ATIP Working Paper 11) found that the main reason why farmers participated in group activities was that the groups provided them with access to new knowledge and with back-up when they wanted to test new technologies on their own fields.

- **Understanding farmer perspectives:** The many contacts between researchers and farmers that occur through the meetings, and the wide range of topics covered in discussions, ensure that researchers have a thorough understanding of farmers' perspectives and constraints. This benefit is an intangible one, but it is absolutely vital for developing practical, relevant technology.

Information

Many kinds of information can be generated by group activities, including accurate data on the performance of technology, suggestions for modifying technology to improve its relevance to farmers' needs, and requests for new technology. Provided feedback mechanisms are adequate, this information can be used to influence research directions, technology development and extension recommendations.

Yield data. During the year, all trials are visited by senior scientists to determine whether they constitute valid comparisons and can be included in statistical analyses of results. Trials that are not valid comparisons, or where all plots fail to yield (due to drought, flooding, pests, etc) are excluded. The reasons for failure are recorded and tabulated as important indicators of field constraints. All valid comparisons are included in yield analyses. Table 4 presents selected results from 1987-88. It shows a typical example of the treatment effects that can often be observed in trials implemented by farmers, particularly where simple trial designs are used and there are many replications. Heinrich and Masikara (1992) provide a more detailed discussion of trial designs and analysis procedures.

When consistent trial designs are used and farmers test technologies over several years, trends in yields can also be observed. This is particularly important in environments characterized by large year-to-year variations. Table 5 presents an example of the impact on yields over years of some of the technologies tested. Data of this kind can be used to confirm the performance and stability of technologies before the dissemination phase, and to highlight priority technologies for dissemination. They are also important in convincing station-based commodity teams of the usefulness of certain technologies. For example, the data in this table were instrumental in confirming the stability of the benefits of double plowing (*see* Box 1).

Farmer contributions to technology development. Through the groups, farmers also contribute ideas for new technology options or for modifications of existing options. Farmers' opinions and ideas are recorded in the minutes of the group meetings and through the end-of-season survey. In 1992, on-farm researchers began experimenting with the use of informal survey techniques to replace the formal

Table 4. Mean Yield Data for Selected Trials in the Francistown Region (1987-88)

Trial type	Crops	Yield (improved variety) (kg/ha)	Yield (traditional variety) (kg/ha)	Increase in yield (%)	No. of trials
Double plowing	Cereals	488 ***	288	69	32
	Cowpea	181 ***	130	39	30
	Combined	339 ***	212	60	62
Groundnut seed treatment	Groundnut (var. Sellie)	342 ***	276	24	44
Row planting vs broadcasting	80% sorghum 20% cowpea	173 NS	131	32	10
P fertilizer	75% cereals 25% cowpea	550 *	366	50	8
Cowpea var. [1]	Blackeye	171	-	-	-
	ER7	145	-	-	-
	TVX	210	-	-	-
	BOO5C	318	-	-	-

Notes
*,**,*** denote significant differences between treatments at the 5%, 1% and 0.1% levels of probability respectively. NS = not significant.
1. Includes only trials where all four varieties were tested together.

Source: ATIP Progress Report F90-2.

Table 5. Effectiveness of Various Technologies Tested over 3 Years, Francistown Region (1986-89)

Technology	Year			
	1986-87	1987-88	1988-89	
	Increase in yield (%)			Average
Double plowing	69	60	85	71
P fertilizer (20 kg/ha)	97	50	20	56
Row planting	6	32	30	31
Groundnut seed treatment	-	24	0	12

Note: Crops were primarily sorghum and millet, but some trials also included cowpea. Groundnut seed treatment was with Captan only in 1987-88, but included both fungicide and fungicide + insecticide treatments in 1988-89.

Sources: ATIP Progress Reports F87-6, F90-2, and F90-6.

methods hitherto used in the end-of-season surveys. It is expected that these techniques, adapted from rapid rural appraisal methods, will strengthen farmer input and feedback, reduce the time researchers have to spend conducting the survey and analyzing results, and speed up the incorporation of feedback into the research process.

One of the most striking examples of a contribution to technology development made by farmers participating in the Francistown groups was their spontaneous adoption of a rotary injection planter,

which was used in a way that researchers had not anticipated (*see* Box 2). The fact that farmers found their own niche for this new technology had two important implications:

- that the technology could be useful to farmers outside its originally identified recommendation domain; and
- that farmers might be interested in developing more intensive production systems for their high-value crops (such as cowpea and groundnut).

