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OFCOR – Case Study No. 1

ZAMBIA
ORGANIZATION AND MANAGEMENT OF THE ADAPTIVE RESEARCH PLANNING TEAM (ARPT), RESEARCH BRANCH, MINISTRY OF AGRICULTURE AND WATER DEVELOPMENT

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

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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 is to analyze the critical organizational and managerial factors which influence how national research institutes can develop and sustain OFCOR programs to realize their specific policies and goals.

What is OFCOR?

OFCOR[1] is a research strategy 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 diagnosis and ranking of problems through 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:

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;

1/ 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

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3) to characterize major farming systems and client groups, using agro-ecological 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 process 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 efficiency of the technology generation and diffusion processes.

Why is 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 of 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 operational 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:

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

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 important insights and lessons on the general issues, as well as specific guidance for research policy and the organization and management of OFCOR in their countries. The cases will be published in 1988. A list of the reports follows.

Comparative study papers providing a systematic analysis across the case studies are a second product of the study. Synthesizing the experience of case study NARS, these papers provide practical advice to research managers on organizational and managerial issues central to effectively integrating OFCOR within their research systems. The themes developed are:

* Alternative Arrangements for Organizing OFCOR: Comparative Strengths and Weaknesses
* Integrating OFCOR and Experiment Station Research: Organizational and Managerial Considerations
* Organization and Management of Farmer Collaboration in Research
* Organization and Management of Linkages between OFCOR and Extension
* Organization and Management of OFCOR Research Process and Decentralized Field Operations
* Development and Management of Human Resources in OFCOR
* Financial Resource Use and Management in OFCOR
* Management of Relations with Donors and External Sources of Knowledge
* Issues in the Institutional Development of OFCOR in NARS

We expect these papers to be published during 1988. They are working papers presenting the results of the analysis of the nine concrete OFCOR situations. At this stage, they are intended to stimulate discussion and debate; they are not presented as "state-of-the-art" pieces on these topics.

OVERVIEW OF THE NINE CASE STUDIES

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The OFCOR efforts reviewed in the cases vary in scope, the emphasis assigned to different objectives and functions, and the specific methodologies employed. They all conform, however, to the general definition of OFCOR developed for this study. The cases reflect a variety of institutional settings and strategies for introducing and developing OFCOR. They also reflect the broad range of models used in the organization and management of OFCOR. The profiles below highlight the salient features of each case and Table I provides some key descriptive indicators for comparison across cases.

Latin America

Ecuador:

OFCOR is conducted by the Production Research Program (PIP, Programa de Investigación en Producción), an autonomous program within the Instituto Nacional de Investigaciones Agropecuarias (INIAP). It has two national coordinators responsible for the highland and coastal macro-regions and 10 regional field teams assigned to different provinces under the administrative auspices of regional experiment stations. Five teams are associated with integrated rural development programs.

Initiated in 1977 with support from CIMMYT, the case is particularly interesting because it allows us to trace the evolution of the organization and management of an OFCOR program from its origins as a pilot project through to its institutionalization as a full-fledged national program.

Guatemala:

An OFCOR philosophy pervades Guatemala's 16-year-old agricultural research institute, the Instituto de Ciencias y Technologia Agrícolas (ICTA) Two units, however, are specifically charged with carrying out OFCOR functions: the Technology Testing Department and the Socioeconomics Department. The first is responsible for testing in on-farm trials all technology developed by the commodity programs. The second conducts diagnosis, on-farm monitoring, and special studies.

The 14 Technology Testing Teams are made up of scientists and technicians whose research is coordinated from regional stations, but who live and work in designated research areas. The Socioeconomics Department is organized at the national level with

representatives in some of the regions. Almost all scientists in the department are agronomists with training in social science methods. Coordination between the two departments is limited.

ICTA's experiences with OFCOR have had a major influence on other countries. What makes Guatemala especially interesting is that OFCOR was not appended onto an existing system. Rather, ICTA was set up from the beginning to incorporate the OFCOR philosophy. Moreover, the ICTA case also allows us to examine the organization and management of OFCOR within a regionally organized research system. This is important because a regionalized research system has generally been regarded as the institutional setting most compatible with the organizational requirements of OFCOR.

Panama:

In the late 1970s, the Instituto de Investigación Agropecuaria de Panama (INIAP) developed a "national plan" through which priority areas for on-farm research were selected. OFCOR is implemented in some of these areas as part of the regular research programs of scientists who also work on-station. In other areas, OFCOR is implemented through projects with full-time staff, developed in collaboration with international agricultural research centers. The projects are variable in organization and operations, and there is no mechanism at the national level for coordinating the diverse OFCOR efforts. What is particularly interesting about Panama's experience is the institutionalization of OFCOR as a research strategy, rather than as a formal program with a discrete OFCOR unit or units.

Africa

Senegal:

The Department of Rural Sociology of the Institut Sénégalais de Recherche Agricole (ISRA) initiated an OFCOR program in 1978. It is now part of the Department of Production Systems and Technology Transfer (DRSP, Departement de Recherche de Systèmes de Productions et Transfert de Technologies en Milieu Rural), one of the four main research departments established in 1982 after a major reorganization of ISRA under the auspices of a World Bank project. The DRSP consists of a Central Systems Analysis Group (GCAS, Groupe Central d'Analyse Systèmes), three multidisciplinary OFCOR teams located at regional stations, a Bureau of Macro-economic Analysis (BAME, Bureau d'Analyses Macro-Economiques), and a division of thematic research. The case focuses on the OFCOR part of the DRSP, namely the GCAS and the three regional teams.

Senegal is an interesting case because the classic regional team model for implementing OFCOR was modified to include a core multidisciplinary group of scientists, the GCAS, which supports the work of the teams. Also of interest is Senegal's experience blending francophone and anglophone approaches to on-farm research.

Zambia:

The Adaptive Research Planning Team (ARPT) conducts OFCOR in Zambia. The ARPT, initiated in 1980, is a national research program under the Research Branch of the Ministry of Agriculture. It is of equal status to and complements the national commodity programs. The ARPT comprises a national coordinator, based at the central research station, and seven teams of scientists and field technicians at provincial experiment stations. Each team is funded by a different donor.

ARPT includes two particularly interesting innovations: the formal integration of sociologists and the inclusion of research-extension liaison officers in the teams.

Zimbabwe:

Zimbabwe's Department of Research and Special Services (DR & SS) adopted OFCOR in 1980 as a strategy for reorienting research to meet the needs of small-farmers in the communal areas. This was in response to the post-independence national policy to emphasize agricultural development for this sector.

There is no integrated OFCOR program. Several research institutes and stations and a specialized Farming Systems Research Unit (FSRU) have developed independent initiatives. The case study examines OFCOR in the FSRU and four institutes -- the Cotton Research Institute, the Agronomy Institute, the Crop Breeding Institute, and a regional research station. This provides us with an unusual opportunity to analyze the implementation and integration of OFCOR under several distinct models for organizing research, but all within a single institution.

In the institutes, individual scientists carry out both on-farm and station-based research, while scientists in the FSRU specialize in on-farm research. The FSRU consists of a core multidisciplinary team based at the central station and two regional teams staffed by technicians. Their research has had a strong systems perspective emphasizing crop-livestock interactions.

Asia

Bangladesh:

The Bangladesh case study concentrates on the on-farm research activities of the Bangladesh Agricultural Research Institute (BARI), the largest unit of the NARS. The On-Farm Research Division (OFRD), created in 1985, has the exclusive mandate for on-farm research in BARI. OFCOR teams are located at 23 stations and substations, from which they direct technicians in 11 farming system research sites and 83 multi-locational testing sites.

The OFRD subsumed four distinct older programs: multi-locational testing of the Soil Fertility and Soil Testing Institute (later renamed the On-Farm Trials Division); cropping system research on

the IRRI model; varietal testing and verification of the wheat program; and the adaptive research of the T & V Extension Research Program. An important aspect of the Bangladesh case study is its analysis of the consolidation of these different approaches to OFCOR under common management.

Indonesia:

OFCOR is implemented in Indonesia's Agency for Agricultural Research and Development (AARD) in sub-programs of the commodity institutes, and also in multi-institute projects organized at the AARD level. The case study focuses on two examples of each major type.

The multi-institute projects are an interesting institutional innovation. These projects are staffed by senior scientists seconded from the participating institutes. They maintain contact with their home institutes and return to them at the end of the project. We wanted to examine this arrangement because of its potential for building strong links between OFCOR and station-based specialist scientists, as well as for the long-term integration of the OFCOR philosophy and methodology within the NARS.

The gradual evolution of OFCOR as a research strategy in the NARS is another important aspect of the Indonesian experience. Starting as an informal program of one institute in the early 1970s, OFCOR methods were slowly integrated into other commodity institutes. Specialized teams have only been developed since the early 1980s. OFCOR in Indonesia has been a national initiative which has drawn on a number of approaches to OFCOR, particularly that of the Asian Cropping Systems Network developed in association with IRRI.

Nepal:

On-farm research programs of different types have existed in a variety of institutions in Nepal since the early 1970s. Out of the diverse settings of OFCOR in Nepal, we chose five sub-case studies which illustrate the major models of organizing OFCOR:

- OFCOR implemented through a commodity program - the National Rice Improvement Program;
- OFCOR implemented through a cropping systems program;
- OFCOR implemented through a specialized unit - the Farming Systems Research and Development Division (FSR & DD), supported by a separate socio-economics division;
- OFCOR implemented as a generalized strategy in two small, externally-funded, regional research institutes - Lumle Agricultural Research Centre and Pakhribas Agricultural Centre.

The contrast between the OFCOR programs of the NARS and those of the externally funded institutes make Nepal an especially interesting case.

Descriptive indicators of the nine OFCOR studies

Case Studies	National Agricultural Research System		Organization of OFCOR	Years in Operation [3]	Scale of OFCOR: (Scientist Years)	
	Institutional Type	Organization of Research Program			OFCOR as % of NARS Human Resources	Size of OFCOR effort
Ecuador	Semiautonomous institute (INIAP)	Regional research stations/commodity programs	Production Research Program (PIP)[b]: National program with two coordinators and 10 teams based at regional research stations	9	6	14
Guatemala	Semiautonomous institute (ICTA)	Regional research programs/commodity programs	Technology Testing Department with 14 field teams in 6 regions and national socioeconomics department with limited regional representation [c]	14	34	65
Panama	Semiautonomous institute (IDIAP)	Commodity programs/ regional offices	National OFCOR plan identified target regions where OFCOR is implemented through special FSR projects or part-time on-farm research	7	16	24
Senegal	Semiautonomous institute (ISRA)	Multi-commodity departments/ regional stations	OFCOR, located within Department of Production Systems Research and Technology Transfer (DRSP)[d], consists of 3 regional teams and a Central Systems Analysis Group.	4	13	22
Zambia	Ministry (MAWD)	Commodity and factor programs	OFCOR program with national coordinator and 7 provincial teams at regional stations	6	20	38[h]
Zimbabwe	Ministry (MLARR)	Commodity and disciplinary based institutes and stations	OFCOR implemented by: - 8 research institutes/stations with combined on-station/on-farm research programs; - Farming Systems Research Unit (FSRU) based at central station with two regional teams	6	18	26
Bangladesh[1]	BARI, semiautonomous institute of larger NARS with council	Disciplinary departments/ commodity programs	On-Farm Research Division (OFRD), with Central Management Unit at headquarters and 24 teams deployed through BARI's network of regional stations, has official mandate for on-farm research. Consolidation of previous OFCOR efforts.	9[e]	12	104
Indonesia[2]	Ministry, Dept of Research (AARD) with multiple institutes and coordinating bodies	Commodity-based regional institutes	Two principal modes of implementation: - Research institutes conduct OFCOR as part of regular programs; - OFCOR projects organized at AARD level with staff seconded from multiple institutes.	11[f]	n/a	57[i]
Nepal[2]	I. NARS: ministry II. LAC and PAC:[a] externally funded autonomous institutes	I. Commodity programs / disciplinary departments II. LAC: Multi-disciplinary research thrusts PAC: Disciplinary departments	I. - Farming Systems Research and Development Division (FSR&DD) with 6 FSR sites, supported by Socio- Economics Research and Extension Division (SERED); - Commodity programs with multi-locational testing and outreach programs. II. LAC and PAC, regional institutes with OFCOR as a generalized research strategy.	14[g]	n/a	35[i]

FOOTNOTES FOR TABLE I.

1. The case study is limited to the Bangladesh Agricultural Research Institute (BARI), the largest of the 5 institutes coordinated by the Bangladesh Agricultural Research Council (BARC).

2. Data refers only to the sub-case studies unless otherwise indicated; NARS-wide data not available.

3. Base year for all statistical data is 1986.

a. Lumle Agricultural Centre and Pakhribas Agricultural Centre.

b. Programa de Investigación en Producción.

c. The Spanish names for these departments are Prueba de Technología and Socioeconomia.

d. Département de Recherche de Systèmes de Production et Transfert de Technologies en Milieu Rural.

e. Refers to NARS. Several OFR programs with complex histories operate within BARI. The oldest, the On-Farm Fertilizer Program dates back to 1957. This program was reorganized in the late 1970's, about the same time Cropping Systems Research was established in BARI. The OFRD was not formally consolidated until 1984.

f. Refers to NARS. In 1973, multiple cropping research in the Central Research Institute for Food Crops took on a systems orientation and was renamed cropping systems research (CSR). CSR moved onto farmers' fields in 1975.

g. Refers to NARS. Cropping/farming systems research was initiated 9 years ago. On-farm rice research is 14 years old.

h. Includes 6 Research-Extension Liaison Officers seconded from extension.

i. Represents totals for sub-case studies only. Not directly conparable to other NARS-wide data.

LIST OF OFCOR CASE STUDY REPORTS (forthcoming in 1988)

-- Zambia: A Case Study of Organization and Management of the Adaptive Research Planning Team, Research Branch, Ministry of Agriculture and Water Development. (S.A. Kean and L.P. Singogo)

-- Zimbabwe: A Case Study of the Organization and Management of Five On-Farm Research Programs in the Department of Research and Special Services, Ministry of Agriculture. (M. Avila, E.E. Whingwiri, and B.C. Mombeshora)

-- Sénégal: Organisation et Gestion de la Recherche sur les Systèmes de Production, ISRA. (J. Faye and J. Bingen)

-- Ecuador: Un Estudio del Caso de la Organización y Manejo de Programa de Investigación en Finca de Productores (PIP) en el Instituto National de Investigación Agropecuaria (INIAP). (R. Soliz, P. Espinosa, and V.H. Cardoso)

-- Guatemala: Un Estudio del Caso de la Organizacion y Manejo de la Investigacion en Finca en el Instituto de Ciencia y Technología Agrícola (ICTA). (S. Ruano and A. Fumagalli)

-- Panama: Un Estudio del Caso de la Organización y Manejo de Programa de Investigación en Finca de Productores, Instituto de Investigaciones Agropecuarias (IDIAP). (M. Cuellar)

-- Bangladesh: A Case Study of the Evolution and Significance of On-Farm and Farming Systems Research in the Bangladesh Agricultural Research Institute (BARI). (M.A. Jabbar and M.D. Zainul Abedin)

-- Indonesia: A Case Study on the Organization and Management of On-Farm Research in the Agency for Agricultural Research and Development, Ministry of Agriculture. (J. Budianto, I.G. Ismail Siridodo, P. Sitorus, D.D. Tarigans, A. Mulyadi Suprat)

-- Nepal: A Case Study of the Organization and Management of On-Farm Research in Nepal. (B.N. Kayastha and S.B. Mathema)

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FOREWORD

The seven years of Zambian experience with developing a major OFCOR program within the Research Branch of the Ministry of Agriculture and Water Development provides valuable insights into and lessons on the organization and management of OFCOR and the process of institutionalization.

The authors of the case study have been closely involved in the development of the Adaptive Research Planning Team (ARPT). Stuart Kean participated in planning and establishing ARPT and served as ARPT National Coordinator for the first six years of the program. Lingston Singogo, who had previously worked with ARPT as a Provincial Agricultural Extension Officer, assumed the position of ARPT National Coordinator in 1986.

With their intimate knowledge of the program and its history, the authors have generated a penetrating analysis of the key organizational and managerial issues which emerged during the development of the program, as well as a rich synthesis of the management experience.

Chapter 1 gives an overview of agriculture and agricultural development in Zambia. Chapter 2 provides a quite detailed description of the organization, management, and resource base of the Research Branch.

Chapter 3 focuses on the organization and management of ARPT within the context of the Research Branch. It includes the evolution of the program, focusing on the key decisions taken and their rationale, in-depth case studies of the research programs and management of three provincial ARPT teams, and an analysis of key issues in the management of the national program. This chapter provides a wealth of information on ARPT as well as a very valuable compendium of management experience on running a large national program coordinating several semi-autonomous regional teams.

Chapter 4 focuses on the three key sets of linkages: those between ARPT and farmers, ARPT and extension, and ARPT and station-based commodity and specialist research teams. The authors assess the level and quality of interaction in each area, analyze the factors determing the nature of the interaction, and synthesize the experience gained in organizing and managing these links to develop more effective and efficient interaction. Their analysis provides some instructive lessons and practical ideas for research managers striving to build stronger links in their own systems.

Chapter 5 is an analysis of ARPT's performance of the seven OFCOR functions identified within the ISNAR study. A similar analysis is carried out in all the case studies in the study as a basis for systematic comparative analysis across OFCOR situations. The performance is assessed, evidence is provided to support the assessment, and then the key organizational and managerial factors determining the performance are identified.

Finally, in Chapter 6, the authors have developed a series of specific recommendations for strengthening the organization and management of ARPT based on the conclusions of their analysis.

Although the case is a detailed analysis of a specific OFCOR situation, the analysis of organizational and managerial factors affecting the performance of the program, and its integration within the NARS, as well as the lessons extracted, are of broad interest and value to research managers and OFCOR practitioners operating in a wide range of institutional situations.

This case study has made a major contribution to the ISNAR study and I, personally, have learned a tremendous amount from the case and from working closely with the two authors.

Deborah Merrill-Sands

Study Leader and
Coordinator for the
Zambian case study

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Stuart Kean was closely involved in the planning stages of the Adaptive Research Planning Team (ARPT) as a member of the Planning Division of the Ministry of Agriculture and Water Development. In 1980 he was appointed as the first National Coordinator of the ARPT. He served in this position until 1987. S. Kean is currently pursuing his Ph.D. at the School of Development Studies, University of East Anglia, Norwich, UK.

Lingston Singogo, formerly a Provincial Agricultural Officer in the Extension Branch, is the current National Coordinator of ARPT. He has held this position since July 1986.

SUMMARY

Zambia, a landlocked country in southern Africa, is facing a grave economic situation. Classified by the World bank as a low-income economy, Zambia has achieved only slow economic growth since the mid 1970s. The economy is highly dependent on copper, which in 1984 accounted for 88% of Zambia's exports. However, since the mid-1970s, the combination of low copper prices and, until recently, rising oil prices, has created serious foreign exchange problems. With an annual population growth rate of 3.1%, per capita GDP has been declining in real terms at an annual average rate of 3.0% since 1977. Malnutrition is a significant problem which has worsened in recent years.

Agricultural Sector

Agriculture has been the most dynamic sector in the 1980s, with an annual growth in agricultural GDP of 2.9% between 1980 and 1985. Zambia continues to require food imports, however, and in 1982 imports represented approximately 2% of GDP. Approximately 7.0% of Zambia's total land area is arable.

Almost two-thirds of rural households are engaged in agriculture. The sector is characterized by a dualistic structure in which less than 1,000 large-scale commercial farmers operate highly mechanized farms, in contrast with some 600,000 small-scale and subsistence farmers who operate farms of lass than 10 ha, relying on oxen or hand cultivation. In some provinces more than one-third of households are headed by women. These are among the poorest households in the country.

Maize is the dominant food crop, although sorghum, millet, and cassava are the principal food crops in areas less well-suited to maize cultivation. In 1981 the value of livestock output accounted for only 11% of total agricultural output.

Agricultural Research

The Research Branch of the Department of Agriculture in the Ministry of Agriculture and Water Development (MAWD) is responsible for most agricultural research in Zambia.

Organization. The Research Branch was organized along disciplinary lines until the late 1970s when, following several evaluations, it was reorganized into a two-level system. The new system includes sixteen Commodity and Specialist Research Teams (CSRTs), established

on an interdisciplinary basis to conduct on-station component research, and a coordinated program of Adaptive Research Planning Teams (ARPTs) established to conduct farming systems research (FSR) in each of Zambia's nine provinces. The ARPT is the focus of this study.

The research system is quite centralized in manpower, resources, and decision-making, despite an extensive network of regional stations and substations throughout the country. In 1986, 44% of the scientists were based at the Central Research Station, and almost half the research teams had their headquarters there. The regional stations have been difficult to maintain, and a consolidation is planned for the near future.

Funding. The greatest problem currently facing the Research Branch is the inadequate allocation of Government funds, especially for operating expenses. Between 1976 and 1985 the toal expenditure of the Research Branch declined in real terms by 33%. Over the same period, allocations of operating expenses declined from 28% to 12% of total expenditure. This has increased the vulnerability of all research teams except those funded by donors. Donor funding has, on average, accounted for 40% of total research expenditure. The financial problems have been exacerbated by erratic disbursement of Government funds and cumbersome budgetary procedures.

Manpower. In 1986, there were 157 scientists and 250 technical staff in the Research Branch. The number of scientists has increased dramatically in recent years, more than doubling since 1977. The official number of civil service positions, however, has remained constant at 68. In 1977, 78% of scientists in the Research Branch were expatriates because there were no Zambian agriculture graduates until 1973. However, by 1986 the number of Zambian scientists had increased sixfold, and expatriates constituted only 46% of scientists. The percentage of Zambian ARPT scientists with M.Sc. degrees increased from 20 to 34 between 1982 and 1986. Although attrition of Zambian scientists has not been a serious problem, many are dissatisfied with their conditions of service and have complained about the low salary levels, poor promotion prospects, and the shortage of housing.

Adaptive Research Planning Team (ARPT)

Organization. ARPT, established in 1980, is a national program. In 1986 it had seven provincial teams backstopped by a national coordinator, four regional sociologists, and one nutritionist. Each provincial team is supposed to have a Farming Systems Economist, a Farming Systems Agronomist and a Research Extension Liaison Officer (RELO). Little attention has so far been given to the problems of livestock, but three Adaptive Livestock Specialists are now being recruited.

The professional staff are based together at regional research stations in the provinces. They are supported by 1-3 Trial Assistants (TAs) who are seconded from the Extension Branch and are based in the field to supervise on-farm trials.

The provincial ARPT staff are responsible, through the ARPT Provincial Coordinators, to the ARPT National Coordinator, and in turn to the Chief Agricultural Research Officer (CARO).

Size. ARPT is a major program in the Research Branch. In 1986 it had 38 professional staff, representing 20% of all scientists, and 17 technicians. In the 1985/86 season, six provincial ARPTs conducted a total of 66 on-farm trials with 371 farmers.

Objectives. ARPT was set up with the overall objective of helping the Research Branch to produce recommendations relevant to the needs of the majority of Zambia's farmers, especially the subsistence and small-scale commercial producers. ARPT's main functions are to:

1) collect information on the different farming systems in Zambia;
2) select components from previous technical research likely to be appropriate to the immediate needs and circumstances of the specific groups of farmers identified and test these under farmers' conditions;
3) feed unsolved technical problems, identified as important for local farmers' development, to the appropriate CSRT;
4) link research closely to both farmers and extension, drawing extension staff into the technology-generation process;
5) pass on relevant information to planners and agricultural service institutions.

Methodology. ARPT methodology has been derived from the CIMMYT Economics Program but has been adapted to suit Zambian conditions. Low-cost survey techniques continue to be used, but these are supplemented with a wide range of more intensive techniques, including participant observation and frequent visit surveys. ARPT's methodology entails: zoning, surveys, on-farm trials, and on-farm tests.

Establishment and Evolution. The initiative to establish ARPT in 1980 came entirely from within Zambia. In concordance with a national development policy initiative focused on small-scale and subsistence farmers, senior research and extension managers in the Department of Agriculture and policymakers in MAWD decided to reform the research program to more effectively meet the needs of this client group. The strong commitment of senior research and extension managers was an important factor enabling the adoption of the more radical option of establishing a separate farming systems research program. In addition, there was sufficient organizational flexibility to institute a major change, since the Research Branch had been in a state of flux since the mid 1970s. Several of these senior managers remained in position for enough years to provide support and continuity of direction for ARPT during the critical period of establishment.

ARPT was established as a separate section in the Research Branch for several reasons. It was recognized that there was incompatability between the national commodity focus of CSRTs and the area focus of FSR. The alternative of placing social scientists in CSRTs would have meant the loss of the systems perspective. In addition, considerable duplication of effort and confusion for

farmers could have resulted from each CSRT carrying out its own surveys and on-farm trials in the same farming systems. It was also recognized that adaptive on-farm research requires different skills from applied on-station research and has different organizational and managerial requirements. Finally, the complementary approach afforded the opportunity to develop a team of experienced researchers which could criticize itself openly and thereby improve its structure, methods, and activities.

Teams were organized by province, rather than agro-ecological zone, largely because the province is the organizational unit for extension and agricultural development. This structure has helped to foster ARPT's links with extension. Most provinces are also large enough to warrant having their own ARPT. In addition, there were already nine provincially based Regional Agronomists who were transferred to ARPT. The provincial organization has involved certain inefficiencies, however; in particular some duplication of effort and incursion of additional costs when two ARPTs work in similar farming systems in the same agro-ecological zone but in different provinces.

It was intended that ARPT would expand gradually after an initial phase of working in four provinces with markedly different farming systems. However, ARPT expanded faster than intended, largely due to donor pressure, and after two years was operating in five provinces. This created certain problems. Research quality was affected because not all provincial teams could be fully staffed from the start, technical supervision was reduced, and there was less time to consolidate experiences. In addition, the rapid influx of funds into ARPT created some resentment among CSRT scientists.

Several mechanisms were helpful in establishing ARPT. In-service training courses on FSR research methods were provided to all ARPT staff; several workshops were held to discuss methodological issues; and both short- and long-term consultants were brought in to advise on a wide range of issues.

National Coordination. National coordination has been an important component of ARPT's activities. The national coordinator (ARPT NC) provided both scientific leadership and administrative support to the provincial teams. Coordination helped to build a coherent program at a time when the concept of FSR was new and many staff were inexperienced in on-farm and systems research methods. It also facilitated supervision of the research of the decentralized teams and ensured interaction between teams so that they could learn from each others' experiences and methodological experiments. The coordinator also took care of the substantial administrative responsibilities associated with establishing ARPT and working with more than nine different donors. The fact that the first ARPT NC held the position for over six years provided continuity to the teams' direction.

In the early years, the National Coordinator was based at MAWD headquarters and reported directly to the Assistant Director of Agriculture (Research). This greatly facilitated the execution of the administrative responsiblities associated with establishing ARPT, but at the same time also created resentment among some scientists. Since 1985 the National Coordinator has reported

directly to the Chief Agricultural Research Officer, as do all other team leaders, and the office has been moved to the Central Research Station. This has facilitated building stronger links with CSRT scientists.

Rural Sociology Section. The ARPT Rural Sociology Section was established following a two-year consultancy to review the need for a sociological input into ARPT's work. The sociologists in the section now backstop the provincial ARPTs, providing advice on all team activities as well as undertaking focused studies. The section has played an important role in helping ARPT to improve its sampling and selection of farmers, but has also contributed information on a wide range of issues, including: intra-household relationships, gender issues, social controls regulating access to resources and community composition.

Nutrition Coordinator. In 1982 there was concern that provincial ARPTs should give greater attention to studying the nature of nutritional problems and to incorporating specific solutions into the experimental programs. Following a successful two-year consultancy in Luapula Province, the position of ARPT Nutrition Coordinator was transferred to the Central Research Station in order to be better able to serve all provincial ARPTs.

Research-Extension Liaison Officer (RELO). Implementing the position of RELO has been somewhat complicated. By 1986, only four of the ARPTs had filled the position. The position is established in the Extension Branch of the MAWD but, as a full time-team member, the RELO is technically and administratively responsible to the ARPT Provincial Coordinator. This joint responsibility has created some difficulties. There have delays in recruitment resulting from ambiguities about whether Research or Extension should initiate the process; confusion over the job description; and operational questions about whether the RELO should be based with ARPT or at the provincial extension headquarters. In some provinces, RELOs have assumed general extension responsibilities to the detriment of their ARPT duties.

Program development and management. Considerable attention has been given to program development and planning, programming, and review within ARPT in order to develop a coherent approach and maintain standards. This was necessary to offset the substantial decision-making and administrative autonomy given to the regional teams. In addition, it has been an important part of ARPT's policy to try to involve representatives from other research, extension, and development organizations in the planning and review processes at both provincial and national levels. The programming and review mechanisms established include: quarterly ARPT staff meetings, ARPT annual review, ARPT Provincial Committees, provincial ARPT exchange visits, Commodity Review meetings, and ARPT annual and quarterly reports.

Administration. Professional staff in all the teams have had to spend large amounts of time on administration to avoid having their research programs jeopardized by delays and shortages of vital equipment. Cumbersome bureaucratic procedures and limited resources for administrative personnel have forced the National and Provincial

Coordinators to spend 30-40% of their time on administration. Even when donor projects supporting ARPT have had administrative units, administration has still been time consuming because donor procedures have often been as cumbersome as those of the Zambian Government. The most effective strategy has been for Provincial ARPT Coordinators to delegate administrative responsibilities between team members, thereby sharing the load and improving team building.

Donor support. ARPT, in common with most other research teams, has received considerable support from donor organizations. Nine donors have provided ARPT with assistance, seven of which have provided long-term personnel and finance. The level of financial support has ranged from 50-100% of total annual expenditure, and four provincial ARPTs have been completely funded by donors, excluding the salaries of local staff.

Donor support has influenced ARPT's development in several ways. On the positive side, it enabled ARPT to become firmly established as a viable program within the Research Branch, even though it also led to overly rapid expansion in the early years. It has enabled experimentation with and use of more resource-intensive methods. It compensated for shortages in operating funds. And, some donor project structures have facilitated interaction with other project staff working in CSRTs and extension. Some of the difficulties have been that donor project objectives have not always matched those of ARPT, some donor-funded expatriate staff have come under short-term contracts leading to discontinuities in research, and the presence of expatriates in teams has sometimes created tension with Zambian team members.

Human resources. Manpower development has been an important objective within ARPT. Zambians have been recruited as new graduates from the University of Zambia and given in-service training in FSR techniques, primarily through training workshops organized by CIMMYT.

The number of professional staff increased from 8 to 38 between 1982 and 1986. In order to overcome the shortage of qualified and experienced Zambian manpower, ARPT has recruited expatriates. In 1986, expatriates constituted 47% of professional staff, a proportion similar to that of the Research Branch as a whole. Education levels of ARPT scientists are comparable with those of other teams when expatriate and Zambian staff are combined, but when disaggregated it is evident that ARPT has a lower proportion of Zambian M.Sc. degree holders than other research teams. However, by 1986, 45% of Zambians had either received or were away on M.Sc. training. In 1986, the composition of professional staff in ARPT was 39% agronomists, 37% economists, 16% RELOs, and 8% rural sociologists.

ARPT has made a strong commitment to incorporating social scientists. However, a current concern of management is that staff positions for social scientists still have not been permanently established in the Research Branch. This makes their status and career prospects within the Ministry ambiguous.

ARPT's Trials Assistants (TAs) are seconded from the Extension Branch to work full-time for ARPT for 4-5 years. The TAs are agricultural certificate holders and have proved to be quite effective at managing the daily field operations. It has been important, however, to select motivated individuals, to provide them with basic refresher training about trial management, and to ensure that they have had adequate administrative support. The TAs are recognized as being vital team members who, by living in the same location as trial farmers, are better able to understand farmers' problems and views about trials. Questions about rotating TAs back to extension are now arising because some teams are so satisfied with their TAs' work that they are reluctant to let them go. Permanent secondment, however, would undermine the valuable opportunity to improve research-extension interaction.

Financial resources. On only a few occasions have shortages of funds affected ARPT's work program, due to the buffering effects of donor funding. The total annual expenditure for running one provincial ARPT, based on actual expenditure figures, has been calculated to be US$ 70,000, including staff salaries.

Management of field operations. The management of ARPT's field operations has generally been quite effective. However, although few trial sites have been lost, ARPT agronomists have expressed concern that the number and scattered distribution of trial sites has occasionally resulted in inadequate supervision and poor results. To avoid these problems, ARPT has tried to use the principle of selecting farmers in clusters within a Target Area of 20 km radius from the TA's home. However, when farmer selection has been left in the hands of the community or extension workers, not only have unrepresentative farmers been selected, but farm sites have been widely scattered. Steps taken recently to improve farmer selection, using more systematic procedures, have helped to reduce distances between sites.

Poor communication systems have created problems for ARPT staff, especially communications between Lusaka and the provinces, but also between the provincial teams and TAs in the more remote Target Areas. Distances are great, roads are of poor quality, and both the postal and telephone systems are unreliable. The situation has necessitated greater delegation of decision-making to the field level.

Functional Analysis

As in all the other cases in this comparative study, the study team assessed ARPT's performance of the seven core functions of OFCOR identified by the general ISNAR study (ref. Introduction to the ISNAR Study on Organization and Management of On-farm Client-oriented Research, p. iii). The assessment was based on information collected through interviews with ARPT and CSRT scientists and senior management, questionnaire responses, and the analysis of secondary information such as quarterly and annual reports. Organizational and managerial factors affecting the performance of the functions were subsequently analyzed. The functions were assessed both in terms of their ideal importance and their actual importance, as indicated by their current level of performance.

The aggregate responses of ARPT and CSRT scientists indicate that they considered all of the seven functions to be at least very important in ideal terms, although their actual importance was variously ranked between moderately important and very important. The function of feeding back farm-level information to CSRT scientists received the highest rating in ideal terms, but one of the lowest in terms of actual performance.

Helping to foster a stronger client-orientation and problem-solving approach within the Research Branch. The study team concluded that ARPT has made moderate progress in performing this function. ARPT is seen by senior research managers and CSRT scientists as having helped the Research Branch to focus on the needs of small-scale farmers. The level of progress has been influenced, in particular, by the strong policy emphasis on small-scale farmers and the commitment of senior research managers.

Contributing to the application of an interdisciplinary systems perspective within the Research Branch. Quite good progress has been made by ARPT with respect to this function. This is apparent from the definition of ARPT research programs in terms of both socioeconomic and agronomic criteria and from the collaboration among team members in program implementation. Numerous factors have facilitated interdisciplinary collaboration, but the continued presence of scientists from each discipline and their location together at the research stations have been the most critical.

Characterizing major farming systems and diagnosing priority production problems. ARPT has made good progress in performing this function. Substantial information has been collected on farming systems in Zambia, which has been used for identifying research priorities. It is clear from the in-depth analysis of the research programs of three ARPT provincial teams that the clarity of the teams' understanding of different target groups of farmers and their research needs has improved over time and that this has helped to sharpen the focus of the trial program. ARPT has, however, been less effective in disseminating this information to CSRT scientists. The presence of experienced economists within the team from the beginning was identified as a very important factor influencing the successful performance of this function.

Adapting technologies through on-farm experimentation. ARPT has made moderately good progress with respect to this function. ARPT has undertaken a large number of on-farm trials in a wide range of farming systems. In most cases these have been closely monitored and the results carefully analyzed and interpreted. The research programs of most teams clearly show an evolving focus and sharper problem definition. The longer established teams have promising technologies emerging and have produced revised provincial recommendations targetted more specifically at distinct client groups.

The emphasis in trial work has been placed on researcher-managed trials, however. Forty percent of trials have been conducted on-station, and only 30% of the on-farm trials have been farmer-managed. This is largely because, until recently, only a few CSRTs have had new technologies ready for on-farm testing. Factors

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identified as facilitating the performance of this function included: experienced agronomists, specialized training in farming systems and on-farm research methods, program review mechanisms, and the preparation of Trial Outlines.

Promoting farmer participation in research. ARPT's role in promoting farmer participation in research has varied among teams, but in general has been between moderate and good. Farmer participation has been greatest in surveys and in the feed back of comments about the utility and performance of technologies under test in on-farm trials. This information has shaped the ARPT trial programs, although farmers have rarely been explicitly consulted during the process of developing trial programs. Also, in general, ARPT staff have not attempted to feed trial and survey results back to farmers.

Farmers in some cases have not fully understood the purpose of ARPT. This has led to misunderstandings and unrealistic expectations about benefits of collaboration with ARPT. Systematic selection of representative farmers has also been a problem area. In the early years there was a bias towards relatively resource-rich male farmers. To correct this problem, more systematic selection procedures are currently being experimented with and evaluated.

A wide range of organizational and managerial factors have improved the level and quality of farmer participation. These include: small-farmer field days, end-of-season meetings, informal discussions between agronomists and TAs, closer clustering of trials, involvement of rural sociologists and, in one province, the training and visit system.

Providing feedback to the research priority-setting, planning, and programming process. Progress in performing this function has been slower and more difficult due to problems in developing effective interaction between ARPT and CSRT scientists. However, interaction and collaboration has improved markedly over time, and by 1986 it was assessed as being between moderate and good.

During the establishment of ARPT, interaction was limited, and some CSRT scientists criticised ARPT for its favorable resource allocation, the number of social scientists, the quality of its experiments, and the unilateral decision-making of some ARPT scientists. In recent years, however, interaction has improved, and an attitude of mutual respect has developed. By 1986 there was very useful interaction in planning trials and review of results. Involvement of CSRT scientists in the design and implementation of ARPT's surveys, however, has remained limited.

Interaction has improved for several reasons. CSRT's interest in collaborating with ARPT increased as they had new technologies for testing on-farm. Senior research managers promoted stronger collaboration and created several formal occasions for interaction. Other factors identified as affecting the level of interaction include: resources allocated to CSRTs; the location of ARPT and CSRT scientists at the same research station; and the structure of donor projects.

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Linking research with extension. ARPT has made moderately good progress in developing effective linkages with extension workers, especially in the Target Areas where ARPT works. The level of interaction has varied with the different levels of extension worker. Camp-level extension staff have been most directly involved in ARPT activities such as surveys, trials, and on-farm tests. There has also been good feedback of comments to ARPT about trials and farmers' problems from camp and block extension staff. At provincial and, to a lesser extent, district levels, the subject-matter specialists (SMSs) have had good opportunity to participate in planning ARPT's work program. Similarly, ARPT staff have had good interaction in planning extension demonstrations, collaborating in extension training and in preparing newsletters, especially when a RELO has been on the team. There has been very little interaction between ARPT and SMSs based at national headquarters.

The support of senior extension managers has been very important in encouraging the level of interaction between ARPT and extension, as exemplified in the secondment of RELOs and TAs to work for ARPT. This has provided direct links between research and extension and it has also facilitated interaction with other extension workers. Other factors identified as influencing the level of interaction include: the organization of extension using the training and visit system; donor project organization; and several manpower factors.

Linking research with development agencies. ARPT's progress in this area has been limited. A number of links have, however, been established with policymakers and development agencies in order to strengthen the capacity of service organizations to support technologies being developed by ARPT. The strongest links have been made at the provincial level. At the national level, the ARPT NC has developed informal contacts with numerous agencies. The lack of formal mechanisms for such interaction has limited effective interaction.

Key determinants of functional performance. The study identified key factors determining the performance of each of the seven OFCOR functions. When aggregated, these can be divided into policy factors (2), organizational factors (11), manpower management factors (8), resource management factors (3), linkage management factors (10), programming and review management factors (5), and methodological factors (3).

The factors assessed as having the greatest effect on the largest number of functions were:

- the support of senior research managers;
- a full complement of staff on the provincial teams;
- experience level of staff;
- specialized training in farming systems and on-farm research;
- joint CSRT-ARPT field visits;
- ARPT participation in CSRT review meetings;
- ARPT methodology.

Accomplishments and Outputs of ARPT

The most important accomplishments and outputs of ARPT include:

- revision of recommendations in some provinces to reflect the needs of different farming systems;
- identification of reasons for non-adoption of some current recommendations;
- identification of new directions for on-farm and on-station research and the confirmation of some existing priorities for research through farm-level diagnosis;
- development of improved understanding of the importance of the socioeconomic dimensions of farming;
- increased involvement of farmers in the research process;
- strengthened links with extension workers;
- development of a team of trained, experienced and motivated staff.

Lessons from the Zambian Experience

The key lessons of the Zambian strategy to institutionalize OFCOR are:

1) Establishing an OFCOR program as a separate section has had major advantages in terms of systematic expansion, the development of a cadre of experienced and well-trained scientists and technical staff, providing a conducive environment for development and refinement of research methods, and efficiencies in resource use. It is contingent, however, upon having strong policy support from senior research managers, experienced OFCOR scientists, strong scientific leadership, and effective mechanisms for formal and informal interaction between OFCOR and commodity or disciplinary scientists. Mutual respect is essential if linkage mechanisms for promoting strong collaboration are to be successful.

2) Locating OFCOR teams in provinces rather than agro-ecological zones has effectively decentralized the research program and facilitated interaction with extension workers.

3) Coordination was essential for establishing ARPT, supervision of decentralized research programs, development of a coherent national program, management of donor support, and facilitating interaction with other sections.

4) More gradual expansion of ARPT would have facilitated the process of consolidation.

5) The initiative to establish ARPT came from Zambian policymakers makers and senior research and extension managers. This and their strong commitment to the team has been critical for successful institutionalization.

6) The incorporation of economists and rural sociologists within ARPT has strengthened ARPT's capacities, particularly in the areas of characterization of farming systems and diagnosis of key problems, selection of farmers, and promotion of farmer participation.

7) Secondment of extension staff to work with ARPT has played a vital role in improving research-extension interaction without impairing the quality of research.

8) Interaction between ARPT staff and individuals in other sections and organizations has been greatly facilitated by the establishment of formal occasions and linkage mechanisms as well as the active encouragement of informal interaction.

LIST OF ACRONYMS

ARRA	Agricultural Research Resource Assessment
ARPT	Adaptive Research Planning Team
ARPT-CP	ARPT in Central Province
ARPT-EP	ARPT in Eastern Province
ARPT-LP	ARPT in Luapula Province
ARPT NC	ARPT National Coordinator
ADA(E)	Assistant Director of Agriculture (Research)
ADA(R)	Assistant Director of Agriculture (Extension)
CARO	Chief Agricultural Research Officer
BS	Block Supervisor
CEWs	Camp Extension Workers
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIMMYT EAEP	CIMMYT Eastern African Economics Program
CIP	International Potato Center
CRS	Central Research Station
CRT	Commodity Research Team
CSRT	Commodity and Specialist Research Teams
CHO	Crop Husbandry Officer
DAO	District Agricultural Officer
DOA	Director of Agriculture
EPAD	Eastern Province Agricultural Development Project
EB	Extension Branch
ETO	Extension Training Officer
FMRO	Farm Management Research Officer
FM/FI	Farmer Managed/Farmer Implemented
FSR	Farming Systems Research
FINNIDA	Finnish International Development Agency
GDP	Gross Domestic Product
GRZ	Government of the Republic of Zambia
GTZ	German Technical Assistance program
ITK	Indigenous Technical Knowledge
IAEA	International Atomic Energy Authority
IARCs	International Agricultral Research Centres
ICIPE	International Center of Insect Physiology and Ecology
ICRAF	International Council for Research in Agroforestry
IDRC	International Development Research Centre
IITA	International Institute for Tropical Agriculture.
ILCA	International Livestock Centre for Africa
IMF	International Monetary Fund
IRDP	Integrated Rural Development program
IRRI	International Rice Research Institute

ISNAR	International Service for National Agricutural Research
KSU	Kansas State University, USA.
LIMA	National LIMA Fertilizer program
LINTCO	Lint Company of Zambia
LEW	Local Extension Worker
MAWD	Ministry of Agriculture and Water Development
MRT	Maize Research Team
NAMBoard	National Agricultural Marketing Board
NCSR	National Council for Scientific Research
NORAD	Norwegian Development Agency
O-i-C	Officer in Charge of a Regional Research Station
PAO	Provincial Agricultural Officer
PEXCO	Provincial Experimental Committee
PPUs	Provincial Planning Units, under the Ministry of Decentralisation
RM/FI	Researcher Managed/Farmer Implemented
RM/RI	Researcher Managed/Researcher Implemented
RRS	Regional Research Station
RELO	Research Extension Liaison Officer
SADCC	Southern African Development Coordination Conference
SAFGRAD/OAU	Semi Arid Food Grain Research & Development
SIDA	Swedish International Development Authority
SMSs	Subject Matter Specialists (Both district and provincial)
T&V	Train and Visit System
TA	Trials Assistant
UNZA	University of Zambia
USAID	United States Agency for International Development
ZAMARE	Zambia Agricultural Research and Extension Project
ZAMSEED	Zambia Seed Company
ZATPID	Zambia Agricultural Training and Planning Project

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Currency Equivalents

The following are average annual exchange rates for selected years.

	Kwacha	US Dollar
1975	K 1.00	$ 1.55
1980	K 1.00	$ 1.27
1981	K 1.00	$ 1.15
1982	K 1.00	$ 1.08
1983	K 1.00	$ 0.80
1984	K 1.00	$ 0.56
1985	K 1.00	$ 0.37
1986	K 1.00	$ 0.13

CHAPTER ONE

THE NATIONAL CONTEXT OF AGRICULTURAL RESEARCH

I. BRIEF OVERVIEW OF ZAMBIA AND ITS ECONOMY

Zambia, a landlocked country, lies in the elevated plateau area of southeastern Africa between 8°S and 18°S latitudes (Figure 1). It is a relatively large country, with an area of 740,720 km^2.

1.0. Demographics

In 1987 the estimated population of Zambia was 7,153,728. Zambia has one of the highest population growth rates in the world - 3.1% per annum between 1969 and 1980. This results from constant high fertility and declining mortality (Table 1).

Table 1: Basic Demographic Statistics

	1969	1980
Population (millions)	4.1	5.7
Crude birth rate (per 1,000)	47.7	51.0
Crude death rate (per 1,000)	19.7	16.6
Life expectancy, males (yrs.)	41.8	50.4
Life expectancy, females (yrs.)	45.0	52.5
Male:female ratio	96.0	95.8
Population in urban areas (%)	29.4	43.0
Population density (pers./km^2)	5.5	7.5

Source: World Bank, 1987 and GRZ CSO, 1985.

Despite rapid population growth, overall population density is low (Table 1). The rural population is scattered, and many areas are sparsely populated. Only the provinces in which mining and industry are concentrated, Copperbelt and Lusaka, have population densities above 30 persons per square kilometer. Urbanization has been rapid in recent years, and in 1980 43% of the population was recorded as living in the urban areas. Unofficial estimates were even higher. The high degree of male rural-urban migration has led to an imbalance in sex distribution in some districts, making households headed by females quite prevalent.

English, Zambia's official language, is spoken by an estimated 50% of the population, but there are 73 local languages and dialects, the main ones being Bemba, Nyanja, Lunda, Luvale, Kaonde, Tonga, and Lozi. The adult literacy rate was 53% in 1980 (GRZ CSO, 1985).

2.0. Level of Economic Development

The Zambian economy depends highly on copper exports. In 1984, copper constituted 88% of total export income. Mining contributed about 14% of the country's GDP and accounted for nearly 16% of total paid employment in the formal sector. Dependence on copper has created economic difficulties in recent years, because copper prices in the world market have fallen dramatically. Copper's contribution to GDP fell by 26.5% between 1969 and 1980, and the contribution to government revenue from copper fell by 95% between 1969 and 1976.

The World Bank classifies Zambia as a low-income economy. The GDP in 1985 was 2330 million U.S. dollars (World Bank, 1987). Economic growth has been slow. The average annual growth rate in GDP between 1973 and 1983 was only 0.2%. Per capita GDP has been declining in real terms since 1977 at an annual average rate of 3.0%.

Malnutrition is a significant problem and has grown worse in the last decade. The daily per capita calorie intake, as a percentage of requirement, was only 74% in 1983 (World Bank, 1985). Between 1972 and 1982, malnutrition among children under five years rose from roughly 20% to over 30% (GRZ CSO, 1985).

Table 2: Basic Economic Statistics

	1965	1985
GDP (million U.S.$)	1,060	2,330
Per capita GDP (U.S.$)	168	390
Sector contribution to GDP (%)		
Industry	54	39
Agriculture	14	14
Manufacturing	6	22
Services	32	45

Source: World Bank, 1987

The combination of low copper prices and, until recently, rising oil prices, has created serious foreign exchange problems. This, together with the deterioration of the international economic situation, has put the Zambian economy under serious pressure. In September 1985 the Government introduced an auction system to allocate the limited available foreign exchange. However, this system was discontinued in May 1987, when Zambia withdrew from its structural readjustment program with the IMF.