Box 1. Double plowing

Winter plowing has long been recommended in Botswana. Plowing the fields before the summer rains increases water infiltration and conservation. However, on-farm research showed that winter plowing was not feasible for many farmers, either because the soil was too hard to plow before the rains or because their draft animals were too weak in winter. Double plowing was a modification of winter plowing, designed to be used during the summer rains. It was developed largely by on-farm researchers after it was discovered that adding a single early plowing to the standard land preparation practice could increase cereal grain yields by 50 to 100 percent, even when the first plowing was done after the onset of the rains.

Double plowing was rigorously examined. Researcher-managed trials were used to examine various technical aspects and to answer economic questions (such as the opportunity cost of the first plowing). Farmer-managed, farmer-implemented trials, organized through the farmer groups, were used to obtain farmer evaluations of the practice and to determine whether the effects observed in researcher-managed trials could be repeated under farmer management.

Farmers implemented over 80 double plowing comparisons between 1985-86 and 1987-88. Their evaluations indicated that the innovation was practical, and there was considerable spontaneous adoption over this period. The yield data indicated that the effects were consistent across years and that farmers could regularly achieve yield increases when using the innovation on their cereal crops. Effects on cowpea yields were not so positive, however.

This information from farmer groups, coupled with economic and technical analyses from the researcher-managed trials, was instrumental in convincing the Land and Water Management Group at the DAR of the value of the modified technique. The research resulted in a well targeted, formal recommendation on double plowing in Botswana.

Feedback to station-based research. When the station-based research teams began collaborating in the on-farm group testing activities, the on-farm teams used to return a simple one-page summary of their results to the station-based researchers each year. These summaries included the raw data of the yield results for those trials considered valid, a summary of farmer observations on the technology they had tested, and a brief synopsis of the results obtained by the OFCOR program as a whole. This procedure provided an important connection between on-farm and on-station researchers and helped the station-based teams to align their research with farmers' needs and to improve the relevance of their technologies.

With the development of the Production Systems Program (PSP) in 1991, a new linkage mechanism was adopted and formalized. Now innovations from the station-based research programs are funnelled through the PSP for on-farm testing. These technology options are, of course, subject to farmers' choice, but there are almost always a few farmers interested in testing any new option. And farmer evaluations

are still part of the testing procedure. Results from nation-wide testing are synthesized by the PSP and fed back to the originating station-based programs. This mechanism also appears to work well, despite the extra step in the feedback process.

One example of the useful feedback provided by the Francistown groups concerned cowpea (*see* Box 3). This example demonstrates how the groups provide an effective mechanism for influencing the research agenda.

Box 2. Adapting and integrating a new technology: the rotary injection planter

Diagnostic research revealed in 1987 that farmers who did not have their own draft power sometimes had difficulty in obtaining good crop stands. Part of the problem was that they had to hire tractors, which often did not arrive in the field when soil moisture conditions were optimal for planting. (Planting was normally done by broadcasting the seed before plowing.) To separate the plowing and planting operations, and to give farmers more control over the time of planting, a hand-pulled rotary injection planter was introduced. This planter, of the design developed by the International Institute of Tropical Agriculture (IITA) based in Nigeria, was tested by farmers and found to be effective. To reduce the cost of the machine, a manufacturer was contracted to produce it locally, with the help of an NGO known as the Rural Industries Innovation Center. A first batch of locally manufactured machines was produced and tested by farmers, who found them unsatisfactory. Eventually, after several attempts, an effective, locally made machine was produced, and this has now been adopted for nation-wide testing under an equipment subsidy scheme in the extension department. Meanwhile, farmers had found another, unexpected niche for the machine—planting small plots of high-value crops (mostly cowpea). The spontaneous development and adoption by farmers of a double-plowing, row-planting system for high-value crops is described in the adoption study paper, ATIP Working Paper 34.

Box 3. Changing research directions: farmer feedback on cowpea

The farmer groups tested various sets of cowpea varieties originating from the national Cowpea Improvement Program. Each year on-farm researchers fed back the results, together with farmers' assessments, to the station-based researchers. They also compiled a summary report analyzing the results over several years. The conclusions of the analysis led to changes in the cowpea breeding program. It was found that the recently released determinate variety, ER7, performed very poorly across all farm environments. An indeterminate type, the improved local variety Tswana, had performed best. In addition, Tswana was popular with farmers because of its consistent grain yield and good leaf-vegetable production. Two other indeterminate types were better adapted to difficult and unpredictable environments because of their ability to weather periodic stress (such as drought and insect attacks). The feedback of this information led the Cowpea Improvement Program to switch its emphasis to indeterminate types.

Chapter 2

BENEFITS OF THE GROUP APPROACH

Several very positive benefits have emerged from the work with farmer groups. The major ones are:

- increased capacity of the research program;
- increased efficiency of the research program;
- improved links between researchers and technology users.

Increased Capacity

In Botswana, as in many other developing countries where farming conditions are highly diverse, researchers cannot hope to develop a standard production package to suit all farmers in all years. Instead, a wide range of options is needed from which farmers can select in response to changes in rainfall patterns and in their own household circumstances (Chambers, 1988).

Thus the OFCOR teams need to examine as many different technology options as possible. This is difficult if researchers must manage all the trials themselves. A major benefit of the group approach is that it greatly expands the number of technology options that can be examined (*see* Table 3, p. 11).

Increased Efficiency

The group approach makes the research program more efficient by increasing the amount of research done per unit of researcher time, and the relevance of that research.

More research, with a minimum of additional input

For a relatively small investment in time and travel costs, researchers receive yield data and farmer evaluations on a large number of technology options, often replicated over a large number of farms (*see* Tables 2 and 3, pp. 10 and 11). Most of the preparation for the group work is done before the onset of the rains. Grain yields are measured and end-of-season surveys conducted after harvest. Thus, during the cropping season itself, researchers have only to attend group meetings for half a day, once a month, in each of the three participating villages, and to spend 2 weeks, late in the season, making individual farm visits.

The efficiency gains in this model come from several sources. First, researchers can provide most of the labor required from them outside the peak periods in the cropping cycle. Secondly, they can meet all the participants regularly as a group; hence farmers also contribute to travel costs, spending their own time travelling to meeting points so researchers do not have to spend as much time and money visiting them individually. Thirdly, farmers themselves add their management skills, labor and resources to the total research effort. Thus the group approach results in enormous savings in the costs of research.

Cost is an important factor in both research efficiency and research capacity. The group approach is relatively inexpensive to operate. Some cost estimates are given in Box 4.

Box 4. Estimated costs of working with farmer groups

The group approach developed in the Francistown Region has been adapted by a non-governmental organization, the Zwenshambe Brigade Development Trust (ZBDT), for use as an extension tool. The ZBDT is applying the approach to assist poor and female-headed households in its target area. The work of its extension groups differs from that of the Francistown research groups in that (a) it does not involve pegging plots on farmers' fields, or weighing and analyzing plot grain yields; (b) it requires more field visits for monitoring and support purposes; and (c) it does not require a senior scientist, since the project draws support as needed from regional extension and research personnel. In all other aspects the ZBDT budget is similar to that required for running research-oriented groups. Capital costs include the purchase of implements for farmer testing, a motorcycle for transport, tools for soil erosion control work and a camera for recording activities. Recurrent costs include salaries and allowances for two extension workers, maintenance and running costs for two motorcycles, seeds, fertilizer and other inputs, film, stationery and other supplies for the extension workers, as well as contributions to ZBDT administration and 2.5 percent for contingencies. The ZBDT estimates are for operating five groups of up to 30 farmers each (150 farmers total) for a full year. The budget breakdown is as follows:

	US$*
Capital costs (equipment)	8 356
Salaries and allowances (2 extension workers)	5 400
Recurrent costs	5 818
Administration and contingencies	1 720
Total	21 294
Capital cost per farmer	= US$ 55.7
Annual recurrent cost per farmer	= US$ 86.3

* Converting Botswana Pula to US dollars at P 2.00 = US$ 1.00

Increased relevance of research

Working with larger numbers of farmers increases the relevance of the on-farm research program because:

- there are more farmers to provide ideas on possible technology modifications or applications;
- it helps to ensure that research focuses directly on farmers' observed constraints and priorities;
- it gives researchers a broader perspective and a deeper understanding of production constraints.