II. THE AGRICULTURAL SECTOR: AN OVERVIEW

1.0. The Agricultural Sector

In 1983, agriculture contributed U.S.$ 469 million to GDP, which breaks down to U.S.$ 117 per capita of the agricultural population. The agricultural sector has been the most dynamic sector in the 1980s. Average annual growth in agricultural GDP between 1980 and 1985 was 2.9% (World Bank, 1987.)

In 1982, agricultural exports amounted to U.S.$ 5.9 million, constituting only 1% of Zambia's total export earnings. In the same year, food imports represented approximately 2% of GDP. Imports of food amounted to 9% of total imports in 1982 (GRZ CSO, 1985).

Nearly two thirds of rural households are engaged in agriculture. The bulk of marketed agricultural produce is produced by small-scale commercial and traditional farmers. Their contribution to total maize/intake by official marketing agencies has been erratic. It increased from 40% in 1973 to a peak of 70% in 1976, and then declined to 60 and 46% in 1980 and 1981, respectively.

2.0. Agriculture and Development

One of the important economic objectives in the Third National Development Plan has been to "... diversify the economic structure in order to reduce the country's dependence on copper and to undertake a crash economic program for promoting agriculture and industry... to give the highest priority to rural development in order to create a strong rural economy." (GRZ MAWD, 1979).

The main development objectives of the agricultural sector for the period of the Fourth National Development Plan are:

i) to achieve a satisfactory level of self-sufficiency in the production of staple foods;
ii) to expand the production of agricultural exports;
iii) to increase the import substitution of agricultural products or inputs;
iv) to improve rural employment and incomes (GRZ MAWDa, 1986).

Between 1970 and 1980 government expenditure on agriculture increased at a higher rate than overall government expenditures in the same period. However, this was due solely to the massive increase in agricultural subsidies paid to several parastatal companies as consumer subsidies. When these are omitted, the proportion of agricultural expenditure in total government expenditure, shows a decline from 6.2% in 1970 to 4.8% in 1980.

3.0. The Natural Resource Base

3.1. Land Use

Approximately 7.0% of Zambia's total land area is arable, according to FAO classification. This equals 0.8 ha of arable land per capita for the total population and 1.3 ha for the agricultural population. Of the remaining land, 47% is classified as pasture land and 27% as forest and woodland. Only 0.1 % of agricultural land is under irrigation. No significant use is made of non-arable land for cropping.

3.2. Major Agro-ecological Zones

Zambia can be divided into four major agro-ecological zones (Figure 1, Table 3):

Figure 1: Agro - Ecological Zones - Republic of Zambia

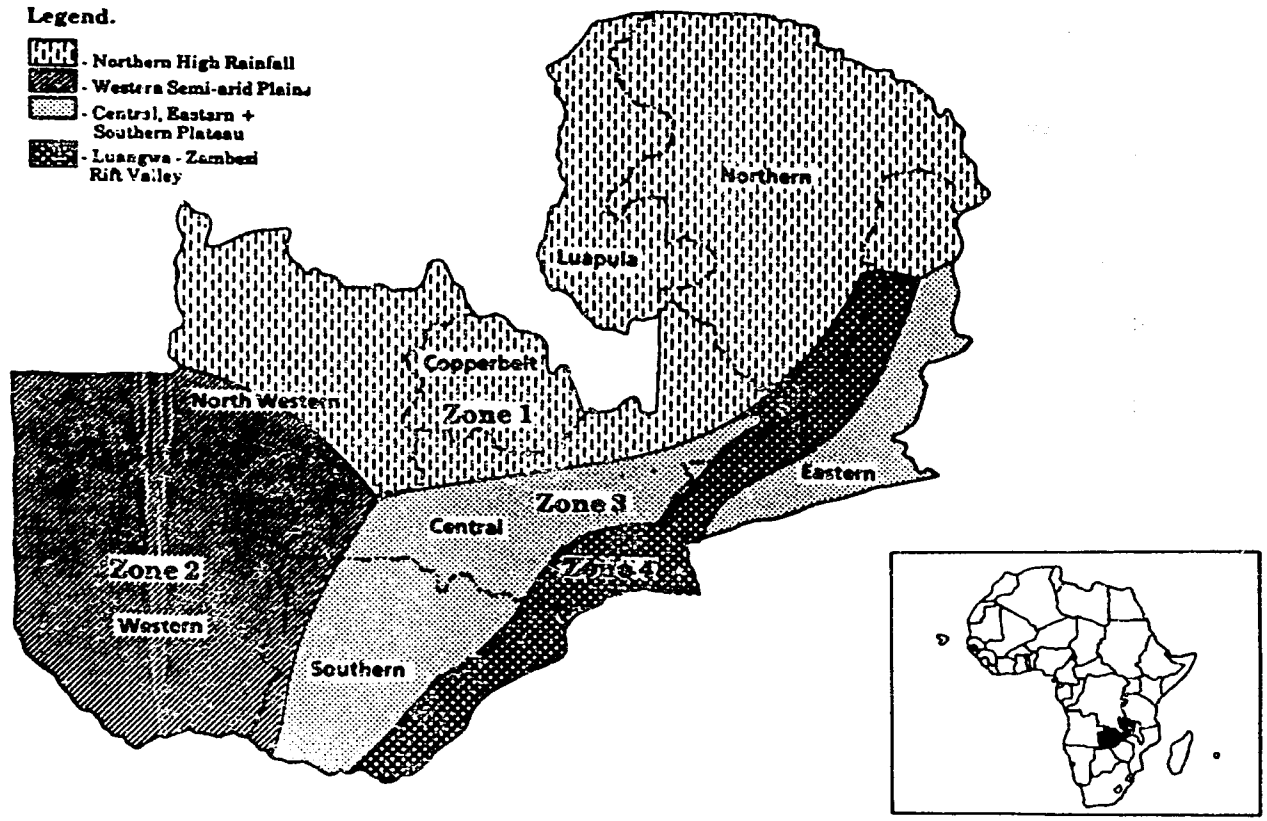


Table 3: Characteristics of Major Agro-Ecological Zones

Zone	Average Altitude (m)	Average Rainfall Range (mm)	Area ($000km^2$)	'000 Rural Population	Population per km^2	Main Vegetation	Main crops/ livestock
1. Northern High Rainfall Zone	1,200	1,000 - 1,500	350	1,200	3.4	Dense woodland cover	Cassava, sorghum, rice, millet, maize
2. Western Semi-Arid Plains Zone	850	600 - 1,000	208	500	2.4	Kalahari sand, woodland and swamp	Cassava, pearl millet, cattle
3. Central, Southern and Eastern Plateau Zone	1,000	800 - 1,200	94	800	8.6	Acacia woodlands	Maize, tobacco groundnuts, cotton, cattle
4. Luangwa-Zambezi Rift Valley Zone	600	600 - 800	108	230	2.3	Thicket with ephemeral grass cover, Mopane woodland	Sorghum, pearl millet

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984

i) Zone 1 - Northern high rainfall

This region covers Luapula, Northern, Copperbelt, and North Western Provinces. The most of the area is a gently undulating plateau. Highly leached sand veld soils of low fertility predominate. Temperature is affected by long hours of cloud cover and averages about 21°C. This zone is best suited for perennial crops such as tea and coffee. Conditions are less favorable for maize, cotton, and tobacco.

Most farmers in the zone are small-scale and subsistence-oriented and practice both shifting cultivation and semi-permanent cultivation. Population pressure has led to the rest-fallows becoming shorter and inadequate. Tseste flies are endemic in large parts of the zone, and limiting the keeping of cattle.

ii) Zone 2 - Western semi-arid plains

The Western semi-arid plains zone includes most of the Western Province and Zambezi District of North Western Province. Extensive areas of the zone are covered by infertile Kalahari sands which are only suitable for grazing. Temperature fluctuates widely, with an annual average of between 21° and 24°C. Cassava and pearl millet are the staple crops, and there is a large traditional cattle herd. This region has the lowest population density of the four zones (Table 3).

iii) Zone 3 - Central, Eastern and Southern Plateau

This plateau area has some of the most fertile soils in Zambia and has the highest population density of all zones (Table 3). The soils are suitable for growing maize, groundnuts, tobacco, and cotton. Most commercial and mechanized farming is found in this region. Ox cultivation is common among small-scale farmers.

iv) Zone 4 - Luangwa-Zambezi Rift Valley

The Luangwa-Zambezi Rift Valley zone comprises the Zambezi River Valley below Livingstone, the area along Lake Kariba, and the Luangwa Valley, in Eastern and Lusaka Provinces. It is the hottest and driest zone. The escarpment areas are virtually useless for agriculture, except for isolated pockets of good soil, and development is confined to valley soils. The area is marginal for agriculture; much of it is utilized for national parks and game reserves. Sorghum and pearl millet are the staple crops.

4.0. Principal Types of Farmers

The farming population of Zambia can be divided into four main categories, as follows (Table 4).

Table 4: Number of Farms by Farm Type

Farm type	Average cultivated area (ha)	Number of farm households
Large-scale commercial	> 40	730
Medium-scale commercial	10-40	21,350
Small-scale commercial	1-10	122,400
Subsistence	1-2	462,600

Source: GRZ MAWD, 1981.

i) Large-scale commercial farmers

The large-scale commercial farmers in Zambia are mechanized and use high-technology inputs. They rely on permanent and hired labor for farm operations. The average farm size is 40 ha, but can be as large as 5,000 ha. They cultivate maize, soybeans, irrigated wheat, seed crops, horticultural crops, beef and dairy cattle. They occupy state land, principally along the railway line.

ii) Medium-scale commercial farmers

The medium-scale commercial farmers market practically all of their produce. They use commercial technologies and rely on ox cultivation for draught power, together with family labor. Farm sizes range from 10 to 40 ha. They are found mainly in the plateau areas.

iii) Small-scale commercial farmers

Small-scale commercial farmers still rely mainly on hand cultivation, supplemented, in some areas, by ox cultivation and some tractor hiring. They use improved seeds and substantial quantities of fertilizer. The average farm size is 3-5 ha. This group produces about 60% of the maize which is marketed to official organizations.

iv) Subsistence farmers

Subsistence farmers, relying almost entirely on hand cultivation, predominate in Zambia (Table 4). They produce primarily to meet their own needs, although they may occasionally sell some produce. The average farm size is about 2 ha.

5.0. Principal Agricultural Commodities

5.1. Crops

Maize and wheat are the main food grains consumed in Zambia, particularly in urban areas. Sorghum, millet, and cassava are the principal food crops in those rural areas less well-suited to maize cultivation (Table 3).

Maize is the dominant crop in area planted, total production, and value of marketed production (Table 5). Quantities of marketed maize have fluctuated each year, but the trend since 1975 has shown

Table 5: Area Planted, Volume Produced, Yield and Value of Production for Major Crops 1982/83 to 1984/85

COMMODITY	Area Planted (ha)			Total Production (M.tonns)			Yield (kg/ha)			Value of Marketed Production (K'000)		
	1982/83	1983/84	1984/85	1982/83	1983/84	1984/85	1982/83	1983/84	1984/85	1982/83	1983/84	1984/85
Maize	545,700	506,500	581,900	115,467	107,622	138,564	1,710	1,710	1,890	108,003	153,557	200,212
Sunflower	48,090	57,700	62,590	13,972	17,203	16,959	750	750	700	13,100	17,383	14,217
Soybean	4,957	9,400	9,836	982	1,624	1,819	1,620	1,440	1,530	3,472	5,574	7,174
Groundnuts (shelled)	31,390	29,520	31,911	1,716	2,074	2,268	320	480	480	717	1,034	2,772
Seed Cotton	33,140	51,990	45,839	20,718	43,907	30,254	625	845	660	10,773	25,466	20,270
Sorghum	16,570	21,780	24,811	1,545	1,848	2,497	720	720	810	17	60	335
Beans	17,650	7,550	8,346	743	667	684	360	720	630	7	12	-
Tobacco	2,180	2,080	1,459	2,289	2,490	2,137	1,050	1,197	1,465	6,038	6,968	7,367
Wheat	5,000	4,000*	4,000*	20,000	13,000	14,000	4,500	3,250	3,500	7,111	5,164	6,611

Notes: * Estimate
Source: Ministry of Agriculture and Water Development, 1985

production remaining essentially constant. The average yield of maize has remained static since the 1960s. With an urban population growth rate of 6%, considerable importation of maize has, therefore, been necessary.

Production estimates for sorghum and millet are uncertain, because relatively small quantities are traded. Both crops are used for food and for brewing beer.

Oilseed production has grown since the 1960s. All oilseed crops, except groundnuts, have shown significant increases in marketed production during the period from 1975 to 1982. The importance of sunflower, soybeans, and cotton has increased considerably since the mid 1970s. Sunflower has been grown mainly by small-scale farmers and has been sold for oil extraction. Cotton has also been grown almost exclusively by small-scale farmers and some lint has been exported. Soybeans have, until recently, been grown mainly by large scale commercial farmers as a rainfed crop, which has fitted conveniently into a rotation with irrigated wheat. Most groundnut is produced by small-scale and subsistence farmers mainly for local consumption.

Cassava is grown by a large number of small-scale farmers, in almost every province, although mainly in Luapula, Northern, North Western and Western Provinces, where it is a staple food. Production figures are speculative, but a figure of 177,000 tonnes of dried cassava has been estimated for 1980.

5.2. Livestock

The most important livestock in Zambia are beef and dairy cattle and poultry. The value of livestock output accounted for 11% of total agricultural output in 1981. The national cattle herd, estimated at 2.1 million head in 1983, consists of 1.8 million in the traditional sector and 0.3 million in the commercial sector. The annual rate of increase has averaged 2% for the national herd and 6% for the commercial sector. The national off-take rate for consumption or sale has averaged between 7% and 10% since 1964, while that for the commercial sector has averaged 16%. The higher off-take for the latter has been due to both its market orientation and its use of quicker-maturing breeds. The major constraints in the beef sub-sector include seasonal forage and feed supply, frequent outbreaks of foot and mouth disease, and tsetse fly infestations.

The dairy industry is still very small, although it has existed for many years. Fresh milk is supplied by smallholders, commercial and parastatal farms. In 1981, only 50% of milk consumed in Zambia was supplied domestically, the balance being reconstituted milk. In that year commercial farmers supplied 15% of local production.

Apart from a few very large poultry farms in the vicinity of the urban areas, most chickens are kept for home use by almost every rural household.

6.0. Structure of the Agricultural Sector

6.1. Land Tenure System

There are two main categories of land tenure in Zambia: State Land and Reserve/Trust Land. State Land accounts for about 7% of Zambia's

total area and is under the control of the President, who may make grants and arrange leases through the Commissioner of Lands. Title holders of State Land are individuals, groups, or townships, to whom 99-year leases and 14-year leases are granted. State Land is concentrated in the areas of high population density, around Lusaka, the Copperbelt, and in parts of Central, Eastern, and Southern Provinces.

Trust and Reserve Land areas have been set aside by the President for public purposes without payment of compensation. Half of Zambia's total land area includes land which may be occupied or used in accordance with customary law without lease or formal right of occupancy. These lands are allocated to individuals through the chiefs and local headmen.

In 1984 it was estimated that most of the State land areas were owned and utilized, compared with only 29% of Reserves and Trust Land areas.

6.2. Socioeconomic Structure

The broad stratification of the farming community into four categories based on farm size and degree of market orientation is discussed above. However, gender is a further important source of variability in the farming community. The 1980 population census indicated that in Luapula, Northern, and Western Provinces more than one third of rural households were headed by women. This has important implications for agricultural development. Recent data have shown that female heads of household, as well as wives, have limited access to agricultural information, guidance and training, credit, membership in cooperatives, improved agricultural inputs, and agricultural technology. They also face serious labor and income constraints that further curtail their agricultural productivity. Thus, female-led farm households have low incomes and constitute the core of rural poverty, with consequent high incidence of malnutrition and inability to take risks, including taking advantage of credit and other agricultural programs (GRZ MAWDb, 1985).

6.3. Farmer Organizations

The main farmers' organizations primarily represent the interests of the large-scale commercial farmers. There is a Commercial Farmers Bureau (CFB), Zambia Seed Producers Association (ZSPA), and Virginia Tobacco Growers Association of Zambia (VTAZ). These groups organize meetings and represent their members' concerns with the Ministry of Agriculture & Water (MAWD), especially with respect to producer prices. The groups send representatives to planning meetings in the Research Branch of the Department of Agriculture to indicate their priorities for research. The ZSPA and CFB also have members on the Variety Release Committee, which approves the varieties to be released by the Research Branch.

Small-scale and subsistence farmers have no formal organization to represent them.

7.0. Principal Organizations in the Technology Transfer Process

7.1. Agricultural Research

Most agricultural research in Zambia is conducted by the Research Branch of the Department of Agriculture, in the Ministry of Agriculture and Water Development (MAWD) (Chart 1).

Some research is also conducted by the School of Agriculture at the University of Zambia (UNZA), quite often in conjunction with the Research Branch. Overall responsibility for coordinating all research in Zambia rests with the National Council for Scientific Research (NCSR), which also conducts some basic research itself. Several parastatal companies have also supported the research efforts of the Research Branch, including the Lint Company of Zambia (LINTCO), the National Tobacco Company (NATCO), the Zambia Sugar Company, and the Kawambwa Tea Company.

7.2. Extension Services

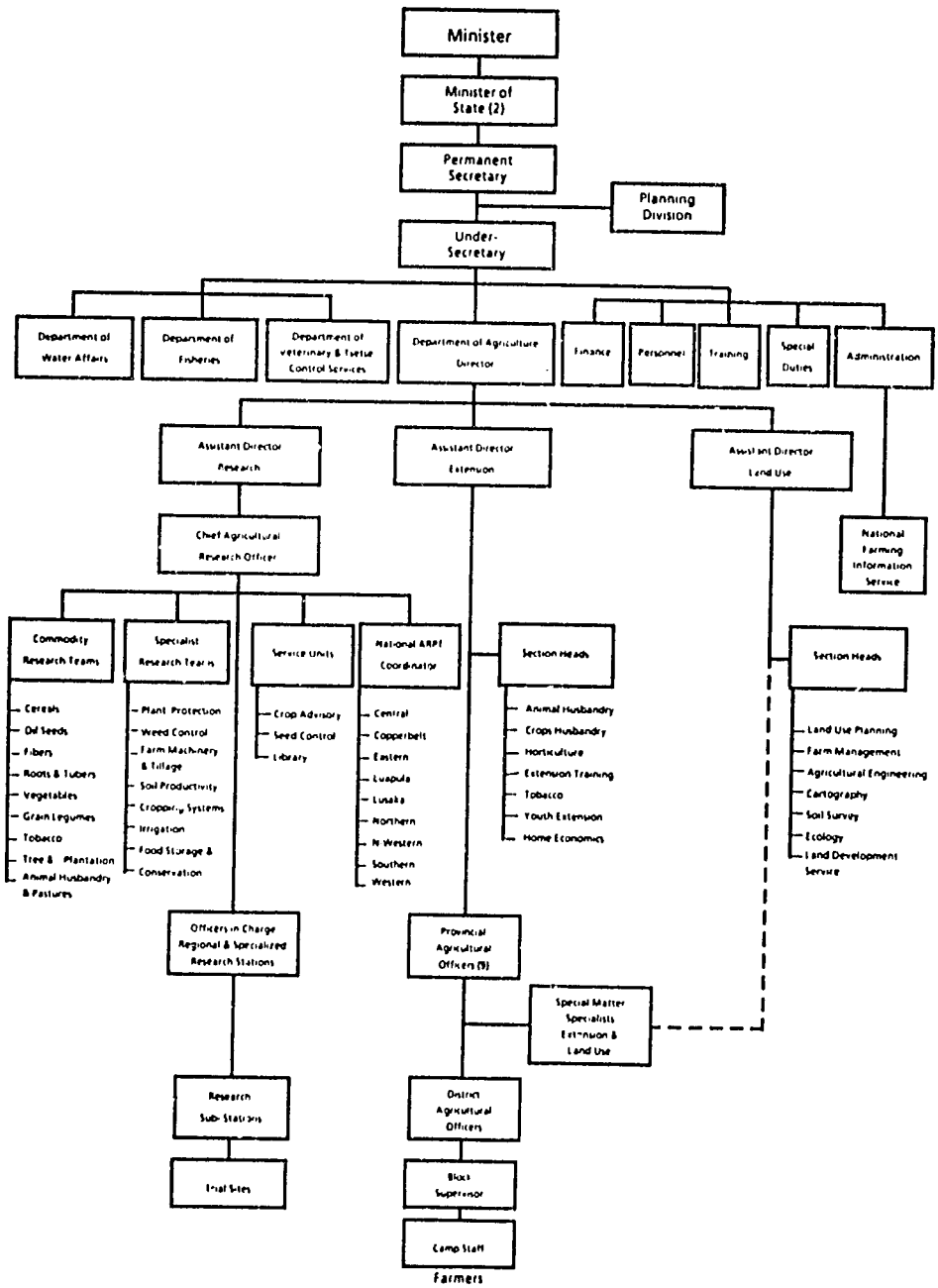
Extension activities in Zambia are the responsibility of the Extension Branch which like research, is a branch of the Department of Agriculture, in MAWD (Chart 1).

The Extension Branch is headed by the Assistant Director of Agriculture (Extension) (ADA/E). The ADA(E) is supported, at the national level, by seven Chief and Senior Subject Matter Specialists (SMSs). At the provincial level the Provincial Agricultural Officers (PAOs) are in charge of all agricultural development activities. The PAOs are supported by SMSs and administrative personnel, and they are responsible for the overall extension activities in each province. Below the PAOs, at District level, are the District Agricultural Officers (DAOs), who are also supported by several SMSs. The DAOs, in turn, operate through Block Supervisors (BSs) and Camp Extension Workers (CEWs). A camp constitutes the ultimate level of extension outreach, and CEWs provide the day-to-day contact with farmers. On the average, 6-8 camps make up a block, and there are between 5 to 8 blocks within a district.

Of the 2,400 extension staff in the Extension Branch, about half are based at the block and camp levels. Nearly two thirds of the CEWs and BSs are diploma and certificate holders, occupying established posts in the Civil Service. The balance are Commodity Demonstrators who, although quite experienced, have had no formal training in agriculture. The average staff-farmer ratio is about 1:600, which is quite satisfactory. However, there is a large range from 200 to 1,500 farmers per extension worker, mainly reflecting varying population densities, farming systems, and agricultural potential.

In 1978 Zambia initiated an extension approach along the lines of the Training and Visit (T&V) system. The classical T&V system involves a programmed and disciplined approach to extension, based on regular farm visits by trained staff, delivering key impact messages to carefully selected contact farmers. These are coupled with a rapid feedback of problems from farmers to researchers. Since 1978, the T&V system has only been partially introduced because of insufficient funding. It is employed currently in three provinces, with donor support.

Chart 1: Present Structure of the Department of Agriculture Ministry of Agriculture and Water Development



To complement the T&V approach, the Lima program was introduced in 1979, to facilitate the adoption of proven technological packages for smallholders. The program encourages the use of agricultural inputs for the major cash crops, on a standard unit, Lima (0.25 ha) of land, using standardized measures of seed, fertilizer, and insecticide.

Zambia has also had a wide range of agricultural development programs and projects during the past two decades, involving extension services as a major component. At present the major programs and projects include four integrated rural development programs, nine area-based agricultural development projects, and ten general projects. These projects, in 1986, accounted for some 58% of the total budget allocation to activities directly related to extension services. Over 90% of the cost of these projects is externally funded.

8.0. Institutional Support Services for Agriculture

8.1. Input Supply and Marketing

The main organizations involved in both the marketing of agricultural produce and the supply of inputs, such as fertilizer, seed, chemicals, and farm equipment are the National Agricultural Marketing Board (NAMBOARD) and the Provincial Cooperative Marketing Unions. The Zambia Seed Company (ZAMSEED) has overall responsibility for the production and marketing of all seed in Zambia. Several other parastatal companies have been responsible for services related to specific crops, including the Lint Company of Zambia (LINTCO) and the National Tobacco Company (NATCO).

There have been problems with the distribution of inputs and the marketing of produce which have discouraged production. These difficulties have been caused by serious problems in the economy as well as logistical and management factors. Most of the parastatal companies have performed poorly, requiring large government subsidies to keep them afloat. More than 85% of the subsidies paid to Namboard, the National Milling Company, and the Provincial Cooperative Unions were consumer subsidies on maize and wheat; the remaining 15% were fertilizer subsidies (GRZ MAWDa, 1986). The Government has begun to liberalize marketing with the decontrolling of all consumer prices, except maize, and parastatals have been encouraged to introduce economic pricing, in order to improve their efficiency. Various changes have been made in the organizations responsible for marketing and input supply.

8.2. Credit

Small-scale farmers are provided with credit by the Agricultural Finance Company, the Cattle Finance Company, and the Zambia Cooperative Federation Financial Services. Larger-scale commercial farmers are serviced by commercial banks, the Zambia Agricultural Development Bank, and the Development Bank of Zambia. In the Fourth National Development Plan it was estimated that 91% of total loan requirements have been met. However, the credit delivery system has faced serious problems which have reduced its efficiency. These include inadequate loan supervision, untimely loan disbursements, insufficient funds for lending, and delayed payments of farmers for their produce, resulting in late loan repayment (GRZ MAWDa, 1986).

8.3. Farm Power

The foreign exchange constraints experienced by Zambia in recent years have accentuated the advantages of oxen over tractor in cultivation. In 1985/86 a medium-scale commercial farmer using oxen would break even at 1,500 kg of maize, compared with the tractor cultivator breaking even at 3,100 kg of maize. There has been a 13% increase in the number of oxen sold between 1980 and 1985, partially representing a shift by medium-scale farmers away from tractors to oxen. However, shortages of ox-drawn equipment, veterinary drugs, and lack of repair facilities for farm machinery at the village level, have impeded progress.

8.4. Roads

Zambia has a comparatively good network of tarmac roads linking the provincial centers to the capital, Lusaka. Communications within provinces are more difficult, but all district centers are connected to provincial centers by all-weather roads. However, in certain more remote areas, communication by road is difficult, especially in the valley areas and on the Kalahari sands of Western and North Western Provinces. Roads normally deteriorate during the rainy season.

The main problem with the transportation of inputs and produce have been the long distances to be covered and the poorly maintained vehicle fleet, which together have resulted in high internal transportation costs.

9.0. Market Structure for Agricultural Products

For many years producer and retail prices were kept low, supported by large government subsidies, in order to provide cheap food for the urban population. However, especially in the last five years, the Government has taken steps to ensure adequate producer incentives, and also to reduce subsidies. Producer and consumer prices of all agricultural commodities and inputs, except maize and fertilizer, were decontrolled, although in May 1987 steps were taken to reintroduce elements of price control. Maize and fertilizer prices have been increased periodically and significantly, and this has enabled subsidies to be reduced. Maize prices have been related to border price equivalents to keep them in line with world prices. However, the Government has found it difficult to remove subsidies from maize completely, and thus the price has continued to be subsidized.

Producer and consumer prices for maize have been set uniformly throughout Zambia, thus distorting regional comparative advantage. The retail prices of fertilizer and maize have not enabled sufficient margins to cover marketing costs. The Government has therefore been considering introducing a regionally differentiated price structure, but the implications of increasing the consumer price for maize have been daunting.

III. CONSTRAINTS TO AGRICULTURAL DEVELOPMENT

The potential for increased agricultural development in Zambia is considerable, compared to other countries, especially when it is considered that only 8% of arable land is being cultivated. However, there are many constraints to overcome before the potential can be realized.

The acute shortage of foreign exchange has probably been the greatest constraint to agricultural development. It has limited the importation of many items, such as fertilizer, fuel, farm implements, spare parts, etc. The effects of drought have also been serious for many farmers in all agro-ecological zones, except the high-rainfall zone. In some areas tsetse infestation and infertile soils limit expansion and increased productivity. However, lack of finance for credit and poor input supply and marketing services have also had serious effects on agricultural development within the commercially oriented farming community.

It is necessary also to consider the relative importance of technological constraints to agricultural development in relation to the different types of farmers in Zambia. The large and medium-scale commercial farmers have, on the whole, demonstrated their ability to adopt the existing technological messages developed for crops and enterprises such as maize, tobacco, wheat, soybeans, cotton, beef, and dairy. These two categories of farmers are faced by shortages of imported inputs, lack of farm machinery and irrigation equipment. Remunerative prices and access to foreign exchange are the main requirements of these farmers. Additional research on varietal improvement would be a useful supplement to these needs.

For the subsistence farmers and small-scale commercial farmers, technological constraints have been more important. It is generally recognized that these groups have only been able to adopt the previous technical messages to a limited extent, largely because they have been developed for farmers with greater resource endowment. Thus, initially, there is need for research to develop technical messages which are compatible with these circumstances and which involve low levels of risk. In particular, research should focus more on labor saving technologies, low-cost methods of enhancing soil productivity, and developing varieties for farmers' specific situations. (More resources also need to be allocated to the extension service, to enable extension workers to deliver the messages being developed.) However, as farmers become more commercially oriented they are also requiring attractive remuneration in the form of price incentives, and thus require more reliable, efficient input supply and marketing services. The scope for increased production from the smallholder sector is considerable, but it requires a longer-term approach to agricultural development.

CHAPTER TWO

AGRICULTURAL RESEARCH AT THE NATIONAL LEVEL

I. THE TECHNOLOGY GENERATION AND DISSEMINATION PROCESS IN ZAMBIA

1.0. Historical Overview of Agricultural Research in Zambia

Most agricultural research in Zambia, especially crop research, is conducted by the Research Branch of the Department of Agriculture. There has been a long history of agricultural research in Zambia, stretching well back into the colonial period, when research focused primarily on the needs of the European farming community. A network of research stations, covering all but a few provinces, had been established by the time of independence in 1964.

Until the late 1970s, research was organized by discipline. Most experiments were conducted at the research stations, under high management conditions, more representative of large-scale commercial farmers than of the majority of Zambia's small-scale and subsistence farmers. Research focused on single crops or activities, and tended to pay little attention to the farmers' social and economic environment. Research information principally covered cash crops and assumed that optimal management levels would be practiced. This meant that the information was relevant mostly for the large-scale commercial farmers who had adequate resources and farmed in low-risk environments.

By the 1970s there was concern within MAWD that the needs of the small-scale farmers with limited resources and risky environments were not being met by the Research Branch. In response to this concern and following several evaluations, the Research Branch was reorganized into a two-level research system. The new system, which has gradually been introduced, includes sixteen Commodity and Specialist Research Teams (CSRTs), established on an interdisciplinary basis to conduct on-station component research. In addition, Adaptive Research Planning Teams were established to operate in each of Zambia's nine provinces to conduct farming systems research, including on-farm trials under farmers' conditions. The latter are the focus of this study.

Until comparatively recently, the research program, even for small-scale producers, was focused on relatively few cash crops, such as hybrid maize, cotton, wheat, soybean, and sunflower. Lately there has been a shift in emphasis to give greater attention to more traditional food crops, such as sorghum, millet, cassava, groundnuts, and beans (GRZ MAWDb, 1984).

2.0. The Intended Technology Generation and Diffusion Process

Until ARPT was established in 1980, it was intended that scientists in the Research Branch would conduct research programs on the basis of problems passed on to them principally by extension workers, as well as through the research tours and Provincial Experimental Committees (Appendix I). Research programs, supervised by commodity coordinators, would be conducted at regional research stations.Annual field days for farmers and extension workers were to be held at the research stations. Trial res lts were to be scrutinized by the other scien ists and senior extension workers at annual research meetings. After recommendations had been released by the Recom- mendations Officer they would be passed to senior extension officers for dissemination to all extension workers, primarily through pub- lications and in-service training courses.

With the establishment of ARPT the process was changed. It was intended that scientists should be in constant contact with farmers diagnosing problems and opportunities, and assessing potential technologies together with farmers in their fields. It was expected that ARPT scientists would draw up their research program in conjunction with CSRT scientists, using available technologies developed by CSRTs at research stations. Any problems requiring further applied research would be fed back to the relevant CSRT. It was further anticipated that many more extension workers would be directly involved throughout the research process. It was envisaged that after technologies had been accepted by farmers in on-farm trials, the adoption process would be closely monitored by extension workers, as part of demonstration and dissemination programs.

II. STRUCTURE AND ORGANIZATION OF THE RESEARCH BRANCH

1.0. Research Branch Structure

Although over the last ten years there have been several organigrams of the Research Branch, Chart 1 provides the most accurate depiction of the current structure of the Research Branch in the Ministry of Agriculture and Water Development.

The Research Branch is headed by an Assistant Director of Agriculture (Research) (ADA (R), who is supported by the Chief Agricultural Research Officer (CARO). Day-to-day operations of the research stations are managed by Officers-in-Charge.

The sixteen interdisciplinary national Commodity and Specialist Research Teams (CSRTs) are based at either the central or regional research stations, where they conduct on-station research in the various agro-ecological zones (Table 6).

The Adaptive Research Planning Teams (ARPTs) are based at the research stations in each of the nine provinces and are conducting farming systems research. The emphasis is largely on adaptive research, including on-farm trials under farmers' conditions.

A small number of agronomists, mainly volunteers from overseas and, based at some regional research stations, conduct agronomy trials for the CSRTs.

Several research support services are based at the Central Research Station (CRS), including crop advisory, library, soil sample analysis, biometrics, and seed control.

The research station network comprises a Central Research Station located near Lusaka and 11 regional research stations of varying size. The system is quite centralized in manpower, resources, and decision-making. In 1986, 11 of the 23 research teams had their headquarters at the Central Research Station, and 44% of the scientists, as well as 33% of the technicians, were based there (Table 6).

Table 6: Degree of Centralization in the Research Branch, 1986

Staff	Central Research Station		Provincial Research Station		Total Staff	
	Number	%	Number	%	Number	%
Scientists						
CSRT	63	50	63	50	126	100
ARPT	6	19	25	81	31	100
Total	69	44	88	56	157	100
Technicians	82	33	165	67	247	100

Source: Data compiled from a survey conducted as part of the OFCOR study in 1986 and Research Branch personnel records.

1.1. Organizational Flexibility

The Research Branch has been in a state of flux since the mid 1970s. There were pressures from within Zambia to reorganize, since several of the first Zambians to be promoted to senior positions, both within the Research Branch and the MAWD, were concerned that current technical information was not being adopted by the majority of small-scale farmers. Some Zambians also believed that efficiency in technology generation could be increased through deployment of interdisciplinary commodity research teams.

The rapid turnover of scientists (especially expatriates) and senior research managers has also contributed to the state of flux. The turnover of manpower has limited the continuity in direction of certain policies, research priorities, and content of research programs.

Moreover, funds to implement the proposed changes could only be partially raised within Zambia. The Research Branch has had to rely on external donor support to implement its proposed strategy for reorganization. With many donors involved and repeated evaluations and reviews, implementation has been slow and rather piecemeal.

The danger with such a state of flux, compounded by the involvement of many donors, is that the general direction and priorities for the organization as a whole tend to get distorted as individuals and

projects go their own individual ways. This was recognized within the Department, and in 1984-85 a Research Strategy was drawn up, with the objective of incorporating the organizational changes and research priorities into a single plan which could be used to coordinate donor assistance (GRZ MAWDb, 1984). In 1987, a large multi-donor project will be initiated, which will enable most aspects of the Research Strategy to be implemented.

On the other hand, the state of flux has meant that there has been a high degree of flexibility in instituting organizational change. This level of flexibility has been an important factor in explaining why it has been possible to institutionalize ARPT within the Research Branch quite rapidly.

1.2. Donor Support for the Research Branch

Support for the Research Branch from external donor organizations has been significant in recent years. Table 7 shows the number of donors supporting different research teams during 1986.

Table 7: Donor Support for the Research Branch in 1986

Research Team	Donor Organizations
ARPT	CIMMYT, GTZ, IBRD/IFAD, Netherlands, NORAD, ODA, SIDA, and USAID
Cereals	Belgium, CIDA, FAO/NORAD, SIDA, and USAID
Oilseeds	Belgium, CIDA, IBRD/IFAD, and USAID
Soils Research	CIDA, IAEA, ODA, and NORAD
Horticulture & Vegetables	Arab Fund, EEC, and SIDA
Animal Husbandry & Pasture	Arab Fund and SIDA
Grain Legumes	IBRD/IFAD
Cotton	France
Plant Protection	Belgium
Irrigation	UNDP/FAO

The donors have provided assistance in many ways, including: providing manpower, finance, training scholarships, and specific items, such as books and laboratory equipment. Although it is difficult to give a precise figure, data indicate that donors have provided between 30% and 50% of total recurrent and capital expenditure in the Research Branch (ref. section 2.IV.1.3).

1.3. Linkages between the Research Branch and External Sources of Knowledge

The Research Branch has established quite strong linkages with many external sources of knowledge.

i) There has been considerable exchange of information with the international agricultural research centers; in particular, with CIMMYT, ICRISAT, IITA, IRRI, and CIP. Links have also been established with ICRAF, ICIPE, ILCA, IAEA, and ISNAR. Several of these organizations have established networks, in which Zambia has been invited to participate.

ii) Within the SADCC region in Southern Africa there has been an increasing amount of information exchange, through various networking activities. There have also been several initiatives by SAFGRAD/ OAU to organize information exchange on different topics, throughout Africa.

iii) Within Zambia, the Research Branch has maintained quite close links with the School of Agriculture at the University of Zambia. Several research teams have had collaborative projects with the university, and individual lecturers have frequently participated in many Research Branch program planning meetings. The Animal Husbandry Research Team has also collaborated with the Animal Productivity Research Unit, which is part of the National Council for Scientific Research.

1.4. Linkages Between the Research and Extension Branch

The Research and Extension Branches are both part of the Department of Agriculture and the Assistant Directors of Agricultural Research & Extension answer to the Director of Agriculture (Chart 1). In fact, the two Assistant Directors also share adjacent offices at the Ministry headquarters, which means that they have a high level of informal interaction.

Despite this organizational proximity, a large gulf has divided research and extension workers in Zambia for many years. The gulf has stemmed from several factors.

a) The disparity in education level has hindered communication. Most camp-level extension workers have had education only to certificate and diploma level, whereas most scientists hold university degrees. Technical jargon, used by scientists, has also hindered communication.

b) Extension workers have considered that a lot of research being conducted at research stations was not relevant to the conditions of the small-scale farmers with whom they were working.

c) There were very few formal occasions when research and extension workers would meet and communicate effectively. A few researchers would meet provincial extension workers during the annual research tours and Provincial Experimental Research Committee (PEXCOs) meetings. However, these were far from adequate mechanisms for jointly identifying small-scale farmers' technical problems (Appendix I).

As a result of these factors, a situation developed where, in essence, extension workers considered that much research work was "ivory towered" and of little relevance to the small-scale farmers. On the other hand, research workers tended to blame extension workers for the non-adoption of research recommendations and generally considered that there was little to be learned from extension workers.

This was the situation in 1978, when the Minister placed high priority on finding ways to improve the coordination of research and extension efforts to help in the transfer of research findings to the farming community. Since that time the issue has been given serious attention.

More recently, there have been several occasions when research and extension workers have interacted. These have included mainly formal meetings and workshops, when research recommendations have been discussed, but occasionally scientists have been invited to take part in in-service training courses for extension workers. Extension workers have been invited to attend the research station field days and also to participate in the research committee meetings, when research programs are planned. The creation, in 1983, of a position of National Research Extension Liaison Officer, has also helped to provide both scientists and extension workers with a channel for communication. Two workshops were held in 1985 to discuss the problem of interaction between research and extension workers.

On the whole, the level of interaction between the Research and Extension Branches was rather minimal and the creation of the ARPT has provided important opportunities for the situation to be improved (ref. section 4.III.).

1.5. Linkages between the Research Branch, Policy Makers, and Development Agencies

There have been very few formal mechanisms enabling Research Branch scientists to interact with policy makers and development agencies. There used to be a Technical Planning Committee within MAWD which provided an opportunity for scientists to comment on a wide range of proposed projects. However, this has long been defunct. With the establishment of ARPT there have been several occasions when scientists have discussed policy issues with provincial authorities. At the national level there have been many ad hoc opportunities when the Planning Division of MAWD has requested technical advice from the Research Branch.

The Research Branch has maintained good working relations with the Zambia Seed Company, which is responsible for purchasing and marketing all seed in Zambia. Individual research teams have also established linkages with companies and development agencies dealing with particular commodities, e.g., Refined Oil Products (Z) Ltd., National Milling Company, the Lint Company of Zambia, the National Tobacco Company, and the National Marketing Board.

III. PRIORITY SETTING, RESOURCE ALLOCATION, PLANNING AND RECOMMENDATION RELEASE

1.0. Priority Setting and Resource Allocation

There is no formal research priority-setting mechanism within the Research Branch. At the most general level, research priorities are expected to correspond to the development priorities outlined in the five-year National Development Plans. Subcommittees have been established to look at development priorities for most crops and livestock. Representatives from the Research Branch have attended these committees to discuss research priorities. However, this process has been rather vague, and it has been difficult to identify clear rankings among commodities. Recently, a Research Strategy was drawn up and the National Agricultural Research and Extension Committee was established to set research priorities. However, it is too early to say how effective these mechanisms will be in helping to improve research priority setting.

Of greater importance in setting priorities in practice has been the actual amount of resources allocated to particular research teams. Allocations from the Ministry of Finance have usually been allocatedto MAWD on the basis of precedent, especially in the case of recur-
rent funds. The Research Branch has thus had only limited funds, but it has actually had the responsibility for allocating funds among the research teams.

The Research Branch, however, has had to rely increasingly on funds from external sources, which has also influenced research priorities. When research teams have had external sources of funds, they have been able to secure the manpower resources required. This situation has led to some rather anomalous imbalances in research capacities. For example, at one time, rainfed wheat and paddy rice received undue attention, compared to other crops, largely because donor funds were being allocated to these areas. These types of distortions have been less serious in recent years because, with the considerable increase in donor support, most research teams have received adequate funding.

2.0. Planning and Programming Mechanisms

The present mechanisms for planning and programming research within teams consist of two types of committee meetings held at the end of each season: Commodity Review Meetings and Research Committee Meetings.

The Commodity Research Review meetings were started in 1984, as a means to ensure that every research team reviewed its results and all team members participated in helping to plan the next season's research program. These meetings have provided an opportunity for scientists in ARPT to discuss the relevant findings from farm surveys and on-farm trials on particular crops, so that such information can be included in planning both the on-station and on-farm trials. The intention is that in future these meetings will be held regionally, so that ARPT and CSRT scientists can discuss the research needs of each agro-ecological zone.

The Research Committee meetings are used to officially approve each research team's program. They are open to the public and are usually well attended. They are now used as opportunities to highlight the results of each season and explain the proposals for the next season. They were considered too large for effective discussion to take place, which was why the Commodity Research Review meetings were introduced.

3.0. Release of Recommendations

The procedure for releasing and revising recommendations is not very clear. An interim set of recommendations was published for Zambia, as a whole, in 1984. The most recent complete set of provincial recommendations for small scale farmers was issued by the Research Branch in 1979. It was compiled by the Crop/Soil Advisory Officer, in consultation with other CSRT scientists. This Officer has recently stated that the responsibility to initiate changes in the recommendations should lie with ARPT in each province. However, so far no formal process based on this recommendation has been implemented.

A formal sequence for recommendation release which gave the lead role to ARPT was outlined in the Research Strategy (GRZ MAWDb, 1984). According to this, when a provincial ARPT considers that a recommendation needs changing, the ARPT Provincial Committee should discuss the changes to be made. The RELO should then submit these revisions to the National RELO, who in turn should find out whether the relevant CSRT scientists have any objections. It is assumed that ARPT and CSRT scientists will already have had informal discussions and final arbitration by the ADA(R) would rarely be necessary. This proposal has yet to be implemented.

The current situation is somewhat more confusing because groups can produce their own recommendations whether they are an ARPT, a CSRT, a parastatal company such as LINTCO, or a donor-funded agricultural development project. The provincial ARPTs in Eastern and North Western provinces have already produced revised crop recommendations. In these cases, extensive discussions were held in the provinces between ARPT and extension workers and, in some cases, lengthy, and occasionally heated, discussions were also held with relevant CSRT scientists. The matter of recommendation formulation needs to be given serious consideration to prevent conflicting advice being issued and to avoid tension between the different groups issuing recommendations.

IV. RESOURCES FOR AGRICULTURAL RESEARCH IN THE RESEARCH BRANCH

1.0. Financial Resources

1.1. Resource Acquisition Mechanisms

The Research Branch acquires funds from the Zambian government and from external donors.

1.1.1. Zambian Government Allocations

The Ministry of Finance allocates both capital and recurrent funds to the Research Branch through MAWD. Until 1984, the allocation for recurrent funds was different from that for capital funds with the former being allocated directly by the Ministry of Finance, whereas the capital funds were allocated by the National Commission for Development Planning. This division of responsibility contributed to the imbalance of funding, in favor of personal emoluments and capital costs as compared with funding of operating costs. Since 1984, the Ministry of Finance has had overall responsibility for both capital and recurrent budgets.

1.1.2. Donor Allocations

Most research teams have received significant financial support from various external donors. Several donors, supporting large agricultural development projects in particular provinces, have regarded support for certain research teams as a legitimate and complementary component of such projects.

1.2. Budgetary System

Research teams prepare their budget estimates in June/July each year, which is rather awkward since, by that time, few teams have worked out the details of their next season's work program. The estimates are subsequently scrutinized by the senior research managers and presented to both the MAWD and Ministry of Finance officials. When the estimates are finally agreed, usually in January, the recurrent estimates are often less than was requested, and the senior research managers have to reallocate the agreed sum between all research teams and regional research stations. Releases of government funds, both capital and recurrent, are made on a monthly basis. It is again necessary for the research managers to allocate the monthly releases of recurrent funds between the teams and stations. The releases of Government funds are not spread evenly throughout the year, which makes careful budgeting even more critical (ref. section 2.IV.1.3.5).

In the last few years each team has been instructed to prepare its estimates within the ceiling of the previous year's allocation, in accordance with the Ministry of Finance procedure to work on the basis of precedence. This has been especially the case with the recurrent costs. It has meant that most of the budgeting has been made primarily on the basis of salaries and research station needs, rather than on the basis of research program priorities. The insistence on not increasing the ceiling for recurrent expenditures has made it extremely difficult for capital projects receiving donor funding with recurrent cost components, to ever be included in the recurrent estimates. In turn, this has made it extremely difficult for any research team to be completely independent of donor support.

While the recurrent budget has been based on precedence, the capital budget has come to consist almost entirely of donor projects, although there are sometimes also small components of Government allocations. Relatively small allocations are also made to the regional research stations from provincial capital votes, controlled by the PAOs (Table I, Appendix II).

Budgeting for donor funds takes place mainly during project preparation, but in most cases there are opportunities for revisions to be made each year. Most donor funds should be indicated as being part of Government expenditure, but this has not always happened, largely because each donor has its own particular budgetary system and not all donor funds pass through the Ministry of Finance. In some cases, payments made outside Zambia are not accounted for in Zambia. Local expenditures are often made through project bank accounts, which are subject to government regulations.

1.3. Main Features of Research Expenditure 1976 - 1985

1.3.1. Problems with Interpreting Research Expenditure Data

It is important to mention that the data on research expenditure are not as complete or as accurate as could be desired. Official publications have been used, as far as possible, supplemented with data collected for this report. Due to the inadequacies in the data, it has been difficult to draw firm conclusions about the trends in expenditure and the relative allocations between different research teams.

The detailed problems with the data are discussed in Appendix II. A detailed breakdown of annual expenditures by the Research Branch between 1976 and 1985 is also presented in Table I in Appendix II.