Improved Links

With farmers

Farmer interest and participation in group activities grew rapidly and was sustained after donor funding was withdrawn. The continuing commitment of farmers is based on several important factors:

- The farmers select their own trials, ensuring that their research directly addresses their needs and fits within their resource limitations.
- In group meetings, farmers are exposed to many new technology options, both from researchers and from other farmers conducting other trials. They can also experiment with interesting options of their own.
- Working with groups of farmers instead of individuals alters the power dynamics of farmer-researcher interactions. In the groups, farmers support each others' arguments, bringing pressure to bear on researchers and so affecting the research agenda and implementation procedures. This subtle change in the dynamics of the relationship ensures that research becomes more responsive to farmers' needs.

The theme underlying all three of these points is that the group approach gives farmers greater access to information and so empowers them to influence the research process. This is the key to retaining their interest and participation.

In addition, the monthly group meetings provide a powerful channel for the exchange of information. During the growing season, researchers sit with groups of 10 to 40 farmers in three different villages every month. They listen as farmers describe their trials and the general situation in their fields. Problems with drought, obtaining draft power, pest outbreaks and so on are regularly mentioned in the meetings, and options for dealing with these problems are discussed. Thus the group meetings serve not only as a means of organizing the testing of technologies but also as a mechanism for including farmers in a continuous process of problem identification, technology design and testing. This interaction ensures the relevance of research efforts and a strong partnership between researchers and farmers.

With station-based research teams

The group approach has had the unforeseen effect of strengthening links between the OFCOR program and station-based research. Before the development of the groups, interaction between the two was minimal. By 1991-92, the groups were being used to test 14 different technology options in collaboration with four different station-based commodity and disciplinary research programs. Information was fed back to on-station researchers both informally and through regular reports, as discussed above.

The improved links were made possible by the new flexibility and increased research capacity of the OFCOR program, introduced through the groups. The group approach allows the program to respond quickly and easily to the needs of station-based researchers, and to provide them with both quantitative and qualitative data on the performance of numerous technologies under farmers' field conditions.

In addition, the group approach provides easier access for station-based researchers who wish to meet farmers directly and observe technology performance in the field. A station-based researcher can come to the region for a day, attend a group meeting in the morning for discussions, visit farmers' fields in the afternoon and depart that evening. Having trials in the field and easy access to farmers has motivated station-based researchers and helped them to target their research more closely to their clients' needs.

With extension

Extension services are important clients of research programs, and as such are entitled to influence the research process. In fact, developing a forum for better research-extension-farmer interaction at field

level was one of the original objectives of the group approach. Village extension agents are regularly invited to participate in group meetings, and generally do so. The group trials are also presented by participating farmers at annual field days, to which all regional extension officers are invited. These links allow extension officers to have an input into research activities, to become familiar with the development of technologies and to hear farmers' reactions to them, before taking technologies into the dissemination phase. Once a technology is ready for dissemination, the farmers in the research groups provide the initial core for farmer-to-farmer dissemination, assisted by the extension-oriented groups.

Some Disadvantages

Few disadvantages of working with farmer groups have been noted in the course of the Francistown experience. Some of those experienced elsewhere are shown in Box 5, which summarizes the advantages and disadvantages experienced at a range of locations.

Box 5. Advantages and disadvantages of working with farmer groups

Advantages

- Group interaction stimulates discussion and highlights areas of conflict to be investigated in more detail, either through sub-groups or individually;
- Group interaction increases farmers' interest in and commitment to collaborative research;
- Group interaction is especially useful for diagnostic or exploratory work;
- The larger ratio of farmers to researchers changes the normal dynamics of interaction, giving farmers more clout and allowing them to ensure their research needs are met;
- The ratio of staff time to the number of farmers covered is more efficient;
- Logistically, farmer groups are an efficient way of handling farmer-managed trials;
- Working with larger numbers of farmers enables many technological options to be tested simultaneously;
- This in turn allows the on-farm research program to be more responsive to the experimental needs of station-based researchers;
- Group discussion is useful for technology evaluation and can provide immediate feedback to station-based researchers
- Groups can be used to increase interactions with types of farmers previously under-represented at the design and implementation stages of research;
- Group discussion is useful for collecting general information on topics such as regional history and indigenous technical knowledge, where group reactions help to sharpen recall and insights.

Disadvantages

- Groups can be dominated or inhibited by the presence of certain people (often wealthier farmers), producing a false consensus or biased comments;
- Members will often withhold opinions on sensitive subjects at a group meeting;
- Group activity may not be culturally acceptable;
- Groups are sometimes less reliable for quantifying farmer opinions because group members influence each other;
- Identifying or forming groups that represent user populations and/or fit research purposes may be logistically difficult or time-consuming when respondents are geographically dispersed.

Source: Modified from Ashby (1990), with input from L. Sperling of CIAT and G. Heinrich.

Chapter 3

MANAGEMENT ISSUES

As the groups developed, several important management issues arose. Some of these were concerned with group management and operations, others with technical matters.

Group Management and Operations

Farmer versus researcher control of the agenda

Researchers consider the groups to be a powerful research tool. Yet farmers are allowed to control the research agenda by deciding which technologies to test.

These two statements appear to contradict one another. The reason why they do not is that, in the case of the Francistown groups, farmers and researchers have the same basic objective—to overcome production constraints and develop improved farming practices. Allowing farmers the final say on the research agenda ensures the relevance of the research program and increases farmers' interest in it.

Where technology options are made available to farmers but not selected for implementation, researchers must consider why they have been rejected. If it is concluded that the technology option is relevant despite its initial rejection, researchers can proceed in one (or both) of two ways. They can seek to persuade a few farmers to try out the option, by way of demonstration, and/or they can take the option back into the researcher-managed section of the program so as to re-examine its demands on labor, the degree of risk it entails, and other factors that might affect farmers' reactions to it.

Composition of groups

Group participants include interested farmers (self-selected), senior researchers in the OFCOR program and local village extension officers. As regards farmers and researchers, two important conclusions can be drawn from the Botswana experience:

- **Senior researchers should participate regularly in group meetings.** This is important for several reasons. First, senior researchers best understand research objectives. Their presence is necessary to ensure that these objectives are met. Secondly, theirs are the tasks of analyzing and interpreting the data obtained from farmers, of applying that information in the field, and of feeding relevant parts of it back to station-based scientists. They cannot perform these tasks effectively if they receive the information second-hand. Thirdly, senior researchers need to attend group meetings to discuss technology options for addressing farmers' constraints, or queries regarding trial implementation procedures. Lastly, the group approach is intended to provide a direct channel of communication between farmers and researchers. If senior researchers do not attend meetings this objective will not be met. Farmers attach greater importance to the meetings knowing that senior researchers regularly attend.

- **Open participation is preferable to restricted participation,** at least in Botswana. Restricting farmer groups to certain segments of the farming population may be desirable in some cultural environments, or if the research groups have a very narrow focus. In Botswana, no such limitations apply, and participation in the groups is open to all. Open participation has several important advantages. First, indigenous technical knowledge is not necessarily evenly distributed throughout a community (Farrington and Martin, 1988). Convening a large, heterogeneous group encourages the spread of local expertise. Secondly, some technology options have applications for all farmers regardless of the level of their resources (for instance, short-duration crop genotypes for late-season planting). Having all farmers in the same group allows this type of option to be introduced to all farmers at once. Thirdly, and perhaps most importantly, farmers understand their own needs far better than researchers are ever likely to. Thus they are better at determining which technology options are useful to them. Sometimes they find uses for specific options that have not occurred to researchers (as in the case of the rotary injection planter). Lastly, when researchers restrict technologies to specific sub-groups of farmers, they eliminate the potential of other farmers to make further use of the innovations, and may actually slow down the adoption of new technology.

Size of groups

The Botswana experience indicates that groups should not exceed 40 if they are to be manageable and to facilitate interaction between farmers and researchers. Groups of 20 to 30 are optimal because each farmer has an opportunity to speak. With groups larger than 40 it is impossible to provide opportunities for all to speak, in which case it is easier for specific individuals to dominate the discussion. Such dominance can bias the information researchers receive and demoralize other group members.

Frequency and regularity of meetings

Meetings need to be held frequently, but not so frequently as to become a burden to both researchers and farmers. In Francistown, the monthly interval between meetings during the cropping season was initially agreed upon with farmer participants. It strikes a balance between meeting too often and having too long an interval between meetings, in which case things can go badly wrong. The compromise seems to work, for the schedule has been maintained for 7 years.

The Francistown experience also shows that, within the growing season, it is important to maintain regular meetings, even during periods of relative inactivity, such as drought periods. Otherwise, researchers' relationships with farmers are disrupted, and farmers lose their commitment to the research process. Meetings are usually held on days of the week when farmers are not normally in their fields. Attendance fluctuates to some extent, depending on the other demands on farmers' time, but if it is low for an extended period researchers should find out why and adapt either the form or the content of meetings accordingly.