1.3.2. Allocation of Research Expenditures by MAWD

The Research Branch has, in most years, received a larger proportion of MAWD capital than recurrent expenditure; very roughly, 8% as compared with 2% respectively (Table 8). Sizable subsidies to various parastatal companies were contained in the MAWD recurrent expenditure; 81% of total MAWD recurrent expenditure in 1982 and 42% in 1984 (Appendix II)

Table 8: Summary of Research Branch Expenditure 1976 - 1985

Research Branch Expenditure [1]	1976	1979	1982	1985
Total recurrent costs	2,494	1,707	1,949	1,469
Personal emoluments[2]	1,401	1,250	1,620	1,150
Operating costs	1,093	457	329	319
Total capital costs	1,361	1,491	2,454	1,113
Total recurrent and capital	3,855	3,198	4,403	2,582
Personal emoluments as % of recurrent	56	73	83	78
Personal emoluments as % of recurrent & capital	36	39	37	45
Operating costs as % of recurrent and capital	28	14	7	12
Capital as % of recurrent and capital	29	33	53	41
MAWD Expenditure[1]				
Total recurrent	127,293	133,166	148,405	18,632
Total capital	19,428	17,115	19,843	18,400
Total recurrent & capital	146,721	150,281	168,248	37,032
Research recurrent as % MAWD recurrent	2.0	1.3	1.3	7.9
Research capital as % MAWD capital	7.0	8.7	12.4	6.1
Research recurrent and capital as % of total MAWD	2.6	2.1	2.6	7.0

Notes: 1) Figures in Kwacha '000 at 1980 prices.
2) Personal emoluments exclude salaries of expatriate staff.
Source: The information contained in this table is summarized from data presented in Table I in Appendix II.

Without the subsidies, the research recurrent expenditure would have constituted about 7% of MAWD recurrent expenditure, in both 1982 and 1984. The increase in the proportion of MAWD funds allocated to research in recent years reflects the gradual reduction in subsidies. The total expenditure on research recurrent and capital declined between 1982 to 1985 in real terms (Table 8).

1.3.3. Personal Emoluments

Personal emoluments include chiefly the salaries and wages of research staff, excluding expatriates. They have made up an annual average 30-40% of combined research recurrent and capital expenditures (Table 8). Since 1982, they have constituted more than 75% of research recurrent expenditures. This indicates the severe reductions which have been made in Government allocations to operating costs. It should be noted that most research staff are provided with housing, for which they pay a subsidized rent, amounting to 7% of their gross salary. This means that personal emoluments do not include large provisions for housing allowances, as is the case in some other countries.

1.3.4. Vulnerability of Operating Costs

Operating costs have gradually declined over the period, from 28% of research recurrent and capital expenditures in 1976 to 12% in 1985 (Table 8). The effect of these reductions on individual research teams can be seen in Table 9. The reduction in Government allocations of operating costs has resulted in many donor projects, nominally capital projects, including large proportions of operating expenses. The importance of this buffer mechanism can be seen in Table 10, which shows several research teams, all of which have been included as capital projects, even though operating costs comprise as much as 100% of expenditures. With such a small proportion of expenditure on operating costs, it is not surprising that virtually all 40 of the research staff attending a Research Management Workshop in 1985, listed the shortage of funds as their principal problem (GRZ MAWDd,1986).

1.3.5. Disbursement and Expenditure of Research Funds

The disbursement of Government funds has often been erratic, due to the irregularity of flows of Government revenue. Table 11 provides an indication of the rate at which money has been released. In 1984, three quarters of the way through the financial year, only 39% of authorized Government operating costs had actually been released. Another common feature of the disbursement of Government funds has been the tendency to release large amounts of money in December, within a week or two of the accounts being closed for the year. With such uncertainty it is difficult to plan activities, and it is extremely difficult to undertake any construction work. It is one reason why many teams try to keep large stocks of certain items. However, once funds have been spent, it can be a long wait before fuel bills or subsistence allowances can be paid. Respondents in the SADCC Agricultural Research Resource Assessment (ARRA) study considered the release of funds to be between a serious and very serious problem (SADCC, 1984) (Appendix V).

1.3.6. Authorized versus Actual Research Expenditures

In most years the actual levels of expenditure have been below those that were authorized. Table 12 shows that in four out of five years, between 1981 and 1985, total research expenditures were, on average, 90% of the authorized budgets, and in 1981 the figure was 60%. These short expenditures have largely been due to lack of funds released by the Ministry of Finance. In some cases, money has been released too late in the fiscal year for the money to be spent.

Table 9a: Operating Expenses per Research Team Provided by the Zambian Government, 1983, 1984 and 1985 (Kwacha in 1980 prices)

Research team	1983	1984	1985
Seed Control Services	44,066	19,844	12,511
Tree & Plantation Crops	7,383	2,294	3,791
Cereals Research Team	29,718	20,041	8,353
National Oilseed Research Team	10,456	8,456	3,350
Stored Products Research Team	2,846	2,860	2,191
Plant Protection Research Team	2,518	17,384	1,267
Weed Control Research Team	825	1,168	866
Soil Research Team	8,267	6,129	2,507
Adaptive Research Planning Team			
Lusaka Province	-	1,515	3,123
Biometrics Section	442	723	375
Vegetable Research Team	2,538	1,922	661
Coffee Research Team	-	2,425	1,932
China/Zambia Rice Project	-	NA	33,404
Library Services	-	NA	488
Irrigation Research Team	8,226	NA	1,666
Fibres Research Team	8,706	4,662	NA
Tobacco Research Team	1,422	286	NA
Root & Tubers Research Team	6,836	4,233	NA
Animal Husbandry Research Team	25,819	22,455	NA
Intercropping Research Team	2,248	452	NA
Grants & Other Payments	15,498	936	833
General & Field Expenses	110,111	92,527	195,766
Travelling on duty/Allowances	18,606	19,687	46,341
Total Operating Costs	306,531	229,999	319,425

Source: Ministry of Finance, Financial Reports for 1983 and 1984
Central Research Station accounts for 1985

Table 9b: Operating Expenses per Scientists Provided by the Zambian Government for Selected Research Teams, 1983 and 1985
(Kwacha in 1980 prices)

Research Team	1983	1985
Seed Control Services	4,687	1,564
Tree & Plantation Crops	1,846	948
Cereals Research team	2,477	269
National Oilseeds Research Team	1,046	304
Stored Products Research Team	712	1,096
Plant Protection Team	251	181
Weed Control Research Team	825	-
Soil Research Team	919	167
ARPT-Lusaka Province	-	446
Biometrics section	442	188
Vegetable Research Team	846	220
Irrigation Research Team	2,057	333

Source: Ministry of Finance, Financial Report for 1983
Central Research Station accounts for 1985.

Table 10: Expenditures by Four Commodity Research Teams in 1984 and 1985[1]
(Kwacha in 1980 prices)

Research Team	1984 Zambian Contribution	1984 Donor Contribution	1985 Zambian Contribution	1985 Donor Contribution
Vegetable				
Operating Costs	1,922	7,182	1,672	6,206
Total Zambian and Donor Operating Costs	9,104		7,878	
Operating Costs as % of Total	100		100	
Donor Contribution as % of Total	79		79	
Sorghum and Millet[2]				
Capital Costs	-	2,704	-	22,566
Operating Costs	6,680	23,465	2,784	36,701
Total Capital and Operating Costs	6,680	26,169	2,784	59,267
Total Zambian and Donor Costs	32,849		62,051	
Operating Costs as % of Total	92		64	
Donor Contribution as % of Total	80		96	
Grain Legumes				
Capital Costs	-	24,443	-	395
Operating Costs	-	76,589	-	64,822
Total Capital and Operating Costs	-	101,032	-	64,217
Operating Costs as % of Total	76		99	
Donor Contribution as % of Total	100		100	
Groundnut Agronomy				
Capital Costs	-	11,950	-	395
Operating Costs	-	39,652	-	41,107
Total Capital and Operating Costs	-	51,602	-	41,502
Operating Costs as % of Total	77		99	
Donor Contribution as % of Total	100		100	

Notes: 1) All figures exclude salaries of professional and junior technicians in the CSRT. Overseas purchases of vehicles and other items are excluded, as the figures are not available.
2) Estimate of Zambian government contribution based on 33% of allocation to the Cereals Research Team.

Source: Central Research Station accounts

Table 11: Disbursement and Expenditure of Government Operating Costs for Selected Research Teams in 1984 (Kwacha in 1980 prices)

Research Team	Authorized expenditure for whole 1984	Money Released by Oct. 1984	Released as % of authorised	Money spent by Oct. 1984	Expenditure as % of released
Seed Control	43,455	16,224	37	15,143	93
Tree and Plantation Crops	10,864	3,934	36	671	17
Biometrics	1,086	634	58	411	65
National Oilseeds	16,295	6,545	40	6,207	95
Cereals	43,455	16,432	38	12,304	78
Plant Protection	3,368	978	29	934	96
Weed Control	2,444	1,033	42	600	58
Soil Research	13,580	5,232	39	4,254	81
Fibres	10,266	4,281	42	3,188	74
Vegetables	5,432	2,190	40	1,822	83
Stored Products	5,432	1,632	30	2,016	124
Animal Husbandry	43,455	18,559	43	10,735	58
Adaptive Research Planning Team	2,173	865	40	683	79
Miscellaneous	27,159	11,601	43	10,320	89
TOTAL	228,468	90,140	39	69,788	77

Source: Ministry of Agriculture and Water Development, 1984.
Zambia: Strategy for Agricultural Research.

Table 12: Authorized and Actual Research Expenditure 1981 - 1985
('000 Kwacha in 1980 prices)

	1981			1982			1983			1984			1985		
	Auth. Exp.	Act. Exp.	Actual as % of Auth. Exp.	Auth. Exp.	Act. Exp.	Actual as % of Auth. Exp.	Auth. Exp.	Act. Exp.	Actual as % of Auth. Exp.	Auth. Exp.	Act. Exp.	Actual as % of Auth. Exp.	Auth. Exp.	Act. Exp.	Actual as % of Auth. Exp.
Recurrent Expenditure	2,030	1,730	85	2,012	1,949	97	1,978	1,998	101	1,932	1,629	84	1,609	1,470	91
Capital Expenditure	2,903	1,250	43	1,716	2,454*	143	1,240	1,184	95	2,021	1,857	92	1,226	1,113	90
Total Expenditure	4,933	2,980	60	3,728	4,403	118	3,218	3,182	99	3,953	3,486	88	2,835	2,583	90

Notes: * Expenditure by Research Extension Project (ZAMARE) was not included in authorized expenditure.
Source: Ministry of Finance, Financial Reports 1981-1985

1.3.7. Dependence on External Donor Support

Financial support by external donors has been important to the functioning of almost all research teams. Table 7 indicates that in 1986 16 different donors supported the Research Branch. However, it is difficult to give a precise figure for the proportion of donor support. In some cases allocations by donors have not been recorded; in other cases external payments for items purchased abroad have not been recorded; and, finally, some donor assistance to the Research Branch has been part of larger projects, for which budget breakdowns are not available. Nevertheless, in Table 8, most expenditure under capital projects has been provided by donors. From this it can be seen that donors have provided between 30% and 50% of total recurrent and capital expenditure on research. No clear trend over time is distinguishable.

Tables 10 and 38-40 also indicate the degree to which donor support has been important for several research teams. In the cases of the Grain Legumes Research Team, the Groundnut agronomy, and ARPT in Eastern and Luapula Provinces, the support by donors has been 100% of total expenditure. In some cases donors have phased out their contributions on a sliding scale over the project life. Other donors, who have given loans, have assumed that the Government will increase its own contribution when the project finishes. It is necessary to emphasize that much of this expenditure, while part of capital projects, has actually been supporting operating costs. This is an important strategy used by the research teams to overcome shortages in Government allocations of recurrent funds.

Financial support from external donors has also been important because it has enabled the Research Branch to have much greater access to foreign exchange, with which to purchase items from abroad. In the ARRA study (SADCC, 1984), the research respondents ranked the access to foreign exchange for the purchase of parts, equipment, and special supplies as being between serious and very serious (Appendix V).

Generally speaking, the Research Branch has managed to productively absorb the donor funding. As far as disbursement procedures have permitted, the donor funds have been fully utilized, and relatively few unnecessary items have been purchased.

1.3.8. Research Expenditures Allocated to Research Teams

The inadequacies of the data prevent a detailed analysis of financial resource allocation among research teams. At the most general level, however, inferences can be drawn, based on the staff levels in different research teams (Table 13).

In general, it can be stated that those research teams receiving external donor support have been adequately funded. This means that approximately 5 out of 16 CSRTs which do not have donor support are prone to the vagaries of Government allocations. These include the following:

- Tree and Plantation Crops;
- Intercropping;
- Animal Husbandry;
- Stored Products;
- Weed Control.

Scientists responding to the ARRA survey considered the lack of funding to be a very serious problem (SADCC, 1984, See Appendix V.)

1.3.9. Research Projects with Crop Production Components

Three large capital projects in the Research Branch have had sizable crop production components, in addition to actual research programs. These include the ZAMCAN Wheat Research and Production Project, the Seed Production Project, and the Zambia/China Rice Project. These three projects alone absorbed 46% of total capital research expenditures in 1976, 76% in 1979, and 20% in 1985 (Table I, Appendix II). This means that the actual capital expenditure on genuine research has been less than that shown in Table 8.

2.0. Human Resources in the Research Branch

2.1. Profile of Human Resources in the Research Branch

2.1.1. Problems with Interpreting Manpower Data

Detailed manpower data for the Research Branch were prepared for the first time as part of this study. They are presented in Tables 13-18. It should be noted that not all the desired information was available for some research teams, particularly for the earlier years of 1977 and 1982 and, for the sake of completeness, some estimates have been used. The problems of interpreting the data are discussed in more detail in Appendix III.

2.1.2. Main Features of the Human Resources of the Research Branch

i) Numbers of scientists between 1977 and 1986

The number of scientists more than doubled between 1977 and 1986 (Table 13). Despite this increase, the official number of established posts allocated to the Research Branch by the civil service has remained constant at 68. The supernumerary increase has largely been the result of the recruitment of expatriate personnel, funded by donors. There have been a few attempts to increase the number of established posts, through donor assistance, but with the Government under severe pressure to reduce the size of the civil service, little progress has been made.

The CSRTs had only just been established in 1977; many teams were thus without scientists and technical staff. Most scientists were grouped by discipline, as Table 13 indicates. This helps to account for the large proportion of general agronomists in 1977, who were undertaking trials on many crops.

From 1977 onward, the numbers of scientists increased in most research teams, especially in ARPT, wheat, maize, grain legumes, fibers, sorghum, and millet. By 1986, ARPT had 20% of all scientists, twice the number of the next largest team, the Soils Research Team. However, certain teams have remained rather weak, notably farm machinery and tillage, weed control, root and tuber crops, and food conservation and storage (Table 13).

TABLE 13: Scientists by Research Team

Research Team	1977	%	1982	%	1986	%
ARPT	-	-	8	9	32	20
Maize	3	4	6	7	11	7
Rice	-	-	-	-	4	3
Sorghum & Millet	-	-	2	2	4	3
Wheat	3	4	3	4	11	7
Cereals (General)	-	-	1	1	-	-
Groundnuts	-	-	2	2	5	3
Soybeans	1	2	4	4	2	1
Sunflower	3	4	4	4	4	3
Fibres (Cotton + Kenaf)	-	-	4	4	7	4
Roots & Tubers	1	2	2	2	2	1
Grain Legumes	-	-	-	-	6	4
Tobacco	2	3	1	1	1	1
Tree & Plantation Crops	2	3	4	4	4	3
Vegetables	1	2	3	4	4	3
General Agronomists	12	17	5	5	8	5
Animal Hubandry	7	10	7	8	5	3
Soil Research	9	13	9	10	16	10
Irrigation	4	6	4	4	5	3
Plant Protection	8	11	10	10	7	4
Seed Control & Certification	5	7	3	4	8	5
Weed Control	1	2	1	1	-	-
Biometrics	-	-	1	1	2	1
Cropping Systems	-	-	1	1	1	1
Documentation	1	2	1	1	2	1
Farm Machinery & Tillage	-	-	-	-	1	1
Food Conservation & Storage	3	4	4	4	2	1
Germ Plasm	-	-	-	-	1	1
Officers-in-charge and Administration*	3	4	2	2	2	1
Total	69	100	92	100	157	100

Notes: * Many officers-in-charge have also been members of research teams and have been recorded as such.

Source: Data compiled from survey conducted as part of the OFCOR study in 1986 and from Research Branch personnel records.

It is important to note that the increases have, in most cases, come about with an allocation of Zambian scientists, not just expatriates. This indicates that donor support has not been wholly responsible for the changes in manpower allocations.

ii) Numbers of technical and administrative staff between 1977 and 1986

The Research Branch employs a large technical and administrative staff to support the scientists. The technical staff have either certificate or diploma-level training. The Certificates of Agriculture are issued to those who complete two years of training in general agriculture at either of the two Zambia Colleges of Agriculture. The certificate course has a strong practical orientation. Diplomas are issued by the Natural Resources Development College. The diploma course lasts for three years and is designed to produce middle-management agricultural personnel.

There has also been an increase of almost 50% in the number of technical and administrative staff in the Research Branch (Table 14). The ratio of technicians to scientists has declined, however, from 2.48 in 1977 to 1.59 in 1984.

The largest single group is the administrative support staff, although they have actually declined in proportion from 29% to 17%. This reflects the Government's determination not to increase administrative staff. It also helps explain why certain administrative tasks take an undue amount of time.

In 1977, the technical staff were not assigned to specific research teams, but rather to the general agronomists. Subsequently, they have been allocated to work with specific teams (Table 14).

In 1986, ARPT employed less than 1% of all technical staff. This reflects the relatively small number of on-station experiments, but, more especially the importance of the Trial Assistants who are seconded from the Extension Branch to work full-time with ARPT.

iii) Disciplines of scientists

Table 15 indicates that agronomists have been the largest discipline in the Research Branch. In both 1977 and 1986, 34-35% of scientists were agronomists. It should be noted, however, that the total number of agronomists more than doubled, between 1982 and 1986. Of the 53 agronomists in 1986, ARPT employed 28%, and general agronomy, rice, and wheat together accounted for a further 28%.

Breeders have been the second largest discipline in the Research Branch, being quite constant in proportion at between 13% and 19%. The actual number of breeders tripled between 1977 and 1986.

The economists in ARPT represented the third largest discipline in 1986, comprising 9% of the total.

Table 14: Technical Staff by Research Team[1]

RESEARCH TEAM	1977	%	1982	%	1986	%
ARPT	-	-	-	-	2	0.8
Maize	-	-	4	2.0	6	2.4
Rice	-	-	-	-	5	2.0
Sorghum & Millet	-	-	-	-	1	0.4
Wheat	-	-	4	2.0	9	3.6
Cereals (General)	-	-	32	15.6	38	15.2
Groundnuts	-	-	3	1.5	4	1.6
Soybeans	1	0.6	4	2.0	6	2.4
Sunflower	2	1.2	5	2.4	5	2.0
Fibres (Cotton & Kenaf)	-	-	-	-	2	0.8
Root & Tubers	-	-	3	1.5	3	1.2
Grain Legumes	-	-	-	-	1	0.4
Tobacco	1	0.6	2	1.0	2	0.8
Tree & Plantation Crops	-	-	12	6.0	17	6.8
Vegetables	-	-	4	2.0	8	3.2
General Agronomists	112	65.3	5	2.4	15	6.0
Animal Hubandry	-	-	13	6.4	12	4.8
Soil Research	5	3.0	19	9.2	22	8.8
Irrigation	-	-	1	0.5	9	3.6
Plant Protection	-	-	6	2.9	6	2.4
Seed Control & Certification	-	-	19	9.2	18	7.2
Weed Control	-	-	1	0.5	1	0.4
Biometrics	-	-	-	-	-	-
Cropping Systems	-	-	1	0.5	-	-
Documentation	1	0.6	1	0.5	2	0.8
Farm Machinery & Tillage	-	-	3	1.5	3	1.2
Food Conservation & Storage	-	-	9	4.4	10	4.0
Germ Plasm	-	-	-	-	1	0.4
Officers-in-Charge & Administration[2]	49	28.7	53	26.0	42	16.8
Total	171	100.0	204	100.0	250	100.0

Notes: 1) Technical staff are junior field technicians and clerical staff.
2) Excludes administrative support staff recruited by donor-funded projects.

Source: Data compiled from survey conducted as part of the OFCOR study in 1986 and from Reseach Branch personnel records.

Table 15 - Disciplines of Scientists in all Research Teams

Discipline	1977	%	1982	%	1986	%
Research Branch						
Agronomy	24	35	24	26	53	34
Plant Breeding	9	13	17	19	27	17
Economics	-	-	4	4	15	9
Pathology	4	6	10	11	10	6
Rural Sociology	-	-	-	-	3	2
Animal Husbandry	4	6	4	4	3	2
Statistics	-	-	1	1	1	1
Virology	-	-	1	1	1	1
Horticulture	2	3	6	7	5	3
Librarianship	1	1	1	1	1	1
Soil Science	4	6	5	6	8	5
Microbiology	2	4	1	1	3	2
Agricultural Chemistry	3	4	3	3	4	3
Entomology	6	9	6	7	9	6
Engineering	3	4	5	5	6	4
Food Technology	1	1	-	-	-	-
Nematology	1	1	1	1	1	1
Seed Technology	4	6	3	3	5	3
Agroforestry	-	-	-	-	2	1
Ecology	1	1	-	-	-	-
Total	69	100	92	100	157	100
ARPT						
Agronomy	-	-	4	17*	15	28*
Economics	-	-	4	100*	14	93*
Rural Sociology	-	-	-	-	3	100*
Total	-	-	8	9*	32	20*

Notes: * Percentages of the total in each discipline.
Source: Data compiled from survey conducted as part of the OFCOR study in 1986 and from Research Branch personnel records.

Table 16 - Percent Expatriate Scientists in All Research Teams

Research	1977 Expatriates as % of Total	1982 Expatriates as % of Total	1986 Expatriates as % of Total
ARPT	-	25	47
Maize	66	50	36
Rice	-	-	-
Sorghum & Millet	-	50	50
Wheat	100	-	82
Cereals (General)	-	100	-
Groundnut	-	100	40
Soybeans	100	50	100
Sunflower	66	50	25
Fibres (Cotton & Kenaf)	-	75	57
Roots & Tubers	100	50	50
Grain Legumes	-	-	50
Tobacco	100	100	-
Tree & Plantation Crops	100	75	75
Vegetables	100	66	50
General Agronomists	100	60	38
Animal Husbandry	71	57	40
Soil Research	66	55	50
Irrigation	75	50	60
Plant Protection	63	50	43
Seed Control & Certification	80	33	38
Weed Control	100	100	-
Biometrics	-	100	100
Cropping Systems	-	-	-
Documentation	100	-	-
Farm Machinery & Tillage	-	-	-
Food Conservation & Storage	66	50	-
Germ Plasm	-	-	-
Officers-in-Charge and Administrators	33	-	-
Total % Expatriates	78	51	46

Notes: Figures for 1977 and 1982 exclude CIDA funded expatriates.
Source: Data compiled from survey conducted as part of the OFCOR study in 1986 and from Research Branch personnel records.

Table 17: Education Level of Scientists in ARPT and All Research Teams

ALL RESEARCH TEAMS

Education Level	1977 Expatriate No.	1977 Expatriate %	1977 Zambian No.	1977 Zambian %	1977 Total No.	1977 Total %	1982 Expatriate No.	1982 Expatriate %	1982 Zambian No.	1982 Zambian %	1982 Total No.	1982 Total %	1986 Expatriate No.	1986 Expatriate %	1986 Zambian No.	1986 Zambian %	1986 Total No.	1986 Total %
B.Sc.	28	(52)	10	(67)	58	(55)	9	(19)	35	(78)	44	(48)	7	(10)	52	(61)	59	(38)
M.Sc.	20	(37)	5	(33)	25	(36)	23	(49)	9	(20)	32	(35)	41	(57)	29	(34)	70	(44)
Ph.D.	6	(11)	-		6	(9)	15	(32)	1	(2)	16	(17)	24	(33)	4	(5)	28	(18)
Total	54	(100)	15	(100)	69	(100)	47	(100)	45	(100)	92	(100)	72	(100)	85	(100)	157	(100)

ADAPTIVE RESEARCH PLANNING TEAM

B.Sc.	-	-	-	-	-	-	-	-	6	(100)	6	(75)	-	-	13	(76)	13	(41)
M.Sc.	-	-	-	-	-	-	2	(100)	-	-	2	(25)	11	(73)	4	(24)	15	(47)
Ph.D.	-	-	-	-	-	-	-	-	-	-	-	-	4	(27)	-	-	4	(12)
TOTAL	-	-	-	-	-	-	2	(100)	6	(100)	8	(100)	15	(100)	17	(100)	32	(100)

Source: Data compiled from survey conducted as part of the OFCOR study in 1986 and from Research Branch personnel records.

iv) Use of expatriate scientists

One of the important features of the manpower in the Research Branch has been the reliance, until quite recently, upon a large number of expatriate scientists, mostly because there were no Zambian agricultural graduates until 1973 (Table 16).

In 1977, 78% of scientists were expatriates. Since then the number of Zambian scientists has increased almost six-fold at a rate significantly greater than that for the Research Branch as a whole, which was only 150%. This has meant that between 1977 and 1986 there was a dramatic reduction in the number of expatriate scientists: from 78% in 1977 to 46% in 1986. The rate of "Zambianization" has been somewhat slower since 1982 (Table 16).

By 1986 there were few research teams without Zambians. In ARPT 53% of the scientists were Zambian, which was the same as the average figure for the whole Research Branch.

v) Education level of scientists

Since 1977 there has been a steady increase in the proportion of scientists with advanced degrees (Table 17). The number of scientists holding M.Sc. degrees nearly tripled between 1977 and 1986, from 25 to 70, and the number with Ph.D. degrees increased more than fourfold, from 6 to 28 over the same period (Table 17).

For the Zambian scientists, M.Sc. training opportunities increased significantly after 1982. The number of Zambian scientists with M.Sc. degrees has increased from 9 in 1982 to 29 in 1986. However, it should be noted that the percentage of Zambian scientists with B.Sc. degrees has not changed markedly since 1977.

In ARPT, in 1986, 47% of all the scientists had M.Sc. degrees, and 12% had Ph.D. degrees. This pattern was comparable with scientists in other research teams, except that a smaller proportion of Zambian scientists had advanced degrees.

vi) Gender of scientists

In the last five years, the Research Branch has had Zambian women in senior management positions of both CARO and ADA(R). Overall, however, not as many women as men have entered the Research Branch, although the opportunities for them to join have existed.

Table 18 indicates that in 1977 there were seven female scientists in the Research Branch and by 1986 there were seventeen. In spite of this more than doubling in number, the proportion of female scientists remained virtually constant. In 1986, ARPT employed three women, which constituted 9% of the total.

Table 18: Gender of Scientists in all Research Teams

	1977		1982		1986	
	No.	%	No.	%	No.	%
All Research Teams						
Female	7	10	12	13	17	11
Male	62	90	80	87	140	89
Total	69	100	92	100	157	100
Adaptive Research Planning Team						
Female	-	-	1	13	3	9
Male	-	-	7	87	29	91
Total	-	-	8	100	32	100

Source: Data compiled from survey conducted as part of the OFCOR study in 1986 and from Research Branch personnel records.

2.2. Degree of Staff Turnover in the Research Branch

Staff turnover in the Research Branch has been a serious problem, mostly because of the expatriates employed on short-term contracts. Most expatriates leave after one contract of two or three years. This pattern differs from that in the 1960s and 1970s, when expatriates tended to work for several contracts.

Attrition of Zambian scientists has not been large. In a few cases Zambian scientists have left the Research Branch and taken employment in parastatal companies, private companies, the university, or international research Centers. The problem may soon worsen, as the rewards have diminished rapidly with the high national rate of inflation.

There has been little turnover of technical staff, and few have sought other employment.

2.3. Recruitment of Scientists

The first four students from the School of Agriculture at the University of Zambia graduated in 1973. Between 1973 and 1986 there were only 317 graduates, of whom 33 graduated in 1986. The limited supply of graduates from the University of Zambia helps to explain why it has taken such a long time to increase the number of Zambians in the Research Branch.

Until about 1983, many of the best graduates joined private and parastatal companies, because the conditions of service, especially the salaries, were much more attractive than those in the civil service. The graduates could pick and chose which jobs to take, and the main attractions of the Research Branch were job security and good prospects for M.Sc. training overseas. Since about 1983, however, the number of job opportunities has been limited and it has been much more difficult for agricultural graduates to find employment. As a result, the Research Branch has had a larger number of applicants to choose from.

On several occasions senior research managers went on recruitment drives to the university, and in some cases some research team leaders, such as the ARPT National Coordinator, also went to the university to recruit new graduates. Most Zambian graduates applying for positions in the Research Branch have not had formal interviews. Some research teams, however, have taken great care with recruitment, and a few teams, including ARPT, have assisted students with their research projects. This provides the team with a good opportunity to get to know students and to assess their potential.

Some of the expatriate scientists have been recruited directly by the donor organization, but an increasing number have been recruited by consultancy companies hired by donors to supply the scientists. In either situation, most expatriate scientists have not been interviewed by the Zambian authorities. Usually, the names of one, sometimes two or three, candidates have been proposed by the donor, and the Zambian authorities have made the final selection. Recently the task of recruiting scientists for a large World Bank-funded project was given to the Zambian authorities, including the processes of short-listing and interviewing.

2.4. Staff Appraisal System

The information in this and the next three sections refers to the Zambian staff in the Research Branch.

The staff appraisal system is quite unrelated to a reward mechanism. Promotion in the civil service is based largely on the length of time in the service. The same criterion has been used in the Research Branch. One scientist interviewed commented that promotion only serves as "a long-service bonus rather than a reward for hard work".

There are few senior positions in the whole of the Research Branch. The staff in all teams look forward to these few positions. It is therefore common knowledge that advancing through the present system is difficult, and chances of holding higher positions are slim. Out of a total of 157 professional scientists in the Research Branch, there exists one position of Chief Agricultural Research Officer (GPS/6), six positions of Principal Research Officers (GPS/7), and one position of Chief Plant Protection Officer (GPS/7). The rest of the officers will continue to be in the grade (GPS/9) they had at the time they joined the Research Branch. Some of these officers have been working on the same grade for more than 10 years. All ARPT professional staff are bound by the same system.

Proposals have been made to create more middle grades of GPS/8, but Government has not yet responded.

The staff appraisal system in ARPT is similar to that of the whole Research Branch. In most cases, promotion is based on seniority. There is no regular schedule for staff appraisal. It is done only when a vacant post occurs. The supervising officer makes recommendations to the appointing authorities and such recommendations are seldom challenged.

Despite this lack of a clear reward mechanism it is interesting to note that the ARRA survey of 1984 did not indicate a serious motivation problem (SADCC, 1984, ref. Appendix V).

2.5. Conditions of Service

Many Research Branch staff consider that their conditions of service are unsatisfactory. This point was emphasized at the 1985 Research Management Workshop, when four out of five working groups ranked poor conditions of service as being either the second or third most serious problem reducing the effective operation of the Research Branch (GRZ MAWDd, 1986).

One of the working groups at the Research Management Workshop identified seven reasons for the "poor staff performance in the Research Branch":

i) poor salary scales, promotion prospects, and limited number of senior posts;
ii) poor accommodation and fringe benefits;
iii) insufficient training opportunities;
iv) poor working conditions.
v) no incentives for being based in remote areas;
vi) lack of recognition by superiors;
vii) discontinuity of staff (GRZ MAWDd, 1986).

These and one additional point are discussed below.

a) The salary scales in the Research Branch are one-half to two-thirds lower than salaries in the private and parastatal sectors. Annual salary increments have been given to Research Branch staff, without consideration of performance. Although few scientists have so far left the Research Branch, most scientists interviewed in the ARRA study considered that the low level of salaries was an incentive for staff to leave the Research Branch for the private sector, as and when vacancies arose (Appendix V).

b) The scientists in the Research Branch consider that there is a serious problem with the promotion system. Among the promotion schedule, the staff evaluation system, and the rewards for superior service, the scientists ranked the problem as between serious and very serious (Appendix V).

The first reason for the dissatisfaction is that the hierarchical structure allows few opportunities for promotion. Unlike the structure in the Extension Branch, there have been no positions of Senior Research Officer in the Research Branch. Second, several scientists have complained that in order to be promoted they would have to do more administrative work and less experimental work.

c) Staff housing has been in short supply, and this has been considered to be a very serious problem (Appendix V). However, Research Branch staff have eventually been provided with housing, and the rental charge has been at a highly subsidized rate of 7% of an officer's gross salary. This has, on balance, been a point in favor of the Government sector.

d) Subsistence allowance paid to staff for each day they are away from their work station has been a significant source of additional

income for many scientists. Newly employed scientists can earn as much as one month's salary by being away from their base for just one week. Overseas trips to attend workshops, conferences, and short courses have also provided scientists with important opportunities to earn additional income, usually paid in foreign currency. When the allowances have been paid from GRZ allocations, staff have sometimes had to wait several weeks before receiving payment.

e) Most scientists have considered the long- and short-term training opportunities in the Research Branch to be important incentives for joining the organization. They have not been so important for retaining staff, however, even though the Government operates a bonding system to keep staff once they have completed their training.

f) Many scientists have become frustrated trying to accomplish their assignments to a satisfactory level. It has been difficult for some of them to work when equipment, transport, and operating funds have been in short supply. For this reason, many scientists prefer to work on research teams with adequate sources of funding, guaranteed by external donor support.

g) Over the last few years there has been an attempt to have professional officers as Officers-in-Charge at research stations. This has meant that some scientists working for research teams have been nominated as O-i-Cs, for which they receive no additional remuneration, but which can take more than 60% of their time. This has seriously limited their contribution to their research teams.

i) With the contraction of the economy, job security has become an increasingly important incentive for joining and remaining with the Research Branch.

2.6. In-Service Training Policy and Opportunities

The Research Branch has not had a coherent training policy or manpower development plan for either professional or technical staff. Some research teams have produced manpower development plans for training their staff, including both in-service and advanced academic training. However, these plans have rarely been aggregated at the Research Branch level, where only general statements regarding procedures on applications for further training have been made. In the last five years, most Zambians have been trained through the support of donor programs. If there has been any training policy at all in the past five years, it has been donor-formulated and driven.

Opportunities for degree training, including technicians being sent for the B.Sc., have been substantial in recent years. Most donors supporting research teams have allocated funding to send Zambian counterpart staff for further training. Numerous other scholarships have been provided to the Government by donors.

Many research staff have also attended short courses, many of them through the international agricultural research centers. Several short term courses in Zambia have been offered for technical staff, Officers-in-Charge, mechanics, and others.

The ARRA study (SADDC, 1984) asked senior, junior, and technical research staff whether there was a lack of training opportunities. Senior staff did not think that there was a serious problem. Junior staff were somewhat more concerned, and the technical staff considered lack of training opportunities to be a serious problem. None of the three groups considered that there was a lack of staff interest in receiving further training (ref. Appendix V).

2.7. The Role of Expatriates and their Relationship with Zambian Counterparts.

Zambian scientists, in both CSRTs and ARPT, recognize that most expatriates train their Zambian counterparts. This is achieved in a variety of ways: through on-the-job training, seminars, in-service short courses abroad, and advice on advanced academic courses abroad. This is the area in which Zambian counterparts have benefited most from interaction with expatriates.

It is generally considered that Zambian professionals should have had at least three years of field experience before they assume the management of a program. Most Zambians have more experience than this, however, and yet they have little control over the direction of the research programs funded by donors. Most donor funded CSRTs and ARPT programs continue to be directed by the expatriates employed by the donors.

Research facilities provided by donors are sometimes considered to be principally for expatriate use and under their control. Where more than one donor is funding a program, each donor has its own rules and regulations about how its resources should be utilized. Such instances are not widespread, but where they have occurred they have had a negative effect on the research programs.

Although the Zambian counterparts generally consider expatriates to be experienced scientists, it is difficult for them to reconcile their difference in experience with the vast difference in salaries. Some ARPT staff have felt that such salary differences, coupled with differences in conditions of service, have undermined the motivation of some Zambian scientists.

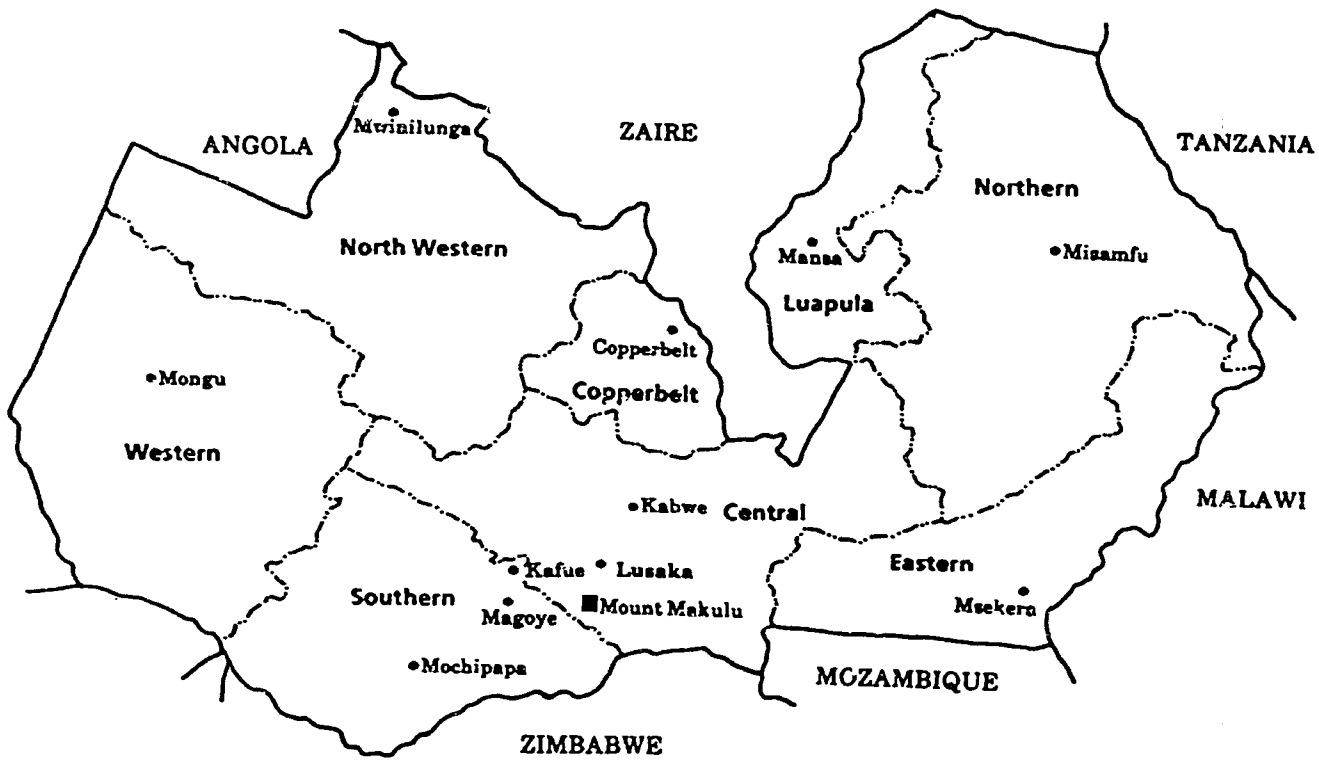
The failure of research managers to carefully assess the ability of experienced Zambians to work on their own is considered to have hindered full cooperation between expatriates and the Zambian counterparts. Experienced Zambians are finding it difficult to continue working under expatriates for many years. One Zambian counterpart working in a CSRT stated, "People should not be perpetual counterparts".

3.0. Physical Resources in the Research Branch

3.1. Scope of Physical Resources

Zambia has had an extensive network of research stations and sub-stations since the 1960s (Figure 2). There is at least one regional research station in each province, and in Central, North Western, and Southern Province there are two. These have been supplemented by twelve substations, one National Irrigation Research Station, and one Central Research Station. Facilities at these stations vary considerably.

Figure 2: Location of Provinces and Research Stations



3.1.1. Central Research Station

As the headquarters for the Research Branch, the CRS has the most extensive facilities, offices, laboratories, workshops, storage, accommodation, and library. The librarian in the Research Branch is based at the CRS and supports the libraries at all other research stations. The CRS workshop undertakes the most extensive vehicle repairs and maintenance for all Research Branch vehicles and, when necessary, sends mechanics to assist at other research stations. Data processing, biometric advice, soil sample and chemical analyses are all undertaken at the CRS.

Unfortunately the CRS is now unsuitable for certain kinds of crop research because dust from the nearby cement factory has raised the soil pH by several points.

3.1.2. Regional Research Stations

Some regional research stations have substantial physical facilities, but few have good laboratory, library, or workshop facilities. Office accommodation is generally adequate, but housing is very limited.

3.1.3. Substations

The substations have limited facilities, at most an office and storage space.

3.2. Quality of the Physical Resources

This very extensive network of facilities has been fully utilized although, increasingly, lack of operating expenses has affected the quality of service. It has also been extremely difficult to maintain the research stations and their equipment; some have become quite dilapidated.

It is difficult to obtain figures for expenditures on research station maintenance, but in 1985 about K18,000 was allocated from central funds for this purpose. If it is assumed that all of the money allocated under the provincial budgets for Regional Research Stations is spent on station maintenance, the proportion of the total capital and recurrent research budget spent on station maintenance fell from 7% in 1976 to below 2% in 1985 (Table I, Appendix II).

In the light of this situation scientists, in responding in the 1984 ARRA survey, described laboratories as being seriously deficient (SADCC, 1984). Equipment at the research stations was considered to be seriously deficient, in both quantity and maintenance. However, offices and meeting rooms were not considered to be a serious problem (Appendix V).

An important component of the Research Strategy document (GRZ MAWDb, 1984), and the World Bank project designed to implement the strategy, is the reduction of the number of research stations and substations. This is intended to increase the efficiency of financial and managerial resources allocated to research and eliminate unnecessary duplication of research effort. The

rationalization of the number and location of research facilities is consistent with the concept of a strong FSR program, such as ARPT. In the strategy ARPT is envisaged as providing the wider geographical coverage, without having the large overhead costs of running and trying to maintain an extensive network of research stations.

4.0. Information Resources in the Research Branch

4.1. Access to External Sources of Information

The Research Branch has had quite strong links with many external sources of information. Through various regional and international networks and affiliation with diverse projects, scientists have had access to a wide range of data.

4.2. Internal Management of Information within the Research Branch

4.2.1. Library System

The main library for the Research Branch, located at the Central Research Station, has the responsibility for serving the regional research stations. The library is generally regarded as having the nation's most extensive collection of publications related to Zambian agriculture and natural resources. Indeed, it has been designated as the central repository for all reports on agriculture in Zambia. In spite of its important role, it has received only limited funding and its ability to keep adding to its collection has depended largely on donations and external support. It has suffered from thefts of documents, which have been particularly serious in the case of documents containing research results, such as CSRT Annual Reports. The library has not received copies of reports produced by many research teams. As a result, access to past research results has become a serious problem.

4.2.2. Research Teams

Each research team conducts its own analysis of trial results, sometimes assisted by the biometrician. Trials are supposed to be written up in detail, following a standard format, and presented in the annual reports. However, there have been several problems with the system, mainly the available data base has been rather limited. Frequently research teams have produced too few copies of reports. The problem of staff attrition has also exacerbated the situation. In some cases, data have been misplaced or lost between the departure of one scientist and the arrival of another. Generally, the handing over of research data has not been very efficient.

4.2.3. Access to Previous Research Results

Table 19: Tentative Findings of Research Data Base Survey

Crop***	Trials Planned	Trials Results Available	Trials with Insufficient Results**	Trials with no Results or Comments*
Maize	808	501	172	135
Tobacco	107	70	24	13
Cotton	240	167	36	37
Kenaf	62	32	7	23
Rice	217	84	35	98
Wheat	288	167	29	92
Barley	13	4	1	8
Beans	172	114	35	23
Cowpea	42	8	34	-
Soybean	265	171	60	34
Chickpea	7	5	1	1
Pigeon pea	13	12	1	-
Groundnut	210	134	48	28
Millet	18	12	2	4
Sorghum	94	70	9	15
Sunflower	133	71	41	21
Pasture	277	132	66	79
Cassava	83	35	14	34
Sweet Potato	14	4	-	10
Tea	23	12	6	5
Coffee	44	32	11	2
Guar	13	10	2	1
Fruit trees	102	35	32	35
Vegetables	242	122	58	62
Soil	31	14	10	7
Green manure	6	6	-	-
Ecology	13	4	6	3
Misc.	24	22	-	2
Total	3,562	2,050	740	772

Notes: * Trials without results because they could not be found, were abandoned, or not conducted.

** Trials were known to be conducted, but results are insufficient for various reasons: no statistical analyses undertaken, no statistical data, not all required measurements were taken, long- term trials lack data for some seasons.

*** The study was looking for all trials undertaken, but the list is known to be incomplete. Results go back in time as far as possible, some to the 1958-59 season, and most go up to the 1983-84 season, with a few including 1985-86.

The biometrician, who helps scientists with research design and statistical analyses, has kept a set of master files on every trial conducted. The data contained in these have sometimes been far from complete. ARPT initiated a research data base in 1985, to try to compile a complete set of all research data. The exercise has been undertaken by a German volunteer, under the auspices of the

biometrics section, drawing on the biometrics section's files, the library, and individual scientists' records. They intend to computerize the data base eventually.

Although the research data base exercise has not been completed, the tentative findings are shown in Table 19. Out of a total 3,562 trials which had been planned, full results are available for only 58%. A further 21% of trials have been conducted, and some data are available, but for several reasons the results are insufficient (ref. footnote to Table 19). For another 21% of trials no results could be found, either because the trials were never conducted or failed after having been planted.

Obviously the problems of data access have hindered scientists trying to review literature before conducting trials. In several cases teams have repeated previous experiments, largely because they were unaware that similar experiments had already been conducted. The problem of data access has generally been worse at the regional research stations.

4.2.4. Production of Research Reports

Until the position of National Research Extension Liaison Officer was created in 1985 the Research Branch gave rather low priority to publicity and the publication of research results for external use. Publication of reports remains limited. Each research team should produce an annual report to include the detailed results and analysis of each experiment. Unfortunately, the annual reports for some teams and for the Research Branch as a whole are not up to date. In addition to the annual reports, scientists have also written papers and articles for the two Zambian agricultural magazines. From time to time extension information on particular crops or animals has also been compiled, and individual scientists have provided information that could be useful. However, no regular synthesis of research results is undertaken.

Since 1983 the National Research Extension Liaison Officer, working at the Central Research Station, has helped to produce articles about research findings, for publication in the national newspapers and magazines. A popular television program produced by the National RELO has given considerable publicity to the work of the Research Branch.

V. IMPACT OF RESEARCH

1.0. Areas of Accomplishment

As part of the Research Strategy, the CSRT scientists were asked to list the major achievements of each research team. Scientists in the Maize Research Team mentioned the purification of parental lines of SR52 and the development and release of earlier hybrids and open-pollinated varieties. The Wheat Team has developed improved varieties, such as Emu-S, Loerie, and Canary. The Sunflower Team mentioned varietal improvement, especially resistance to Alternaria. The Soybean Team has released three new varieties and has identified two freely nodulating lines. The Plant Protection Section mentioned that recommendations for pest and weed control had been formulated.

Other research teams which have made considerable progress with varietal improvement have included those working on vegetables, groundnuts, and cotton.

At the Research Management Workshop, held in 1985, some forty staff from the Research Branch were divided into six working groups. One of the tasks assigned was to rank the major achievements of the Research Branch. The groups came up with large and varied lists. The achievements listed by three or more of the working groups are presented in Table 20.

Table 20: Research Branch Achievements

Area of Achievement	No of groups out of Six
Release of varieties suited to Zambian conditions	5
Development of "Lima" recommendations	4
Effective manpower development and training program	4
Attraction of external donor support	4
Good cooperation with international institutions	4
Introduction of new crops	3
Reduction of pre- and post-harvest losses	3
Establishment of ARPT	3
Establishment of the Zambian seed industry	3
Provision of advisory services	3

Source: GRZ MAWDd, 1986

2.0. Problem Areas

Several problem areas have also been recognized as affecting the work of the Research Branch. In the Fourth National Development Plan, the chapter on the agricultural sector lists four areas (GRZ MAWDa, 1986):

i) insufficient allocation of funds, particularly for operational purposes;
ii) inadequate linkages between research and extension;
iii) lack of housing and office accommodation;
iv) insufficient access to current scientific journals.

CHAPTER THREE

ORGANIZATION AND MANAGEMENT OF ARPT

I. CURRENT ORGANIZATION OF ARPT: A PROFILE

1.0. Position of ARPT in the Research Branch

The Adaptive Research Planning Team (ARPT), established in 1980, is a separate section within the Research Branch of the Department of Agriculture. It is designed to complement the work of the Commodity and Specialist Research Teams (CSRTs) (Chart 1). The CSRTs have a commodity focus and a national mandate, whereas ARPT has an area focus and conducts research on the needs of specific farming systems in each of Zambia's nine provinces. The CSRTs emphasize applied research and conduct their research largely, but not exclusively, at the research stations located in the four main agro-ecological zones. ARPT, with teams based by province, draws on the technologies developed by the CSRTs and adapts and tests them in regional farming systems. ARPT is the section with primary responsibility for on-farm client-oriented research within the Research Branch. It is the largest section within the Research Branch (Table 13).