Researchers' attitudes

Researchers need to consider farmers as their colleagues in these activities, collaborating with them on an equal basis. They must see the groups as the farmers' experimental forum, not their own. Every

attempt must be made to ensure that research addresses farmers' interests and needs. This is why farmer participation is open to all, and farmers themselves are expected to decide which technology options they wish to explore. However, researchers also have information they wish to obtain. The approach used in Francistown is to seek compromises with the farmers to meet the needs on both sides. When farmers understand researchers' perspectives (for example, the need to have both plots in a comparison planted on the same day) they are generally quite happy to comply. In this way research procedures are developed that are acceptable and beneficial to both parties.

The same attitude must be shown towards attendance at meetings. Farmers are free to decide whether or not to attend meetings. Researchers record the number of people present and the number of females and males (the former usually far exceeding the latter), but not specific names. Some farmers come late, some leave early. Meetings are always scheduled for a specific time, but only begin when a quorum has assembled.

This attitude accords the farmers the respect due to equals, contributing to the strong positive response observed over the years.

Labor allocations of group participants

Efforts are made to ensure that neither researchers nor farmers are overburdened with extra work during busy periods in the cropping cycle. Most of the group work is done either before the rains or after the harvest. During the busy season, farmers implement their trials as part of their regular cropping activities and attend meetings once a month. Researchers are responsible only for attending monthly meetings, and can make their mandatory field visits during slack periods in the season. Thus the group approach makes relatively few demands on researchers or farmers during critical periods in the cropping cycle. This is important for increasing efficiency (*see* Chapter 2).

The village field staff are, however, burdened with an intensive labor period at the outset of the season, when they have to peg experimental plots in a large number of fields in a short period before planting. Extra casual labor is hired for several weeks to ensure that this is done in a timely manner.

Feeding farmer innovations back into research

One weakness of the group approach used in the Francistown Region is that no formal mechanism is employed to feed farmer innovations back into mainstream research. Farmer innovations (such as different combinations of compatible technology options) are revealed in group discussions and observed by researchers in the field, but are not systematically fed back to the groups for further testing. These processes could easily be formalized by recognizing farmer innovations more explicitly and listing them as options for farmers in the trials selection process. Feedback of this kind would probably help in the more rapid refinement and dissemination of technology, as well as in encouraging greater farmer commitment through improved recognition of farmers' contributions.

Participation of non-governmental organizations

Where NGOs are active in rural communities, they may be able to contribute greatly to research and/or extension activities. Their existing activities are usually of a participatory nature, and often they are

already working with groups. In addition, they frequently enjoy considerable flexibility in the work they do, and have access to funds and resources beyond government budgets. Partnerships between national on-farm research groups and NGOs have been tried in several countries.

In Francistown, there has been only limited interaction between the research-oriented groups and NGOs. One NGO used the groups as a point of entry when providing a tractor hire service. Another has started using the group approach for an intensified extension program focussed on poor and female-headed households. This program is carried out in collaboration with regional research and extension offices, which offer technical guidance and ensure that duplication is avoided.

A better example of interaction between farmers, researchers and NGOs that specifically incorporates the group approach can be found in Gilbert (1990), who describes experience in The Gambia.

Technical Issues

Trials management and maintenance of scientific rigor

A common complaint about farmer-managed, farmer-implemented trials is that they do not maintain sufficient rigor to be subjected to statistical analysis. This is not the case with the Francistown groups.

That farmers select research topics themselves and have the opportunity to discuss and modify trial designs constitutes an important starting point. It ensures from the outset that farmers conduct trials in which they are interested, using simple trial designs that they have understood and accepted. This makes all subsequent activities much easier.

In addition, research field staff assist farmers in pegging out their plots, and provide them with a weighed amount of seed for each plot. They also weigh plot yields. This ensures that, across the region, a given experiment is planted within a known plot size at a consistent seeding rate with known crop cultivars. Experimental variables are agreed upon with farmers and applied at the same levels across all farms.

Within farms, farmers determine the levels of all non-experimental variables, but apply the same levels to all plots in the comparison. For example, in a cowpea variety trial a farmer choses his or her own tillage and planting system, but applies the same system to all plots, and plants all plots on the same day. A farmer's control plot is included in all trials.