2.0. Internal Organization of ARPT

By 1988 there will be an ARPT in each of Zambia's nine provinces. Each provincial ARPT is to have one Farming Systems Agronomist, one Farming Systems Economist, and one Research Extension Liaison Officer (RELO). The position of RELO is in the Extension Branch, which helps to make ARPT, first and foremost, a section of the Department of Agriculture, rather than solely of the Research Branch. The ARPT members are based together at the Regional Research Station (RRS) in each province and are in most cases supported by one to three Trials Assistants (TA), seconded from the Extension Branch to supervise the trials on a day-to-day basis. Each team has a Provincial Coordinator, responsible for administration and supervision of its research program.

The provincial teams' activities are conducted in Target Areas, which are representative areas selected within the chosen farming systems. The Target Areas are approximately 40 kilometers in diameter. On-farm trials are located in clusters, usually three in each Target Area. Trials Assistants (TAs) are based within the Target Areas.

An ARPT National Coordinator (ARPT NC) coordinates and supervises the work of the provincial teams and liaises with CSRTs, extension workers, and planners. An ARPT rural sociology section, which will eventually have four regionally based rural sociologists, supports

the work of the provincial ARPTs. A nutritionist has also been working in the section, with responsibility for ensuring that nutritional considerations are given greater attention in ARPT's work.

ARPT, to date, has given little attention to the problems of livestock, but three Adaptive Livestock Specialists are included in ARPT's long-term development plan. They will be based in the provinces where livestock are particularly important: Eastern, Southern, and Western Provinces.

Table 21 shows that at the end of June 1986 ARPT was working in seven provinces. There were 38 professional staff, including six Zambians who were abroad on M.Sc. training. ARPT, in common with other research teams, has relied heavily on the support of expatriate staff; in June 1986 47% of ARPT scientists were expatriates. This relative proportion is similar to that of the Research Branch as a whole (Table 16). Most of the Zambians were in counterpart positions, but a few had full responsibility for their own programs.

During the 1985/86 season, six provincial ARPTs conducted a total of 66 on-farm trials, including on-farm tests, on the fields of 371 farmers (Table 21).

ARPT has received considerable support from external donors. Each provincial ARPT is supported by an external donor (Table 21), with a variety of different funding arrangements. These include direct support to ARPT, but also support as part of larger donor-funded projects to research and, sometimes, extension. This has resulted in a complex set of funding and reporting relationships and has reinforced the need for the position of ARPT NC to hold the different units together and maintain an integrated program.

The progress made by ARPT since its establishment in 1981 leads to

Table 21: Internal Organization of ARPT as of June 1986

Province/ Section	Team Size: Agronomist	Economist	RELO	Total Scientists	Trials Assistants	Year Team started research	Number On-Farm Trials[1]	Number of Trial Farmers	Donor Organization	Donor Funds as % of Total (Approximate)
Central	1	2	2	5	3	1981	13	65	USAID	75
Lusaka	1	-	-	1	2	1981	10	60	ODA and CIMMYT	50
Eastern	1	1	-	2	2	1982	18	111	World Bank & IFAD	100
Western	1	2	-	3	2	1981	4	45	Netherlands	90
Luapula	2	2	1	5	4	1982	13	60	SIDA	100
North Western	3	2	2	7	2	1984	10	58	IFAD and GTZ	100
Northern	1	2	1	4	*	1985	*	-	NORAD	100
Sociology	-	-	-	3		1983			ODA	50
Nutrition	-	-	-	-		1983			SIDA	100
ARPT National Coordinator	1	1	-	2		1980			ODA and CIMMYT	50
Away on Training	4	2	-	6		NA				
Total	15	13	6	38	15	NA	66	371		

Notes: [1] The figures include trials replicated in different farming systems and on-farm test demonstrations.
* 1986 was the first season for ARPT in Northern Province, and there were no on-farm trials.

Table 22: Indicators of Progress in Seven Provincial ARPTs

Indicator / Province	Evidence of Adoption	Farmer assessment of on-farm trials	New Recommendations from on-farm trials	Thrusts for on-farm trials from surveys	Understanding why current recommendations not widely adopted	Areas for commodity research from surveys	Improved research extension links	Improved links with agriculture services & planners
Central	*	**	*	**	*	*	**	*
Eastern	*	**	**	**	*	*	**	*
Luapula	*	**	*	**	*	**	**	**
Lusaka	-	**	-	**	*	**	*	*
Northern	-	-	*	**	*	*	**	*
North Western	-	*	**	**	*	*	**	*
Western	*	*	*	**	*	*	*	*

Notes: Key: - No progress
* Moderate progress
** Good progress

Source: Kean & al., 1985 (Revised)

The basic objectives have not changed since the inception of ARPT, although ARPT has found it necessary to conduct a larger number of station trials than had been intended originally. This was necessitated originally by the limited number of technologies available for on-farm testing, by the resource limitations of CSRTs, and concern by some ARPT agronomists to have control plots at experiment stations as well as on farmers' fields. This development of a technology-generation role has meant that ARPT has had a sizable program of on-station trials, in 1985/86 40% of the trial program.

The emphases have changed over time. For example, greater attention has been given to developing feedback from and closer interaction with CSRTs in the last two to three years. This change was, to some extent, the result of the need to reduce tension between scientists in ARPT and CSRTs, and of the need to have technologies emanating from CSRTs which could be immediately put into on-farm trials.

Each provincial ARPT also places somewhat different emphasis on certain objectives. In Luapula Province, for example, the team has worked closely with service institutions and development planners, partly because of the very low initial level of infrastructure and support services and partly due to the subsistence nature of farming, with inherent malnutrition in many areas. By way of contrast, ARPTs in both Central and Eastern Provinces have laid emphasis on developing close linkages with extension on account of the donor project organization in which both ARPTs have been working.

ARPT is currently performing all seven of the OFCOR functions examined in the ISNAR study.

4.0. Emphasis on ARPT within the Research Branch

ARPT has been given equal status with CSRTs in various policy statements. These include the MAWD Research Strategy document (GRZ MAWDb, 1984) and a statement made by the Minister of Agriculture to Parliament in 1982.

The previous ADA(R), who was responsible for establishing ARPT, gave the program greater emphasis than other programs during its establishment but recently agreed that in the long term it should have equal weight. The current Director of Agriculture considers that ARPT is a "critical section" within the Research Branch and is of at least equal status with CSRTs, if not slightly senior to, because it cuts across the work of all CSRTs. In common with the Director, the current ADA(R) considers that ARPT has had a disproportionate amount of the resources allocated to research and that there is a need to give a larger share to CSRTs. This imbalance has been redressed to some extent over the past few years, because several donor projects have been initiated to support the CSRTs.

5.0. ARPT Methodology

The sequence of activities followed by ARPT is outlined in Chart 2. This sequence, and the general methods used to implement them, have been derived principally from CIMMYT's economics program (Byerlee, Collinson et. al., 1980). The team has tried to adapt the methods to suit Zambian conditions, and variations can be found in different provinces. The ARPT National Coordinator has welcomed experimenta-

Chart 2: Adaptive Research Planning Team – Methodological Sequence

Research Stage	Objective	Activities	Time Frame
Zoning	Group farmers by their farming activities into different farming systems.	ARPT staff interview extension workers and community leaders.	3-6 months
Survey	Study the constraints of each farming system to understand the farmers' problems and identify potential for development.	ARPT staff interview farmers using extension workers as enumerators.	3-9 months
Research Priorities	Formulate a program of applied and adaptive research which aims to solve the most important technological problems identified in the farming system.	ARPT staff with Commodity and Specialist Research Team staff plus Provincial ARPT Committee members.	2-3 months
On-Farm Trials	Test and, if necessary, modify the possible reseach solutions on farmers' fields under realistic conditions until acceptable solutions are found. The trials are conducted on 3-10 farms within the Target Area.	ARPT staff with the Trial Assitants provided from Extension Branch.	2 + years
On-Farm Tests	Information about technological components or packages successful in on-farm trials are extended by various means, including on-farm tests/demonstrations, still within the Target Area. The level of adoption is monitored.	Research Extension Liaison Officer with camp-level extension workers.	1-2 years
Recommendation	Technological components or packages which are adopted by the majority of farmers within the Target Area are then released and extended to farmers throughout the farming system.	ARPT staff, CSRT staff, and Provincial APRT Committee	

tion with different methods, provided they can be justified and provided they are carefully evaluated by the national team, as a whole. There has been some assessment of the different methods and sharing of experiences by team members during the quarterly and annual ARPT meetings. There was initially a concern to keep costs low, and this was an important criterion in assessing the different methods. It has become of less concern as team members have found it necessary to use more costly methods to thoroughly investigate issues related to labor and cash bottlenecks, and certain agronomic, social, and nutritional factors.

In brief, the methodology entails the following:

i) Zoning

Identifying the different farming systems within a province has usually been done through analysis of data collected from extension workers and a few other key informants. Provincial teams have experimented with this stage. For example ARPT in Northern province placed greater emphasis on use of secondary data and took agro-ecological boundaries as the primary determinants.

ii) Surveys

Most ARPTs start work in a new farming system by conducting both informal (exploratory) and formal (verification) surveys in order to identify the key points for technological intervention within the system. Subsequently most teams have embarked on a range of more detailed studies, including;

- focused surveys of specific agronomic variables;
- frequent visit surveys to collect quantified flow data on variables such as labor, income, and expenditure;
- collection of quantified anthropometric and nutrition data;
- participant observation of certain sociological variables.

Some provincial teams have kept the costs of frequent visit surveys down by using extension workers as enumerators. This approach has only been partially successful and, from experience in Central Province, appears to depend on the amount of training and supervision given to the extension workers. Other teams have tried to use Trials Assistants to collect data, but this has not been very successful, largely because TAs have not been able to take on the additional work.

To save time and money, the ARPT National Coordinator has been concerned that maximum use should be made of previously collected data, whether by ARPT or by others. Additional data collection should be justified in relation to the team's work program and the trial program hypotheses. Evidence of greater interdisciplinary input into the survey work is seen in several ways. Assistance and suggestions have been sought from sociologists about sampling methods, use of indigenous knowledge, and interview methods. Similarly, some teams have requested the nutritionist to identify nutritional problems during surveys.

iii) On-farm trials

The general typology of trials conducted by ARPT is quite similar to that used by CIMMYT (Palmer, et al., 1982). The broad distinction between trials has been as follows:

a) Research Managed/Research Implemented trials (RM/RI) in which scientists tightly control all aspects of the trial and farmers provide the land and very occasionally the labor. The trials are primarily assessed by statistical methods.

b) Research Managed/Farmer Implemented trials (RM/FI) in which farmers participate fully in all activities, but the trial management is controlled by the scientists.

c) Farmer Managed/Farmer Implemented trials (FM/FI) in which farmers are fully responsible for trial management as well as implementing the trials. Farmers' assessment of the outcome is the most important analysis.

iv) On-farm tests

Only a few provincial teams have reached this stage and those that have are still trying to determine the most appropriate methods. At this point in ARPT's activities, the RELO and camp-level extension workers disseminate information about technologies which have been successful in FM/FI on-farm trials and monitor whether and how farmers adopt the new technology when there is no close supervision by ARPT or provision of free inputs. Information about the new technology is disseminated in demonstrations and other ways. Adoption is monitored on a larger number of farm sites than during the on-farm trial stage. This stage enables extension workers to determine the best communication techniques for explaining the new technology to farmers. It also provides a realistic market test of the demand for the new technology and related inputs, thereby enabling potential commercial suppliers to see the size of the market.

6.0. ARPT's Linkages with Other Sections and Organizations

This section briefly outlines ARPT's linkages with other sections within the Research Branch and with other organizations involved in agricultural development. The organizational and managerial mechanisms which help or hinder such interaction with CSRT scientists and extension workers are examined in more detail in Chapter 4.

6.1. Links with Experiment Stations

Each provincial ARPT is based at a Regional Research Station (RRS). The ARPT National Coordinator, Sociology Coordinator, and Nutrition Coordinator are based at the Central Research Station. It is convenient for ARPT scientists to be based at the research stations because, in some cases, it enables them to have more frequent contact with CSRT scientists based at the same station. Although 78% of research teams have scientists based at regional research stations, 48% have their headquarters at the Central Research

Station, where most decisions are made. The ARPT teams also inform the Officers-in-Charge of the research stations about the teams' work program and discuss any matters relating to personnel, such as accommodation and disciplinary matters.

Prior to the reorganization of the Research Branch, there were regional agronomists who implemented the trial programs for the commodity coordinators. The nine regional agronomist positions were transferred to ARPT when it was established and have been used to recruit the FS agronomists. However, in two or three provinces expatriate volunteers have been recruited to work as station agronomists, essentially implementing the trial programs for CSRTs which do not have scientists based at those stations. These station agronomists have had large trial programs and have not generally been able to help ARPT to conduct its station trials. Nevertheless, where there have been such station agronomists, there has been interaction between them and ARPT agronomists.

6.2. Links with Commodity and Specialist Research Teams

From the beginnings of ARPT it was realized that effective communication between ARPT and CSRTs was of high priority. The earliest documents about ARPT mentioned the need for a two-way flow of information between ARPT and the CSRTs, with scientists from relevant CSRTs being involved in ARPT's exploratory surveys providing insight on specific problems encountered and suggesting possible solutions to be tried in on-farm trials. This would also enable information on farmers' problems, requiring further technical component research, to reach CSRT scientists. This has proven to be a difficult link to develop effectively.

The evolution and effectiveness of the interaction between ARPT and CSRTs, as well as the organizational and managerial mechanisms developed to strengthen this link are examined in detail in chapter 4, section II.

6.3. Interaction between ARPT and Extension

ARPT has created a range of opportunities to involve extension workers, of all levels, more fully in the technology generation process (ref. Table 48). Interaction between ARPT and extension workers takes place on many different occasions, including the following:

- Extension workers take part in many ARPTs activities, such as, informal surveys, formal surveys, and ARPT field days.
- The RELO in the ARPT team is seconded from Extension.
- The Trial Assistants are seconded to ARPT from Extension.
- Farmers' adoption of technology is monitored by the camp-level extension workers, under the RELO's supervision.
- In the Provincial ARPT Steering Committee research and extension staff have an opportunity to plan the province's research program together, as well as to discuss the content of extension messages and to make suggestions about changes in research recommendations.
- The ARPT Provincial Coordinator attends the PAO's staff meetings.

Linkages with extension have been stronger in some provinces than in others, partly because of the structure of the donor project supporting ARPT in particular provinces. For example, in Central, Eastern, and North Western Provinces, support for ARPT has been through donor projects which have a general mandate to improve extension as well as research. These variations are examined in more detail in Chapter 4, section III.

6.4. Links with Policy Makers and Development Agencies and Projects

ARPT needs to interact closely with policy makers and development agencies.

ARPT is trying to understand how farmers make decisions on adopting technology. Some of the important constraints farmers face have policy implications such as costs of inputs and producer prices. When ARPT is identifying areas of potential improvement, it needs to know which constraints are likely to remain fixed and which are likely to be improved. This requires close contact with both policy makers and development agencies.

It is important for development agencies, in particular, to be kept informed of forthcoming recommendations which could require reliable institutional support. Planners must be able to prepare for new recommendations and, if necessary, strengthen the relevant institution or infrastructure.

ARPT has few formal links with national policy makers, development agencies, or projects, because most of these organizations are working at the provincial level. Nevertheless, there have been numerous informal contacts between the ARPT National Coordinator and such organizations as:

- Department of Agriculture, including sections, such as National LIMA Fertilizer program, the Home Economics section, Development Support Communications, Land use planning, Zambia Research and Extension Project,
- Planning Division, MAWD, including sections such as Manpower Development and Training, Women's Development, Zambia Agricultural Training and Planning Project,
- National Commission for Development Planning,
- Central Statistics Office,
- National Food and Nutrition Commission,
- Primary Health Care Secretariat,
- Various donor organizations such as SIDA, NORAD, Netherlands Technical Assistance, GTZ, German Volunteer Service, USAID, etc.

At the provincial level, ARPT has had the opportunity to develop close links with various development organizations including; Integrated Rural Development Programs, Provincial Planning Units, Cooperative Marketing Unions, and specific production project, such as the Maize Development Project in Central Province and the Cattle Development Area projects in Eastern, Western and Southern Provinces.

In most provinces, ARPT has invited representatives from the key development agencies and projects to attend the ARPT Provincial Committee meetings and, in a few cases, they have also been invited

to field days. In turn, in some provinces, ARPTs have collaborated actively with development projects. Some ARPTs have also been involved in provincial planning exercises for the agricultural sector. ARPTs participate on a regular basis in many workshops on agricultural development organized within the provinces.

6.5. Links with the University of Zambia

ARPT has had several links with the University of Zambia, including: the School of Agriculture, the Department of African Development Studies, the Department of Economics, the Rural Development Studies Bureau, and the Institute of African Studies.

The ARPT NC has given several lectures, in different departments, about the work of ARPT. Several students have undertaken research projects on subjects of interest to ARPT and have been supported financially by ARPT. Some vacation students have also worked with ARPT.

The most important area of cooperation, however, has been with the School of Agriculture, where ARPT has helped establish a farming systems research project for final-year students. The project, which receives CIMMYT support, will enable several students to undertake their compulsory research project working as part of an interdisciplinary team in a small-scale farming system some 30km from UNZA. In the course of this work both students and staff will gain practical experience in FSR methods and will collect information for use in teaching other courses. The ARPT NC has also discussed aspects of a course on interdisciplinary cooperation in agricultural development.

7.0. Channels of Responsibilities and Reporting Mechanisms for ARPT Staff

The provincial ARPT staff are responsible, through the ARPT Provincial Coordinators to the ARPT National Coordinator for almost all technical, administrative, financial, and personnel matters. Through the ARPT National Coordinator they are responsible to the CARO, the Assistant Director of Agriculture (Research), the Director of Agriculture, and ultimately, the Permanent Secretary of MAWD (ref. Chart 1). The job descriptions for both the expatriate and Zambian FS agronomist and FS economist describe this hierarchical structure.

The position of the RELO is rather more complex because, although the RELO post is in the Extension Branch, the job description states that the RELO is both technically and administratively responsible to the ARPT Provincial Coordinator. Yet in practice, while the RELOs have been responsible to the ARPT Provincial Coordinators for their work programs, on other administrative matters, including secondment and recruitment, they have been more responsible to the ADA(E). This joint responsibility has delayed recruitment of some RELOs, and the job description has confused some RELOs. It is an issue requiring attention by the ADA(E) and ADA(R).

In practice the issue of ARPT staff responsibility is rather more complicated than the foregoing might imply. There are several possibilities for divided loyalties, especially for expatriate personnel, and these vary from province to province.

First, in several provinces the ARPT Provincial Coordinators have considered that they should work hand in hand with the PAOs, partly to build close working relationships with extension workers and partly to gain the support the PAOs can provide on administrative and personnel matters. They have therefore considered themselves to be partly responsible to the PAO. One of the most important areas where PAOs exercise considerable authority over Research Branch personnel is that of staff discipline. Disciplinary matters have been decentralized to the provincial authorities and, apart from staff transfers, the PAOs are expected to handle all cases and brief the Provincial Permanent Secretary when necessary.

Some PAOs hold that all Government officers working on agriculture in the province should report to them, including all scientists working in the province. However, given the role of the CARO, the PAOs recognize that their breadth of responsibility is narrow. They accept that, in the case of ARPT, their responsibility covers mainly matters related to administration, personnel, and accommodation. In general, there have been no conflicts between the teams and PAOs. The position of the PAO as the chairman of the ARPT Provincial Committee has worked well and has provided the PAO with opportunities to have a major say in what the team is doing. However, the emphasis placed on the relationship between ARPT and the PAO has varied in different provinces, depending on the PAOs' interest in research and the ARPT Provincial Coordinators' concern to interact with extension workers.

Second, some donor projects supporting ARPT, have project managers who are responsible for the larger projects. The project manager is able to act as a spokesman for the ARPT expatriate technical assistants and as such assumes some responsibilities of the team members, e.g., to obtain Zambian counterpart staff, to resolve financial and administrative problems, and even communication problems between ARPT, CSRTs, or extension. To some extent, expatriate technical assistants can consider themselves to be responsible to the project manager.

Third, the donor organizations themselves may have particular administrative requirements that their technical assistants are expected to follow. They may also be able to help their staff with various administrative and financial matters. Both factors can increase the feelings of responsibility that the staff may have for the donor. This is particularly likely if the technical assistants are hired directly by the donor, as in Lusaka, Luapula, Northern and Western provinces. The most confusing situation arose for the technical assistant personnel in ARPT-Central Province. The USAID-funded personnel on the team had some problems during the initial phase of the project because there were four potential supervisors, including the ARPT National Coordinator representing the Chief Agricultural Research Officer, the ZAMARE Chief of Party, the USAID Zambia Representative, and the contracted universities. With several different supervisors there were occasions when interests conflicted. This issue was taken up by the Project Evaluation Team a year after the project had started.

Fourth, when expatriate technical assistance personnel have been recruited through a firm of consultants, FAO or a university, there have been cases when the staff have considered themselves to be responsible first and foremost to the recruiting agency.

II. EVOLUTION OF ARPT WITHIN THE RESEARCH BRANCH

1.0. Institutional Foundation for the Development of ARPT

1.1. Motivations and Stimuli for Developing and Implementing ARPT

The motivation to establish ARPT was wholly Zambian. However, the procedures for conducting adaptive research and the subsequent implementation of ARPT benefitted considerably from external advice and support.

The key individuals responsible for developing ARPT were all working in three sections of MAWD: the Planning Unit, the Research Branch, and the Extension Branch of the Department of Agriculture (Chart 1). At the policy level, in all three sections there was a convergence of views among certain individuals on the need to reform the research program.

1.1.1. Planning Unit

The Director of Planning of MAWD was concerned that the research program should be made more relevant to the needs of Zambia's small scale producers. In 1976, he initiated a study of the research program to identify ways in which this could be achieved. This was undertaken by an economist, who later transferred to the Research Branch to become ARPT National Coordinator. The study identified several weaknesses with the research program, including: the lack of a well-defined target group, the neglect of socioeconomic constraints facing farmers, and the gap between research and extension workers.

The growing pressure for change could be seen in various policy documents, such as the background reports used to prepare the Third National Development Plan. These contained references to the need for greater attention to the problems of small farmers; to solving local problems; to the need for an integrated interdisciplinary approach to research; and to improving the farming system as a whole, and not only individual commodities.

Several policy statements made by senior officials from MAWD emphasized that the research program should give greater attention to the needs of small-scale farmers. For example, at the PAO's bi-annual conferences in 1976 and 1978, the opening speech by the Minister of Agriculture stressed that efforts must be directed at the small-scale farmer and at "proper coordination of our research needs and transfer of research results", because without it "there is likely to be a gap in the transfer of technology to the farming community". (GRZ MAWD, 1978).

For these reasons the Planning Unit responded positively to the request by CIMMYT's East African Economics program (EAEP), in 1977, to demonstrate adaptive research planning procedures. The

Ministry's support for the development of ARPT was important because it was, and still is, the overall policy-making body in agriculture. Policy statements are closely adhered to by the Department of Agriculture.

1.1.2. Department of Agriculture

Within both the Research and Extension Branches of the Department of Agriculture senior managers and some scientists were coming to the same conclusion as the Ministry about the need for change.

Four senior managers played a key role in helping to introduce the concept of farming systems research as a means to focus research on the needs and problems of small-scale farmers: the Director of Agriculture, previously ADA(R), the two Assistant Directors of Agriculture for Research and Extension, and the Chief Agricultural Research Officer. The fact these four individuals had broadly similar views on the problems of technology generation and dissemination helped to speed up the process of institutional change.

All four individuals supported the idea of the CIMMYT EAEP demonstrations. The then Director of Agriculture (DOA) has recently commented, "There was a need to find out exactly how farmers go about their business. It was this desire that enabled me to accept CIMMYT to assist in defining the problem" (Mumba, Personal Communication).

Both the DOA and ADA(R) had been exposed to research systems in other countries, where they saw greater interaction between research scientists, extension workers and farmers. The DOA had visited the USA, CIMMYT, IITA and Amadhu Bello University in Nigeria, and the ADA(R) had visited the USA, where he saw "research which was for the farmer and research that was perceived by the farmer to be necessary" (Chibasa, 1986). This was what he wanted to introduce into Zambia on his return home.

Policy makers were not the only ones who recognized the need for change, however. Three agronomists in the Weed Control Research Team carried out a small-farm weed program between 1978 and 1981. They lived in a village in Central Province and conducted a program of on-farm trials with farmers. They tested "best-bet" packages which station research had indicated should be suitable for their farmers. However, after three years they concluded that the package was not appropriate for the category of farmers they were working with. From this experience they became strong advocates of diagnostic survey techniques which would first identify farmers' research priorities. The scientists on the Weed Control Research Team provided much support for the introduction of social scientists and on-farm research into the Research Branch (Parker, 1981).

An important factor facilitating the introduction of ARPT was the general state of flux of the Research Branch, since it had been decided to reorganize the scientists into multidisciplinary commodity research teams (ref. section 2.II.1.1).

This structural reorganization, which began in 1976, has helped to create an atmosphere of institutional flexibility.

1.1.3. CIMMYT Demonstration Steering Committee

The convergence of opinion within MAWD that there was need to improve the relevance of the research program for small-scale farmers was reflected in the composition of the Steering Committee set up to monitor the demonstrations of adaptive research planning procedures undertaken by CIMMYT. The committee met under the chairmanship of the ADA(Extension) and included the ADA(R), the CARO, four other scientists, the Director of the Rural Development Studies Bureau at UNZA, and an economist from the Planning Unit. It is interesting to note that the committee was chaired by the head of extension, indicating that, at least between Assistant Directors, there was a high level of interaction between research and extension. It also indicates the assumption that the demonstrations would also be of relevance to extension. It helps to partly explain why the same ADA(E) later supported the idea of including a RELO in each provincial ARPT, seconded from the Extension Branch.

The committee monitored the two demonstrations by CIMMYT: first, how diagnostic survey techniques could be used to design an adaptive research program and, second, how to demarcate different farming systems within a province. The demonstrations started in March 1978, and by December the committee had already agreed to identify two economists to work within the Research Branch. No overall organizational plan of how the two economists would fit into the structure had yet been decided, but it was provisionally agreed that they should both be loosely attached to the Weed Control Research Team, which was undertaking a small-farms weed project. In December 1979 a decision was taken by the committee to fully institutionalize the procedures demonstrated by CIMMYT, and the economist on the committee was asked to present proposals as to how this could be done. The proposals were presented to a large meeting of scientists in February 1980, and it was at that meeting that ARPT was established.

1.2. Initial Expectations for ARPT

The ADA(R) at the time saw the overall objective of ARPT to be "an instrument that would bring to the forefront the fact that the majority of Zambian farmers needed agricultural research that was relevant to their circumstances" (Chibasa, 1986). He expected ARPT to perform the following functions:

i) help small-scale farmers better articulate their problems;
ii) help in the reorientation of disciplinary scientists to the technological problems being faced by small-scale farmers;
iii) assist extension officers to better appreciate the prevailing circumstances and decision making of small-scale farmers;
iv) conduct on-farm experimentation to test, adapt or demonstrate improved production techniques and technologies;
v) help improve the adoption by small scale-farmers of improved technological packages (Chibasa, 1986).

In the past, these functions had either not been undertaken or were implemented ineffectively.

There was previously no effective means of identifying the problems of specific groups of farmers. Therefore it was impossible to formulate research programs to meet specific needs. When research was completed, a single set of recommendations was released to cover all farmers in a province, giving little recognition to the diverse nature of different farmers' circumstances. Small-scale farmers had no means of presenting their problems directly to scientists, and interaction between extension workers and scientists was limited. The problems with the research tours and PEXCOs, the intended mechanisms for communication and identification of farmers' problems, are explained in Appendix 1.

Social and economic factors influencing technology adoption were neglected. Apart from two Farm Management Research Officers (FMROs), research was undertaken by natural scientists who looked exclusively at the farmers' natural environment. The two FMRO positions had been vacant since 1974, and previous incumbents had done most of their research on Unit Farms at certain research stations.

Most trials were conducted on research stations under high management conditions, which differ considerably from farmers' own conditions. However, a few long-term fertilizer trials had been conducted on large-scale commercial farms and, between 1978 and 1981, the Weed Control Research Team conducted some on-farm trials on small-scale farmers' fields.

Research had been conducted on individual crops in isolation from one another. No consideration was given to the farm in its totality: its crops, livestock and off-farm activities, nor to the interaction between components.

ARPT was designed to correct these identified weaknesses. In the view of the ADA(R) in charge when ARPT was established, ARPT was expected to "create an awareness for small-scale farmer problems and their prevailing circumstances. ARPT was, further, expected to have direct influence on commodity research to the extent where at least 40% to 60% percent of the CSRT research effort would address small-scale farmer problems, as identified by ARPT" (Chibasa, 1986).

The former ADA(R) does not believe that ARPT promised too much. "If anything, there was a lot of caution expressed." This was because the methods were new to Zambia. "ARPT was not designed to be a panacea; ARPT was never to be a substitute for strong commodity-oriented research programs" (Chibasa, 1986). Rather, ARPT was designed to be complementary and to utilize the pool of knowledge which was assumed to exist from previous research conducted by the Research Branch. In this way ARPT was helping to make the Research Branch more relevant and efficient to the needs of small-scale farmers; which would subsequently be observed by more speedy and widespread adoption of research recommendations.

At no point was ARPT perceived as being a means to attract donor funding. Donor support came only as a consequence of the Government's policy change, towards increasing small-scale farmers' productivity.

ARPT was not designed to deal with regions where nothing had previously worked. However, it was recognized that circumstances in each province were different, and ARPT's methods might need to

change to reflect these differences, as, for example, in areas where off-farm activities, such as fishing, dominate household resource allocation. This was one of the main factors determining the selection of the provinces where ARPT would first work.

It was not originally intended that ARPT should perform any extension functions. However, the inclusion of a Research Extension Liaison Officer in the provincial ARPTs meant that certain extension training functions would be undertaken by ARPT. In the same way, the RELOs and Trial Assistants, seconded from extension, would help to organize field days at trial sites. More important, it was assumed that ARPT would help to bridge the gap between research and extension workers, and this would entail close involvement in each other's programs. Certain "spinoff" benefits were also expected through informal advice that ARPT staff could give to farmers as they went about their research activities.

1.3. Focus of ARPT

ARPT was established to give greater priority to the needs of Zambia's small-scale and subsistence farmers, who constitute some 80% of rural households. This objective has not always been fully implemented, however. Some evaluations have found that, in certain provinces, ARPT has been working largely with larger farmers. As a result, the ARPT rural sociology section has put considerable effort into improving the team's process of selecting farmers, for both surveys and trials. The presence of the ARPT nutritionist in the team also emphasizes the fact that the team should be doing research relevant for subsistence farmers.

ARPT has a mandate to focus on all activities being undertaken by rural households - the "farming system in the large". However, to date almost all of ARPT's work has concentrated on crops, with little work on livestock (ref. section 3.II.2.6.5)

2.0. Institutional Development of ARPT

2.1. Different Options Considered for Institutionalizing FSR in Zambia

The process of institutionalizing FSR into the Research Branch involved the introduction of three elements:

- inclusion of social scientists;
- working with a farming systems perspective;
- conducting on-farm experiments.

Various informal discussions were held about the different institutional options, especially between the MAWD economist from the planning unit and the ADA(R). Three options were considered.

The first option would have been to undertake a major reorganization and establish regional research institutes, which contained all the different disciplines and which would have been capable of focusing on the problems of the local farming systems. This option was never a serious possibility, as it was at variance with the recently agreed policy to establish multidisciplinary Commodity and Specialist Research Teams (CSRTs).

The second option would have been to include social scientists in the CSRTs. The disadvantage was that the systems perspective would have been incomplete, owing to the commodity focus, and it would have been difficult to set research priorities according to farmers' needs. In addition, considerable duplication of effort and confusion for farmers could have resulted from each CSRT carrying out its own surveys and on-farm trials in the same farming systems. Poor acceptance of the young and inexperienced social scientists by the majority of natural scientists in the CSRTs could have seriously hindered their effective involvement, as experience elsewhere had shown (Collinson, 1982). It would also have been harder to build a cadre of professionals with skills in FSR.

The third option, widely endorsed within MAWD, was to establish a separate team to conduct FSR. This recognized that the CSRTs have a national commodity focus, whereas FSR has an area focus. This option recognized that adaptive on-farm research requires different organization and management from applied research on research stations. The complementary approach afforded the opportunity to build a team which could criticize itself openly and thereby improve its structure, methodology and activities. That this more radical option was selected is an indication of the high level of commitment to the concept of FSR by senior managers in the Department of Agriculture.

A version of this third option was elaborated in a paper reviewed at a meeting of scientists. The proposal was for a separate team composed solely of four economists, with three based in the main agro-ecological zones and one as coordinator. The number of economists proposed was based on CIMMYT's experience in other countries in the region. In this option it was expected that the economists would work closely with five of the Regional Agronomists, who were part of the original Research Branch structure and were based at the RRSs.

This option was rejected partly because it laid too much emphasis on the role of economists. In addition it was realized, that the positions of Regional Agronomists no longer fit anywhere within the reorganized Research Branch structure. It was considered most sensible to transfer the positions to ARPT to make a team by joining regional agronomists together with the economists.

The plan was modified, and it was agreed in the meeting that the final structure for ARPT should be a separate research team, composed of one economist and one agronomist in each province. The decision to base the teams by province, rather than agro-ecological zone, was taken partly because the province is the administrative unit for development. In addition, each province is large enough to warrant its own team, and considerable logistical problems would have arisen if a team had to cover a whole agro-ecological zone. Furthermore, nine Regional Agronomists were already based in the provinces and they would be transferred to ARPT. The movement towards decentralization has increased considerably since the original decision was made. This has reinforced the support for the provincial structure.

With the provincial organization there have been some inefficiencies, in particular where two provincial ARPTs are working in systems in adjacent similar agro-ecological zones. In this situation there can be some overlapping of work and additional costs, but they can be reduced with effective coordination and planning mechanisms.

The meeting also decided to have a national ARPT coordinator to supervise the team's activities and coordinate it with other research teams and organizations.

It should be noted that the RELO position was not initially included in any option. It was added five months later, during discussions with extension staff about donor support for one provincial ARPT.

2.2. Role of the ARPT National Coordinator during ARPT's Establishment

The ARPT National Coordinator (ARPT NC) played an important role during the establishment of ARPT. This role was facilitated by a direct reporting relationship to the ADA (R), unlike other CSRT team leaders and coordinators, who report through the CARO. The ARPT NC had his office in the Ministry headquarters in Lusaka, rather than at the Central Research Station. The ADA(R) has given the following reasons to justify the arrangement:

i) to provide for quick consultations, control and direction in the development of ARPT, vis-a-vis MAWD policy;
ii) to provide for rapid decision-making in the initial development of ARPT;
iii) to signify the importance attached to the development of ARPT in the Department of Agriculture as a whole and the Research Branch in particular.

The ADA(R) explained, "The major reason why I opted for this managerial system was basically to ensure the success, and therefore the overall acceptance, of ARPT in the Research Branch" (Chibasa, 1986). While donors were very supportive of ARPT, this feeling was not shared by the majority of senior scientists within the Research Branch.

The Director of Agriculture supported the ADA(R) in this decision, on the grounds that ARPT needed this extra assistance during the initial phase, while the team was being established. He considered that while the concept was being developed it was necessary to have close dialogue in order to remain on target.

The direct access of the ARPT NC to the ADA(R) unquestionably assisted the establishment of ARPT, as did the location of the ARPT NC in Ministry headquarters. In particular, it was possible for the ARPT NC to know the Ministry administrators and to cut through much of the bureaucratic red tape, which could have slowed progress. It was also an important factor that the ARPT NC had previously worked for four years as an economist in the Planning Unit of the Ministry, because he knew many of the administrators and planners. This situation was occasionally exploited by both ADA(R) and ADA(E), who realized that the ARPT NC could help them to deal more rapidly with certain matters, even if they were not related to ARPT.

However, this privileged position did cause some resentment among certain CSRT scientists and research managers. Eventually, in 1985, senior research managers agreed that the ARPT NC should move to the Central Research Station, by which time ARPT was well established. The ARPT NC considered that, on balance, the benefits of the privileged position outweighed the costs during the development stage.

2.3. Implementation of ARPT

Table 24 outlines the calender of progress in implementing ARPT.

The use of a provincial team structure enabled a more gradual, phased expansion of activities (Table 23).

Table 23: ARPT's Rate of Expansion

	1980	1981	1982	1983	1984	1985	1986
Number of provinces being worked in	NA	3	5	5	6	6	7
Total number of professional staff	3	4	8	19	22	23	38

It was intended that in the first phase, from 1981-83, ARPT should work in Central, Luapula, Lusaka, and Western provinces. These four provinces were selected because they have quite diverse farming systems, and there was interest in testing ARPT's methodology under such different conditions. The farming systems in Central Province are quite diverse but include important systems where crops and livestock support one another commercially. In Luapula Province, fishing is a major activity, competing for resources households might put into agriculture. Western Province has a large traditional livestock sub-sector. Lusaka Province was included because of its proximity to the Central Research Station and its importance for public relations purposes. It was also possible to have Zambian staff working there temporarily, pending permanent posting.

The rate of expansion was in reality much faster than had been intended, largely due to strong donor interest. In one case donor support for a much larger project was contingent upon support to ARPT. ARPT started work in Eastern Province in 1982, as part of a World Bank-supported province-wide agricultural development project. This meant that during its first phase, ARPT was working in five provinces. If loan negotiations had been faster, the ARPT in North Western Province would also have started work in 1983 rather than in 1984. However, although the number of teams increased rapidly, it took over three years before the teams could be fully staffed because of recruitment difficulties. Table 23 shows how short of manpower the section was between 1980 and 1982.

The problems of expanding too rapidly were mainly related to the fact that so much of the team's work was new and untested. Consequently, it was inevitable that some mistakes would be made. As the then ADA(R) commented recently, "We were rushed in putting together teams almost everywhere without sufficient prior experience" (Chibasa, Personal Communication). Had there been three rather than five

Table 24: A Calendar of Progress in Implementing the Adaptive Research Planning Team

Year	Event
1975-76	Evaluations of the research program, which identified the problem of farmer adoption of research output.
1977	Decision to invite CIMMYT to demonstrate procedures for planning adaptive research.
1978-79	Demonstrations of FSR techniques by CIMMYT.
1980	Decision to build a national capacity in FSR and establish ARPT.
1980	Recruit National Coordinator.
1980	Recruit first Zambian staff.
1981	Work started in Central, Lusaka and Western Provinces.
1981-present	Organizing relationships between ARPT and extension.
1982	Work started in Eastern and Luapula Provinces.
1982-present	Organizing relations between ARPT and CSRTs.
1983-84	In-country training program for all ARPT staff mounted by CIMMYT.
1984	Work started in North Western Province.
1984	First on-farm trial results.
1985	Work started in Northern Province.
1985	Crop recommendations released for three farming systems in Eastern Province.
1986	Recruit Zambian National Coordinator.

provinces, the lessons learned might have been avoided later in other provinces, and it would have been easier for the ARPT NC to supervise and work alongside them.

The ARPT NC tried to minimize the problem in several ways. Considerable emphasis was placed on training of all staff in FSR methodology and skills. As the program developed, care was also given to monitoring, and to some extent evaluating, the experiences of each provincial ARPT by having quarterly staff meetings and a two-day Annual Review. These meetings discuss and review technical, methodological and administrative issues of ARPT's activities (ref. section 3.IV.2.2).

2.4. Recruitment of Staff during ARPT's Establishment

2.4.1. Zambians

With Zambia's shortage of skilled manpower it was very difficult to find experienced staff to join ARPT. All CSRTs were also trying to increase their staff, and no team was willing to have its staff transferred to another team. All five regional agronomists in 1982 had strong CSRT programs and could not be transferred. As a result, it was necessary to recruit ARPT Zambian staff straight from the university.

Agronomists joining ARPT were required to have the B.Sc. in agricultural science, and economists needed to have either an agricultural economics degree, an economics degree supplemented by an M.Sc. in agricultural economics, or a degree in African Development Studies, majoring in economics, rural development or sociology.

The recruitment mechanisms, especially at the start, were very informal, and contacts were made through teaching staff at UNZA, using them to help identify suitable candidates and managers (ref. section 3.IV.6.4).

2.4.2. Expatriates

The first two expatriates were individuals who had been working in Zambia for some time on work more or less directly related to ARPT. When their original contracts were due to expire, both individuals and their donor were requested to renew their contracts. There has been much variation in how expatriate ARPT staff have been recruited subsequently (ref. section 3.IV.6.4).

2.5. Mechanisms used for Developing ARPT

The development of ARPT involved several elements: the development of FSR skills among team members, methodology appropriate for Zambia, and issues of organization and management. Several different mechanisms were used to facilitate the development of these elements.

2.5.1. Training

Much attention has been given to developing a cadre of skilled Zambians capable of running ARPT. Between 1979 and 1983 six Zambians were sent to learn about FSR skills at the Regional FSR training workshops organized by CIMMYT in Kenya. Between 1983 and 1984 all ARPT staff, including expatriates, attended the five-call in-country training program organized by CIMMYT in Zambia. This training program taught FSR skills by working through a practical example in the field over an 18-month period. Subsequently, any new Zambians have been sent to the FSR Regional Training workshops which are now held at the University of Zimbabwe, in conjunction with CIMMYT.

With donor support, there have been adequate opportunities to send Zambians for master's training, usually to the UK or the USA. The intention behind sending Zambians for master's training has been to improve their understanding of their particular discipline, rather than sending them to take courses in FSR. However, a few of the master's programs have had courses including aspects of FSR methodology.

2.5.2. Workshops

In addition to the regular ARPT quarterly meetings and Annual Review, a number of technical workshops have been held within Zambia in order to share experiences. In 1982, a workshop was organized, with CIMMYT's help, to discuss on-farm methodology. Four specialists were brought in to share their experiences with ARPT staff. A second workshop, again with CIMMYT's support, was held in 1984 to discuss the role of rural sociologists in FSR and participants from seven countries and several IARCs attended. This workshop was held partly to assist ARPT which, at the time, was deciding how to incorporate rural sociologists into its activities.

ARPT has sent representatives to several workshops held outside of Zambia, especially within Eastern and Southern Africa. Many of these have been organized by CIMMYT, which has a mandate to organize an FSR network within the region. Some have been for technical staff and others have been for senior research and extension administrators. These workshops have included reviews of FSR programs in other countries. At all of these workshops much information has been exchanged and new ideas have been incorporated into the ARPT program.

2.5.3. Consultants

CIMMYT's Regional Economist in East and Southern Africa, Dr. M. P. Collinson, played a major role in the initiation and implementation of ARPT. Between 1977 and 1986 he visited Zambia two or three times each year and gave advice on all aspects of ARPT's activities. Once ARPT was established, Dr. Collinson's main contribution was through training and organizing networking activities.

Two other kinds of consultants have assisted ARPT. The first have been the long-term consultants who became team members, e.g. the ODI Rural Sociologist, Dr.A.J. Sutherland, and the SIDA-funded nutritionist, Ms. A. Gobezie. Both of these consultants were asked to undertake major studies on specific issues, which had major organizational implications for ARPT.

The second kind of consultants provided valuable advice in the short term. They included some people who were working full-time in Zambia, others who were on missions for donors, and others brought in on a short-term basis to give advice on specific topics (Appendix IV).

2.6. Significant Changes in the Organization and Management of ARPT

Since ARPT started in 1980, there have been several significant changes in both the organization and management of the section.

2.6.1. Research Extension Liaison Officer (RELO)

When the structure of ARPT was reviewed and agreed on in 1980, there was only general discussion about the need for ARPT to work closely with extension. Five months later Dr. D. Norman proposed including a Research Extension Liaison Officer (RELO) in each provincial ARPT team. This idea was included in the Project Paper for USAID's

Zambia Agricultural Research and Extension Project ZAMARE, which subsequently supported ARPT in Central Province. Reaction within the Department of Agriculture was divided. Some people considered that the functions outlined for the RELO were already contained within the existing job descriptions of the Extension Training Officers and Crop Husbandry Officers. Others said that experience had shown that neither of these officers had been able to effectively accomplish the task of bridging the gap between research and extension. It was further argued that the Department had recruited three RELOs some years earlier, in order to promote the research findings emanating from three CSRTs: food storage, oilseeds and irrigation. The final decision to establish the RELO positions was made by the ADA(E) who, as chairman of the CIMMYT demonstration Steering Committee, was a strong advocate of ARPT. He agreed that the Extension Branch should create nine positions for RELOs to work as full-time members of ARPT.

The uncertainty about the RELO position has continued, and no definitive statement has yet been made on the RELOs functions. There have been delays in recruiting RELOs, and the RELO job description has been changed twice since it was drawn up in 1980. In provinces where extension has had limited resources, the RELO has tended to become involved in many general extension programs, largely because they have some resources. There remains an urgent need to clarify the position of the RELO vis-a-vis the other subject-matter specialists, agree on the channel of responsibility, and produce a definitive job description.

2.6.2. Trials Assistants

With the professional ARPT team members based at Regional Research Stations it was necessary for the teams to have technicians living in each Target Area where the trials were conducted. The need for Trial Assistants was not recognized until trials for the 1981/82 season were planned. It would have been extremely costly if the Research Branch had to recruit, pay and house its own field personnel in the target area. In addition, it was realized that this would be a very good opportunity to involve extension staff fully in the research program. Thus the Director of Agriculture decided that extension workers would be technically seconded to work full-time for ARPT for a period of 3 to 5 years. The Director in his letter to PAOs informing them to recruit suitable TAs said: "This is the most important point of contact between research and extension workers and indeed, the success or failure of the on-farm trials depends on finding officers with the right abilities". On the whole, ARPT has been successful in having very able extension workers appointed as TAs.

2.6.3. ARPT Rural Sociology Section

i) Defining the need

The original approach, advocated by the CIMMYT Regional Economist, was that economists should be the social scientists employed in ARPT. He probably considered that social variables and issues could be dealt with by sensitive economists; hence the frequent use of the title "socio-economist" when referring to economists working in FSR projects within East and Southern Africa.

However, the ARPT National Coordinator, an economist, considered that some important sociological issues could be effectively handled only through a professional sociological and anthropological input. The ARPT NC's awareness of the importance of social variables came, in part, from his contacts with several sociologists in Zambia during the formative period of ARPT. They stressed the need for ARPT to consider social variables affecting the decisions made about technology adoption. From his own training and experience, the ARPT NC recognized the importance of such factors, but considered economists might not be the best persons to investigate and fully analyze them. The ARPT NC asked one of the sociologists, Dr. J. Jiggins, to prepare some notes on issues which a rural sociologist in ARPT might address. Subsequently, a list of factors was prepared and discussed with the ADA(R). The list included such issues as:

- inter and intra household relationships;
- social institutions influencing farming systems, e.g., household, kinship, tribe, community and the nature of the relationships and ways they affect decision making;
- social control over economic resources;
- social influences on consumption;
- terms and nature of hired seasonal or permanent labor;
- dynamics of the rural labor market;
- nature of rural-urban migration and linkages.

The ARPT NC believed that the issue of including sociologists in ARPT should be thoroughly investigated before any action was taken. Cost-effectiveness was uppermost in his mind. He felt that ARPT economists could be trained and sensitized to handle at least some of the sociological variables and that the number of sociologists could be kept to a minimum. Approval was given for a consultancy to explore whether there was a need to employ sociologists within ARPT and if so how they should be incorporated into ARPT.

Thus, through the auspices of the Rural Development Studies Bureau at UNZA, the U.K. Overseas Development Institute was requested to support a rural sociologist to work with ARPT for two years. ODI agreed and, after some delay, the sociologist arrived early in 1983. The terms of reference defined the main function of the rural sociologist as "to examine those sociological factors which influence the different farming systems and draw conclusions as to how these factors should be best investigated within the overall ARPT structure". In addition, the terms of reference emphasized the importance of cost effectiveness, stressing the need to investigate the number of sociologists required in ARPT and the methodology they should be using.