In this way, farmers can test technology options under their own management systems, yet there is sufficient consistency across farms to allow simple statistical analyses.

For analyzing results across farms, paired t-tests and regression analysis have proved useful. When using regression analysis, the different levels of non-experimental variables across farms are treated as environmental effects. Regression analysis has several advantages. In particular: (a) it benefits from having more variability (thus covering a broader range of environments); and (b) it is predictive in nature, and thus helpful in developing recommendations. In addition, modified stability analysis (Stroup et al., 1991) is an adaptation of regression techniques, specifically designed for on-farm research, that can be extremely useful for analyzing data from these types of trials.

In any given year, a few farmers make mistakes. But when farmer interest and understanding are backed up by regular consultations (through the monthly meetings) and field visits by senior researchers, it has been found that farmers can conduct trials according to fairly rigorous standards. Because of the large number of replications, researchers are able to be relatively strict in assessing the validity of each trial and deleting invalid comparisons.

Providing inputs to farmers can be controversial. In the Francistown case the disadvantages are far outweighed by the benefits obtained in maintaining the validity of comparisons across farms. In addition, seed is the major input provided and the amounts of seed are quite small (only 200 g per plot for sorghum, for instance). In a study on the groups by the Rural Sociology Unit of the Ministry of Agriculture, the vast majority of farmers said they participated out of interest in the new technology; only a few said they did so because they liked the free seed.

Testing technology options versus production packages

The Francistown groups represent a different approach to farming systems development. In the past researchers have tried to develop an optimum production package, combining several innovations intended to work synergistically. As stated earlier, resource-poor farmers more often need a flexible series of options from which they can choose in response to the way the season develops and to the resources they have at their disposal. Thus, while the groups test individual options, it is hoped that farmers will eventually use these options to develop their own packages. A study conducted on spontaneous farmer adoption found that by 1989 some farmers had already begun to do this (*see* Box 2, p. 15). The approach of developing options instead of packages thus appears a good one. This approach has now been partially adopted by the extension department.

Data volume

The huge volume of data that can rapidly accumulate in this type of research presents special problems. Just collecting very basic data on 150 trials—such as village, name of farmer, type of trial, crops, equipment and source of draft animals used, dates of operations, incidence of pests and diseases, and plot grain yields—creates a fairly large data set. When farmer assessments of technologies are added, the data set can become very large. When details of farm household resources and demographics are included, processing becomes extremely tedious. And this data set is entirely separate from any special studies that are done, such as that on spontaneous adoption.

Two important ways of addressing this issue are used in the Francistown group work. The first is to consider carefully exactly what data are desirable and meaningful and to restrict data collection to this minimum necessary amount. The second is to divide data collection and analysis among specialists within the team. For example, the agronomists collect and analyze quantitative production data, while the socio-economists collect and analyze data on farmer opinions in the end-of-season survey. In some cases external teams are invited to assist in special studies.

The introduction of informal survey techniques for use in the end-of-season survey will, if successful, greatly reduce the volume of data collected, and hence the time-lag between data collection and analysis.

Chapter 4

CONCLUSIONS AND LESSONS

Conclusions

Several major conclusions emerge from the group work in the Francistown Region. In many respects they confirm the experiences of Ashby et al. (1989), working with farmer groups in Colombia. They may be summarized as follows:

- **Groups increase the capacity and efficiency of an OFCOR program**

  Working with groups of farmers greatly expands the number of technology options researchers and farmers can examine on farm, and increases the number of technologies entering the extension process. At the same time, the approach helps to ensure that the technologies developed by research are practical and relevant to farmers. Since the Francistown groups have continued to function after donor funding ceased, they demonstrate that this approach to increasing farmers' participation in research can be institutionalized in a national research system.

- **The group approach is superior to individual farmer contacts**

  Researchers working with the groups concluded that the group approach is far superior to working with individual farmers. Groups allow major gains in research capacity and efficiency. Additionally, group dynamics, and particularly the change in farmer-researcher relationships that occurs under the group approach, are very beneficial. As Ashby et al. (1989, p. 131) have stated, "Consensus and dissent within a group are highly productive in highlighting farmers' management problems and constraints." And the the larger ratio of farmers to researchers enables farmers to extend their influence over the research program.