The sociologist spent three years on the study. During his first year he had a reasonable level of involvement at the field level, which included work on several special studies related to methodological and subject-matter issues within ARPT including community approach, gender issues, extension and technology transfer, indigenous knowledge and target area selection. During the second year, a checklist of sociological factors was prepared and after some time was circulated to provincial teams for feedback. In addition, an effort was made to sensitize and train other ARPT team members in both sociological factors and research methodologies. The sociologist acquired a Zambian counterpart after almost nine

months, which permitted covering more provinces, and also to more effectively assess the issue of institutionalizing sociology by training Zambians. In fact, by the end of the first year an "ARPT Rural Sociology Section" was recognized within ARPT, with its own budget and offices, and reporting to the ARPT NC.

After the first year other activities, not envisaged in the original job description, also intervened. During the last two years the sociologist spent a considerable amount of time organizing and writing up the results of a CIMMYT-sponsored regional workshop on the role of sociology and anthropology in FSR. This workshop brought together experts in the region to explore issues detailed in the sociologist's terms of reference for Zambia. The workshop prompted two important developments. It stimulated the checklist of sociological factors and methodological issues (ref. Appendix VI). It also gave the sociologist an opportunity to work with the ARPT national coordinator on a paper detailing the rationale and plans for institutionalizing sociology within ARPT, and the opportunity for these plans to be discussed by a wider audience.

ii) Issues and implementation

After considerable discussion, the sociologist and the ARPT NC identified five factors which needed to be considered for institutionalizing sociology in ARPT (Kean and Sutherland, 1984).

a) The structure of ARPT, with economists in each provincial team, meant that, if sociologists were added to each team, there would be a danger of making the team "social science heavy" and making the agronomists feel "crowded out".

b) The knowledge from previous social research in Zambia is considerable, although access to it is difficult. Much of this information could be available to ARPT sociologists, thereby, to some extent, reducing the need to collect new data.

c) The considerable geographic, social and cultural variation across Zambia, and the large size of the country meant that a highly centralized sociological input would be difficult.

d) The long-term prospects for recruiting sociology graduates was good, provided the build-up was gradual, and provided in-service and post-graduate training was made available.

e) Financial resources would not permit a sociologist in each provincial ARPT, even though the benefits of daily interaction with other team members was recognized as valuable.

They concluded that the best option was to compromise between a centrally and a provincially based sociology section. Zambia divides conveniently into four broad cultural regions and, allowing for logistics of travel and communication, it was decided that a sociologist could be based in each region and still cover the nine provinces. Within these four regions their work could be concentrated in, but not be confined to, subsistence-oriented farming systems. (See Appendix VII for the Job Description of the Farming Systems Sociologist, compared with that of the Farming Systems Economist). A sociology coordinator, who would also serve

as the sociologist in the southern region, was considered necessary to establishing the section, although the position would be phased out when regionalization had been completed. (Kean and Sutherland, 1984). It was also thought that by sharing the services of a sociologist between provincial teams, inter-provincial cooperation would be improved.

The proposal was considered favorably by the senior research managers. A paper was prepared that proposed the subject areas, methodologies, and staffing arrangements for a sociological input. ARPT staff members reviewed the paper at an internal review. The teams had varied reactions, but two main views emerged. Two teams felt that they could handle important sociological issues with minimal support from a national sociologist. The four teams with which the sociologist had previously worked saw the value of having a sociologist in their provincial team, but did not think it was feasible to share him/her with other teams. Overall, it was felt that there was sufficient encouragement to proceed with the institutionalizing of sociology. Table 25 presents the chronology of institutionalizing the Rural Sociology Section

Table 25: Evolution of Establishment of ARPT Rural Sociology Section

Year	Event
1979	CIMMYT economist and future ARPT coordinator discuss zoning with Zambian-based sociologist.
1981	Future ARPT coordinator requests same sociologist to list areas of work for sociologist in ARPT and approach ODI re provision of a full-time position.
1982	Full-time sociologist recruited.
1983(Jan)	Sociologist starts work.
1983	ARPT sociologist attends CIMMYT in-country training course.
1983(Sept)	First Zambian sociologist recruited.
1984	Zambian sociologist resigns and replacement recruited.
1984	Regional workshop to discuss role of sociologists in FSR.
1985	ARPT internal review on role of sociology and strategy for institutionalization; regional strategy approved.
1985	Zambian sociologist recruited and donor assistance secured for Northern region.
1986	ARPT sociology coordinator starts work.
1986	Donor assistance secured for two other regions.
1986	Zambian sociologist goes for M.Sc. training.

iii) Donor support

The World Bank project designed to help implement Zambia's research and extension strategy had initially agreed to provide one rural sociologist, but this was subsequently changed. Later, the World Bank pledged temporary support for a position and operational funding in the Eastern Province. Other donors have been interested in supporting the sociology positions. In 1985, NORAD agreed to fund a rural sociology position and operational costs for the northern region. In 1986 the U.K. agreed to provide technical assistance for the Southern region and for the ARPT sociology coordinator position. The Dutch government also agreed the same year to fund a post and operational support for the Western Region.

iv) Conclusion

The ARPT Rural Sociology Section has provided the provincial teams with greater insight into the social context of farmers and has high- lighted some of the social and cultural factors which influence farmers' decisions on adopting technology. The section has contributed information about intra-household relationships, gender issues, social controls regulating access to resources, and community composition (ref. Appendix VI). Sociologists have also played an important role in helping ARPT to improve its sampling and selection of farmers.

The provincial teams have by now largely welcomed the introduction of sociologists. Indeed, several teams have said that they would prefer to have sociologists as full-time members of provincial teams, rather than sharing their services. The role and potential contribution of sociologists is still not well understood by most CSRT scientists, however.

The most serious problem for the Sociology section has been how to effectively work with the teams in other provinces. Ensuring effective involvement in provincial team activities has been difficult, and the logistical problems of covering at least two provinces have not been easy to resolve. When new provincial teams have been established, strong efforts have been made to ensure that a sociologist has been able to participate in the team's activities from the outset.

There have been a few problems in integrating the sociologists into the teams and, in particular, the economists and sociologists have had to work out their relationship with one another. (Appendix VII describes the job descriptions for the FS economist and FS sociologist, respectively).

2.6.4. ARPT Nutritionist

With ARPT's mandate to focus on the needs of subsistence and small-scale farmers, it was obvious that ARPT needed to give greater attention to studying nutritional problems and to incorporating specific solutions into the experimental program. Many of the long-term causes of malnutrition relate to limited household food production and the excessive demands placed on family labor by multiple agricultural operations. However, while the link between appropriate technology and nutrition was clear in theory, it was not clear how the needs varied across a range of diverse farming systems.

Consequently, in 1982, the ARPT NC initiated discussions with several people working on nutrition problems. These included Dr.J. Martin, the Primary Health Care Coordinator for Zambia, and Dr.B. Luijquist, SIDA's Nutrition Advisor. The ARPT NC had several basic questions. How much data would ARPT need to collect itself, as opposed to using existing data? Then, assuming that additional nutritional data would have to be collected, to what extent could the ARPT team collect and interpret it, without the skills of a professional nutritionist? In addition, what should be the institutional links between ARPT and organizations already working on nutrition?

The ARPT NC used the approach as was used for sociology. He recruited a nutritionist to undertake a study of how ARPT could give greater attention to nutritional issues. With SIDA support a two-year study was undertaken by a nutritionist who worked with the ARPT in Luapula Province, where it was known that many people suffered from nutritional deficiencies.

After two years, the work program of ARPT in Luapula Province had incorporated many new ideas derived from the nutrition study. Clearly, most of the program was addressing nutritional issues, through increased production of nutritious foods, labor-saving devices, especially for women, and improved food preservation and storage techniques. In addition, a manual and a set of guidelines for informal interviews had been prepared.

It was realized that there was a need for more training of ARPT staff and nutritionists on why they should work together and how they could do so. Since this work could best be done from the center, the position of ARPT Nutrition Coordinator was moved to the Central Research Station. SIDA has continued to support this position.

2.6.5. Farming Systems Livestock Specialists

Although ARPT has a mandate to focus on all activities undertaken by rural households, to date almost all of ARPT's work has concentrated on crops. This is largely due to the strength of crop research within the Research Branch relative to livestock research. However, there has been strong pressure from within the provincial teams to recruit Adaptive Livestock Specialists because of the importance of livestock in certain farming systems. This was not done originally because of the concern to limit numbers of staff. When The Netherlands was recruiting an agronomist for ARPT-Western Province, however, they agreed to change the job description to that of Farming Systems Agriculturalist, to increase the chance that someone with some livestock experience might be recruited. In the end an agronomist was recruited.

Cooperation between ARPT and the Cattle Development Areas (CDAs), has been increasing. Proposals have been made to merge the research component of CDAs into ARPT's activities.

More recently, following the approach used with both rural sociology and nutrition, the ARPT National Coordinator has tried to initiate a methodological study of how adaptive livestock research should be undertaken in ARPT and what the organizational requirements would be. Two donors have expressed an interest in assisting with this study.

2.6.6. Location of ARPT National Coordinator

The ARPT NC originally had his office at the Ministry headquarters, where he was directly responsible to the ADA(R). In 1985, the senior research managers agreed that his office should move to the Central Research Station, where he was responsible directly to the CARO. This has helped to improve links with the CSRTs.

2.6.7. Assignment of ARPT Provincial Coordinators

Until October 1982 there were not enough ARPT scientists to warrant assigning any particular team member as provincial coordinator. However, the ARPT NC realized that it was essential to delegate authority for a wide range of duties to the provincial level. This was not only due to the logistical problems of supervising a large number of professionals located hundreds of kilometers apart, but was also part of the process of decentralizing decision-making within the section.

The ARPT Provincial Coordinators are appointed or nominated by the ARPT NC from among the team members on the basis of their experience and leadership ability. Their duties include supervising the work program, representing ARPT and coordinating with provincial organizations, and carrying out a wide range of administrative and fiscal duties. These are in addition to the normal professional duties, and the extra work load is substantial. The Provincial Coordinators have delegated many of the tasks to other team members, which has helped the process of team building (ref. section 3.IV.4.).

For the first few years all of the ARPT Provincial Coordinators were expatriates, reflecting the fact that they had longer working experience. However, by 1987 three were Zambians. In 1986 five of the Provincial Coordinators were agronomists, one an economist, and one a RELO.

2.7. Opposition to ARPT

There was no serious opposition to ARPT during its initiation or the first phase of implementation. However, some scepticism about the role of ARPT was expressed, and some considered that ARPT was being favored in the allocation of resources. Staff also expressed concern about the limited experience of the ARPT staff. In addition, the methodology for conducting on-farm trials has continued to be the object of considerable criticism by some CSRT scientists.

Until 1985, the ADA(R) and, to a lesser extent the CARO, supported ARPT. However, when a new CARO took over the post in 1985, she became a rallying point for opposition to ARPT. The CARO was skeptical of the role of ARPT, the value of social scientists in agricultural research and the ability of various ARPT team members. The CARO considered that ARPT had received more than its fair share of resources and that the imbalance should be redressed. As the CARO's familiarity with ARPT has grown, however, she has become more supportive.

The ADA(R) who established ARPT is now working outside the Research Branch, but in a position where he can be an independent observer. He recently commented that he believes that the level of opposition to ARPT has greatly reduced and that there is now mutual respect and understanding between ARPT and CSRTs (Chibasa, 1986).

2.8. Relative Ease of Implementing Functions

The functions which required a high level of communication with other organizations or sections within the Research Branch were at first most difficult to implement. These included collaboration with farmers, feedback of information to CSRT scientists, and collaboration with extension and development agencies. Problems arose because it took time for ARPT to work out its own role before it could clearly explain itself to others and could have information for them to use. Also, the difficulties associated with achieving effective linkages were underestimated (ref. Chapter 5).

III. THREE PROVINCIAL CASE STUDIES - CENTRAL, EASTERN AND LUAPULA PROVINCES

1.0 Introduction

Three provincial ARPTs have been selected for in-depth examination in this study: Central, Eastern and Luapula Provinces. They were selected for two principal reasons. All three teams have been in existence for at least five years and thus have substantial accumulated experience. In addition, all teams have received large amounts of support from external donors. Donor support has had an effect on the teams' interaction with other components in the system and has influenced certain aspects of the teams' management and administration.

The main features of the three provincial ARPTs are described below. Detailed analysis of the organizational and managerial features, as well as the lessons learned from each of the provincial case studies, are reviewed in of chapters three and four.

2.0. Case Study of ARPT in Central Province

2.1. Characterization of ARPT in Central Province

2.1.1. Description of Central Province

Central Province is relatively well situated between the capital, Lusaka, 150 kms south, and the Copperbelt to the North (Figure 2). Infrastructure within Central Province is quite well developed, with good paved main roads, a relatively good network of feeder roads, and two railways.

Agriculture is important in Central Province. The demarcation of the province's farming systems made by CIMMYT, recently revalidated by ARPT, includes: large-scale commercial, emergent and subsistence farmers. About 400 large-scale commercial farmers cultivate on average 200 ha. each, using tractors. Maize, tobacco, soybean, irrigated wheat and beef are the major enterprises. Some 23,000 "emergent" or medium-scale commercial farmers cultivate between 10

and 40 ha., on which they grow maize, cotton and sunflower. They mainly own oxen and supplement them with the hired oxen and tractors. The 46,000 small-scale commercial and subsistence-oriented farmers cultivate between 2 and 5 ha., usually by hand, although a few own oxen.

There is a high degree of heterogeneity across the "traditional" farming systems in the Province. The range of major starch crops includes maize, sorghum, finger millet and cassava (CIMMYT, 1979). Compared with Luapula Province, and to a lesser extent Eastern Province, farming in Central Province is more market-oriented, with more farmers using purchased inputs and selling produce to formal markets. However, in some areas off-farm sources of cash are more important than farming. The proportion of households headed by females in Central Province ranged from 12% - 18% in 1980.

2.1.2. ARPT in Central Province

Central Province was one of the first selected for ARPT work because the CIMMYT demonstrations had been undertaken there in the late 1970s. It was also representative of more commercially oriented agriculture, such as could be found in Lusaka and Southern Provinces.

i) Location of ARPT and its activities in Central Province

The team is based at the regional research station, which is 10 km North of Kabwe, the provincial center (Figure 2). The Tobacco and Kenaf Research CSRTs are also based here, but they are both small, with only one scientist each.

ARPT in Central Province began work in Recommendation Domain RD2, in Serenje District. This was selected by the ARPT NC, in conjunction with the PAO, in 1981, because diagnostic surveys had been conducted as part of the CIMMYT demonstration, and an adaptive research program had been drawn up. The system has the largest number of small-scale commercial farmers in the province. Maize and finger millet are the main starch crops.

The second farming system, Recommendation Domain 3, in Mkushi District, was selected in 1982 after discussions with the ARPT NC and the PAO, largely because it was expected that the farmers would be resource poor and that sorghum would be a dominant starch crop in the system.

The selection of the third farming system, RD 5, in parts of Kabwe Rural and Mumbwa Districts, was influenced by the fact that CIMMYT was engaged to conduct an in-country training program for all ARPT staff in Kabwe. It was important that the area for survey and trial work be within easy reach of Kabwe and have relatively good infrastructure. Recommendation Domain 5 has the most commercially oriented of the small-scale farmers in Central Province. Maize is the dominant starch crop; cotton and sunflower are important cash crops. Oxen provide most draft power. The PAO agreed to the selection of RD 5.

Table 26 shows that, apart from RD 2, distances between the research station and the Target Areas are not as extreme as in other provinces (Tables 29, 32). Supervision of the TAs and Enumerators has

been difficult only when the team has been short of transport. However, there have been communication problems when the TAs have been sick, their motorbikes have broken down, or they have had serious problems with the trials.

Table 26: Distances between Kabwe Research Station and ARPTs Target Areas

	RD2 SERENJE	RD3 MKUSHI	RD5 KABWE RURAL
Distance from Kabwe (KRRS)	280km	80km	50km
Shortest time from Kabwe	3 hours	1 hour	50 minutes
Longest time from Kabwe	4 hours	1.5 hours	1.5 hours

ii) Staff position in ARPT Central Province

Table 27 shows that between 1983 and 1986 the team had at least one agronomist, economist and RELO for most of the time, which is better than the case for most ARPTs. It was helpful for team building that the USAID-funded personnel arrived at about the same time, in 1982.

There has been a problem with continuity of staffing when Zambians have gone for M.Sc. training and, especially, when the first team of expatriates left. At the end of 1985 there was a nearly complete change of staff. The new members used 1986 to familiarize them-themselves with the needs of the program and to consolidate the team's position.

The most serious deficiency in stafring ARPT-CP was the absence, until late 1985, of a full-time Zambian RELO counterpart. He arrived just two months before the first USAID-funded RELO returned home. In 1983, the Provincial Extension Training Officer was assigned to work as a part-time counterpart to the RELO until he was transferred in early 1984. This delay in recruitment of a Zambian RELO reflects the uncertainty about the RELO post (ref. sections 3.II.2.6. and 4.III.5.2).

iii) Features of donor support

USAID has supported the ARPT in Central Province as part of the Zambia Agricultural Research and Extension Project (ZAMARE). The project has also supported several CSRTs, including the Maize, Sunflower, Soybean and Microbiology Research Teams.

Donor support has influenced the activities of ARPT in Central Province in several important ways . First, by supporting both ARPT and several CSRTs, the ZAMARE project has enabled scientists from the two sections to interact more frequently. Furthermore, The Project Paper and the job descriptions for scientists both state that the two groups should interact. Both project and staff evaluations have taken this factor into account. The ZAMARE project

Table 27: ARPT Staff in Central Province 1981-86 (1)

	1981	1982	1983	1984	1985	1986
FS Agronomist						
Zambian	1	1	1	1	1	-
Expatriates	-	-	1	1	1	1
FS Economist						
Zambian	-	1	1	1	-	1
Expatriates	-	-	1	1	-	1
RELO						
Zambian	-	-	-	-	-	1
Expatriates	-	-	1	1	1	1
Trial Assistants						
Zambian	1	2	3	3	3	3
Total Team						
Zambian	2	4	5	5	4	5
Expatriates	-	-	3	3	2	3
GRAND TOTAL	2	4	8	8	6	8

Notes: (1) Figures are for June 30th of each year.

has had monthly or bimonthly meetings and many informal opportunities for team members to meet. ZAMARE team members have also been encouraged to attend each other's field days. Communication between team members has been relatively easy through the project radio network and the ZAMARE office in Lusaka. Resources, such as vehicles and field equipment, have also occasionally been shared by team members. The drawback of such strong team identification has been the tendency to give less attention to other CSRT scientists, especially Zambians.

Donor support has also led to complexity in administrative and financial arrangements. The expatriate team members had several potential supervisors, including the ARPT NC for the CARO, the ZAMARE Chief of Party, the USAID Representative in Zambia, and the U.S. universities, from which the staff were contracted. At times interests have conflicted. The situation had to be resolved during the visit of the Project Evaluation Team in the second year.

ARPT in Central Province has received funds from four sources, including: the Zambian Government, the USAID Project Support Unit, the ZAMARE Chief of Party, and the contracted universities in the USA. This has made it difficult for the ARPT Provincial Coordinators to keep an accurate account of expenses and to prepare budgets.

The team has had the administrative support of both the Chief of Party's office and the Project Support Unit in the USAID office. This has removed some of the burden of procurement, but team members have complained that procedures are time consuming. For nine months the ARPT did not have a project bank account in Kabwe, which meant that they had to travel to Lusaka to make purchases.

Donor vehicle use regulations were also a source of discontent. Only ZAMARE staff were supposed to drive the project vehicles. Thus Zambian counterpart staff had to rely on the expatriate staff for transport. Moreover, since project funds could not be used to purchase fuel for Government vehicles, the Zambian staff were frequently grounded. These problems isolated Zambian staff and undermined team building. Both were eventually resolved.

iv) Links with other organizations

ARPT in Central Province has had close links with several CSRTs, especially those supported by the ZAMARE project. The team has had comparatively little to do with the CSRTs based at Kabwe research station, because tobacco and kenaf are not important for most of the farmers with whom the team works.

Many extension workers in Central Province have heard about ARPT. But since few have actually participated in the team's activities, they know little about the content of ARPT's program. Extension workers have heard about ARPT mainly through the numerous training courses and workshops organized by the RELO.

The RELO in Central Province was the first in Zambia. He was dissatisfied with the job description, however, and preferred to work through the PAO or the ADA(E) rather than through the ARPT Provincial Coordinator. He considered also that ARPT nationally and the CIMMYT methodology did not give sufficient attention to extension involvement in research. As RELO, he organized many training workshops, started a monthly newsletter for extension workers, organized extension demonstrations, and participated in ARPT activities, especially organizing field days and training TAs. The PAOs commented that he perceived the RELO as helping the Department of Agriculture carry out its extension activities which, for one reason or another, the Department could not undertake (ref. section 4.III.5.2.).

The team has had limited interaction with planners and development agencies. In Serenje District, ARPT is a member of the Agricultural Sub-Committee, and ARPT has cooperated with the Integrated Rural Development Program (IRDP), and with the Sunflower Research Team in drawing up a program of research and development to encourage local production of sunflower oil.

2.2. Overview of ARPT's Research Program in Central Province

The size and nature of the work program undertaken by ARPT in Central Province is outlined in Table 28. The details of the surveys and trials are given in Appendix VIII.

2.2.1. Survey Program

The survey program has had an important input from CIMMYT. The survey to demarcate the different farming systems in Central Province and the informal and formal surveys in RD 2, in Serenje District, were undertaken as part of the CIMMYT demonstrations in 1978-79 (ref. section 3.II.1.). CIMMYT staff also took part in the informal and formal surveys in RD 5, in Kabwe Rural District, as part of the In-Country-Training course.

Table 28: Overview of the Research Program for ARPT in Central Province

	1981/82	1982/83	1983/84	1984/85	1985/86
No. of target areas	1	2	3	3	3
Survey program					
Informal	-	2	-	-	1
Formal	-	1	2	2	2
Frequent visits	-	1	1	-	-
Trial program					
No. of trials					
On-station*	2	4	3	1	-
On-farm:**					
Researcher Managed	2	7	8	7	7
Farmer Managed	-	-	2	1	4
No. of on-farm trial sites	17	35	51	48	65

Notes: * The on-station trials include replicates of on-farm trials.
** Trials replicated in more than one system are recorded only once.

The ZAMARE Project Paper suggested that the team could experiment with methodology; especially with the collection of data to assess the results of on-farm trials which might need a more quantitative approach. This was also encouraged by the ARPT NC. A detailed labor study, collecting quantitative flow data on a frequent visit basis, was undertaken over two seasons in RD 3, in Mkushi District. Quantified agronomic data were also collected from trial farmers' fields, using extension workers in 1983/84, but limited training and supervision led to data of poor quality. In subsequent years, the team used TAs to collect the same type of data; which helped to improve the quality. The team has also been concerned to monitor changes in the different systems. They monitored the increase in sunflower production in RD 2, in Serenje District.

In 1986, the new team decided to check on the validity of the original zoning of the farming systems and undertook an informal survey, which verified that little had in fact changed. The new team also decided to incorporate a "community perspective" into their work. The team undertook an informal survey and identified the political unit of the "section" as the most appropriate social unit to work with. The team then collected additional data on the 25 households in each "section", to facilitate farmer selection (ref. section 4.I.3.1.).

The second Provincial Coordinator, an economist, has argued that more time should be allocated to fully utilizing and publishing the data already collected. As a result, additional surveys have been mainly informal and limited in scope.

2.2.2. Agronomy Program

The agronomy program has focused on the identified problems in each of the three farming systems. The primary constraints in all three systems relate to the scarcity of labor, capital, and cash during the critical periods of crop establishment and cultivation.

The team has developed both "short-term" and "long-term" research interventions to introduce into the systems. The "short-term" interventions focus on crop management to fine tune current farmer practices in order to increase returns to labor and capital. Two examples:

- Yield and labor-saving advantages have been derived from combining weeding and top dressing earlier in the growth cycle of maize.
- Row seeding of sunflower plantings have enhanced weed control and plant development, but broadcast seedings in January have been more profitable because they involve less labor, without encountering yield reductions from weed competition.

The "long-term" interventions have a greater potential for improving the total productivity of the farming system. They involve introductions such as herbicides and lime. In the 1985/86 season 33% of the trials had a long term focus.

The majority of the trials undertaken to date have been RM/FI in character. In addition, the team was frequently involved in the actual implementation of the trials at critical stages. The ZAMARE Mid-term Evaluation Mission cited this as a major reason why the team had not developed a very high level of farmer participation. The agronomists note that they relied more on RM/RI and RM/FI trials because they were still trying to understand the biological relationships. However, the trial program has continued to move forward, and in the last two seasons there have been several FM/FI trials, under extension supervision (Table 28).

2.3. Technology Vignette: The Value of Early Weeding and Top Dressing of Maize in RD2, Serenje District

2.3.1. Introduction

A diagnostic survey undertaken in RD 2 (Serenje District), in 1978, revealed that farmers faced constraints on the amount of labor and capital available and, as a result, their management of maize was being compromised. In particular, they were found to be applying less than optimal levels of fertilizer, and serious competition for labor (from other crops) meant that maize was planted late and weeded only once. Weeding of other crops was also limited. Farmers preferred to continue planting more maize, rather than weed early maize plantings, because it helped them to spread risks. But it meant that they were forced to weed and top dress together, very late when the maize was already 70cm in height. (Most of the information for this technology vignette comes from the 1985/86 Annual Report for ARPT Central Province (GRZ MAWDb, 1986).

2.3.2. 1982/83 Season - Exploratory Trial to Understand Interactions

The team wanted to be able to quantify the effects of late weeding and low fertilizer levels on maize yields, with a view to under-

standing how farmers could make best use of their limited cash and labor. The exploratory trial studied several different fertilizer levels and times of weeding. It was concluded that if farmers could only weed once, it would be better to weed when the maize plants were 20cm rather than 70cm, because yields at 20cm weeding were found to be 17% higher. This confirmed previous results from the Weed Control Research Team.

2.3.3. 1983/84 Season - Response Trial (RM/RI)

The team wanted to go one step further to determine the optimal timing and placement of basal fertilizer, in relation to the timing of a single weeding and of top dressing. The intention was to see whether some of the operations could be combined, to save labor, without significant loss of yield. The results of the trial were very interesting. They confirmed that early weeding would have the single greatest effect on yield, but a combination of weeding and top dressing when the maize plants were 20cm, produced an additional increase in yield. Furthermore, no significant relationship between yield and the timing of basal fertilizer was found. The results therefore suggested that increased returns to labor could be achieved by delaying basal fertilizer application and making a single pass through the field for both fertilization and weeding when the plants were 20cm. It was estimated that this strategy could save six person days of labor during the peak period. Farmers responded quite enthusiastically. Four out of the six involved said they preferred the delayed application of basal fertilizer because it enhanced growth.

2.3.4. 1984/85 Season - Verification Trial (RM/FI)

The team thought that the trial should continue under research management because the results contradicted the current recommendations, which indicated that, under rainfall conditions similar to those in RD 2, a split application of nitrogen significantly increased maize yields. However, they considered that they could superimpose the trial treatments over farmers' own maize fields, thereby allowing farmers to determine the timing and method of land preparation, basal fertilizer application and planting, as well as the rates of fertilization and population density. The trial consisted of just two treatments: farmer practice and an early weeding combined with top dressing at 20cm.

The results indicated that the early weeding/top dressing treatment increased maize yields by 19%, resulting in a marginal rate of return on investment in labor of 75.1%. However, this result was based on the analysis of the combined results of only two sites, each with four replications, because other sites had been lost. Thus the conclusion was to move tentatively forward and move the trial into the hands of extension workers for so-called "extension testing demonstration".

2.3.5. 1985/86 Season - Extension Test Stage

The extension demonstrations were superimposed on the maize fields of four farmers using the same treatment as before: combined top dressing and a single weeding when the maize was 20cm. The results indicated that farmers could realize a net benefit of K1,945 and a

marginal net benefit of K574, with a marginal rate of return of 277% for weeding at 20cm, as compared with farmer practice. The team is satisfied that there has been enough testing of this technology and wants to have it released as a recommendation.

3.0. Case Study of ARPT in Eastern Province

3.1. Characterization of ARPT in Eastern Province

3.1.1. Description of Eastern Province

Eastern Province is connected by a paved road to Lusaka, 600km from Chipata, the provincial center (Figure 2). Most of the population is concentrated on the plateau. The plateau has a good network of feeder roads, but roads in the valley become impassable during the rainy season. Although only about 25% of the provincial population live within 7.5km of all-weather roads, road access is not a major constraint to agricultural production.

Farm households in the traditional sector number about 140,000, one-third of which are headed by women and belong to the poorest category. Farms are generally small. An estimated 95% of holdings have less than 4 ha. and 61% less than 1.4 ha. Most farms are cultivated by hand, because only about 25% own cattle.

The principal farming systems identified by ARPT are the Eastern Plateau, which has three sub-systems and the Luangwa Valley system. On the plateau, maize, groundnuts, and beans are the main subsistence crops, with the main cash crops hybrid maize, cotton, sunflower and groundnuts. In the valley, sorghum, millet and maize are the main subsistence crops, with cotton the main cash crop. A few large scale-commercial farmers can be found on the state land, mainly around Chipata.

3.1.2. ARPT in Eastern Province

Eastern Province was not originally selected as one of the provinces where ARPT would start work, because it was considered that conditions were broadly similar to those in Central Province. However, ARPT was established in Eastern Province because there was strong donor interest in supporting it as part of the Eastern Province Agricultural Development Project (EPAD). The research component of the project was quite flexible. Agreement between the Zambian authorities and the World Bank resulted in support for ARPT, the Grain Legume Research team, and the groundnut agronomist.

i) Location of ARPT and its activities in Eastern Province

The team is based at Msekera research station, 10km east of Chipata, with the Grain Legumes and Groundnut Research Teams, which has facilitated interaction between ARPT and these two CSRTs.

ARPT in Eastern Province has been unique in that from the beginning it has undertaken work in all farming systems in the Province. This has been due largely to the mandate of the World-Bank-funded EPAD project. The terms of reference of the ARPT agronomist were to "manage on-farm verification trials at representative locations throughout the province." The agronomist believed that this mandate

could not be accomplished through the use of Target Areas and Trials Assistants, because two TAs could handle only 5 trials, assuming that there were 40 sites with sufficient replications. In addition, by working only in Target Areas, the agronomist considers that there would be insufficient exposure to variations in soil and rainfall regimes. Furthermore, the agronomist believes that wider coverage exposes a larger number of extension workers to the new technologies.

The agronomist has therefore tried to conduct trials throughout the province, but he has concentrated on the four principal systems, which are differentiated primarily between the plateau and valley areas, and between cultivation by hand or with oxen. Most work has been conducted in the Eastern Plateau (South) system, which contains approximately 80% of the province's farm families, with both hand and ox cultivators. The ARPT Provincial Committee did not play any part in selecting the areas where ARPT has been working because it was not established until 1983.

The ARPT has had a large program of on-station trials at Msekera research station, Masumba sub-station in the valley, and at two sites closely supervised by professional staff from two donor-funded projects (Table 29).

In the team's second year, at the urging of the ARPT NC, the agronomist introduced a modified form of the Target Area concept. Since then he has had two TAs working in two Target Areas in the Eastern Plateau (South) system, but on different soil types. Both areas are quite accessible from the station (Table 29). The trials, conducted on farms within the Target Areas and supervised by the TAs, have been RM/RI in character, and labor for most operations has been supplied from the research station.

The other on-farm trial sites, both within the Target Areas and elsewhere in the province, have been supervised by Extension Block Supervisors, with some assistance from camp level-officers. Most on-farm trials supervised by Block Supervisors have received minimal supervision from ARPT. Both the number of trials reported and the quality of data returned have been rather disappointing.

Table 29: Distances between Msekera Research Station and ARPT Trial Sites

	Sayiri Target Area	Katete Target Area	Mwase CDA*	Masumba Substation**
Distance from Msekera	30km	90km	160km	90km
Avg. time from Msekera	.5 hour	1 hour	1.5 hrs	1.5 hrs

Notes: * Mwase Cattle Development Area, where ARPT has had live mulch trials.
** Masumba substation is the research station in the valley.

ii) Staff position in ARPT - Eastern Province

Work in Eastern Province began in 1982 with the recruitment of an expatriate agronomist. Four points are worth noting about the team's manpower situation between 1982 and 1986 (Table 30).

First, the team had no economist until a Zambian was transferred to join the agronomist in September 1984. No expatriate economist for ARPT was included in the EPAD project because it was expected by both the donor and the ARPT NC, that the economist within the EPAD Research and Evaluation Unit would be able to support ARPT by providing data from the unit's own surveys and by participating in ARPT's surveys. Information from the Research and Evaluation Unit has been supplied, somewhat slowly, but there has been virtually no direct participation by the unit's economist in ARPT's surveys. Furthermore, there were too few Zambian economists within the ARPT section to be able to staff Eastern Province, until one returned from M.Sc. training.

Second, a full-time RELO was not appointed to work with ARPT until late 1986. The EPAD Farm Management Officer has terms of reference almost identical to those of the RELO, but he was unable to give much time to such issues because he was heavily involved in establishing the T&V system and other extension responsibilities. Nevertheless, various support activities have been undertaken by the Farm Management Officer and his Zambian counterpart, most notably, help in revising the crop recommendations and incorporating the information into monthly bulletins used by extension workers as part of the T&V system (ref. section 4.III.5.7.).

Table 30: ARPT Staff in Eastern Province from 1982-86
(As of June 30th each year)

	1982	1983	1984	1985	1986
F.S. Agronomist					
Zambian	-	1	1	1	-
Expatriate	1	1	1	1	1
F.S. Economist					
Zambian	-	-	-	1	1
RELO	-	-	-	-	-
Trials Assistants					
Zambian	-	2	2	2	2
Total Team					
Zambian	-	3	3	4	3
Expatriates	1	1	1	1	1
GRAND TOTAL	1	4	4	5	4

Third, at one time or another the Zambian agronomist and the Zambian economist have both had to undertake the duties of Officer-in-Charge of Msekera research station. This has effectively reduced the amount of time they could spend on ARPT activities by half. As a result of all these factors, it has been a one-man team for much of the time.

Fourth, although two TAs have worked with the team since 1983, most on-farm trial sites have been supervised by Block Supervisors and camp staff.

iii) Features of donor support

ARPT in Eastern Province has been jointly supported by the World Bank and the International Fund for Agricultural Development (IFAD) through the EPAD project. The EPAD structure has influenced ARPT's work in four ways.

First, support of the Grain Legume and the Groundnut Research Teams, as well as ARPT in Eastern Province, has led to close cooperation between the teams. However, in contrast to Central Province, this has been due more to informal contacts at Msekera research station, than to any formal mechanisms established as part of the project. These two CSRTs have national mandates, and although both crops are grown in Eastern Province, especially groundnuts, the scientists have had to cover the whole country.

Second, since the EPAD project has a mandate to cover all Eastern Province, several EPAD team members have looked to ARPT to supply relevant extension messages for the whole province. The agronomist responded by producing a set of revised research recommendations for the province within three years.

Third, a major component of the EPAD project has been the establishment of the T&V system within the provincial extension service, which has provided effective opportunities for two way flows of information between ARPT and camp-level extension workers and farmers (ref. section 4.III.5.7.).

Fourth, economic input within ARPT has been weak. Since the economist in the Research and Evaluation Unit did not participate in the surveys conducted by ARPT, the major research priorities were initially identified by the agronomist. By the time the Zambian economist joined the team, the research program was well established, and the Research and Evaluation Unit had already collected much data. Defining his role has therefore proven to be difficult.

iv) Links with other organizations

The links between ARPT in Eastern Province and CSRTs and extension workers have already been discussed.

The team has had close links with several development projects, such as the Mwase Cattle Development Project and the Katangalika Rice Scheme. Project staff have assisted the agronomist in supervising trials over several years. The team has also conducted a few trials on cotton and soybean in conjunction with the Lint Company of Zambia (LINTCO).

Through the EPAD project manager, the team has also provided advice to planners on several issues, including fertilizers and maize varieties which should be supplied to Eastern Province. The team has also been involved in promoting the novel idea of the Marketing Union providing farmers with fertilizer in exchange for their sunflower seed.

3.2. Overview of ARPT's Research Program in Eastern Province between 1982 and 1986

The size and nature of the work program undertaken by ARPT in Eastern Province is outlined in Table 31. Details of the surveys and trials are given in Appendix VIII.

3.2.1. Survey Program

Until the end of 1984, all of the surveys were undertaken without the participation of an economist. Nevertheless, the findings of the surveys, administered in 1982-1983, were used to identify the priorities for the experimental program. These surveys have been supplemented with data from the Research and Evaluation Unit and, since 1985, with data from focused informal and formal surveys undertaken by the ARPT economist.

Table 31: Overview of the Research Program for ARPT in Eastern Province between 1982 and 1986

	1982/83	1983/84	1984/85	1985/86
Survey Program				
Informal	2	1	2	2
Formal	-	-	1	1
Trial Program				
On-station	6	10	8	4
On-farm:				
Research Managed	4	4	7	12
Farmer Managed	2	4	7	6
No. of On-farm Trial sites	88	110	74	83

The surveys identified three main constraints common to all of the farming systems: the shortage of labor at peak periods, limited finance, and a shortfall of staple foods from January to March. These constraints remain the focus of the team's trial program. The economist has examined the labor shortage problem in greater depth through a participant observation study of farmers' management of peak labor periods. The team has also monitored changes in some of the systems. A survey was undertaken recently to discover the extent of and reasons for an apparent dramatic decline in sunflower production and an increase in maize production.

3.2.2. Agronomy Program

The agronomy program has been the dominant component of the research program. It has been focused on the three constraints identified during the surveys. The labor constraint has been addressed, for example, through trials looking at the timing and methods of weeding maize, and variety trials on maize, sunflower and rice. The financial constraint has been tackled by several trials investigating methods of saving fertilizer. Several trials have been undertaken to deal with the problem of food shortage, including trials on early-maturing open-pollinated maize varieties, and maize varieties with better storage qualities.

The agronomist began with a large number of on-station trials but gradually moved more of them onto farms within the two Target Areas in the Eastern Plateau (South) system as he became more confident of the expected outcomes (Table 31). These RM/RI trials, closely supervised by the TAs and the agronomist, have formed about 50% of the on-farm trial program.

The on-farm trials managed by extension workers have been spread thinly across the whole of Eastern Province. They have been managed, in theory, by the Block Supervisors, to avoid interrupting the camp extension workers schedule of farmer visits, but in practice this work has sometimes been delegated. With between 70 and 110 sites to supervise, the agronomist agrees that at times he was overstretched. The number and quality of results returned have not been satisfactory, and several CSRT scientists have been critical of this aspect of the program. Recognizing these management problems, the agronomist reduced the number of on-farm trial sites in the 1984/85 season and, in the 1985/86 season, placed the economist in charge of trials in one target area (Table 31).

The ARPT in Eastern Province has produced a revised set of recommendations for the three main farming systems. The agronomist's considerable experience in Africa gave him confidence to undertake this task. He conducted an extensive review of all previous research results. Then, with this information and results from two seasons' trials, he prepared a draft set of revised research recommendations. After several meetings with CSRT scientists and some heated debate, the revised recommendations were issued in 1985 for the Valley Hand Hoe System, the Eastern Plateau Hoe System and the Eastern Plateau Ox System. The process was eagerly supported by the extension component of the EPAD project, and information from these "Crop Memos" has been incorporated into the monthly bulletins of the T&V system.

3.3. Technology Vignette: Maize Hybrid/Variety Trial

3.3.1. Introduction

Data collected on all systems in Eastern Province revealed that there is insufficient available labor to undertake all agricultural activities on time in the early part of the season. Priority is given to food crops, such as local maize. As a result, hybrid maize tends to be planted late, which reduces yields. The team identified the need to find shorter-duration maize varieties which would be acceptable to farmers.

3.3.2. 1982/83 Season

The team tested on-farm two short-duration maize hybrids, R215 and R201, imported from Zimbabwe and available for sale to farmers, against the long-duration hybrid SR52. The results indicated that R215 was superior for plantings after mid-December, a view shared by farmers.

3.3.3. 1983/84 Season

The trial incorporated new material, including new Zambian hybrid material and an open-pollinated variety. MM752, which had the purified parental lines of SR52, significantly out-yielded all other material. Farmers ranked MM752 and R215 as equally popular because they viewed R215 as early maturing.

3.3.4. 1984/85 Season

The team developed a complementary approach to the problem, based on survey data from the EPAD Research and Evaluation Unit. They realized that the key to development in Eastern Province farming systems was local maize, which was planted on 60% of the average holding and absorbed a correspondingly large share of early-season labor. It was estimated that less than 30% of local maize was being fertilized.

They considered that labor could be released for hybrid maize and other cash crops if the hectarage of local maize was reduced through a combination of efficient use of moderate levels of fertilizer and higher-yielding open-pollinated varieties with acceptable storage and pounding qualities. The team continued with variety testing, but employing the systems approach gave greater emphasis to flinty types of grain, research on fertilizer use, and to late-season cash crops to finance fertilizer purchases.

For variety testing, the maize breeder was able to provide three new shorter-duration Zambian hybrids as alternatives to R215, and two Zambian open-pollinated varieties, one of which was of very short duration. The team split the trial into two separate trials; one for hybrids and one for open-pollinated varieties. Of the hybrids, MM601 and MM604 were found to be suitable for December plantings, although farmers still preferred the familiar large-cobbed MM752. This trial went on into demonstrations of MM752 and MM601 the following season. In the open-pollinated variety trial, the hybrid MM752 clearly out-yielded all open-pollinated varieties, in spite of the low fertilizer levels. The need for a long-duration open-pollinated variety suitable to replace the main November-planted local maize was highlighted, and discussions were held with the Maize Research Team.

3.3.5. 1985/86 Season

In this season's hybrid trial, there was no difference between MM752 and the shorter-duration hybrids. Since MM601, MM603 and MM604 were being released by the Maize Team, a recommendation was made to extension for farmers to use MM603 and MM604 in their December plantings. Although MM601 yielded equally well, it was more expensive to buy as seed, since it was a single cross. Little progress was made with finding a suitable long-duration open-pollinated variety to replace local material.

3.3.6. 1986/87 Season

The hybrid trial was discontinued as MM603 and MM604 were widely available to farmers in the province. Some improvement had been made by the breeders in the flintiness of ZUCA, an open pollinated variety, and this was included in on-farm trials. Although farmers found ZUCA acceptable, the ARPT Provincial Committee considered that it should not be included in extension demonstrations because release was not imminent.

3.3.7. Conclusion

The evolution of this trial clearly demonstrates the dependence of ARPT-EP on the Maize Research Team for material to test in on-farm trials. Initially, only imported hybrid material could be tested. Subsequently, new Zambian hybrids became available for testing. However, progress has been slower in research for open-pollinated varieties suitable for on-farm testing.

The trial also shows how survey data helped the team to more fully appreciate the problems farmers were facing and to develop a wider range of possible solutions.

4.0. Case Study of ARPT in Luapula Province

4.1. Characterization of ARPT in Luapula Province

4.1.1. Description of Luapula Province

Luapula Province is relatively remote, only recently linked directly to the capital by an 850km tarmac road (Figure 2). The feeder road system within the province is poor, especially on the plateau (ref. section 3.IV.8.3.).

Fishing is a major activity, engaging about 15% of non-farming households, and there is little small-holder cash-crop agriculture. Most households grow cassava and finger millet on semi-permanent cultivation. However, cassava fields have recently been devastated by mealy bugs and green spider mites, and farmers have had to look for alternative starch crops. Virtually all farmers use hand hoes. A very high proportion of households are headed by women. In 1980 the proportion of such households ranged from 31% to 41% in different districts of the province. Malnutrition is a major problem, especially calorie deficiency among children under five years of age.

ARPT has demarcated eight farming systems in Luapula Province; one for small-scale commercial farmers, and seven for traditional, principally subsistence, farmers.

4.1.2. ARPT in Luapula Province

Luapula Province was selected as one of the first four provinces in which ARPT should work because the Research Branch managers wanted to test ARPT's methods and procedures in a situation in which farming was mainly for subsistence, and off-farm activities, such as fishing, were important for many households.

i) Location of ARPT and its activities in Luapula Province

The team is based at Luapula regional research station, which is about 10km from Mansa, the provincial center, with relatively good access to other parts of the province (Figure 2). The Rice Research Team and Root and Tuber Research Teams are also based here, which has enabled ARPT to develop quite close cooperation with both teams.

The team began its work in Recommendation Domain 4 (RD 4), in Mabumba village. The PAO selected Mabumba as the first Target Area, because it was close to the research station and the team had very limited transport. Nevertheless, the Target Area is representative of a large proportion of farmers in the province.

In 1983, the ARPT Provincial Committee decided that the team should work in a second Target Area, where fishing was an important activity. Several areas were suggested, but the committee, strongly supported by the PAO, considered that the team should work in Mukunta, a very remote area in the north which had been largely neglected by prior development efforts.

The third Target Area, Mabo, in RD 2, was selected in 1985 largely on the basis of the close working relationship ARPT had developed with the Integrated Rural Development Program (IRDP). IRDP had selected Mabo for intensified rural development activities because it is an extremely poor and remote area, with very limited infrastructure and some serious malnutrition problems. IRDP needed relevant technical messages for farmers in Mabo, in order to justify the proposed investments being made in the area. ARPT was hesitant to move into a third area so soon, but agreed when IRDP said they would assist with resources and supervision of trials.

Table 32 indicates the distance and time needed to travel from the research station to each of the Target Areas. Because of the distances and poor quality of the roads during the rainy season, there have been serious problems in communicating with the Trial

Table 32: Distances between Luapula Research Station and ARPT Target Areas

	RD 2* Mabo Samfya District	RD 4 Mabumba Mansa District	RD 7 Mukunta Nchelenge District
Distance from Res. Station	120km	10km	300km
Shortest time from Res. Station	1.5 hrs	.25 hrs	5.5 hrs
Longest time from Res. Station	3.0 hrs	.5 hrs	10.0 hrs

* RD = Recommendation Domain.

Assistants in both Mabo and Mukunta Target Areas. Supervision of the trials by the professional staff has generally been

satisfactory, but the team has had to rely heavily on the TAs, who have been highly satisfactory in two of the three areas. The extensive travelling and the poor road quality have taken their toll on the vehicles, which have had to be replaced every two years.

ii) Staff position in ARPT Luapula Province

ARPT's work in Luapula Province began in 1982, with the recruitment of a Zambian economist, an expatriate agronomist and one Trial Assistant. The manpower development of ARPT in Luapula Province is summarized in Table 33. Three points are worth noting.

Table 33: ARPT Staff in Luapula Province 1982-86 (1)

	1982	1983	1984	1985	1986
F.S. Economist					
Zambian	-	1	1	-	1
Expatriate	-	-	-	1	1
F.S. Agronomist					
Zambian	-	-	-	1	1
Expatriate	-	1	1	1	1
RELO					
Zambian	-	-	-	-	1
Expatriate	-	-	-	-	1
Nutritionist					
Expatriate	-	-	1	1	-
Trial Assistants					
Zambian	-	2	2	3	4
Total Team					
Zambian	-	3	3	4	7
Expatriates	-	1	2	3	3
GRAND TOTAL	-	4	5	7	10

Notes: (1) Figures are for June 30th each year.

First, it took almost four years to build a complete team with both expatriates and Zambian counterparts for each position. There was always at least one agronomist and economist, but there was little overlap for Zambians to work with expatriates. This was due largely to the careful but lengthy recruitment for the expatriate economist and to the limited number of Zambian recruits available. The delayed recruitment of the RELO definitely reduced the interaction of the team with extension workers (ref. section 4.III.5.6.).

Second, a nutritionist was recruited to work with the team, as part of the study of how ARPT could give greater attention to national nutritional issues. The nutritionist, who was with the team for two years, had a major influence on the direction of the team's program (ref. section 3.II.2.6.4).

Third, the team recruited a fourth TA in 1986 to assist with on-station trials, as well as supporting the three other TAs, when necessary.

iii) Features of donor support

ARPT in Luapula Province has been supported by the Swedish International Development Authority (SIDA) as part of their Agricultural Sector Support Program (ASSP) to Zambia. SIDA's support to ARPT has two important features. First, it is provided directly to the Government department, in this case ARPT, and is not administered by a separate project organization. Thus, support to ARPT has not been influenced by the donor project structure, as in the case of Eastern and Central Provinces.

Second, SIDA has tried to ensure that its support, whether funds or manpower, strengthens Zambian institutions. ARPT in Luapula Province has had to follow government administrative, financial and personnel procedures. This has helped the SIDA-funded personnel to identify more closely with the Zambian authorities in trying to institutionalize ARPT nationally. SIDA has also encouraged Zambian authorities to participate in the recruitment process by nominating candidates and taking part in interviews.

SIDA views ARPT in Luapula Province as highly successful. It has become something of a model for similar projects undertaken in other countries.

iv) Links with other organizations

The team has had close interaction with the Rice Research team and the Roots and Tubers Research team based at the research station.

In recent years the ARPT has developed close links with the PAO, who has given the team a lot of support. He has also requested that the team supply him with information on a range of issues, such as the most appropriate varieties of maize to be supplied to the province. With the arrival of the RELO, the team has developed closer links with a larger number of extension workers.

The Team has also had close links with planners and development agencies, particularly the Provincial Planning Unit (PPU) and the Provincial Projects Coordinator. They have also been involved in producing the agricultural section of the Provincial Development Plan for the Fourth National Development Plan. The team has cooperated with several development agencies, such as IRDP, mentioned above. They have been involved in a joint project with the IRDP, PPU and Cooperative Marketing Union in conducting research on appropriate sunflower oil expelling equipment.

v) Role of local leaders

ARPT has developed good working relations with traditional and political leaders in all three Target Areas and has benefitted greatly from their support. They have helped to explain ARPT's objectives to the community and have encouraged farmers to cooperate fully with ARPT. On a few occasions they have helped to resolve disputes, and in the case of Chief Mabumba, several pieces of land have been provided to ARPT as trial sites.

4.2. Overview of ARPT's Research Program in Luapula Province between 1982 and 1986

Table 34 summarizes the trial and survey program. Details are given in Appendix VIII.

4.2.1. Evolution of the Research Focus

The research program has become much more sharply focused on the priority needs of farmers over the past four years. The team considers that the 1986/87 proposed program now clearly reflects an acceptance of present realities in the province: the dominance of subsistence needs, widespread malnutrition, the large proportion of female-headed households, and the probability that excessive work loads for women are, in part, responsible for child malnutrition (GZR MAWDc, 1986).

Table 34: Overview of the Research Program for ARPT in Luapula Province

	1982/83	1983/84	1984/85	1985/86
No. of Target Areas	1	2	2	3
Survey Program				
Zoning	1	-	-	-
Informal*	1	2	1	-
Formal	1	3	2	1
Frequent visit	-	-	-	2
Nutrition**	-	5	3	2
Trial Program				
No. of trials on-station	5	5	19	15
On-farm:				
Researcher-managed	4	6	9	10
Farmer-managed	-	-	2	3
No. of on-farm trial sites	17	30	45	60

Notes: * Informal surveys include participant observation.
** The nutrition surveys included a range of informal, formal and frequent visit surveys.

It took several years for the team to come to terms with these realities. An extensive survey program, using a range of survey methods, was needed to put together a satisfactory data base (Table 34). The research focus also sharpened with the recruitment of experienced scientists, particularly in economics. The expatriate economist's study of resource flows demonstrated the poverty of most households. His findings supported those of the of the nutritionist, whose work strongly influenced the ARPT research program. As a result of both research efforts, the team has made nutrition improvement an important focus of its work.

ARPT also had to combat strong pressure from extension to work on commercial crops, even though these were not the priority of the majority of farmers in the province. Indeed, at the 1986 ARPT

Provincial Committee meeting, ARPT was hard-pressed to convince extension workers of the importance of the nutritional focus and the need to reduce research on rice, a commercial crop in some parts of the region.

The "clarity of focus" is evident in the 1986-87 trial program. The team has established a clear set of priorities for each component of the program and Target Area so that "...given any eventuality, such as an unforeseen reduction in material or human resources, it is quite clear which activities would continue and which would be suspended" (GRZ MAWDc, 1986). The general principles have been to give high priority with strong nutrition implications and to areas where current knowledge is limited and continued work should give the highest return.

4.2.2. Survey Program

When the experienced expatriate economist joined the team in 1984, he argued that the team should have a better household sampling system and initiated a household sample census. He also carried out a frequent visit survey in 2 areas in order to have a more complete body of quantified data available on resource flows and production patterns. The economist, agreeing with the focus on nutrition, also initiated a survey to establish a baseline of data to be able to monitor the nutritional status of households over time. The greater emphasis on quantified data has meant that the team has had to hire enumerators on a temporary basis.

ARPT sociologists have supported the work of ARPT in Luapula Province by looking at issues such as whether female farmers should be considered as different target groups for technology generation; the influence of fishing on farming activities; and the reasons for the decline in rice production in Mukunta Target Area. The conclusions of the studies have been incorporated into the team's program.

4.2.3. Agronomy Program

The agronomy program has evolved in all three Target Areas, with nutritional issues becoming dominant. The team's rainy-season trial program has focused on ways in which the production of energy food could be increased, such as with sunflower and various leguminous crops. It has also looked at ways to save household labor, especially women's labor.

The dry-season trial program on "dambos" has been another component of the team's work. The potential for cultivating dambos, which are areas with residual moisture, has frequently been lauded by scientists, but few farmers consider them to be worth while cultivating on any significant scale. In 1984, the ARPT agronomist began a large program of trials, with the objective of trying to relieve the problem of malnutrition by identifying crops which could grow on "dambos". Because of the dearth of any previous research, this work has all been exploratory. The trials have been conducted as on-station trials laid out on a dambo provided by the local chief. (This accounts for the large number of on-station RM/RI trials recorded in Table 34.) The team has also helped to organize and participate in two workshops on dambo cultivation. These workshops stimulated several CSRTs to assume responsibility for some of the trials.

In the Mukunta Target Area, the team's previous focus on rice cultivation has shifted considerably, after several surveys indicated that rice production was declining because it could not compete with fishing as a source of income, rice prices were unattractive, and no reliable tractor hire services were available.

The team has recently initiated some trials concerned with the long-term sustainability of the systems; e.g., intercropping, rotations, minimum tillage and mulching.

Two trials have reached the stage of on-farm test demonstrations: one on maize varieties and management and the other on bean seeding rates.

4.3. Technology Vignette: Maize Variety and Management Trial in RD 4, Mansa District

This vignette provides a good example of how a trial has evolved as more information has been learned about farmers' circumstances and the technology being tested (Figure 3). The description relies heavily on a paper produced by the ARPT Provincial Coordinator (Dougnac, 1987).

4.3.1. Introduction

The farming system is characterized by subsistence production of crops such as cassava, maize and finger millet. Shifting cultivation Chitmene is still widely practiced and hand hoe cultivation is dominant. Most farmers retain their own seed, and only a few practice any crop rotation. There are also a few small pockets of commercially oriented farmers, who purchase fertilizer and seed and sell maize, beans and groundnuts. These so-called "Lima" farmers are the ones who have received most attention from extension workers and have managed to obtain credit.

4.3.2. 1982/83 Season - Testing a Maize Package

The ARPT conducted a small survey in 1982 which indicated that maize was one of the major staple crops in the system and was also the most important cash crop in the area. It was, thus, one of the crops given high priority in the team's program. The survey indicated that farmers were growing two varieties, Kanjilimine and SR 52.

Kanjilimine is a local variety which, over many years, has been crossed between open-pollinated and hybrid varieties, such as SR 52. It has medium-sized cobs, with several grain colors on the same cob. It has very uneven vegetative growth, limited response to fertilizer and good tolerance to maize streak virus and soil stresses. Farmers usually grow Kanjilimine as a subsistence crop, mainly for green maize in small fields around their houses or intercropped with other crops in shifting cultivation.

SR 52 is an old hybrid variety developed in Zimbabwe in the 1950s. It needs to be planted early in good soil and under high management. It requires large amounts of fertilizer and is very susceptible to streak virus and other diseases, pests and weed competition.

The survey indicated farmers were obtaining low yields, between 500-1,000kg/ha, with both varieties. The team decided to conduct a trial testing different packages, including both varieties, different methods of seed bed preparation, spacing and different fertilizer levels. The trial results indicated that in all treatments, SR 52 performed the same as or worse than Kanjilimine. Thus for farmers with very limited resources it made no sense for them to grow SR 52, as extension workers were advising them to do. However, the potential for Kanjilimine was limited, not least because its multi-colored grain would never be accepted by official marketing agents.

4.3.3. 1983/84 Season - Variety Introduction

The team consulted the Maize Research Team, which was beginning to test some promising new varieties. ARPT were given two open-pollinated varieties, ZUCA and MMV600, which were then tested as alternatives to Kanjilimine and SR 52. The results showed that the two new varieties were both superior under a range of input levels. However, ZUCA had some characteristics which farmers disliked, such as its height. MMV600 was accepted as an interesting variety.

4.3.4. 1984/85 Season - Targeting the Technology

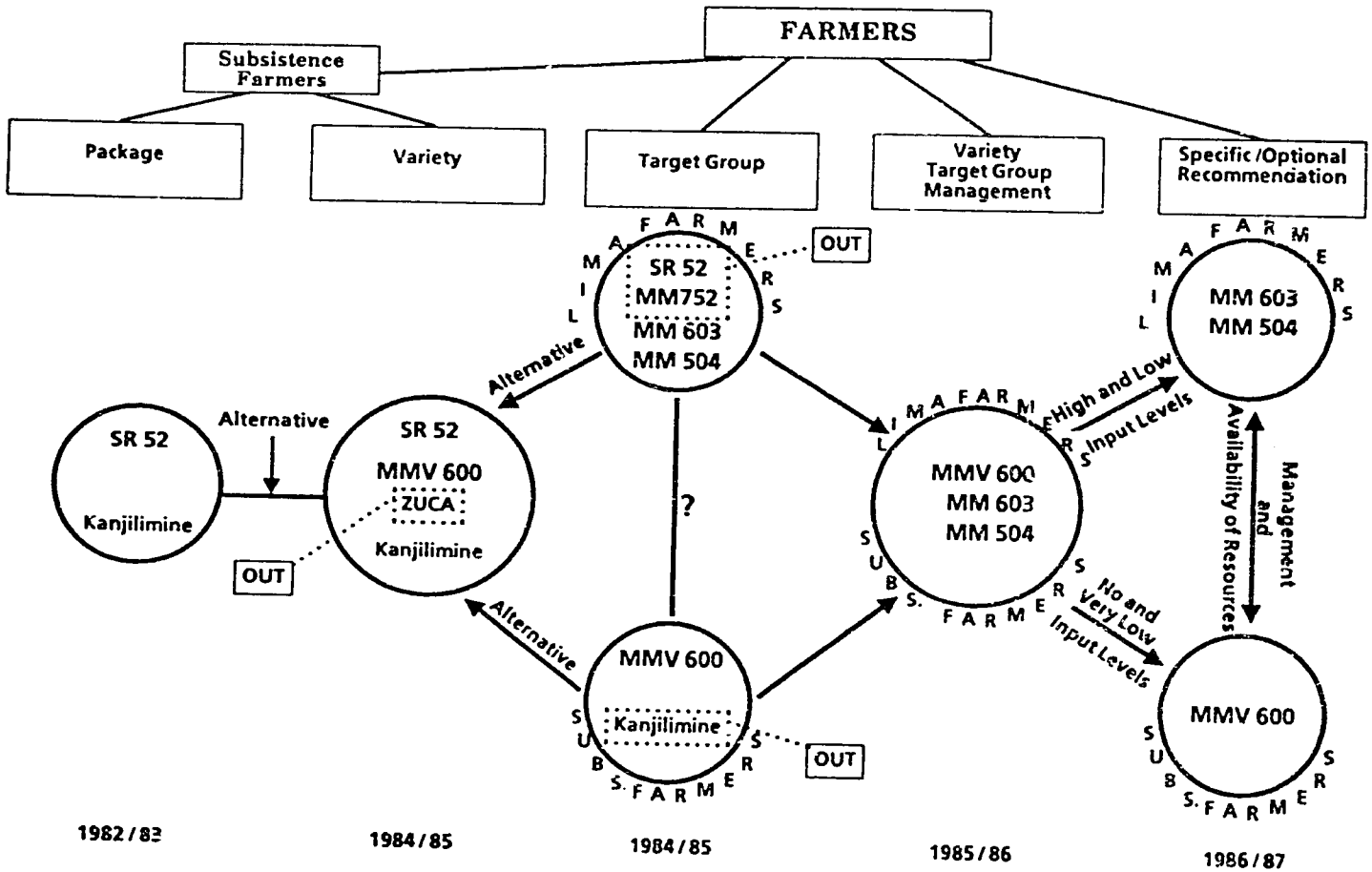
Up until this time the team had not seriously considered the issue of target groups for the technology. It was clear that "Lima" farmers wanted ARPT to test varieties responsive to fertilizer. The team decided to give attention to the needs of these farmers as well as to those of the subsistence farmers, who would be unlikely to apply any fertilizer.

After further discussions with scientists in the Maize Research Team, ARPT decided to conduct two trials: one for the subsistence group and the other for the "Lima" farmers. The trial for the subsistence farmers tested MMV600 as an alternative to Kanjilimine. The trial for the "Lima" farmers focused on finding an alternative hybrid variety. The Maize Research Team was able to supply three new varieties: MM603, a streak-virus-tolerant variety which was less susceptible to late planting than SR 52; MM504, a shorter-maturing variety which could fit into this system when maize is often planted late; and MM752, the cleaned-up elite version of SR 52. Three levels of fertilization - zero, 200 and 400kg/ha - were tested with "Lima" farmers, but only the two lower levels with subsistence farmers.
The results confirmed that MMV600 was superior to the Kanjilimine for subsistence farmers, at both zero and the low fertilizer level. For the "Lima" farmers, MM603 outyielded all the other varieties at zero and 200kg/ha levels of fertilizer. MM504 reached the yield level of MM603 only at the highest fertilizer rate. However, MM603 showed no significant yield increase at the highest fertilizer level. The other two varieties, MM752 and SR 52, were both severely affected by streak virus and gave poor yields.

4.3.5. 1985/86 Season - Testing the Management Factor

There was enough evidence to show that MMV600 was a better alternative than Kanjilimine and SR 52 for subsistence farmers. For "Lima" farmers, MM603 and MM504 were clearly superior. However, the question then emerged whether only one variety should be recommended for both categories of farmers.

Figure 3: Evolution of the Maize Variety and Management Trial in Luapula Province



In 1985/86 the two trials were combined to test the preferred hybrids against the open-pollinated variety MMV600 under a range of fertilizer levels. The trial was tested with both subsistence and "Lima" farmers.

The results showed that there were no significant differences between varieties and farmer category at the zero level of fertilizer. However, the management level did play an important role in the fertilizer response for the subsistence farmers whose land preparation and weed control are usually rather poor. All three varieties showed a continuing positive response to fertilizer level, up to 400kg/ha. For the "Lima" farmers, who usually manage their crop better than subsistence farmers, only MMV600 showed a continuing positive response to additional fertilizer. Both hybrids showed negligible response to fertilizer levels higher than 200kg/ha.

4.3.6. 1986/87 Season - Final Testing

In 1986/87 the team has planted large 0.25ha plots repeating the 1985/6 treatments, in both subsistence and "Lima" farmers' fields. It expects to be able to make a recommendation at the end of the season.

The team anticipates that the results will lead to two different recommendations, depending on whether they are targeted at low-management subsistence farmers or "Lima" farmers with prior exposure to improved practices. For either group, if fertilizer is not available or if there is no intention to use it, MMV600 should be recommended. Similarly, if hybrid seeds are not available in the local depots, MMV600 is recommended because it will respond positively to increasing applications of fertilizer.

However, if hybrid seed and fertilizer are available, a hybrid should be used. For "Lima" farmers, MM603 is the best choice because of its streak virus tolerance and its ability to yield well at 200Kg/ha of fertilizer. It is less risky than MM504. For subsistence farmers who can afford fertilizer, MM603 is also the best choice, although MMV600 is preferred by farmers because of its taste and better storage characteristics. MM504 could also be important because of its value as a short-season variety, suitable for late planting.

4.3.7. Conclusion

This vignette shows how the focus of the trial sharpened as the team gained understanding both about the farming system and material available from the Maize Research Team. It also shows how the team improved its definition of the client group(s) of farmers and came to recognize the need to have different recommendations for each. It emphasizes the need to constantly reassess, diagnose and design potential solutions for a farming system in the light of data collected each season.

IV. MANAGEMENT OF ARPT

1.0. Coordination and Supervision of ARPT

The need for overall coordination of ARPT's activities was recognized from the beginning. A National Coordinator was appointed to perform the following functions:

i) provide technical leadership;
ii) develop the scientific capacities of the program, e.g., supervising and monitoring the teams' work;
iii) maintain the integrity of the program;
iv) coordinate activities and interaction within the team;
v) represent ARPT within the Research Branch;
vi) coordinate activities and liaise with ARPT and other programs, e.g., CSRTs and extension;
vii) negotiate assistance from donors;
viii) develop manpower;
ix) administer the program, including arranging postings and transfer of Zambian staff.

Coordination has been an important component of ARPT's activities for a number of reasons.

First, it was important to ensure the build-up of a coherent program because the concept of FSR was new in Zambia and technical and methodological guidance had to be provided. Similarly, mechanisms were needed for monitoring the experiences with FSR, both within Zambia and elsewhere. The use of various consultants, workshops, and review mechanisms, especially during the first few years, is discussed in section 3.II.2.5.

Second, there was a need to supervise the research of the decentralized provincial teams and to ensure adequate coordination and interaction among staff. Mechanisms initiated to deal with these concerns were: the nomination of provincial coordinators for each ARPT; the preparation of quarterly and annual reports; the holding of quarterly and annual staff meetings; and sending ARPT staff on provincial ARPT exchange visits.

The ARPT NC placed a high priority on ensuring effective interaction and flow of information among staff of the various ARPT provincial teams. This has been important for building a strong, integrated, program, in terms of fostering staff identification and allegiance to the national program, and for efficient build-up of capacities. With sufficient interaction, the teams could learn from each other's experimentation and experiences in technical, methodological, and administrative aspects of the research program.

Third, administrative responsibilities have been substantial, especially during the establishment of ARPT. These include: the development of appropriate administrative procedures within the provincial teams; budgeting; donor support; opening of project accounts; and procurement, both within and outside Zambia. The location of the ARPT NC in the Ministry headquarters in the early years greatly facilitated the execution of these activities (ref. section 3.II.2.2).

Fourth, the ARPT NC has played an important role in ARPT's manpower development, in particular, recruitment of Zambian and expatriate staff and programming of both in-service and formal training (ref. sections 3.II.2.4, 3.II.2.5).

Fifth, another extremely important role has been the coordination of ARPT's activities with those of other sections of the Research Branch, and other organizations, like extension, policy-making bodies, and the University of Zambia. The ARPT NC helped to introduce a range of formal occasions for ARPT staff to interact more effectively with representatives from these organizations (ref. Chapter 4).

Sixth, it has been necessary for ARPT to have a representative at many meetings and forums. It was important for this to person represent the interests of the whole program, not simply of one provincial team.

Seventh, the involvement of nine donors in ARPT's activities has required coordination and direction. This been an important issue for several reasons:

- In some provinces, donor support to ARPT has been provided as part of larger projects. In some of these projects, there have been planning meetings which have involved only the expatriate personnel and not Zambian counterparts. In other cases, ARPT's objectives had to be compromised to suit those of the larger project.

- Some donor projects have required expatriate personnel to use administrative and reporting procedures different from those required by Zambian authorities. These have sometimes been very time consuming and have hindered institutionalization of ARPT (ref. section 3.IV.5.3.2.).

- The presence, on the donor-funded projects, of so many expatriate personnel with different backgrounds and experience has occasionally been a source of confusion (ref. section 3.IV.5.3.3.).

There have been some difficulties with coordinating donor activities, and several directive and participative management techniques have been used (ref. sections 3.IV.2.2. and 3.IV.1.4.2). In addition to these, several other measures have been useful.

i) During the project design stage, Zambian authorities have tried to have the role, objectives and organizational structure of ARPT clearly outlined in the project document. Senior research managers consider that this still needs to be specified even more clearly in both the project documents and in the job descriptions of any expatriate personnel.

ii) Zambian authorities have tried to be involved in the recruitment of expatriate personnel and to get at least three names submitted for each position. This has not always been possible.

iii) The ADA(R) and CARO have sometimes met the expatriate personnel soon after they have arrived in Zambia, to inform them that they are responsible to the CARO and the ARPT NC. It has also been

emphasized that the expatriate personnel should follow the standard procedures set up for running the team. These have not always been adhered to.

1.1. Factors affecting the Role of the National Coordinator of ARPT

Several factors facilitated the work of the first ARPT National Coordinator, who finished his contract in early 1987, after ten years in Zambia.

i) The ARPT NC had access to various facilities and resources, including a vehicle, drivers for long journeys, secretarial and typing services, telephone and telex. A vehicle, photocopier and financial support for coordination were provided by CIMMYT.

ii) The ARPT NC also had a large network of individuals, within and outside the Department of Agriculture, who were able to facilitate various aspects of managing and supervising the program. He relied considerably on the support of other ARPT staff based at the Central Research Station, especially the Agronomist for ARPT in Lusaka Province and the Senior Rural Sociologist. Many non-ARPT individuals, such as PAOs, CSRT scientists, administrators, donor representatives and donor evaluation teams, they were also relied upon to help implement and monitor various aspects of ARPT's development. This network helped overcome some of the difficulties of managing such a widely dispersed team from a distance.

iii) The ARPT NC had been working for four years as an economist in the Planning Unit of MAWD, during which time he was the Ministry representative on matters concerned with research. This association with the ministry gave some degree of authority to his work. His personal acquaintance with many senior administrators helped to smooth some of the administrative problems involved in establishing ARPT.

iv) The ARPT NC had a clear concept of where the team should be going because he had been involved in the planning of the program from the earliest stages.

v) The first ARPT NC remained for six years. This gave continuity to the work of institutionalizing ARPT, giving the ARPT NC time to shape aspects of both the organization and management of ARPT to meet the changing environment. Over this period he was able to meet many people and build a network of useful contacts.

vi) The ARPT NC's direct access to the ADA(R) during the time ARPT was being established was very important for reasons already mentioned in section 3.II.2.2. Of equal importance was the degree of freedom allowed the ARPT NC to have discussions with people from many different organizations.

vii) As an expatriate, it was possible for the ARPT NC to push harder with senior managers than might have been possible with a Zambian in the position.

viii) The ARPT NC was highly motivated because the position represented an important career development and a major professional challenge.

Few factors seriously impaired the National Coordinator's work. The numerous sources of external donor support with, in some cases, ambiguous reporting relationships, made the work of the ARPT NC more difficult. Also, the fact that the first National Coordinator was a social scientist hindered his interaction with certain scientists.

1.2. The Perceived Role of a National Coordinator

Some interesting insights into the role of the ARPT NC were identified during interviews with ARPT and CSRT scientists.

Both ARPTs and CSRTs see the role of a National Coordinator as vital and central to the smooth operation of ARPT and its relationship with the CSRTs. It is also recognized that the National Coordinator has been concerned with the supervision and evaluation of the performance of ARPT. He has facilitated the processes of learning from ARPTS and from other countries.

The National Coordinator's influence on the program direction of provincial teams is perceived to have been variable. Some teams have had more confidence in the National Coordinator and have taken his comments more seriously and worked more closely with him than others.

Regarding the future role of a National Coordinator, three major areas are considered to be important. First, more effort will have to be invested in soliciting GRZ funds for the provincial units, especially as the level of donor funding decreases. Second, more relevant farm-level information on small-scale farmers should be brought to the attention of national policy makers in order to create greater awareness of the circumstances of small-scale farmers and their need for assistance. Third, the quality in ARPT work must be maintained. ARPT trial results and reports have been criticized by some research scientists, in both ARPT and CSRTs. There is significant room for improvement.

1.3. Mechanisms for Monitoring and Supervising the Quality of ARPT's Activities

A key feature of decision making in ARPT is that most of the important decisions are made within the province, in line with the general policy of decentralization. Several review mechanisms have been set-up at the center to support this system, to monitor progress, to share ideas, and to enable sufficient input from CSRT scientists and senior extension workers into the planning process.

The Provincial Coordinators supervise the research within the provincial ARPT on an ad hoc basis. Most teams also have regular meetings, at which each member presents his or her work program for discussion. These meetings have sometimes been very important in helping the Zambian team members become part of the decision-making process.

The ARPT Provincial Committees, initiated in 1982, review the work of the provincial ARPT teams. The committees are chaired by the PAOs are made up of provincial representatives from research (Officer-in-Charge and CSRT scientists), extension (Subject-matter Specialists and District Agricultural Officers), and development and planning bodies. The committees are largely responsible for policy issues. They can decide certain issues, like, where the team will work, what trials should be undertaken, and whether present recommendations should be revised. However, although the committees should play an important role in making ARPT a genuinely decentralized research team, in practice this has rarely occurred (ref. section 3.IV.2.1.2).

The ARPT NC has frequent interaction with the provincial teams. He tries to visit all provincial ARPTs twice a year to review and supervise their field activities. In addition, the ARPT NC meets the provincial teams during the quarterly staff meetings and the ARPT Annual Review meeting. These staff meetings have become an important forum for sharing experiences and knowledge among ARPT teams (ref. section 3.IV.2.2).

Several other mechanisms have also enhanced monitoring and supervision.

First, the team receives comments on its trial program from CSRT scientists during the Commodity Research Team Review meetings.

Second, the team presents the highlights of their work at the ARPT Research Committee annual meeting.

Third, some donor projects have steering committees or team meetings which supervise the work of all sections of the project, including ARPT. However, these can also undermine coordination of ARPT by influencing ARPT's activities in support of the larger project. They also tend to include mainly expatriate team members, which can create a team within the team, because Zambians feel excluded from the decision making process.

Fourth, most donors have project evaluations, which aim to identify solutions to problems the team might be facing. The frequency of these evaluations varies considerably, from once every six months, in the case of the of the teams supported by the World Bank, to one evaluation at the end of the project as with the Netherlands-supported projects. Some of these donor evaluations are carried out together with GRZ representatives; others are purely internal. The level of participation by team members and by GRZ representatives is an important factor in determining whether the recommendations of the evaluation are implemented.

1.4. Field Visits to Review Provincial Programs

Field visits have also served as important mechanisms for monitoring and reviewing the research programs of provincial ARPTs.

1.4.1. Provincial ARPT Exchange Visits

Provincial ARPT exchange visits were started in 1984, as a means of enabling the teams to discuss their respective programs, methods and

problems in more detail. The ARPT NC arranges visits as far as possible between provincial teams based in the same agro-ecological zone or facing similar research problems.

The teams' assessment of the value of the exchange visits varies considerably. ARPT-Central Province commented about a visit made to ARPT-Luapula Province that...the experience was mutually beneficial with both teams profiting from peer evaluation. However, the team in Luapula Province got the impression during a visit to another ARPT that they viewed the visit as an obligation directed out of the central office. Generally, the ARPTs and most of the provincial teams have considered these exchange visits to be worthwhile. They have been particularly helpful for teams in the process of getting established.

1.4.2. Visits by CSRT Scientists to Provincial ARPTs

Since 1984, the ARPT NC has arranged for groups of CSRT scientists to visit each provincial ARPT to discuss the trials while they are in the ground. These field visits have been very useful for interaction; more so than the visits made to each other's offices. However, the timing of the formal CSRT visits to ARPT trials has not been easy to arrange (ref. section 4.II.4.4).

2.0. Program Planning

The procedure and calendar for drawing up the work program for a provincial team is outlined in Table 35. The team's proposed program is discussed at a meeting of the ARPT Provincial Committee, usually in August. There may subsequently be further discussion during the ARPT Annual Review. However, the important discussions about the trial program take place during the Commodity Research Review meetings in August, prior to the Research Committee meetings (ref. section 4.II.4.2.1). Subsequently, the Trial Outlines, containing the rationale and treatment details for each trial, are circulated to scientists in relevant CSRTs.

2.1. Program Planning at Provincial Level

2.1.1. Programming at the team level

Research programming is a "bottom-up" process originating with the individual scientists within the ARPT team. The team develops its proposed annual program in July, at the same time they are preparing the annual report. Each researcher generally develops his/her own program, which is then reviewed by the team and integrated into a research proposal for the team as a whole.

Most ARPT trial programs have been drawn up without assigning priorities to particular trials. When the trial programs are designed, months before financial allocations are known, the team assumes that it will have sufficient resources to implement the full program. This tendency is encouraged when donor funds are guaranteed. However, when pressed, most teams can give an approximate ranking for each trial.

Table 35: Calendar of Program Planning Meetings

January	Review work undertaken during previous quarter at ARPT quarterly staff meeting.
February	ARPT staff make exchange visit to another province. These continue until March.
	CSRT scientists make formal field visits to see and discuss the trials of each provincial ARPT. These continue until April.
March	Provincial field days at on-farm trial sites, with separate days for farmers and extension workers.
April	Review of work undertaken during previous quarter at ARPT quarterly staff meeting.
May	Harvesting of trials.
June	End of rain fed crop season.
July	Review of work undertaken during previous quarter at ARPT quarterly staff meeting.
	Provincial ARPT/Research Committees meet to discuss the previous season's findings as presented in the Provincial ARPT Annual Report and review the proposed work program for the next season.
	Submit government budget estimates for the next year.
August	ARPT Annual Review meeting.
	Commodity Research Team Review meetings (previously pre-research committee meetings).
September	Start of Research Committee meetings for each research team. These continue until October.
October	Some donors have their annual program review meetings.
November	Start of the rainfed season in most provinces. Trial planting begin.
December	Planting of trials continues.

ARPT in Luapula Province is the only team that has established clear priorities both for Target Areas and for trials. This was done as a result of the team experiencing problems, for several seasons, with unforeseen shortages of both finance and manpower after the program had been drawn up (ref. section 3.III.4.2).

2.1.2. ARPT Provincial Committees

The Provincial Committees were designed to decide on policies and programs of the ARPT teams. The committees are expected to meet two or three times each year to discuss issues including:

- the results of ARPT's research;
- the proposed annual program of work;
- the program of field days for farmers and extension workers;
- revision of research recommendations for the different farming systems in the province;
- technical messages to be included in the different extension demonstrations;
- priority farming systems for ARPT attention.

It was expected that the committees would be an important forum for research and extension workers to meet to discuss the provinces' research program, as well as the formal occasion for provincial planners to hear about the infrastructural and institutional improvements needed for the support of technologies being developed.

Unfortunately, the committees have not been particularly effective, and in some provinces not much interest has been shown in them. Most did not meet until a year after they were created. Since then, most committees have only met once a year, usually to review the previous season's results. Even then, discussion has been limited, partly because the annual report is often not distributed until the meeting, and members have insufficient time to read it.

Few SMSs realize the potential power of the committee. The Provincial SMSs have not been very active in planning and reviewing ARPT's programs, partly because of their lack of time and also because on certain occasions some ARPTs have not made enough effort to involve them in their work throughout the season. It is clear from comments made by extension workers that the committees will become effective only when the members, through active involvement, fully understand the purpose of ARPT's work and are able to see how it relates to their own work.

Most ARPT staff consider that the committees have had very little effect on their work programs. This is not to say that people from other organizations have not helped in the planning and programming process, but simply that informal discussions have been more important than this formal mechanism. In North Western and Northern Provinces, the Committees have been more active because both provinces have had RELOs. On a few occasions the committees have been quite strong and have directed ARPT on where it should be working. This has sometimes had major logistical implications, such as in Luapula Province, where the team was directed to work in a very remote area 300km from the research station.

2.2. Program Planning and Review at the National Level

2.2.1. ARPT Quarterly Staff Meetings

The quarterly ARPT staff meetings were established in 1982 to enable all team members to know the progress and problems of other teams. In this way they have served an important monitoring function. They

have become an important forum for sharing experiences in a wide range of issues related to ARPT's activities. The format of the meetings has changed with the evolution of ARPT.

Initially the format was for each team to present their quarterly report describing the work undertaken and problems encountered during the previous quarter, and then the proposed program for the next quarter. This was followed by discussion.

The format was changed in 1984, because most of the teams were established by then, and many people were bored with listening to long lists of familiar administrative problems. The new format involves two parts: 1) all ARPT staff meeting as a group to discuss selected topics; and 2) meetings between the staff of each provincial ARPT and the ARPT NC. The team meetings with the ARPT NC have become an important coordinating mechanism, because with the larger number of teams, the ARPT NC has not had enough time to regularly visit all teams. Topics discussed in the whole-group sessions include on-farm trial methodology, organization of farmer field days, ARPT's links with the National Demonstration program, the link between agro-ecological zones and farming systems, ARPT's role on the Variety Release Committee, problems with farmer selection, and the use of Indigenous Technical Knowledge in ARPT's work.

Since late 1984, Senior and Chief Subject Matter Specialist Officers based at Ministry headquarters have been invited to attend the first part of the ARPT quarterly staff meetings. It is one of the few opportunities for them to keep informed about ARPT's activities. Furthermore, these meetings also occasionally provide an opportunity for ARPT and CSRT staff to discuss specific topics, such as the use of agro-ecological zones, the Variety Release procedures, and how recommendations should be revised.

The most recent change has been the addition of a session to provide team members from the same discipline with an opportunity to meet and discuss matters of mutual concern. At the time of writing, only one such meeting has been held, but most members were enthusiastic and agreed that they would like to have sessions twice a year. The ARPT NC considers that the deliberations of such meetings should be written up for the benefit of all team members and to help avoid disciplinary factions.

A few team members consider that too many staff meetings are held in Lusaka. However, most team members have business to attend to in Lusaka at least once every three months and, with careful planning, they can combine attending the quarterly meetings with other matters. Their reluctance also partly reflects indifference towards matters related to the team as a whole, as discussed in section 3.II.2.3.

2.2.2. ARPT Annual Review

This meeting serves the same purpose as the quarterly staff meetings, but it lasts for two days and enables team members, together with Senior SMSs, to reflect on the past season. During the first three years, discussions focused on the technical work programs of each team. This was found to be boring; so in 1985 a new approach was used

The ARPT NC had been impressed by several experiential management techniques which stimulated teamwork, taught by Dr.D.M. Warren at several management training workshops. The ARPT NC put the ARPT members into small discussion groups which first drew up a list of priority problems, using "brain storming" and "nominal group" techniques and then reviewed its top-priority problems, discussing possible solutions to each. The groups reported back briefly to the other team members at the end of each session. This approach increased the level of discussion and interaction considerably. Some ARPT staff still preferred more discussion of the technical aspects of their program. As a result, in 1986 a morning was set aside when the teams were divided into two groups, roughly along agro-ecological lines, in order to discuss the highlights of their programs.

One of the ARPT NC's intentions for the annual review has been to try to move towards some degree of standardization, based on the experiences of different teams. Thus, the small working groups are encouraged to produce recommendations with the view that these should be adopted by each team. However, as already discussed, several factors are working against standardization (ref. section 3.II.2.3.) and no one considers that ARPT is at the stage when immutable guidelines can be laid down for all provincial teams to follow.

2.2.3. Trial Outlines

The final stage of the planning process is the completion of a Trial Outline for each trial the team intends to undertake. The ARPT format for the Trial Outlines is, by and large, the same as that used by CSRTs, except that it gives greater emphasis to the systems context of the problem, to the hypothesis of how the problem can be solved, and to the criteria necessary for disproving the hypothesis (see Appendix IX for an example of a completed Trial outline). The format headings are:

- Master Number
- Title
- Location: Recommendation Domain, Agro-ecological Zone, Number of Farms
- Agricultural System: Salient Agro-ecological and Socio-economic Features
- Hypothesis: the Key Constraint
- Treatments
- Experimental Design
- Criteria for Evaluation (including data to be collected)
- Literature (on technology)
- Duration
- Management and Implementation
- Staff Involved

At the 1986 ARPT Annual Review, the use of a protocol/format for each of the team's activities, not only the trials, was proposed. It was agreed that this would encourage provincial team members to help in planning each other's work program. A section would also indicate individuals outside of the team who should be involved in each activity and when. This would help to improve forward planning and increase involvement of other people in ARPT's activities. The protocol will be implemented during 1987.

3.0. Management of Data Analysis, Reporting and Dissemination of Information

3.1. Access to Data

A key problem with data analysis has been the poor availability and access to previous research data and information, including that of ARPT. It has been extremely difficult to find out what surveys and experiments have been previously undertaken. Even if they are known, it is often difficult to get access to the findings. The end result is that surveys or experiments may be repeated unnecessarily. This has led to ill feeling by some CSRT scientists, who know that the research has been conducted before, but they don't have access to the results.

Anther problem experienced in ARPT is the temporary disappearance of questionnaires for preparation of M.Sc. theses. Data from two surveys were taken out of Zambia before they had been analyzed. Not even a copy of the data was left behind. This impeded planning of the next season's work program, and some of the same data had to be collected again.

To help address these problems, the ARPT NC initiated two data base studies. One was to identify any rural surveys undertaken in Zambia. A bibliography listed the surveys by province and stated where copies could be found. In the process, copies were made of scarce reports, and they were placed in the ARPT library. The intention has been that all teams should organize provincial libraries, which would at least contain all the references within the bibliography. But shortages of time and difficulties of photocopying have kept some teams from achieving this.

The second study is the research data base discussed in section 2.IV.4.2. The intention is to have a computerized data base and a bibliography of all Research Branch trials, so that anyone can easily determine what trials have been undertaken in the past and the results.

3.2. Use of Data

Some teams have made considerable use of secondary data sources. For example, ARPT Northern Province used secondary data to demarcate the farming systems in the province. They have also established a "key word" system, such that when any team member reads a report about Northern Province, he/she completes a checklist, specifying the kind of data contained in the report. The checklist contains the main headings for data required in an informal survey. This has improved access to secondary sources of information for all team members. The team has found the key word system useful because they started working in the province quite recently, and it has helped them to have a general understanding of previous research relatively quickly. However, teams from other provinces were skeptical about its use when it was discussed at a quarterly staff meeting.

Some provincial ARPTs have not made full use of secondary data. This is partly due to the lack of availability and partly to the tendency of team members, of all disciplines, to prefer to collect their own data.

Similarly, many ARPTs could have made greater use of their own data. Although ARPT in Luapula Province has made good use of their data, the Provincial Coordinator admitted that greater use could still have been made, especially with respect to time series analysis. He considered that the pressure of work had prevented the team from allocating enough time to writing up results, producing reports, and disseminating information about its research.

When new Central Province staff arrived at the end of 1985, they decided to build on the work of the previous team. They have put a lot of time into establishing a library and producing reports based on data collected mainly by their predecessors. The Provincial Coordinator has tried to avoid the temptation to collect more data without first thoroughly utilizing existing information.

3.3. Processing and Analysis of Data

Most of ARPT's data processing is undertaken in the provinces. Only a few services are provided by the Central Research Station, including soil sample analysis and some trial analyses by the biometrician.

The analysis of soil samples has been quite slow, in some cases taking more than a year, and some samples have even been lost. Consequently, several teams are doing their own simple analyses, such as pH readings and texture assessment. The biometrician at the Central Research Station has only occasionally had problems with the analysis of experimental data.

Data analysis by the provincial team members themselves has been quite effective, mainly for the analysis of experimental data. In Central and Eastern provinces, the trial results have always been ready for inclusion in the provincial annual reports, even when only hand calculators were available. Some provinces have been slow in completing annual reports because of work pressure and limited staff.

Analysis of survey data, especially from formal surveys, has caused problems in several provinces, largely because of the time taken to do the analysis manually. For example, in Central Province the data collection for both the formal survey and the Labor Use Study was finished in 1984, but the detailed analysis was not available until the end of 1986. Similar problems have been encountered in Luapula Province. The length of time taken to complete data analysis has meant that quite a lot of data has not been fully analyzed. Now most provinces have bought or are in the process of buying microcomputers. This should significantly facilitate analysis of survey data.

Another problem with data processing, common in almost all provinces, has been the delay in report writing caused by poor-quality secretarial services. Teams in Central, Luapula and Lusaka Provinces, where the pool typists were very inaccurate and slow, have recently employed their own secretaries to alleviate the bottleneck.

The quality of analysis has generally been quite good. Economic analysis has been rather limited in some cases, but has improved with the placement of experienced economists in the teams. The quality of some of the team's reports has been masked, at times, by rather poor English.

3.4. Presentation and Dissemination of Data

Most trials are presented in full and in summary form in the Provincial Annual Report. The results of surveys are usually presented in separate reports and are only summarized in the ARPT Provincial Annual Report.

In 1983, the ARPT NC introduced a format for the Provincial Annual Reports which would highlight the systems perspective, make maximum use of the data collected, and show how the work of the team members related to one another. The main topics are:

- summary of report
- administrative matters - staffing etc.
- for each farming system;
    - description of the farming system
    - issues being worked on
    - discussion of the trial program based on agronomic and economic analysis as well as farmers' comments; detailed results in Appendix
- extension activities
- reassessment of the farming system in the light of the year's work
- expected work program for next season
- bibliography of ARPT publications.

The ARPT NC also produces a summary annual report for the whole team. This basically follows the same format as the provincial annual reports, and emphasizes the main findings of all teams.

In 1984, the ARPT NC, concerned that CSRT scientists might not read through the rather lengthy ARPT reports, proposed the use of an agronomic data summary sheet. The intention was that each provincial team would present quantified data on specific crops so that information about farmers' production practices would be more easily accessible and digestible for CSRT scientists. The data were to be presented in the form of distributions, e.g., x% of farmers in a designated farming system apply y kilos of basal fertilizer.

A few teams took up the idea. ARPT in Luapula Province for example presented data on maize, beans, groundnuts, cassava and common maize weeds. But most teams did not. They faced time constraints and considered the agronomic data sheet redundant. On the other hand, CSRT scientists have complained that they receive little useful farm-level information, especially agronomic data, from ARPT. The issue remains unresolved.

An important means of providing data to CSRT scientists has been through the format presented at the Commodity Research Team Review meetings (ref. section 3.IV.2.2). Most provinces have presented some information at these meetings, even if it does not strictly follow the suggested format.

In spite of ARPT disseminating information in these various forms, several CSRT scientists have complained that they have not received adequate information from ARPT. Clearly, some problems with effective information flow remain (ref. section 4.II.4.6).

3.5. Role of Computers in ARPT

It is recognized within ARPT that microcomputers effectively speed analysis of survey data and statistical analysis of agronomic data. However, the process of introducing microcomputers has taken some time.

In 1982, the ARPT NC was concerned that ARPT would end up with a lot of unanalyzed data if they had to rely on doing analysis by hand. He therefore brought in a consultant to investigate the data requirements of ARPT, as well as the whole Research Branch, since at that time virtually no sections were using microcomputers. The consultant and the Government were concerned about standardization and local back-up for the hardware. The Government's Computer Utilization Committee granted authority for the Research Branch to purchase only three microcomputers on a pilot basis for Central, Lusaka and Western Provinces. There were serious delays in procuring and installing the equipment and, to make matters worse, the supplier went out of business. By the end of 1986 six teams had direct access to microcomputers, with Lusaka Province having occasional access to a pooled machine.

Standardization has been difficult to enforce, because other suppliers have opened offices in Zambia and different donor projects have brought in their preferred hardware. ARPT is using machines from IBM, Epson, ICL and Memory Systems.

Training in the use of computers is recognized to be essential, but so far no complete approach to training has been designed. Shortly after the decision was taken to install three micros, it was agreed that FAO would organize two training workshops for ARPT staff in the use of FARMAP, a farm management analysis package. The workshops were not very successful because of serious problems in installation of the micros and because of changes in ARPT staff between the two workshops.

Training in ARPT has been on a more ad hoc basis. A Zambian economist remained in UK after completing his M.Sc. studies in order to take a course in the use of microcomputers and software packages. Two Zambians attended a CIMMYT workshop which discussed the use of microcomputers in FSR. Recently, two more Zambian economists were sent for a two-week CIMMYT/ILCA course in the use of microcomputers.

In conclusion, further standardization of microcomputer hardware, both by ARPT and CSRTs is needed. Similarly, there is an urgent need to ensure that all scientists have adequate training in the use of microcomputers and relevant software packages.

4.0. Management of Administration

4.1. Time spent on Administration

The Research Branch has administrative staff based at all of the research stations, whose function is to support the scientists in all research teams. However, limited resources and cumbersome bureaucratic procedures have severely hindered their effectiveness. As a result, scientists in many research teams have been spending considerable time in administration. Although they have complained,

they have considered it necessary to ensure that their experimental programs do not suffer. ARPT has been no exception. All of the ARPT Provincial Coordinators and the ARPT NC, in particular, have had to undertake a range of administrative tasks.

At the national level, the ARPT NC estimated that while ARPT was being established he spent as much as 50% of his time on administration. This has been reduced to 40% in recent years. With more staff in the provincial teams, it has been possible to decentralize the administration, and in some of the donor projects, administrative support staff have been specifically recruited to handle some of the responsibilities. When the ARPT NC moved to the Central Research Station he hired a secretary who has assisted with some of the administrative duties.

At the provincial level, the ARPT Provincial Coordinators have also had administrative responsibilities. In addition, they have sometimes had to oversee the construction of houses and laboratories. The provincial ARPT scientists have spent different amounts of time on administration. In general, all teams have spent more time on administration while they were getting established.

The nature of the donor support to the team has also had an important bearing on the amount of time scientists have needed for administration. Three of the provincial ARPTs have been part of larger donor projects with their own administrative support units. This has in some cases reduced the amount of administration the ARPT staff have had to undertake. Three other ARPTs have had assistance from the donor's embassy staff, especially with procurement of items from abroad. Four donors have insisted that their financial support and technical personnel should follow the administrative and financial procedures developed by the Zambian Government. To illustrate the differences, information is presented for the provincial teams in Central and Luapula Provinces.

In Luapula Province, SIDA support for ARPT is not part of any larger project, and there is no administrative support unit. SIDA has had a clear policy that the technical personnel should follow Zambian government administrative procedures. This arrangement has required the Provincial Coordinator to spend about 30% of his time on administration, although in 1986, when there was a large building program to supervise, he spent 60%. The Provincial Coordinator has adopted a deliberate strategy of delegating as many administrative duties as possible. This has required the other team members to spend about 15-20% of their time on administration. By delegating responsibility the Provincial Coordinator has helped to increase team spirit by making Zambians and expatriates alike feel that they are responsible for decisions affecting the running of the team. This is important because Zambian personnel frequently know little about the budget, how money is spent, and have little control over vehicle use.

In Central Province, USAID support to ARPT has been part of the larger ZAMARE project. The team has had administrative assistance from several sources.

i) The ZAMARE Chief of Party has an office in Lusaka staffed with an administrative assistant, a secretary and a driver. Although the

office has not been responsible for procurements, it has been involved in making payments and in assisting with procurement in times of dire need. The office has also handled many personnel and manpower issues and has helped out with secretarial services.

ii) The USAID Project Support Unit in Lusaka has assisted the team with certain secretarial facilities and has been responsible for clearing all imported items.

iii) Other ZAMARE project members have informally assisted ARPT with access to certain inputs and equipment.

iv) The team's house-building program was handled by the PAO's office.

With this range of administrative support, the team has followed several different administrative procedures, of which the Zambian Government system has been but one of many. In spite of this assistance, the first ARPT Provincial Coordinator reported spending too much of his time on administration, estimating between 25 and 35%. He also reported many delays in the arrival of various items of equipment and shortages of consumables. He commented, "it is impossible to be a full-time ARPT Agronomist and a full time ARPT Provincial Coordinator." Because he was the first ARPT Provincial Coordinator, he had more administrative tasks. However, he delegated few administrative responsibilities. Nonetheless, the additional assistance has been greater than that received by any other ARPT and prompted a Zambian team member to comment that it seemed that the team was working outside of the Government system. This could provide problems for institutionalizing the program when USAID support comes to an end.

The second Provincial Coordinator has delegated more administrative tasks to other team members. He estimates that he has spent only 20% of his time on administration.

From these two examples and experiences in other provinces, it cannot be concluded that administrative support units have necessarily reduced the administrative burden of team members. In some cases, the donor project procedures are more cumbersome than those of the Zambian Government system. However, by delegating administrative tasks between team members, team spirit has been improved and the Provincial Coordinator's burden has been reduced.

4.2. Key Issues in ARPT Administration

A number of time-consuming problems affecting the administration of ARPT have occurred in several provinces.