- **The group approach can strengthen links**

  The group approach can strengthen the links between the OFCOR team, farmers and local extension staff. In the Francistown case it also had the unforeseen effect of improving links with station-based researchers. This occurred because the groups increased the demand for the products of station-based research, facilitated the testing of these products and the feedback of results, and provided station-based researchers with easy access to farmers.

- **Farmer participation can be sustained**

  Farmer participation in group activities has been sustained over a period of 7 years. Continuing farmer interest is probably due to the flow of useful new information, the individual selection of research topics, and the availability of back-up support for testing new technology options.

Lessons

The 7 years of experimentation with the group approach in the Francistown Region have yielded some useful lessons for research managers interested in adopting the approach elsewhere. To reap the full advantages of group work, managers need to:

- **Define and communicate clearly the objectives of farmer participation in the research program**

  Before OFCOR programs start group activities, their managers should clearly define the objectives of such activities and decide what resources they will devote to them. This will help to define the most appropriate way to proceed.

  When launching farmer groups, it is important to discuss the objectives and the approach (how the groups might work) with both farmers and village-level OFCOR staff (as well as NGOs, if they are to participate). This will help to ensure that the groups are designed to function in ways that are attractive to farmers, practical for village-level support staff, and culturally acceptable. When these criteria are met, the groups are likely to function smoothly and enjoy good support not only from farmers but also from their families and friends.

- **Ensure senior scientists attend group meetings**

  Managers must do all they can to persuade senior scientific staff to participate regularly in group meetings. This is true not only in the initial stages, when numerous logistical and management decisions will need to be made, but also once the research is fully under way. Experienced researchers are needed to respond creatively to farmers' questions and observations. Their absence undermines the credibility of the research program. Thus researchers' attendance at the meetings they themselves have sought with farmer groups is not an optional extra—something to be fitted into an already crowded schedule if time allows—but a vital ingredient for successful on-farm research. Farmers rapidly lose interest when researchers start to miss scheduled meetings on a regular basis.

- **Start small**

  It is good to start with fewer and smaller groups. This allows researchers and farmers time to discover how to work together, as the program grows. Large groups require exceptionally good organization and experienced staff if they are to work well.

- **Ensure that researchers' attitudes to farmers are collegial**

  It is vital that researchers organizing group activities listen to farmers and respect what they are saying. A durable and effective program will require that both researchers and farmers feel they are getting something useful from the work. Farmers are likely to accept some external conditions

on experimental designs as long as their own interests are met. Farmers should be regarded as colleagues, not as an extra source of cheap labor for the research program.

- **Meetings are held regularly, at an agreed interval**

  Regular meetings are beneficial. When meetings are not held for 6 to 8 weeks, farmer interest tends to decline. The interval between meetings should be agreed at the outset. The optimum interval depends on the group objectives, and on whether the meetings are a one-off series (two or three meetings only might be organized for diagnozing specific problems) or part of an ongoing process (as with the Francistown groups).

- **Anticipate problems of data overload**

  One of the most difficult logistical problems in group work is how to manage the large information output from the groups. Data collection and analysis need to be tightly focussed on specific research objectives, and tailored to the analytical capabilities of the program personnel and to the computer facilities available.

- **Recognize that full participation can take time to develop**

  It should be clear from the start that researchers are not there simply to demonstrate technology, but are seeking a research partnership. Farmers in Botswana initially had difficulty in understanding that they were being asked for their ideas and opinions, and not simply being preached at. Eventually they became more relaxed about providing their views on the performance of the technologies being tested, but it took even longer to engage them in the design process. Researchers, as well as managers, need to recognize that building an effective partnership takes time, and to continually encourage farmers to experiment and to share their results with the group. To support this process, ways have to be found of bringing farmers' experimentation into the mainstream of group activities. Aim for the day when farmers' experiments are the rule, not the exception.

- **Be creative and flexible in organizing group work**

  The group approach to working with farmers may be new to many OFCOR programs. In this case, experience elsewhere will provide useful guidelines. However, managers introducing the approach will need to develop their own procedures, tailored to their own location, in collaboration with farmers and any other local participants. The approach must be developed to meet the objectives of all, not just some, of the participants, and in accordance with local cultural norms. To develop the best approach for a given situation requires creativity and flexibility in generating ideas, incorporating farmers' interests and dealing with unexpected opportunities or problems. A maxim from participatory rural appraisal methodology is an appropriate note on which to end: "Use your own best judgement at all times."

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