4.2.1. Bureaucracy

Bureaucratic procedures have increased the work load of ARPT staff in all provinces. Some of the procedures stem from donor project regulations, but many are part of the Zambian Government regulations. The procedures have influenced several areas of ARPT's work, such as budgeting, procurement, travel abroad and overseas training.

i) Budgeting

The budgetary system is described in section 3.IV.7.3. The main administrative problem has been the compilation of budgets for all provincial ARPTs requiring a Government contribution. The provincial teams have usually been requested in June to supply budgetary requirements for the following year, before they know what the next season's program will involve. The ARPT NC has usually had to reformulate the information into standard formats, which have changed almost every year. Since Government allocations have been so small and have usually been based on previous allocations, devoting much time to the exercise has been regarded as rather futile. The ARPT NC has, over time, decentralized the process of budget preparation to distribute the work load. The intention to computerize the budgetary system at the Central Research Station may help to reduce the time required for this process.

ii) Procurement

The procurement of items, using the Government system, is extremely time-consuming and has been the most frequent source of complaints by team members. The purchase of any item worth more than K500 required authorization from the Provincial Supply and Tender Boards. The ceiling was raised to K10,000 in 1987. Until 1986, there was some flexibility about this ceiling, but after that time the rule has been strictly adhered to and, in theory, three quotations had to be submitted to Tender Board for any item, unless there was only one supplier. The Provincial Tender Boards have taken between a day and four months to approve purchases, although the average has been one month. However, with prices increasing almost daily, the original quotations are frequently out of date by the time they are approved, and the process has to start all over again, with three new quotes!

To purchase any item, with or without Tender Board approval, the administrative staff (stores section) at the Research Station are required to prepare a Local Purchase Order and a Payment Voucher. These are then sent to the Provincial Accounting Officer for a check to be written. When overseas items are purchased, the approved quotation must be sent to Ministry of Agriculture headquarters in Lusaka. In the case of ARPT in Luapula Province, a letter, written to SIDA, must then pass through the Ministry of Finance for endorsement, before SIDA can authorize payment to be made from Sweden.

Collecting purchased items also takes a long time; especially if they arrive from overseas, in which case local charges usually have to be paid to the local supplier, and then the items need to be cleared through customs.

Four provincial ARPTs have had to use this procurement system. Significant staff time has been consumed. Several teams estimate that professional staff spend 25% of their time on procurement, and as much as 35% when financial and budgetary aspects are included. This applies even when some teams assign reliable drivers to procurement, or their TAs. The professional staff can usually exert more pressure and push the process faster, however, especially when items are urgently required. The ARPT NC and the Lusaka Province

ARPT staff have also spent considerable time assisting the procurement of items for other provincial teams because of their proximity to Lusaka.

The teams have been obliged to spend so much time on procurement because the Stores Officers from the research stations and the PAO's office often have had no reliable means of transport and have not had the same motivation as the team members. The ARPT staff in Luapula Province estimated that if they had left these matters to the assigned staff, the process would have taken six times longer and would have seriously impeded their work program.

In addition to involving ARPT staff directly in the procurement process, some other measures have been taken to make the procurement system more efficient. Some Provincial Coordinators have managed to have imprest accounts approved, enabling them to purchase items up to a certain amount without Tender Board approval. Some expatriate staff have purchased items using their own cash and have been reimbursed by their donors. Some donors have become involved in procurement from overseas and have also applied pressure for the K500 ceiling to be raised. Some ARPTs have been assisted in procurement by other development projects, with which they have established close relations. Most teams have established sizable stocks of certain items, to reduce the frequency of purchases.

Procurement has usually been less time consuming in those provinces where ARPT has had the benefit of donor project administrative support units. However, donor regulations are also sometimes cumbersome. For example, any item purchased by the USAID-funded personnel in ARPT Central Province must be taken from the shop and placed in the USAID store, so that a stock entry can be made. This requirement has greatly hindered the procurement of a range of items.

iii) Travel abroad

Whenever Zambian civil servants travel outside the country, whether to attend a workshop or to go for long-term training, they are required to have authorization from the Cabinet Office. The procedure aims to ensure that only useful visits are supported from Government coffers, but even fully sponsored trips require Cabinet authorization. The forms for ARPT staff are submitted by the ARPT NC to the Ministry of Agriculture for processing to Cabinet Office. In most cases the approval has been given only one or two days before the proposed trip. As a result, the ARPT NC and/or the individual concerned have often had to visit the Cabinet Office several times to accelerate the process.

iv) Long-term training

Zambians going abroad for long-term training must go through several formalities. In order to qualify for study leave, the candidates must be confirmed in their appointment to the civil service, a procedure which can take many months. This process has kept some ARPT staff away from their work for a long time. Other formalities, such as obtaining Cabinet Authority and tax clearance certificates and attending orientation courses arranged by some of the funding organizations, have also consumed time.

5.0. Management of Donor Support to ARPT

5.1. Amount of Donor Support to ARPT

Considerable support has been provided to ARPT by several donor organizations. Sixteen donors have been supporting different research teams within the Research Branch (Table 7), of which nine have supported ARPT (Table 21). Seven of these have provided long-term technical assistance personnel, as well as financial support. The other donor, CIMMYT, has provided financial support and short-term consultancies.

Table 16 shows that the number of expatriates working in ARPT increased from 2 to 15 between 1982 and 1986. By 1986, 47% of ARPT staff were expatriates, provided by different donors.

In general terms, the proportion of funds provided by donors to provincial ARPTs ranges from 50% to 100% (Table 21). Although the figures are very approximate, it is clear that donors have provided a substantial proportion of the teams' capital and operating expenses. In the case of four provinces, the donors have provided 100% of the financial assistance, excluding only the salaries of the Zambian professional and technical staff.

5.2. Reasons for Donor Support to ARPT

MAWD has requested assistance from donors because there has been a shortage of fully qualified and experienced scientists to work within the Research Branch. Similarly, all research teams have been constrained by limited capital and operating funds. For a new team to get established, it has been essential to obtain external sources of manpower and finance.

All of the donors supporting ARPT have had the overall objective of helping small-scale farmers improve their standard of living. Some donors have been working in particular provinces for many years, trying to assist farmers by funding a range of different projects, such as extension, input supply, marketing, and credit. The donors in five provinces have been interested in supporting ARPT as a way to identify relevant technical messages for the small-scale farmers and thereby complementing the activities in their other projects. In two of those five provinces, Eastern and North Western, donor support to ARPT was part of larger extension-oriented projects. In the other three, assistance was provided to ARPT as separate projects. In the case of Central Province, assistance was provided as part of a larger research and extension project, which ARPT viewed as complementing the support provided to several CSRTs by "introducing a 'bottom up' approach into the process of setting research priorities".

For these pragmatic reasons many donors agreed to support ARPT. They were not simply "jumping on the FSR bandwagon". Moreover, donor assistance to ARPT has not been at the expense of support to CSRTs. All the donors supporting ARPT have also supported one or more CSRTs. Most donors have expressed satisfaction with the progress of ARPT, and three donors have drawn up proposals for second-phase assistance. In the case of SIDA's support to ARPT in Luapula province, it has become a model for their assistance in other countries.

5.3. Key Issues in Managing Donor Support to ARPT

The involvement of so many donor organizations has influenced ARPT in several ways.

5.3.1. Rate of Expansion

There was some pressure from donors to expand faster than had been originally intended. In two provinces ARPT was established earlier than had been anticipated because donors were interested in supporting ARPT as part of a large province-wide agricultural development project.

The problems with expanding too rapidly related to the fact that much of the team's work was new; it was almost inevitable that some mistakes would be made. Working in a large number of provinces from an early stage meant that less support and supervision could be given to all of the teams.

5.3.2. Influence on Institutionalization

i) The goals and structure of donor support

The structure of the donor support to ARPT has been of three types: support solely to ARPT, as in Luapula, Lusaka, Northern and Western Provinces; support as part of province-wide agricultural development projects, such as in Eastern and North Western Provinces; and support through projects covering CSRTs as well as ARPT, as in Central Province. In each case the structure of the donor project has influenced the level of interaction between ARPT and other organizations supported by the project, usually CSRTs and extension. Generally speaking, the donor project structure has had a positive effect on the level of interaction between groups, although the interaction has sometimes been mainly among the staff onthe project, many of whom have been expatriates. The types of formal and informal mechanisms for inter-action used are discussed in Chapter 4.

In some cases the larger projects or donor provincial strategies have influenced, directly or indirectly, the goals and activities of ARPT, especially through the work of expatriate personnel. The type of influences include the speed with which the team produces extension recommendations and the collection of certain data not directly related to ARPT's activities.

ii) Resource availability

One of the potential dangers of donor support is that it brings in additional resources which can encourage methodological development which a fully Zambian team would not be able to continue. The selection of farmers and location of trial sites is one example of where an abundance of transport and operating expenses has resulted in several provincial ARPTs paying too little attention to the number and distribution of trial farmers. The limited resources available to ARPT in Lusaka Province has been an important reason why the team has given greater attention to farmer selection and clustering of trials (ref. section 4.I.3.1.). Similarly, several provinces have undertaken lengthy, frequent visit surveys to collect information on

flows of labor and cash. While it can be argued that short-term donor assistance should be fully used to build up adequate data bases, the long-term implications for institutionalizing, using more cost-effective survey techniques, should not be ignored.

The number of Target Areas the team can work in has also been determined by the resources available. This is one reason why the ARPT NC has suggested that the teams should work first in very distinct farming systems so that work in further areas subsequently would involve less adaptive research.

Many of the Zambian staff in ARPT, as well as senior research managers, are concerned about the long-term availability of donor funding for ARPT and other research teams.

5.3.3. Team Building

Having such a large number of expatriate scientists within the team may cause several problems. The first is that although many expatriate staff have had substantial experience in other countries, this experience may not be relevant to the Zambian situation. Few expatriate scientists have had prior experience in Zambia. This problem has been exacerbated by the fact that expatriate personnel have often changed after only two or three years - the length of their contracts. Having several expatriates with different experiences and views on FSR over a short period of time has, at times, been a source of confusion to Zambian counterpart staff. Furthermore, some personnel, expatriate and Zambian alike, have been more concerned for their individual, disciplinary or provincial interests than for team building.

Within the provincial teams, the presence of expatriates has sometimes been a source of tension with Zambian team members. Tension has arisen over control of resources, such as transport and funds, and decision making about the team's work program. There has also been some resentment about the vast difference in the salaries and conditions of service between expatriate and Zambian team members. The tensions have been reduced in provinces where responsibility for team administration has been delegated effectively by Provincial Coordinators to other team members. Team building has been facilitated in Luapula Province by all team members sharing the same office and in other provinces by holding regular team meetings.

5.3.4. Coordination of Donor Support

With so much donor support to ARPT, it has been necessary to coordinate all such activities (ref. section 3.IV.1.). All donor support to Zambia is ultimately coordinated by the National Commission for Development Planning, and then from there through the MAWD to the Director of Agriculture. Further down the Research Branch hierarchy, coordination of donor assistance is provided by the ADA(R), the CARO and Research Coordinators, such as the ARPT NC. For all of these individuals, much time is spent in meetings and negotiations with donors discussing project proposals and reviewing projects in progress. In the case of ARPT, each of the donors has its own review and reporting procedures. For some donors these procedures are rather time consuming and could be reduced, with no ill effects to the projects.

Within ARPT a range of review mechanisms, guidelines and procedures has been drawn up to help with the coordination of the donor assistance. These have involved a combination of directive and participative mechanisms (ref. sections 3.IV.1.1.4 and 3.IV.2.2.). The ARPT NC has considered that certain aspects of coordination, particularly those related to the interaction between ARPT and CSRT scientists, would have been easier if the donor project documents and job descriptions for expatriate scientists had more clearly specified what was required.

6.0. Manpower Management in ARPT

6.1. Overview of ARPT Manpower in Relation to the Research Branch

Research Branch professional staff in ARPT increased from 8 to 32 between 1982 and 1986 (Table 13), but including RELOs, the numbers increased from 8 to 38. ARPT increased its proportion of

Table 36: ARPT Staff 1980-86*

POST	1980	1981	1982	1983	1984	1985	1986
F.S. Agronomist							
Zambian	1	1	3	4	4	5	7
Expatriate	-	1	1	4	5	6	8
Total	1	2	4	8	9	11	15
F.S. Economist							
Zambian	1	1	3	6	6	6	8
Expatriate	1	1	1	3	3	4	6
Total	2	2	4	9	9	10	14
RELO **							
Zambian	-	-	-	-	-	-	3
Expatriate	-	-	-	1	1	1	3
Total	-	-	-	1	1	1	6
Rural Sociologist							
Zambian	-	-	-	-	1	1	2
Expatriate	-	-	-	1	1	1	1
Total	-	-	-	1	2	2	3
Nutritionist							
Zambian	-	-	-	-	-	-	-
Expatriate	-	-	-	-	1	1	-
Total	-	-	-	-	1	1	-
Trials Assistants							
Zambian	-	3	5	9	10	12	17
Total Zambian	2	5	11	19	21	24	37
Total Expatriate	1	2	2	9	11	13	18
Grand Total	3	7	13	28	32	37	55

Notes: * Position as at 30th June for each year.
** Posts of Research Extension Liaison Officers are established in Extension Branch.

scientists in the Research Branch from 9% to 20% over the same period. ARPT has had virtually no junior technicians from the Research Branch. There were only 2 in 1986, because the section has used TAs seconded from the Extension Branch. The number of TAs increased from 5 to 17 between 1982 and 1986 (Table 36).

ARPT has had an equal proportion of agronomists and economists since the team was established. However, because here were delays in recruiting RELOs, in 1986 there were only 6 RELOs compared with 15 agronomists and 14 economists (Table 36). The 15 agronomists in ARPT constituted 28% of the total number of agronomists in the Research Branch. The economists and sociologists in ARPT make up 94% of the social scientists in the Research Branch.

The proportion of expatriate professionals in ARPT is almost the same as the average for the Research Branch. However, while the proportion of Zambians has been increasing in the Research Branch from 22% to 54%, in ARPT the trend has been different. In real terms the number of Zambians has been increasing, but the percentage has decreased between 1982 and 1986, from 75% to 53% (Table 16). This has been due to increased numbers of expatriates recruited through donor support.

The education levels of ARPT scientists have been comparable with those of other teams when expatriate and Zambian staff are combined (Table 17). However, when disaggregated, it is evident that in 1986 the Zambians in ARPT had lower education levels than the average for the Research Branch: 76% B.Sc. in ARPT against 61%; and 24% M.Sc., compared with 34% for the Research Branch. This has resulted mainly from the fact that ARPT was established with fresh graduates, owing to the shortage of experienced staff in the Research Branch. In addition, there have been certain administrative delays in sending staff for M.Sc. training.

Since the inception of ARPT, only two members of staff have resigned from the team. This 6.3% attrition rate within ARPT compares with 7.6% for the Research Branch as a whole between 1981 and 1986. The two resigned from ARPT were female one rural sociologist and one agronomist who was working in Lusaka Province based at the Central Research Station. It is not known where the rural sociologist went, but the agronomist joined the University of Zambia in the School of Agricultural Sciences under the staff development fellowship scheme. Most of those who left other research teams joined parastatal and private companies. A few obtained international jobs within the region in agricultural research related activities.

6.2. Composition of the Provincial Teams

Most scientists in ARPT and CSRTs agree that the minimum team should be an agronomist and an economist. However, if resources were extremely limited, to the extent that there could be only one discipline, then most scientists interviewed considered that priority should be given to an agronomist. A few scientists thought that if an agronomist had some working knowledge of economics, then the position of an economist could be replaced by a RELO. Several CSRT scientists suggested that economists would be better utilized at the national level by all research teams, rather than limiting their services to ARPT.

Sociologists are seen by most ARPT scientists as playing an important supportive and occasional advisory role to the provincial teams (ref. section 3.II.2.6.3). CSRT scientists have a more vague understanding of the role of sociologists and tend to be more sceptical about their utility.

It is recognized that in areas where livestock production is important, Adaptive Livestock Research Specialists should be included in the provincial teams. Additional livestock personnel are being considered for three provinces, to undertake exploratory studies to help with subsequent institutionalization. A few ARPT staff have suggested the need for personnel in agroforestry and veterinary science. However, it is expected that the services of other institutions will be called upon.

6.3. Issues Related to Field-level Staff in ARPT

Most field-level staff in ARPT are TAs, but there are also a few enumerators who have been employed for one or two years by ARPT in Central, Luapula and Western Provinces. The enumerators, like the TAs, have been seconded to ARPT from extension in all except Luapula Province, where the team did its own recruitment.

The first three TAs recruited in 1981/82 were of different levels: Agricultural Supervisor, Senior Agricultural Assistant and Agricultural Assistant. Agricultural Supervisors are diploma holders; the other two have Certificates of Agriculture. It has generally been agreed that with adequate supervision, certificate-level staff can effectively undertake the work of a TA. In 1986 most TAs were Senior Agricultural Assistants. However, it has been recognized that in more isolated areas where communication is difficult between the TA and professional staff, it is advisable to have a TA of the rank of an Agricultural Supervisor who is more able to work independently. ARPT-LP has also used an Agricultural Supervisor to conduct on station-trials and to supervise and support other TAs in their work. According to ARPT-LP, this arrangement has worked very well. Several other provincial teams consider that it would be beneficial to incorporate Agricultural Supervisors.

TAs consider their secondment to ARPT to be an honor and reward, in recognition of their hard work. They consider it a privilege to work with scientists, conducting research with farmers. Several TAs interviewed believed that only the best extension workers are seconded. They consider themselves to be at an advantage in getting first-hand information on the latest innovations coming out of research.

Most provincial teams have invested a lot of effort and time in training TAs to bring them up to the present expertise in OFR. They therefore propose that TAs should be retained within ARPT. This means they are ready to sacrifice improving the overall extension system in order to produce high-quality OFR results. They argue that extension links with ARPT could be improved through occasional training sessions and participation in OFR alongside TAs.

While most TAs are quite satisfied with the administrative support they receive from both ARPT and the DAOs, some have expressed concern that their problems with housing repairs and maintenance have

not been attended to because neither ARPT nor the DAOs feel responsible. "It seems as if we don't belong anywhere", commented one of the TAs in Eastern Province. If TAs are to be retained in ARPT for a long time to come, their administrative support has to come from ARPT.

6.4. Recruitment Procedures

6.4.1. Zambians

The recruitment procedures, especially in the beginning, were informal. Contacts with candidates were made through teaching staff at UNZA. However, by 1982 the mechanism was made more systematic and involved the ARPT NC going to UNZA to speak to students interested in joining ARPT. Usually a large number of students expressed interest; so a short list of candidates to be interviewed had to be drawn up, after consulting with the lecturers. In addition to interviewing the candidates, the ARPT NC tried to speak to several UNZA lecturers about each student and obtained their grades for all courses taken. A final interview for the best candidates was held with the ADA(R).

The recruitment procedure has been quite rigorous and competitive, more so than for other research teams. The intention was not only to recruit intellectually strong individuals of research caliber, but also individuals who were interested in working in the field with small farmers as part of an interdisciplinary research team. This has not always been easy, and in some years positions were left unfilled because no suitable candidates could be found. Recruitment of agronomists and economists was equally difficult.

RELOs, TAs and the few technical staff working in ARPT have mostly been seconded either from the Extension or Research Branches. This secondment has been quite selective. In most provinces the best among extension staff have been seconded to ARPT, since PAOs have viewed ARPT as a special program requiring high-quality staff.

6.4.2. Expatriates

Recruitment of expatriate scientists for ARPT has in many ways been the same as for other research teams (ref. Section 2.IV.2.3.). However, there has been greater involvement by Zambian officials, especially the ARPT NC, in the recruitment process for ARPT. This has been most notable in the case of bilateral donors and can be illustrated by the positive example of SIDA's recruitment for ARPT in Luapula Province, which has been rather exceptional in the level of care taken.

SIDA normally recruits personnel for its agricultural projects through the Swedish Agricultural University at Uppsala, which advertises posts usually only within Scandinavian countries. The results of the interviews and the name of the recommended candidate are forwarded to SIDA. If SIDA agrees, the candidate is proposed to MAWD for Zambian approval.

The same broad procedure has been used to recruit personnel for ARPT-LP, but with greater care and flexibility. First, SIDA involved Zambian officials in the recruitment process more than

usual. This was especially true in the case of the Farming Systems Economist, for which the ARPT NC not only provided the names of about ten possible candidates but also participated in interviewing a potential candidate.

Second, SIDA realized only a few Swedish nationals had experience working in FSR projects, and so it was prepared to recruit other nationalities and eventually recruited a Briton and an Ethiopian.

Third, SIDA was prepared to have positions vacant rather than fill them with inexperienced candidates. In the case of the FS Economist, recruitment took two-and-a-half years, which was something of a record for SIDA. But the care paid off. ARPT in Luapula Province has high-caliber expatriate staff who have clearly demonstrated loyalty to ARPT as a program and a commitment to institution building within the Research Branch.

SIDA took such care with recruitment for the ARPT posts for several reasons.

i) There was genuine concern to involve local officials in all major activities regarding the project, including recruitment.
ii) It was realized that farming systems research was a new activity in agricultural research institutions in developing countries in general, and Zambia in particular, and that extra care was needed.
iii) It was recognized that few Swedish nationals had much experience with FSR projects.
iv) The importance of recruiting individuals who could work together as part of a team was recognized.

Recruitment of most expatriates for ARPT has not involved the same degree of care and local participation, but several donors have realized that extra care has been necessary when recruiting for ARPT.

6.5. Training

6.5.1. Management of Training

The ARPT NC has placed a high priority on building scientific capacities in ARPT through training. The training needs of ARPT staff have been determined by the provincial teams and the ARPT NC, and have been discussed with the CARO and /or ADA(R). In a few instances individuals have identified particular courses themselves. The ARPT NC has tried to ensure that each team member has adequate opportunities to attend relevant seminars and workshops. Most ARPT staff have been sent for short courses which have direct relevance to their field activities.

ARPT, in common with other research teams, has considered that professional staff should be trained to the M.Sc. level. This opportunity has been available to any member who has worked for ARPT for at least one to two years and has proved to be a capable, motivated scientist. ARPT has had no serious problem in securing donor funding to support Zambians to undertake M.Sc. training or to attend short courses and seminars. However, the process has been fraught with bureaucratic problems which have caused serious delays and absorbed excessive amounts of time of both the ARPT NC and individual scientists.

Training opportunities exist equally for ARPT and CSRT scientists working in donor-funded research teams. However, because of the small size and satellite nature of some provincial ARPTs, the team has tended to have more definite training plans than other research teams. The ARPT NC has also emphasized training because ARPT was a new program involving new approaches and methods.

ARPT has no formal mechanisms for evaluating training programs. However, all who attend seminars/workshops write reports assessing their utility. Most reports have been quite positive.

Under GRZ conditions, all staff leaving for training for a period of more than 6 months are supposed to sign a bonding contract, which stipulates that they must serve GRZ for a period equivalent to the time spent out on training. However, this obligation has not been strictly enforced.

6.5.2. Formal Training of ARPT Professional Staff

By the end of the 1985/86 academic year 9 (45%) of the Zambians in ARPT had been sent for M.Sc. training (Table 37) and one was away for his Ph.D. This included 5 economists and 4 agronomists. Only one person sent for M.Sc. training has subsequently left ARPT.

The promise of formal training was initially a very important incentive for graduates to join any research team, but this has become less important as job security itself has become more critical (ref. section 2.IV.2.3). Nevertheless, in ARPT, training has been seen by most Zambians as an incentive and a reward for good work. M.Sc. training is not automatic. It has to be earned.

Table 37: Zambian Scientists in ARPT sent for M.Sc. Training

	1982/83	1983/84	1984/85	1985/86	Total
Agronomist	-	-	3	1	4
Economist	2	2	-	1**	5
Total	2	2	3	2	9

Notes: * Staff are listed according to the year when they were sent for training.
** Ph.D. candidate.

6.5.3. Exposure of Zambian Scientists to FSR Concepts

When recruited to work in ARPT, most Zambian staff had little or no exposure to the concepts and methods of FSR. Until 1986/87, the School of Agricultural Sciences at the University of Zambia did not have any course dealing with FSR perspective and methodologies. Recently, the ARPT NC helped the School to initiate a course and a practical field project. Most training in FSR has taken place after staff have joined ARPT (ref. section 3.II.2.4).

6.5.4. In-Service Training for ARPT Scientists

In-service training, provided to virtually all ARPT scientists, has been focused on teaching FSR skills and methodology. It has been organized by CIMMYT, both during the five-call in country training program and through the FSR Regional Training Workshops held in Zimbabwe (ref. section 3.II.2.5.). Many of the ARPT staff, including the expatriates, consider these courses to have been the most useful in-service training courses they have attended. The courses provided staff with practical skills and information which they were able to use immediately in their provincial research programs.

The in-country training seminars were based on the principle of learning by doing. Participants have taken part in discussing the ideas and methods presented, have done exercises, and have conducted field practicals in small groups.

There has been no provision for training ARPT scientists as internal trainers of FSR concepts and skills. So far, CIMMYT's contribution to training ARPT staff has been sufficient. Moreover, since the team has been in existence for less than 5 years, there has been no one among the Zambians with sufficient skills and experience to assume this role. ARPT's first priority has been to staff the teams. With the shortage of staff, little attention has been given to establishing trainers within FSR.

In addition to the in-country training program, several Zambians have attended short courses abroad on topics such as the use of microcomputers, survey techniques and agricultural statistical methods.

Several areas have been highlighted by team members as requiring further attention in future in-service training. These include:

i) Data analysis using computers. This has been brought about by two main factors. First, the volume of data to be handled has increased over time, requiring more efficient methods of analysis and storage. Second, most ARPTs are now in possession of, or are about to purchase, computers and computer packages.

ii) Evaluation and monitoring of agricultural projects. The need for such training has arisen for two reasons. First, several provincial ARPTs are in the on-farm testing and demonstration stage of the technology generation process. During this and the subsequent dissemination process, the teams will need to direct more effort towards monitoring the adoption of technologies. Second, several provincial ARPTs will soon be entering the second phases of donor support. They need evaluation skills in order to be able to assess their achievements.

iii) Some ARPT scientists consider that in-service training should be provided in areas where ARPT has been weak, notably livestock and agroforestry research. The ARPT Nutrition Coordinator has also proposed arranging more systematic training for ARPT scientists, and others, as a means to further incorporate a nutrition perspective into ARPT and the Research Branch.

iv) ARPT agronomists consider that more in-service training on the design and analysis of on-farm trials is needed. A recommendation has been made for ARPT to invite key agricultural research statisticians, with a bias toward on-farm research, to conduct a national workshop on this subject.

6.5.5. Training of Trials Assistants

In-service training of TAs has been on a rather ad hoc basis. In 1982 a one-week course for all TAs was organized by the ARPT agronomist in Lusaka Province. To help the TAs feel like part of the national ARPT section, they were brought together at the Central Research Station. The training explained:

- the background to ARPT;
- the need for more appropriate research for small-scale farmers;
- how to select representative farmers and establish working relations with them;
- how to lay out trials;
- practical hints on conducting trials;
- data collection;
- how the TAs should organize their time.

A set of handouts was provided, which was subsequently used by the provincial ARPTs. The training was quite useful, although many of the TAs later said that they already knew the material.

A similar course was put on in 1983, but thereafter the training of TAs was decentralized to the provincial teams. This decision was taken because most TAs had already attended the course and because it was seen as a means of building stronger provincial teams, enabling TAs to participate in discussing the trial results and planning the work program. The result has been that in most provinces the teams have organized little training, but have usually tried to hold planning meetings involving the TAs. The general view is that most TAs already have sufficient skills to undertake the tasks required by ARPT. What remains to be done is to involve the TAs more in decision-making within the team and to provide adequate incentives and support for them.

6.6. Establishment of ARPT Positions

A current concern of management is that staff positions for ARPT social scientists have still not been formally established within the Research Branch. Consequently, all but two social scientists are not officially appointed to the Ministry. This means that their status is temporary and vulnerable if Government decides to reduce the civil service, that their pension benefits are not secure, and that they could be denied the right to travel or study abroad. While none of these problems have yet arisen, it is a point of serious concern with respect to the long-term institutionalization of ARPT within the Research Branch. The lack of employment security and long-term career prospects could make it difficult to retain Zambian social scientists who have a wide range of job opportunities outside of the Ministry. To rectify this situation, the Assistant Director is now working actively to secure official appointments within the Ministry.

7.0. Management of Financial Resources

7.1. Allocation of Funds to ARPT

It is not possible to say what proportion of Research Branch funds have been allocated to ARPT, for reasons outlined in Appendix II, section 3. It has only been possible to present detailed expenditure data for ARPT in Eastern, Luapula and Lusaka Provinces (Tables 38-40).

In Tables 41 and 42 an assessment is made of average annual expenditure for running one provincial ARPT. The information, based on actual expenditures over four years in three provinces, indicates that the costs are in the order of K55,000 per annum, based on constant 1980 prices, or approximately US$ 70,000.

Generally speaking, apart from a few short periods, ARPT has not experienced shortages of funds which have seriously affected the amount and quality of the work undertaken. This is largely attributed to significant donor support.

7.2. Features of Expenditure by ARPT

7.2.1. Dependence on External Donor Support

If payments for local salaries are excluded, only three provincial ARPTs have received allocations of funds from the Government: Western Province, 10% of expenditure; Central Province, 25%; and Lusaka Province, 55%. In Eastern, Luapula, Northern and North Western Provinces, external donors have provided 100% of the financial support, excluding only the salaries of Zambian professional and technical staff. This high level of dependence on donor support is a general feature of most research teams in the Research Branch (ref. section 2.IV.1.3.7, and Table 21).

The main concern is how ARPT teams can gradually wean themselves from donor support and receive larger contributions from Government. The experience of Luapula Province provides a good example of the difficulties in achieving this goal. Increasing Government contribution has proved extremely difficult for ARPT in Luapula Province, where SIDA has provided 100% of the team's funding on a capital allocation. The allocation has been designated as being fully donor supported, which means that Government funds cannot be provided on that vote. Government funds can also only be provided on the capital budget to projects which have a finite period.

This means that ARPT can only expect to obtain Government contributions on the recurrent budget. However, allocations of such funds are made on the basis of previous year's allocations. This makes it almost impossible to get an increased allocation.

ARPT in Luapula Province experienced a serious shortage of funds because it had been assumed, during budget preparation, that a Government contribution could be made. This never materialized, however, and the team had difficulties for several months. They had to borrow funds from other development projects, expatriate team members used their own money to purchase items, and staff had to forego receiving subsistence allowances.

7.2.2. Capital versus Operating Costs

Table 42 indicates that capital costs for three provinces, averaged over four years, amounted to approximately 28% of the total costs of running ARPT. This proportion has generally declined, after the team has been in existence for a few years, as can be seen in Tables 38-40. In most provinces, ARPT has built houses and purchased vehicles in the first year or two and then subsequent capital expenditures have been to replace vehicles or construct houses in new Target Areas. In Eastern Province, the proportion of total expenditure on capital decreased from 50% to nil between 1982 and 1985. In Luapula Province, ARPT obtained funds from SIDA to help improve the infrastructure at the regional research station, for the benefit of all scientists based there, which is explains why expenditure on capital items has been relatively high.

The level of operating costs required to run a Provincial ARPT has remained relatively constant, at around 22% of total costs, when salaries, including expatriates, are included in the total (Table 42). In all three provinces for which expenditure figures are available, annual operating costs have been between K20,000 and K30,000. The most important operating expense has been the purchase of fuel and oil, followed by the payment of subsistence allowances and casual laborers.

7.2.3. Professional Staff Salaries

Some very rough estimates have been made of ARPT professional staff salaries (Tables 38-40 and 42). The estimates include expatriate salaries which, in two of the three provinces, have comprised more than 90% of the total figure for professional salaries. When the expatriate salaries are added to the total expenditure for each team, they generally constitute between 30% and 60% of total costs (Tables 38 - 40).

Table 42 presents an estimate of the expected costs of running one fully Zambianized provincial ARPT without the high cost of expatriate staff. The total costs for the team would be substantially decreased.

7.3. ARPT Budgetary System

7.3.1. Budgetary System for Zambian Government Funds

Three provincial ARPTs have received funds from the Zambian Government, although only in Lusaka Province have they been a significant proportion (Table 40). In these provinces the budgets have been prepared and disbursed according to the procedures described in section 2.IV.1.2. The cumbersome procurement process has contributed to delays in spending money, once it has been released (ref. section 2.IV.1.3.5.). The ARPT NC has played an important role in coordinating the budget preparation, although most of the preparatory work has been increasingly undertaken by provincial team members.

7.3.2. Budgetary System for Donor Funds

In most provinces, administering the donor budget has involved team members, usually the ARPT Provincial Coordinator, in preparing the

budget, collecting checks from the donor to deposit in project bank accounts, disbursing the money according to both donor and Zambian Government procedures and keeping accounts. With expenditures for items purchased outside Zambia, the team members usually obtain authorization and then the donor handles payment and accounting (ref. section 3.IV.4.2.1.).

In some provinces, notably Central Province, the team has had difficulties in administering and accounting for funds because they have come from several sources. The team has received funds from four sources: the USAID Project Support Unit, the Project Chief of Party, the Zambian Government, and the supporting foreign universities. Each of these has its own disbursement and accounting procedures. The ARPT Provincial Coordinator has consequently had considerable difficulties estimating how much the team has actually spent, which in turn has made budget preparation rather difficult.

Although budget estimates for donor projects are prepared during the planning stage, most donors expect annual budgets to be prepared as well. These are usually discussed at annual donor review meetings. This has provided considerable flexibility for variations and additions to be made in the budgets.

7.4. Control of Funds

Once funds are released to provincial ARPTs, either from the donor or the Zambian Government, they are controlled by the ARPT Provincial Coordinator. The Provincial Coordinators, using project bank accounts, have to account for the funds to the Provincial Accounting Officers, to the accountants ultimately in the Ministry of Finance, and also to the donor organization.

In some provinces, the control of funds by the ARPT Provincial Coordinators, who are mainly expatriates, has created tension with some Zambian team members. They have considered that they have had insufficient involvement in deciding how the funds should be spent. Some Zambian team members have said that unless they are given responsibility from an early stage, it will be difficult for them to manage ARPT's finances when the expatriate personnel depart. The use of donor administrative and budgeting procedures further reduces the opportunities for Zambian staff to gain experience in running a fully institutionalized team.

There has generally been no serious problem for teams wishing to move funds between items on the agreed budget, provided that the variation remains within the original ceiling. The practice of moving funds has been frowned on, and approval has to be sought from MAWD, but it has been possible. The annual reviews of most donor projects have also been quite positive in supporting not only variations in original budgets, but also in obtaining additional funds.

7.5. Timeliness and Availability of Funds

No really serious problems with the timing of releases of donor funds have occurred, although on a few occasions the donor or Government were slow in completing necessary paperwork and, as a result, funds were not available on time. On such occasions the

Table 38: ARPT Eastern Province Expenditure 1982 - 1985[1]

Kwacha in 1980 prices

	1982	1983	1984	1985
A. Capital Costs				
Vehicles	8,029	3,390	141	-
Housing	-	6,973	1,978	-
Furniture	-	117	882	-
Laboratory equipment	1,078	-	-	-
Total capital costs	9,107	10,480	3,001	-
B. OPERATING COSTS				
Salaries, wages & overtime*	1,586	5,202	13,970	12,440
Stationery	450	146	85	585
Fuel, oil and kilometer allow.	2,630	2,387	4,571	4,379
Field requisites	593	2,847	951	1,476
Subsistence allowance	2,745	1,510	2,801	6,135
Repairs and maintenance	713	7,039	1,342	5,828
Total Operating Costs	8,717	19,131	23,220	30,843
T Capital & Operating Costs	17,824	29,611	26,721	30,843
Operating Costs as % of T Costs	49	65	89	100
Estimate of ARPT Salaries	50,702	49,804	45,518	36,047
GRAND TOTAL (incl. salaries)	68,526	79,415	72,239	66,890
Expat. salaries as % of GT	68	54	54	46

Notes: * Includes only wages of casual workers.
1 Expenditure has all been provided by the EPAD Project funded by IBRD/IFAD.
Source: EPAD Project Management Unit

Table 39: ARPT Luapula Province Expenditure 1982 - 1985[1]

Kwacha in 1980 prices

	1982	1983	1984	1985
A. CAPITAL COSTS				
Housing	31,201	79,201	16,826	-
Laboratory building	-	-	-	4,940
Vehicles	32,761	11,082	-	15,810
Motorcycles	-	-	-	-
Office equipment	-	5,218	-	-
Laboratory equipment	-	1,304	25,517	24,703
Spare parts	-	-	-	3,953
Total Capital Costs	63,962	96,805	25,517	24,703
B. OPERATING COSTS				
Salaries and wages*	-	3,963	4,579	3,884
Subsistence allowance	780	4,027	4,579	6,052
Fuel and oil	1,560	12,588	6,808	11,545
Field requisites	780	2,890	1,945	2,611
Repairs and maintenance	-	7,314	4,487	5,950
Stationery	-	3,444	1,082	1,447
Total Operating Costs	3,120	34,226	23,482	31,489
Total Capital & Operating Costs (A+B)	67,082	131,031	48,999	56,192
Oper. Costs as % of Capital + Operating	5	23	52	44
Estimate of ARPT Salaries	9,750	54,367	91,146	97,272
Grand Total (including ARPT salaries)	76,832	185,398	140,145	153,464
Operating Costs as % of Grand Total	4	18	17	21
Expatriate Salaries as % of Grand Total	10	26	60	59

Notes: * Includes only wages of casual workers.
1 Expenditure has all been provided by SIDA.
Source: ARPT - Luapula Province quarterly reports

(Kwacha in 1980 prices)

Table 40: ARPT - Lusaka Province Expenditure 1981 - 1985

	1981		1982		1983		1984		1985	
	Zambian Contrib.	CIMMYT Contrib.	Zambian Contrib.	CIMMYT Contrib.	Zambian Contrib.	CIMMYT Contrib.	Zambian Contrib.	CIMMYT Contrib.	Zambian Contrib.	CIMMYT Contrib.
A. CAPITAL COSTS										
Vehicles	12,406		9,147	11,116	-	1,337	-	-	-	-
Motorcycles	2,979		-	-	-	-	-	-	-	3,953
Office furniture & renovations	2,193		-	2,457	-	1,014	584	867	-	480
Medium-cost housing	-		-	-	24,117	-	-	-	-	-
Subtotal - Capital	17,578		9,147	13,573	24,117	2,351	584	867	-	4,433
Total Capital (Zambian + CIMMYT)	17,578		22,720		26,468		1,451		4,433	
B. OPERATING COSTS										
Wages and allowances*	3,007			1,087	347	4,907	1,298	7,404	949	1,821
Fuel, oil and kilometer allowance	2,620			6,428	7,019	2,212	2,369	5,696	540	687
Repairs and maintenance	558			543	669	1,417	1,398	881	868	138
Field requisites	365			977	425	243	940	338	101	52
Stationery	424			975	651	1,107	285	760	666	1,091
Bank charges	-			70	-	-	-	296	-	44
Subtotal - Operating Costs	6,974			10,080	9,111	9,886	6,290	15,375	3,124	3,833
Total Operating Costs (Zambian + CIMMYT)	6,974		10,080		18,997		21,665		6,957	
Subtotal Capital + Operating Costs	24,552		9,147	23,653	33,228	12,237	6,874	16,242	3,124	8,266
Total Capital + Operating (Zambian + CIMMYT)	24,552		32,800		45,465		23,116		11,390	
Operating costs as % of Total Costs	28		31		42		94		61	
CIMMYT as % of Total Costs	0		72		27		70		73	
Estimate of ARPT salaries	4,650		30,615		29,790		27,548		24,584	
GRAND TOTAL (including ARPT salaries)	29,202		63,415		75,255		50,764		35,974	
Expatriate salaries as % of grand total	0		37		29		39		46	

Notes: * Includes only wages of casual workers.
Source: ARPT - Lusaka Provinces quarterly reports.

Table 41: ARPT Expenditure in Selected Provinces 1981-1985 (1)

(Kwacha in 1980 prices)

Province	1981	1982	1983	1984	1985	Total	Average Provincial Expenditure
Eastern	-	21,724	36,390	33,130	36,060	127,304	31,826
Luapula	-	69,032	137,810	55,408	62,634	324,884	81,221
Lusaka	29,202	40,990	53,743	31,209	19,374	174,518	34,904
Total	29,202	131,746	227,943	119,747	118,068	626,706	156,677
Annual Average Expenditure/ Province	29,202	43,915	75,981	39,916	39,356	N.A.	52,226

Notes: (1) Figures include capital, operating costs and salaries of Zambians, both professional and Trials Assistants.
Salaries of expatriate staff are excluded.

Table 42: Breakdown of Average Annual Expenditure by ARPT in Eastern, Luapula and Lusaka Provinces (1982-1985)

(Kwacha in 1980 prices)

	Eastern Amount	% (2)	Luapula Amount	% (2)	Lusaka (1) Amount	% (2)	AVERAGE Amount	% (2)
Capital Costs	5,647	8	52,747	38	14,530	29	24,308	28
Operating Costs	20,602	29	23,079	17	12,935	25	18,872	22
Salaries - Actual (3)	45,518	63	63,134	45	23,457	46	44,036	50
Salaries - if fully Zambianized (4)	11,976	N.A.	11,976	N.A.	11,976	N.A.	11,976	N.A.
Total (with actual salaries)	71,767	100	138,960	100	50,922	100	87,216	100
Total (when Zambianized)	38,225	N.A.	87,802	N.A.	39,441	N.A.	55,156	N.A.

Notes: (1) Expenditure in Lusaka Province based on average for 5 years (1981-85).
(2) % of total, based on actual salaries.
(3) Actual salaries include Zambian and expatriate salaries.
(4) Salaries for ARPT, when fully Zambianized, assumes the team includes 3 professionals and 3 Trials Assistants, using salaries for 1985.

Expatriate staff have usually been prepared to meet certain expenses themselves and to make reimbursement claims when the funds have been released. Similarly, when equipment, such as vehicles and computers, has not been available, expatriate staff have been prepared to use their own resources, thereby ensuring that the work has been undertaken.

The availability of donor funds for ARPT in Central Province was seriously hindered when all payments had to be made through Lusaka, some 150km away from the team. The problem was solved when a project bank account was opened in Kabwe, the Provincial Capital.

There have been problems with erratic releases of funds from GRZ, and sometimes large releases have been made within one or two weeks of the accounts being closed at the end of the financial year (ref. section 2.IV.1.3.5). Project bank accounts have been a helpful mechanism for counteracting this problem, because funds deposited in the accounts are not returned to the Ministry of Finance at the end of the year. The provincial ARPTs have thus been able to spend the money as needed, rather than rushing to spend it before the end of the year.

7.6. Vulnerability of ARPT Funding

ARPT has had few problems with funding, but only because it has been so heavily supported by external donor funding. Most donors have been pleased with their investment in ARPT, and second phases of support have been planned in three provinces. However, some donors, such as CIMMYT, have very limited funds, which they use to help new projects get established. Thereafter, they assume that the Government will take over financial responsibility. Senior research managers have expressed concern about the future funding of ARPT, when and if donor monies are not available. However, the prospects for long-term financial support by donors are reasonably hopeful, with new long-term donor projects just about to begin.

The general strategy of those provincial ARPTs which have relied quite heavily on Government funding has been to diversify their sources of funding. Thus in the case of ARPT in Lusaka Province, besides Government funding, the team has turned to CIMMYT, IDRC and to the PAO's provincial capital research vote.

8.0. Management of Field Operations

8.1. Target Area Selection

The selection of Target Areas and farming systems in which ARPT is working is an important decision, which should be made locally. Until the ARPT Provincial Committees were established, these decisions were made on a rather ad hoc basis by the provincial ARPT staff in consultation with the PAO, and possibly the ARPT NC. In provinces where ARPT has recently started work, such as Northern and Southern, the ARPT Provincial Committees have taken a very active role in deciding the areas where the Team should work. However, even with the ARPT Provincial Committees, the criteria used to select Target Areas were not always technical. Logistical factors, such as availability of accommodation and transport, distance and accessibility of the area, have also been important criteria.

Examples from three provinces illustrate of the criteria used. In Western Province, logistical criteria predominated decision making whereas in Luapula Province logistical and developmental criteria were both important. In Eastern Province the approach has been rather different because, although there are three Target Areas, the FM/FI type trials have been scattered across the province (ref. section 3.III.).

It is interesting to note that in several areas, such as Mabumba and Mabo in Luapula province and Chipapa in Lusaka province, specific villages were selected, with little consideration of the farming systems they represented. This occurred because in some provinces ARPT started conducting trials before the farming systems had been demarcated. Most agronomists in ARPT have wanted to have trials in the ground as soon as possible, thinking that agronomic observation can accompany trials. However, as the program has evolved, several agronomists have begun to place much more emphasis on developing a thorough understanding of the natural environment through careful agronomic observations, with less emphasis, at least initially, on conducting trials.

There have been a few cases of teams selecting two Target Areas within one farming system in order to incorporate secondary levels of variation, such as differences in soil type. In one farming system in Eastern Province, for example, there are two Target Areas to cover the differences between lighter and heavier soils.

8.2. Overview of Managing the Trial Program

ARPT has conducted an increasing number of on-farm trials, although the proportion of on-farm trials within the total program has remained relatively constant (Table 43).

Table 43: ARPT Trial Program 1981/82 to 1985/86

	1981/82	1982/83	1983/84	1984/85	1985/86
On-station trials	3	18	23	38	41
On-farm trials:					
Researcher-managed[1]	5	19	24	33	47
Farmer-managed	-	2	8	12	19
Total on-farm	5	21	32	45	66
Total number of trials	8	39	55	83	113
On-farm trials as % of total	63	54	58	54	58
Farmer-managed as % of total	0	10	25	27	27
Number of farmers	35	174	238	208	371

Notes: [1] Researcher-managed trials include: Research-Managed/Research-Implemented and Research-Managed/Farmer-Implemented

The number and relative proportion of farmer-managed trials has only increased gradually, largely because of the lack of new technologies

ready for testing (Table 43). Also, a few agronomists have not had much experience in designing and managing farmer-managed trials and, consequently, have used trials with greater researcher control. It should be noted that the number of farmers involved in the ARPT on-farm trial program has increased from 35 in 1981/82 to 371 in 1985/86 (Table 43).

Table 44 indicates that for Central and Luapula Provinces, the average number of sites per professional team member has been around 11 or 12. Of course, in practice the agronomists do most of the supervision of trials, but as more of the trials have become farmer-managed, the RELOs have assumed a larger share of the work. In Eastern Province, trial management has been quite different. The number of trial sites per ARPT professional has been around 40 because the agronomist has relied heavily on extension-managed trials (ref. section 3.III.3.1.).

Table 44: On-Farm Trials* and ARPT Staff

	1982/83	1983/84	1984/85	1985/86
Central Province				
No. of On-farm Trials	7	10	8	11
No. of Trial Sites	35	51	48	65
ARPT Prof. Staff	5	5	3	5
ARPT Trials Assistants	3	3	3	3
Av. No. Sites/Prof. staff	7	10	16	13
Av. No. Sites/TA	12	17	16	22
Eastern Province				
No. of On-farm Trials	6	8	14	18
No. of Trial Sites	88	110	74	83
ARPT Prof. Staff	2	2	3	2
ARPT Trials Assistants	2	2	2	2
Av. No. Sites/Prof Staff	44	55	25	41
Av. No. Sites/TA	NA	NA	NA	NA
Luapula Province				
No. of On-farm Trials	4	6	11	13
No. of Trial Sites	17	30	45	60
ARPT Prof. Staff	2	3	4	6
ARPT Trials Assistants	2	2	3	4
Av. No. Sites/Prof. Staff	8	15	11	10
Av. No. Sites/TA	9	15	15	15

Notes: * The on-farm trials include those managed by researchers and farmers.

Agronomists have expressed some concern that the number of trial sites and their scattered distribution has resulted in inadequate supervision at times. However, loss of trial sites has not been a serious problem. In Luapula Province, the agronomist reported losing about two sites per season. In Eastern Province, the proportion was much larger, about 35% , in the first years when extension workers were managing the trials, but it has declined to about 15% for the trials managed by the TAs in the Target Areas.

The number of trial sites per TA in Central and Luapula provinces has been around 15 (Table 44). The agronomists have been generally satisfied with the work quality of the TAs. Some have expressed concern that with the scattered distribution of trial sites, supervision by the TAs has not been as frequent as is desirable. They thought that TAs should visit trial sites 1 to 2 times per week, whereas, in practice, they had sometimes been visited less than once a week. The agronomists did not think that the TAs had time to handle large programs of data collection. This is why, in Central and Luapula Provinces, the team has recruited temporary enumerators to collect data.

8.2.1. Farmer Selection - Clustering of Trial Sites

From the beginning, ARPT has tried to use the principle of selecting farmers in clusters from within the Target Areas; usually three clusters per Target Area, which are on average 40km in diameter. This has been done in order to minimize logistical problems and enhance supervision.

Unfortunately, in most provinces ARPT has faced problems with selecting trial farmers who have been both representative of the community and had fields within close proximity to one another. This has resulted from the methods used to select farmers, and an underestimation of the difficulties involved (ref. section 4.I.3.1.). By leaving selection of trial farmers in the hands of the community or extension workers, ARPT has ended up with not only rather atypical farmers, but also with farmers widely scattered throughout the clusters. The distances between trial sites within a cluster have been as much as 3 or 4km. Consequently, if a farmer is away from the farm on the day of a scheduled visit by a TA, it has not been easy for the TA to simply go and visit another farmer.

In the light of these problems, the teams, in most provinces, have come to take a much more active role in farmer selection and have introduced more rigorous methods for selecting farmers. By the 1986/87 season, several teams had completely changed the farmer selection procedure, such as in Central Province, where 90% of the trial farmers selected were new. In some provinces, such as Luapula ARPT has had to change farmers more gradually, to avoid discontent among existing collaborators. The need for tighter clustering of trial farmers has been fully recognized and in most provinces steps have been taken to ensure that this happens.

8.3. Communications

The administration of ARPT has been hindered at all levels, in one way or another, by communication problems.

8.3.1. Communication between ARPT Provincial Teams and Lusaka

Staff in the Provincial ARPTs have to communicate with and visit Lusaka, to attend meetings, to collect project funds, and to purchase many items not available in the provincial centers. Most of the provincial research stations, are 600km from Lusaka, and in some cases 850km. The telephone system between Lusaka, the Central Research Station, and some research stations is unreliable. Mail

delivery to the more remote research stations can take up to three weeks. The long distances, poor road quality and unreliable telephone systems in some provinces have been costly in time, in travelling, and in wear and tear on the vehicles.

The provincial teams have taken various steps to minimize the communication problems. They have reduced the number of trips to Lusaka by combining visits for different purposes, when early planning has been possible. They have also tried to purchase their annual requirements during a single visit, which has necessitated keeping large stocks. The ARPTs in Central and Luapula Provinces have installed shortwave radios to keep in daily contact with the ZAMARE Chief of Party and SIDA. From their experience, the location and maintenance of the radios needs to be given careful consideration, to ensure that someone will be at the other end to answer calls.

8.3.2. Communication between ARPT Professional Staff and Trials Assistants

To fully understand the relationship between provincial ARPT staff and TAs it is necessary to consider not only the frequency but also the quality of communication. The interaction between the team and TAs has mainly been perceived from the point of view of ensuring adequate supervision of the trials. In this respect interaction has been quite effective.

For communication of ideas and participation by TAs in decision-making, however, the level of interaction has been less effective. Very few of the TAs interviewed considered that they had participated in planning the team's program since they had not attended any formal planning meetings. Furthermore, few teams have made much effort to communicate and discuss the trial results to the TAs, even though the TAs usually have had to explain the results to farmers. The problem is still one which needs greater attention.

Most ARPT agronomists interviewed reported that they tried to visit the TAs in the Target Areas at least once a fortnight during the critical period when the trials are planted. Thereafter, they have tried to visit the trials once a month, although this has not always been possible with the more distant Target Areas. Most of the agronomists would have liked to visit the trial sites more frequently, but in general they did not consider that the program had been adversely affected by lack of supervision. They acknowledged that the TAs had generally been able to take the right decisions, when required.

The facilities for communication between the ARPT scientists and the TAs have varied, both between provinces and between Target Areas within each province. The communication systems, in most cases, have been quite difficult. Most TAs have not had access to telephones and have had to rely on chance lifts to take them to the research station to communicate with the professional staff. Tables in the provincial case studies (Tables 26, 29 and 32) indicate the range of distances and times taken to reach the Target Areas in those three provinces.

In Central Province the TA 300km away from the team has been able to communicate with the team by telephone or police radio. However, in the same province the TA some 50km distant from the research station has had great difficulties communicating with the team and has usually had to wait for transport to take him to the provincial center.

In Luapula province communications have been most difficult with the TA based in Mukunta Target Area, some 300km away from the station. The trip can take 10 hours during the rains, and there is no telephone system between Mukunta and the research station. In addition, there are no guest houses or Government rest houses in the area, which means that there is nowhere for staff visiting the TA to stay, except in the TA's house. Despite these problems, the team has managed to continue visiting the area, although with less frequency, and the staff have endured considerable hardships in the process. The work program has not really suffered, due largely to the high caliber of the TA in Mukunta, who has taken initiative in making decisions about the trial management.

8.3.3. Communication within the Target Areas

Communications with the Target Areas have generally not been difficult, except when the TA's motorcycles have broken down. In Eastern Province, problems with repairs and lack of two-stroke oil kept the TA's motorcycle off the road for more than a month. This caused problems in site supervision because it took him almost 6 times longer to travel to clusters by bicycle. In Lusaka Province, after chronic problems with the TA's motorcycle, the team decided to move the trial sites to within walking distance of the TA's house. With the general move towards closer clustering of farmers, the distances will be reduced and communication problems should be minimized (ref. section 4.I.3.1).

8.4. Transportation

There should be one four-wheel-drive vehicle available for each disciplinary section in ARPT, with equal access for Zambian and expatriate team members. Virtually all donors have provided such vehicles, including motorcycles for the TAs. In all but two provinces, the vehicles have been registered with Government rather than private license plates. The team members are permitted to drive the vehicles when they have obtained a Government Certificate of Competence. However, most team members prefer to recruit their own drivers because it is less tiring, and the drivers can do some simple maintenance. Responsibility for the day-to-day use of the vehicles is vested in the ARPT Provincial Coordinators, although in some provinces the routine allocation of transport has been delegated to other team members. Every journey is recorded in the vehicle logbooks.

Several problems have limited the availability of transport to team members. First, there have been delays in the procurement of vehicles. Second, some vehicles have been damaged and even written off in accidents. Third, some vehicles have frequently broken down and have been continually in workshops. This problem has been most severe in Luapula Province, where the roads are in poor condition

and the life expectancy of vehicles is barely two years. Fourth, one vehicle has also been stolen. Fifth, fuel, especially diesel and two-stroke oil, has not always been readily available in the provincial capitals.

In the light of these problems, the provincial teams have adopted a number of strategies:

i) The team members have had to plan their travelling more carefully, reserving transport for the most important programs.
ii) In some provinces, where the teams have cultivated good relations with other projects, they have been able to borrow vehicles.
iii) In provinces where ARPT has been part of a larger donor project, the teams have usually managed to obtain transport from other sections of the project
iv) Many of the expatriate team members have also used personal vehicles for work and have claimed kilometer allowance from the project.
v) Teams have tried to have the vehicles maintained regularly and have kept large stocks of spare parts. More teams are trying to purchase large quantities of spare parts when the vehicles are purchased.
vi) The teams have tried to standardize on the vehicles being used, to help simplify the keeping of spares and enabling parts to be exchanged between vehicles. The teams have also tried to purchase strong vehicles suited to the rough conditions off the paved roads.
vii) In an attempt to ensure that they have always had sufficient fuel, some provincial teams have made bulk purchases with local filling stations or have had bulk deliveries placed in tanks at research stations.

In several provinces there has been a problem with the relative availability of transport for Zambian team members. Some Zambians have felt that they have not had the same degree of access to vehicles as the expatriates, who have tended to control vehicle use. The expatriates consider that access has been equal but in some cases, they have been concerned about vehicle misuse. Most friction has arisen over personal vehicle use. In some cases, even though the expatriates have private cars, the donors permit them to use project vehicles if they pay for fuel. However, the Zambian staff don't have personal vehicles, and with most research stations several kilometers from towns, they need transport to do shopping. No completely satisfactory arrangement has been found, but flexibility by the expatriates and demonstrated responsibility by the Zambians have helped to reduce the conflict. This has been less of a problem in provincial teams where, besides donor-purchased vehicles, there have also been Covernment-purchased vehicles.

Maintenance of Government vehicles is the responsibility of the Mechanical Services Department, but in most provinces lack of spare parts has prevented effective servicing. Some research stations have workshops with the facilities to do routine maintenance, as long as spare parts and materials are provided. In some cases, however, provincial teams have had to go to private workshops in the provincial capitals. When that has failed, vehicles have had to be serviced in Lusaka or on the Copperbelt, which has been both costly

and time consuming. Even the local dealers are sometimes without basic spare parts, which has meant that most teams have tried to maintain sizeable stocks of spares.

The TAs, in most provinces, have had motorcycles, most of which have been registered as Government vehicles. They have had to obtain Government Certificates of Competence to ride the motorcycles and, they are required by law to wear crash helmets. The team has been responsible for supplying fuel to the TAs. The TAs have been able to do simple maintenance on the motorcycles, and in some provinces local mechanics undertake annual servicing. However, when major repairs have been necessary, the teams have had to take the motorcycles to the dealers in Lusaka. Availability of spare parts has also been a problem. When the motorcycles have broken down, the TAs have usually had to travel on foot or bicycle. The problem of maintaining motorcycles, has been one of the reasons why most teams have started selecting trial farmers living closer to one another.

8.5. Housing in the Field

The ARPT scientists in most provinces are housed at the research stations. Accommodation for all levels of staff has been in short supply at most stations. This has induced all of the donors supporting ARPT to build a number of high-, medium- and low-cost houses at the stations.

Having the TAs living in each Target Area has helped the team to build closer links with both extension workers and farmers in the local communities. In two areas the chiefs and local farmers have helped the TAs to find temporary accommodation. There has been no resistance by the TAs to living in the Target Areas because it is the kind of situation most of them were used to as LEWs, before they joined ARPT. To avoid depriving the Extension Branch of houses, ARPT builds appropriate housing for the TAs. In Luapula Province ARPT has built two prefabricated houses, and in one of them they have installed electricity, as an incentive for the TA to continue his good work.

8.6. Supplies of Inputs for On-Farm Research

The Provincial ARPTs supply the TAs with the inputs necessary for conducting the trials usually seed and fertilizer. There have been problems with the arrival of these supplies only when the teams have had transport problems. Some of the CSRTs have been late in supplying seed when it has had to be multiplied during the dry season.

Some of the inputs have been taken directly to the field by the team, without the TAs having to store them. When inputs and field equipment have needed to be stored, the TAs have usually kept them in their houses, because very few TAs have offices or stores.

CHAPTER FOUR

ANALYSIS OF ARPT'S INTERACTION WITH FARMERS, CSRT SCIENTISTS AND EXTENSION WORKERS

I. MANAGEMENT OF FARMER PARTICIPATION IN ARPT'S ACTIVITIES

1.0. The Importance of Farmer Participation in ARPT's Activities

Most ARPT scientists would agree with the ARPT Provincial Coordinator in Luapula Province that the overall reason for involving farmers in the research process is to ensure that the research program "keeps in the right direction". ARPT staff, in general, consider that although there has been moderately good farmer participation in ARPT's activities, more could be done to involve them more fully. Some provincial ARPT's consider this issue to be an area for priority attention.

How important has farmer participation been in guiding the direction of the ARPT research program? Two indicators help to make an assessment: 1) examples of how farmers' comments have been used to shape ARPT's program; and 2) the farmers' level of understanding of ARPT's role and the objectives of specific trials.

1.1. Use of Farmers' Comments to Shape ARPT's Program

Farmers' assessments of on-farm trials have been useful in three ways. First, when positive, the technology has proceeded from an on-farm trial into more wide-spread on-farm test demonstrations. Second, they have resulted in the modification of treatments in on-farm trials. Third, the assessments have led ARPT to discontinue work and/or pass the problem on to CSRTs. Examples follow.

1.1.1. Positive Assessments

a) In Central, Eastern, Luapula and Western Provinces, farmers commented favorably about several different maize varieties, both hybrids and composites, some of which are shorter in duration than material previously available. As a result of these comments, supported by statistical and economic analysis, these varieties have gone into test demonstrations.

b) In the valley system of Eastern Province, farmers commented positively about the "Steadfast" variety of finger millet. It had larger heads than the local variety and was judged to be acceptable for food. Farmers in Eastern Province were also in favor of the "Carioca" bean variety, and this has gone into wider testing.

c) In Luapula Province, farmers in one area have agreed that the reduction of the bean seeding rate, together with one weeding, has produced significant benefits, and this has proceeded into more widespread demonstrations.

1.1.2. Farmers' Assessment Modifying Trial Treatments

a) In a system in Central Province, the farmers questioned the wisdom of planting beans in flat seedbeds because of waterlogging and convinced the team to plant the trial on ridges. Farmers also disliked a treatment in a maize/bean intercrop trial, because beans planted between maize rows slowed weeding, and so it was dropped. Also in Central Province, the team included a fertilizer treatment on a finger millet trial, after some farmers explained that it was their practice to fertilize on certain field types. Farmers had also requested more work to be done on maize and soybean varieties, and so the ARPT conducted some observation trials.

b) In Eastern Province, farmers' comments about weeding maize led ARPT to change its control plot of simulated farmer practice from one to three weedings. Farmer preference for maize and sorghum varieties that stored well was observed by the team and the information was passed on to the two CSRTs.

c) In Luapula Province, the idea to focus the maize/bean intercrop trial specifically on improving the nutritional status of small-scale commercial farmers came from discussions with both small-scale and subsistence farmers. It became clear that the small-scale commercial farmers, unlike subsistence farmers, were no longer intercropping.

The ARPT in Luapula Province has not always agreed with farmers' comments. For example, the team had tested rice transplanting compared with the farmers' practice of broadcast seeding. At first farmers either dropped out or complained that transplanting was too laborious. However, the team continued with the trial, and the remaining farmers found that the advantages from transplanting were significant and interest has gradually increased.

1.1.3. Negative Assessments Resulting in Trials Being Discontinued

a) When a poorly fabricated rotary jab planter was tested on farms in several provinces, it gave highly variable seeding rate and depth. Farmers' comments were also very critical. In the light of these comments and poor trial results, the work was discontinued, pending the arrival of a Farm Machinery and Tillage Research Team.

b) In Luapula Province, the team had found that it is possible to grow finger millet on permanent fields using fertilizer rather than using shifting cultivation, chitemene. However, women farmers said that they would refuse to give up chitemene because, in the event they were widowed or divorced, the chitemene fields would be their property. Also in Luapula Province, an open-pollinated variety of maize called ZUCA, was dropped from a variety trial in one area because farmers complained that the plant was too tall, the cob size was uneven and the variety was very prone to streak virus.

1.1.4. Modifications to Trial Design

The ARPT in Central Province was aware that farmers found certain trial designs too complicated to understand. On one occasion farmers' comments about a maize weeding trial resulted in the agronomist changing the trial design.

1.2. Farmers' Level of Understanding about ARPT

Another useful way to see the effect of farmer involvement with ARPT has been to determine their perception of the role of ARPT and their level of understanding of the trials they have been helping to carry out.

1.2.1. Farmers' Understanding of ARPT's Role

Interviews with farmers showed that none had any idea of the organizational structure of the Research Branch and its different sections. In fact, most farmers did not distinguish research from extension, and assumed that the ARPT staff were simply part of the Department of Agriculture. Most farmers knew about the Department of Agriculture because of their dealings with local extension workers (LEWs). However, some Trials Assistants said that it had taken most farmers a few years to realize that there was a difference between ARPT's work and that of the LEWs.

There are several reasons why it has taken such a long time for farmers to understand the difference between ARPT and extension. First, the trials have been managed by Trials Assistants, many of whom the farmers knew as LEWs. Second, ARPT has usually provided trial inputs free of charge, as several extension programs have done. Third, the limited involvement of farmers in the planning and design of trials has also contributed to their poor understanding of the trials. ARPT scientists in several provinces also considered that they had not spent enough time explaining the objectives of ARPT to farmers.

The farmers' perception of ARPT's role became a serious problem in one area of Luapula Province. Farmers had assumed that ARPT would be providing free inputs and credit, like some other programs in the Department of Agriculture. This misunderstanding created some resentment among farmers when ARPT did not make such provisions. But the team was sensitive to this resentment, and with the support of the local leaders they put a lot of effort into clarifying the role and objectives of ARPT. ARPT is much better understood now, and farmer collaboration is stronger.

Roughly half of the 13 farmers interviewed in the 3 case-study provinces realized that there is a difference between the work of ARPT and that of the LEWs. They perceived how the trials differed from extension demonstrations. About half of the farmers said that there were differences. The trials had more treatments than demonstrations, they needed closer supervision and more work, and they generally gave higher yields.

1.2.2. Farmers' Understanding of Trial Objectives

When farmers were interviewed about the objectives and treatments of the trials they had conducted, about two-thirds of them were able to

explain the main features. However, farmers who had in some way participated in Research Managed/Research Implemented trials tended to have a less clear understanding of the trials' objectives.

2.0. Occasions for Interaction between Farmers and ARPT

An assessment of aspects of ARPT's performance in interacting with farmers is presented in Table 45. The information presented is based on an assessment of performance in the three provincial case studies. Table 45 provides an indication of the level of performance at each of the six principal occasions when farmers are able to interact with ARPT, either through direct participation or by making comments. The occasions listed roughly follow the sequence of ARPT's activities found in Chart 2.

Table 45: Level of Interaction between ARPT and Farmers

Activity	Degree of Interaction
Demarcation of farming systems	*
Surveys	***
Planning and pre-season discussion of trials	*
Participation in trials	**
Feedback of farmers' comments to ARPT	***
Feedback of results by ARPT to farmers	*

Notes: * Very Limited Interaction, ** Moderate Interaction, *** Good Interaction.

2.1. Demarcation of Farming Systems

A few farmers in a few provinces have been used as key informants to provide information which has been used to "zone" or demarcate the different farming systems in each province. They have been used more frequently in recent years, especially in provinces where ARPT has decided to recheck the original "zoning" undertaken.

2.2. Surveys

ARPT staff have made good progress in obtaining information about farmers' circumstances and hearing about their problems and preferences. Farmers in all provinces have been interviewed in many different surveys, ranging from informal surveys to detailed studies of income and labor flows. This information has been the backbone of ARPT's problem identification.

ARPT has seldom conducted trials until surveys of farmers have been undertaken. On two occasions, however, teams have drawn up research programs for farming systems without first conducting interviews. In those cases, the economist was either not yet in position or was dominated by the agronomist.

The farmers selected for surveys have not always been representative of the community from which they were drawn. The tendency has been to select the more wealthy, innovative male farmers, with whom it is easier to interact (ref. section 4.I.3.1.).

The farmers have never had an opportunity to make suggestions about survey methods or design used by ARPT.

2.3. Planning and Pre-Season Discussion of Trials

There have been no formal occasions when farmers could discuss the forthcoming season's trial program and have a direct input into its content and design. For this reason only a few farmers and TAs interviewed considered that farmers had any input into planning ARPT's trial program. However, some of the TAs and all of the ARPT staff were able to give examples of how farmers' comments, made on a wide range of occasions, have been incorporated into the trial program (ref. section 4.I.1.1.).

The research priorities identified through farm surveys have seldom been communicated back to farmers and have never been taken back for discussion. When ARPT in Luapula Province ranked its trial program in order of priority, it did not verify its ranking with farmers. The pre-screening stage in CIMMYT's approach could be adapted to include some formal assessment of research priorities by farmers. The ARPT Senior Sociologist has suggested that this could be done by making use of both traditional forums and occasions such as T&V group meetings (Sutherland, 1986).

In several provinces formal meetings have occasionally been held with farmers just before the start of the season, but these were to explain the next season's trial program. These meetings have usually been initiated by the TAs, since most ARPT researchers regard this task as being the TA's responsibility. The emphasis at these meetings has been on explanation, rather than on gathering farmers' comments for use in modifying the trials. Although most provincial ARPTs had examples of such meetings, some even with the scientists present, none could give examples of the trial program being changed because of feedback from farmers.

2.4. Participation in Trials

Farmers' involvement in trials has been moderate. Although the number of farmers hosting on-farm trials increased from 35 in 1981/82 to 371 in 1985/86 (Table 43), farmers have not had a major role in the management or implementation of trials. Most trials have been managed by the ARPT agronomists, with TAs carrying out much of the implementation. Farmer involvement, however, has increased over time. The number of on-farm trials managed by farmers has increased from 10% in 1982/83 to a maximum of 29% in 1985/86 (Table 43, section 3.IV. 8.2).

In Central, Eastern and Luapula Provinces, the majority of ARPT's trials have until recently been Researcher-Managed/Researcher Implemented (RM/RI), either on-station or on-farm (Tables 28, 31 and 34). Farmers have had little involvement in these trials, either in terms of providing physical inputs or comments about the results. Farmers have provided land, site protection, and some labor, while ARPT has provided most other inputs, including most of the labor. In Eastern Province, for example, the agronomist takes a team of laborers from the research station to undertake operations at on-farm trial sites.

Approximately 30% of ARPT's trials have been Researcher Managed/ Farmer Implemented (RM/FI). In these trials, farmers have been expected to contribute more to the trials and participate more fully in discussion of the results (Table 43). Farmers have provided land and most of the labor, while ARPT has provided other treatment inputs. However, in some cases ARPT has provided quite a lot of labor as well, especially during planting, harvesting and fertilizer application. With RM/FI trials the TAs supervise the trial operations. In the case of a maize variety trial in Luapula Province, for example, the TA first showed farmers how to prepare the land, plant and apply fertilizer and then left the farmers to finish the operations.

There have been times in most provinces, however, when farmer participation in trial operations has been sacrificed in order to save trials. For example, one year in Central Province there was little time to harvest the on-farm trials before they were destroyed by termites, and so the agronomist reluctantly hired some casual laborers, foregoing the involvement of farmers.

The experience with Farmer Managed/Farmer Implemented (FM/FI) trials has been rather limited until recently, when more technologies have become available for testing under farmer-controlled management conditions. Obviously, the level of farmer involvement has been greater in these trials. ARPT staff have rarely provided any labor, although they have supplied the necessary treatment inputs. In Central and Eastern Provinces the FM/FI trials have tended to be left in the hands of extension workers, and have received less attention than other trials. Supervision has been better when there has been a RELO, but it has still been below that for other types of trial.

The TAs interviewed during the study did not consider that farmers would be more interested in trials if they had to provide a greater proportion of the inputs. This was in keeping with other comments that farmers appreciated receiving the trial inputs and, in some cases, complained that the trial plots were too small.

2.5. Feedback of Farmers' Comments to ARPT

Feedback of farmers' comments to ARPT about trials has been good in general. Farmers' comments appear to have been taken seriously and to have influenced the trial program (ref. section 4.I.1.1.). The format for the provincial ARPT annual reports also contains a section for farmer comments about the technologies under trial, and most teams have cited examples of helpful comments made by farmers.

Farmers' comments have reached ARPT scientists through a variety of ways, which can be divided into two channels: formal occasions and informal visits. Opinion among ARPT scientists and TAs is equally divided about which is the most effective means of receiving farmers' comments.

2.5.1. Formal Occasions

In most provinces, farmer field days have been the principal formal occasion for farmers to make comments about the trial program. These meetings have usually been held once a season and are

considered by most provincial ARPTs to have been very useful. The numbers and types of people attending has varied from area to area, but in general 30 to 40 trial and non-trial farmers meet in each Target Area. Local leaders, political and traditional, have played an important role in field days held in some provinces. Several useful modifications have been made to the way in which the field days have been organized. These are outlined in section 4.I.3.5.

Some provincial ARPTs have experimented with additional feedback mechanisms. In Luapula Province, the team holds a meeting in the Target Areas at the end of each season to enable the trial farmers and a few local leaders to discuss the trial results. The team prepares handouts describing the season's results in English and Bemba, the local language. The TAs organize the meetings and present the results, although the ARPT scientists are in attendance. The LEW takes a record of the meeting, which is chaired by the local Block Supervisor.

In Eastern Province, ARPT has benefited from the feedback provided from the T&V system in those areas where demonstrations and on-farm trials have been conducted by extension. The farmers' comments have been raised at farmer group meetings and then passed on to the District Training Teams by the LEWs. The District Training Teams, in turn, have passed the comments on to provincial-level SMSs, from where they are relayed to ARPT. This channel of communication and the discipline of the system have improved feedback considerably (ref. section 4.III.5.7). When the selection of contact farmers is improved to ensure that farmers are more representative, greater use could be made of them as trial collaborators.

2.5.2. Informal Visits

The ARPT scientists, especially the agronomists, visit the trial sites quite frequently during the season, as often as once every two weeks at critical times. The ARPT scientists usually make a determined effort to speak with farmers when they visit the trials, in order to discuss the farmers' opinions about the trials. These provide valuable opportunities for feedback, which some teams rank above formal occasions.

The Trials Assistants visit the trial farmers on average once every two weeks, and at critical times even more frequently, depending on the number of sites and the TA's mobility. From the information collected during interviews with TAs, farmers and LEWs, it seems that the TAs make a genuine effort to speak with the trial farmers on each occasion. As a result, the TAs are frequently in contact with farmers and are able to follow the farmers' views about the trials throughout the season. TAs in Luapula Province found that a useful method for soliciting farmers' comments was through informal meetings of one or two trial farmers, together with a few non-trial farmers.

Although the TAs are also in relatively frequent contact with the ARPT scientists, approximately every 2-3 weeks during the peak periods, the weak point in the communication link is the frequent failure of TAs to systematically report farmers' comments. The TAs have logbooks, but they are sparsely used. The problem stems from the team not giving sufficient emphasis to the need for TAs to promptly record the farmers' comments.

2.6. Feedback of Results by ARPT to Farmers

Feedback of ARPT's results to farmers has been limited. On virtually no occasions have the results of surveys been discussed with farmers, but in occasional years some of the ARPT scientists have arranged meetings to discuss the trial results with farmers.

In Central Province the team held farmer group meetings at the end of the season for two years and then abandoned them, partly because communication about technical matters in the vernacular was very difficult for the expatriates. So the team decided that the responsibility for the feedback of trial information to the farmers should rest with the TAs. This has not been followed up systematically, however.

The general tendency in all provinces has been to leave the feedback to the TAs (ref. section 3.IV.8.3.). Some TAs have arranged formal meetings to discuss the season's results, sometimes combined with discussing the next season's trial program. In some cases, as in Eastern Province, a meeting has been held to discuss results, even though the ARPT scientists had not formally reviewed the results with the TA. If the TAs are to continue being the principal feedback medium, the team will have to make sure that the TAs are fully informed of the trial results themselves, otherwise the quality of feedback will be dubious.

3.0. Factors Influencing the Level and Quality of Interaction between Farmers and ARPT

3.1. Representativeness of Farmers

If farmers are to be involved in ARPT's activities, they must be representative of the farming community as a whole. If unrepresentative farmers are selected, it would be unreasonable and illegitimate to expect their comments to influence the research program to the benefit of most farmers. Thus, the first factor to consider in building effective interaction with farmers is the selection of truly representative farmers.

The selection of representative farmers to collaborate in surveys and trials was initially given very little attention by ARPT, largely because the difficulties of farmer selection were underestimated. In addition, the CIMMYT methodology and manual (Byerlee et al, 1980) which has shaped much of ARPT's methodology, also rather underestimates the problems involved in farmer selection. However, by the time of the ARPT Annual Review in 1985, four of the five working groups ranked the problem of farmer selection as being one of the top four problems requiring attention. The problem was also highlighted by an evaluation of ARPT in Central Province.

The worry of staff in several provincial ARPT's is that unduly large proportions of relatively wealthy, male, progressive farmers have tended to be selected to take part in surveys and trials. The ARPT Senior Rural Sociologist identified these and other potential biases and grouped the sources of bias into three main classes:

- bias arising from the locality under study, through the use of middlemen such as extension workers, local leaders, heads of households;
- bias arising from ARPT's internal characteristics favoring articulate, wealthy, and innovative male farmers;
- biases arising from logistical constraints within the program favoring, for example, farmers close to roads and administrative centers, "home-centered farmers" and those farmers who normally attend meetings (Sutherland, 1986).

The discussion which follows focuses on farmer selection for trials, although the comments are equally applicable for farmer selection for surveys. The selection of farmers to conduct on-farm trials has been the subject of more attention because, unlike the single visit made to farmers in most of ARPT's surveys, the team has tended to work with trial farmers over a number of years.

In the absence of a standard approach to farmer selection, each province has evolved its own approach. However, during the first two to three years the teams generally used one of two methods. The first was to use the LEWs to organize meetings of farmers, at which the ARPT trial program was discussed and volunteers were requested to act as community representatives. The second method was to ask the TAs and LEWs to recruit farmers, sometimes giving them certain characteristics the farmers should have. Both of these methods have been criticized for several reasons:

a) Experience has shown that social pressures within communities resulted in the more prominent, wealthy, male members, such as local leaders, being selected.

b) In those cases where LEWs and TAs were given the responsibility for recruiting farmers, there has been a tendency for more progressive and innovative farmers to be selected because in many areas, extension workers have spent most of their time working with these farmers (ref. section 4.III.5.6.).

c) These two methods ignored the location of farmers and their fields, with the result that trial farmers were widely scattered, resulting in logistic inefficiencies.

Each Provincial ARPT has responded differently to these general problems and has been assisted by the ARPT Sociology Section in finding ways to improve the selection process. The lessons learned have been quite varied in different provinces, and even within some provinces several approaches have been tried. For this reason experiences with farmer selection in three provinces will be briefly reviewed.

3.1.1. Luapula Province

The ARPT Provincial Coordinator in Luapula considers that after five years the team still has not found the best method of farmer selection, even though three different methods have been tried.

At first the team held group meetings of farmers, at which the team explained the trial program, and then the community itself would select representatives to host trials. No firm selection criteria

were used. As a result, mainly influential people (including witch doctors) and the most successful farmers were selected. This method also had the disadvantage that farmers were quite scattered.

The next method was to hold the same group meetings but to give the LEWs a greater role in the selection process. However, the same biases continued to be found because of the tendency for the LEWs to work mostly with the more progressive farmers who are frequently male.

The third method, tried for the first time for the 1986/87 season, has made use of the detailed household sample frame which was drawn up in two of the Target Areas. The sample frame has given the team an accurate, detailed picture of the characteristics of the communities in both Target Areas (Allen, 1987). Using this information, the team has set clear criteria for the desired characteristics of collaborating farmers, relating to the objective of each trial. The team has also specified that 50% of farmers selected should be female heads of households, in accordance with the proportion of such households within the community as a whole. The team also specified that the farmers should also be cooperative and willing to participate in the trial.

Eliminating unrepresentative farmers has been a problem in all three selection methods. Generally speaking, many farmers want to be selected to host trials in order to receive inputs and assistance provided to trial farmers. This problem was quite serious during the first two years, and it arose in part because ARPT was seen by many farmers as a "Government project" which should be assisting farmers on easy terms. The team has not completely resolved this problem, and in each area some farmers are continuing to host trials even though they are not representative. The team's attempts to improve farmer selection, including the reduction of distances between farmers and between clusters have, therefore, been only partially successful.

3.1.2. Central Province

In 1981 the first trial farmers were selected with considerable care and a report was produced on the procedure used. The team had seven criteria, to ensure that farmers were representative of the target group. These related to: area cultivated, draught power used, adequacy of family labor, production of maize, and receipt of credit. The team then went with the TA to the three clusters and selected nine farmers, including four women. Unfortunately, the team had given insufficient attention to the labor available in many households, and the team was obliged to provide much of the labor itself.

Most of the team had changed by the following year, and they used the group meeting method for selection. Subsequently, the team relied on the TA to find additional farmers. These procedures had the tendency to be biased in favor of relatively wealthy male farmers, some of whom were important figures in their community. These biases were reported in the USAID mid-term evaluation mission. They observed that in one system the team had the objective of increasing labor efficiency and spreading the labor peak. However, they noted that there were biases towards better-

endowed male-headed households. Thirteen (93%) of the 14 cooperators were male, four (27%) owned tractors, eight (53%) owned oxen, and three (20%) hired oxen or tractors. The average cultivated area for trial collaborators, at 9.5 ha, was four times greater than the 2.7 ha reported in the formal survey (ZAMARE, 1985). An important factor contributing to the selection of more progressive farmers was that, until 1985/86, most trials were RM/RI in nature. The larger farmers could generally be counted on to undertake the necessary operations on the trials. As the mid-term evaluation mission noted, "the reliability and receptiveness of more progressive farmers has tended to be seen as a valuable attribute... and representativeness of the target group is secondary" (ZAMARE, 1985).

The new team of USAID-funded personnel, arriving in 1986, were concerned that the trial sites had previously been too scattered for effective monitoring. They were also concerned about building closer links with farmers and helping more farmers to come in daily contact with ARPT's trials. For all these reasons, the team wanted to select trial farmers living more closely to one another, and they introduced the idea of using a "Community Perspective".

They surveyed each Target Area and found that the lowest political boundary, called a "section", was the most suitable unit to work with as a community. Each "section" is composed of 25 households. To select trial farmers, the TA collected information on all 25, including location of fields, and then the ARPT staff surveyed each field. Farmers were asked to indicate their willingness to participate in trials, and finally the objectives of ARPT and the details of the trial program were explained to them (GRZ MAWDb, 1986).

The team used this approach in 1986/87, and dropped virtually 80% of the previous trial farmers. It is still too early to assess how effective this approach will be, and there have been a few questions about why households within the same extended family have been selected as trial farmers. Other concerns have been expressed about the representativeness of the sections selected.

3.1.3. Lusaka Province

The ARPT agronomist, new in 1985/86, decided to change the farmer selection procedure, in consultation with the ARPT Senior Sociologist. For the previous four seasons, farmer collaborators had simply volunteered at group meetings organized by LEWs. There were two reasons for the change. First the agronomist considered the previous trial farmers to be unrepresentative. Second, it was uncertain that the TA would have a motorcycle: so it became important for the sites to be within walking distance of each other. The change was facilitated by the fact that the TA was new and did not have established relationships with previous trial farmers.

They decided to select farmers within 45 minutes walking distance of the TA's house. This would enable better relationships to be established with farmers, would reduce travelling time between sites, and would eliminate the TA's dependence on a motorcycle. A list of 15 villages within the camp area was compiled and five, within easy

walking distance, were selected. Basic data on these were collected by the TA. ARPT staff then interviewed all the households to verify the data on the household lists. During this process, household heads were asked if they would be willing to participate in the trial program. This verification took only one morning, together with identification of the three clusters to be used, on the basis of proximity of fields. The TA was left to draw maps showing proximity. To allow for attrition, one-third more farmers than actually needed were selected. Selection was made according to certain criteria, including access to draught power, gender and cropping history.

Overall, the selection procedure worked according to plan, with a rapid selection of a relatively large number of representative farmers in a short period of time. The main problem encountered was farmers who dropped out during the implementation of the program; 16 out of 40 failed to plant the trial. The problem was serious for those relying on others to assist with plowing, and was exacerbated by a prolonged wet spell, which encouraged weed growth. The team considered that more time could have been spent collecting background information, particularly with regard to location of fields in relation to dwelling, and the scattering of fields. Additional information on cropping histories and competing activities would also have been useful (Sutherland, 1986).

3.1.4. Conclusion

In two of the three provinces, major staff changes in ARPT preceded the experimentation with different methods of farmer selection. In all three provinces the teams have recently adopted new approaches to farmer selection which are much more rigorous than those used previously. They have in common the use of information on the characteristics of households, collected for whole villages/communities and the use of purposive sampling techniques. Moreover, specific criteria have been used to select the farmers according to the objectives of individual trials. The teams have invested more time in the process of farmer selection and, although it is still too early to tell how effective the new methods will be, it is generally considered that the time has been well invested. The same attention will, no doubt, be given to selecting farmers participating in ARPT's surveys.

3.2. Farmers' Level of Understanding about ARPT

Unless farmers understand the purpose of an organization or activity, they cannot be expected to provide the desired interaction. Especially with an organization that is providing free inputs, there is a tendency for farmers to make comments they think are desired, rather than giving their honest opinions.

It is clear that ARPT's role has been misunderstood by a large proportion of farmers (ref. section 4.I.1.2.). The experience of ARPT in Luapula Province has been particularly interesting, in how the team learned about farmers' perceptions of ARPT and in the conclusions they drew. When farmers in Mabumba Target Area complained about ARPT not providing sufficient inputs or credit and began to withdraw from cooperating, the economist undertook a study of the local perceptions of ARPT. He interviewed trial and non-

trial farmers, as well as a few local leaders. The "perception study" found that many farmers perceived ARPT as an extension project which, unlike other previous and current Government projects, was not providing enough benefits. The farmers questioned why they should cooperate. There was also concern that ARPT was ignoring non-trial farmers, and some of the local leaders felt rather left out. Some farmers said that they could not understand how diverse ARPT's activities related to each other, e.g., how trials related to surveys.

The team realized that they had not spent enough time explaining ARPT's objectives, and they had not involved the local chief sufficiently. So the team enlisted the local chief's support and mounted a campaign to explain ARPT's role. They took every opportunity to meet with farmers to explain what they were doing. As a result, the farmers have gained a much better understanding of ARPT, and the local chief has provided invaluable support.

3.3. Complexity of Trials

An important point identified during interviews with farmers, TAs and LEWs was that farmers are better able to understand the objectives of trials if trial designs are kept simple. Because the majority of ARPT's trials have been RM/RI or RM/FI in nature, they have tended to use more complex designs. The trials have focused on understanding biological relationships, and greater weight has been given to statistical analyses than to farmers' assessment.

3.4. Involvement of Local Leaders

ARPT has tended to overlook local leaders like chiefs and Ward Chairmen in its activities. This is unfortunate because the local community holds these leaders in high esteem. They can play an important role in helping to explain ARPT's purpose and in motivating farmers to participate fully. In Central Province, one TA said that if the local political leaders do not agree with something, they can enforce an effective boycott, but if they support an activity they can ensure full support. It must be noted, however, that there can also be disadvantages to involving local leaders, notably biases in selection of target areas and collaborating farmers.

The experiences of ARPT in Luapula Province show the advantages of involving both traditional and political leaders. In the Mabumba Target Area, the chief has helped explain the role of ARPT, which he once described as "the agricultural school coming to the field" to teach and discuss new ideas with farmers. The chief helped to defuse the tension caused by farmers having false expectations of ARPT and by disgruntled farmers not selected for trials. He has also been openly critical of collaborating farmers who have not been serious in their attitude towards their trials. He provided ARPT-LP with part of a dambo, an area of residual moisture, which was adjacent to the research station, so that the team could have enough land for their dry-season research program. In addition, he has recently provided another piece of land on a dambo close to the main road, so that the team's work could be seen by a larger number of people. The Chieftainess in Mukunta Target Area, in Luapula Province, has also been equally supportive.

In Mabo Target Area in Luapula Province, the Ward Chairman has played a major role in explaining ARPT. Because the farmers in the area consider that they have received little attention from Government and because they associate ARPT with the Government, the team has met with some hostility, which the Ward Chairman has helped to pacify. The Ward Chairman has been included as a trial farmer, even though he was not considered to be representative of farmers in the area.

3.5. Organization of Field Days

Farmer field days have been held in all provinces and are considered to be one of the most important occasions for farmers to provide ARPT with feedback.

Two important developments have been adopted in most provinces. First, separate field days have been organized for farmers without extension workers and local leaders present. This has increased farmer participation, because farmers have tended to feel inhibited when other groups are present. The second development has been the use of the vernacular language throughout farmer field days. Another useful change, introduced in some provinces, has been to involve the farmers as much as possible in presenting information at field days. In many cases, the less ARPT staff have been involved in presenting information, the more farmers have been willing to participate.

In Central Province, the most recent development has been to hold field days with small groups of farmers at each cluster of trials. This was found to be very effective and it reduced the need to move large numbers of people around, even though it increased the number of field days.

In Luapula Province, the ARPT scientists explained the trials for the first two seasons and then gave the responsibility to the TA. However, during the last season's field days the team found a two-stage field day to be very effective. During the first stage, small groups of collaborating farmers and their neighbors visited the trials in each cluster they wanted to see. The TA and LEWs made the arrangements, but the explanations were given by the trial farmers. The second stage involved farmers from all clusters meeting together and discussing their observations. Local leaders attended this larger meeting, and a record of the discussions was taken by the LEW. The team was very satisfied with this method and intends to continue using it.

The ARPT in Western Province also considers that a two-stage field day is very effective, although they have taken the whole group of farmers to see the trial sites. Farmers are told to note their observations and bring them up during the meeting. The agronomist from Western Province remarked that farmers "agreed that what they had seen could not have been conveyed by word of mouth" (GRZ MAWDc, 1985). However, he added that field days could not be a substitute for frequent contact with farmers and, in order to better plan the field day, "familiarity with the farmers should be cultivated well before hand" (GRZ MAWDc, 1985).

3.6. Trials Assistants' Relations with the Local Community

Many agronomists consider TAs to be in the best position to build close relationships with farmers and determine farmers' genuine opinions about technology under test. Because the TAs are living in the same community as the farmers, they are well situated to meet with farmers, both in their fields and on social occasions. The experience and personality of the TAs have varied considerably, but very few have lacked commitment or failed to develop good relations with farmers. TAs in two provinces have built such close links with farmers that the community helped to find them local accommodation.

In the majority of cases, the TAs have visited the farmers at least once every two weeks, and almost all of them have made an effort to speak with the farmer each time they visit the trials. In Eastern Province, both the TA and the farmers have found it useful to draw up a schedule of visits for each farmer, thereby reducing the inconvenience of not finding the farmers at their farms.

As noted earlier, the main area of concern on feedback from farmers has been how well information about farmers' views on the trials is communicated from TAs to the ARPT scientists. Unfortunately, the TAs have tended to record in their logbooks only a small proportion of the comments made by farmers during the season. Some TAs say that the ARPT scientists have not placed much emphasis on written comments, and they prefer to give verbal reports instead. However, with this method, both the TAs and team members agree, some comments are not transmitted and others may be forgotten. Moreover, with verbal communication the TAs have not always distinguished between farmers' comments and their own views. An agronomist in Central Province also noted that the TAs do not always know which farmers' comments are relevant to the team.

There is general agreement that the recording of farmers' comments as a feedback mechanism to ARPT scientists needs to be given greater emphasis.

3.7. Establishment of ARPT Rural Sociology Section

The establishment of the ARPT Rural Sociology section has been an important factor in helping ARPT give greater attention to interaction with farmers (ref. section 3.II.2.6.). The sociologists have conducted surveys in several provinces which have helped to improve the teams' understanding of farmers' circumstances. They have also organized presentations and discussions within ARPT meetings to increase the team members' general level of awareness of key issues related to farmer participation, such as farmer selection, sampling, intra-household interactions, and gender issues.

3.8. Size and Dispersion of the Trial Program

In the last two seasons most provincial ARPTs have tried to reduce the distances between trial sites by using tighter clustering methods. Some of these methods have been discussed earlier in section 4.I.3.1. Use of the "community perspective" in farmer selection has not only enabled more representative farmers to be selected, it has also reduced the distances between trial farmers.

Furthermore, it has enabled neighboring non-trial farmers to be more aware of what is happening on the trials. The TAs and ARPT scientists are seen by a larger proportion of the community, which has the potential for enabling closer relationships with farmers.

3.9. Research Managers

The ARPT NC has emphasized the importance of farmer involvement in trials since the formation of ARPT. He endeavored to keep the issue in the forefront of team members' minds through discussions at ARPT staff meetings and through the organization of workshops, such as the one held in 1987 to discuss various aspects of intra-household linkages.

3.10. Manpower Issues

3.10.1. Staffing

It is clear that the presence of economists and RELOs in the provincial teams has stimulated greater farmer participation. The number of farmer surveys has been significantly greater when an economist has been posted to the provincial team. Similarly, in the relatively few provinces where there have been RELOs, certain aspects of farmer participation, such as field day organization, have been improved as a result of the RELO's participation.

The continuity of ARPT staff, particularly the TAs, has also been important in building close relationships with farmers. This is one of the reasons most ARPT scientists are reluctant to have the TAs return to their extension duties after four or five years.

3.10.2. Attitude Towards Farmer Involvement

ARPT scientists on the whole have shown a genuine interest in working with farmers. In particular, team members with previous experience of working with subsistence farmers have responded positively to the need to involve farmers in the research process.

In Luapula and Western Provinces, the agronomists have collected local germ plasm for use by several CSRTs, indicating that they regard farmers as a potential source of valuable material. Similarly, the incorporation of farmers' comments into the trial program is an indication of a positive attitude, as too, is the fact that ARPT staff, including TAs, have usually tried to speak with farmers whenever they have visited the trials.

3.10.3. Medium of Communication

Communication with most farmers requires use of the vernacular. This has been a problem for the expatriate members of ARPT and even some Zambian staff. When they have had to rely on interpreters, some team members have not been able to follow the subtleties of answers given by farmers and occasionally misunderstandings have resulted.

To minimize the communication problem, ARPT scientists have tried to avoid difficult concepts and terminology during surveys or discussions with farmers. Furthermore, the ARPT Sociology section has tried to promote the idea of using farmers' Indigenous Technical

Knowledge (ITK) and a one-day staff meeting was devoted to this concept. Only a few provincial teams have made use of local taxonomies for soil, vegetation, field types and varieties. However, some teams have tried to use farmers' local units of measurement, such as cups, bottle tops, baskets, or tins.

Because communication with farmers has been a problem at times, the expatriate agronomist in Central Province considered that a sociological study to identify communication patterns and to help explain how farmers acquire and interpret information was needed. He thought this would help to overcome one of the biggest weaknesses in ARPT.

3.11. Extension Structure

It has already been noted that the T&V system in Eastern Province has been an important factor in improving the two-way flow of information between ARPT and farmers. The regular meetings have placed a level of discipline on the extension hierarchy, to ensure that information is fed from farmers to Provincial SMSs and onward to ARPT.

Experience in some Target Areas indicates that the LEWs can be helpful in explaining the role of ARPT and the details of trials to farmers, if they are sufficiently involved in ARPT's activities (ref. section 4.III.5.2.).

II. MANAGEMENT OF INTERACTION BETWEEN ARPT AND CSRT SCIENTISTS

Most of the information given in this section derives from interviews with 14 ARPT and 16 CSRT scientists, conducted at the end of 1986.

1.0. Historical Background

From the earliest discussions of the need for ARPT within the Research Branch, the importance of a strong relationship between the section and the CSRTs was recognized. In spite of this realization, however, the strength of the relationships between provincial ARPTs and CSRTs has varied considerably, both between different teams and over time. There have been, broadly, three phases in the evolution of these relationships.

1.1. 1980-1982 - Design Phase

In mid-1980 a document outlining the structure and role of ARPT spelled out the contribution CSRT scientists would make, at different points in the sequence of ARPT's activities. CSRT scientists would:

- participate in exploratory surveys and help to formulate formal questionnaires; this would help ensure that they would have the information required for undertaking applied research programs;
- design adaptive and applied research programs, together with ARPT, to solve identified problems;
- provide ARPT with possible technical solutions, based on previous research, that could be tried in on-farm trials;

- conduct applied research, at research stations, on identified farmer problems.

The 1980 and 1981 ARPT Research Committee meetings were used to explain the role of ARPT to scientists in the Research Branch. The ARPT NC presented the paper referred to above and highlighted the areas where cooperation between ARPT and CSRT scientists would be necessary. The ADA (R) indicated at the 1981 meeting that he expected up to 60% of the CSRTs work program to eventually be based on problems identified through ARPT's surveys. This was interpreted by some CSRT scientists to indicate a bias toward the new ARPT and caused some resentment.

The key feature of this phase was that ARPT was not operational, and there had been very few opportunities for interaction between ARPT and CSRT scientists. The 1981-82 season was the first season of trials, and by the end of 1982 only 8 team members were working in 3 provinces (Table 23).

1.2. 1983-1985 - Establishment Phase

By the end of this phase, six provincial ARPTs, with 23 scientists, had been established. Some resentment among some CSRT scientists was brewing . They knew very little about ARPT and thought that the ADA(R) was favoring ARPT in the allocation of resources.

There was quite a lot of informal interaction between provincial ARPTs and CSRTs, most of it initiated by ARPT scientists. However, it was principally a time when most ARPT staff were trying to get their own programs, started and cooperation with others was not considered the highest priority. Several ARPT scientists were frustrated because many CSRTs had few new technologies available for on-farm trials, and it was difficult to get access to previous seasons' results (ref. section 3.IV.3.1.).

By the time a new CARO took over in mid 1985, there was quite a lot of friction between ARPT and scientists in several CSRTs. The new CARO, who had been abroad studying when ARPT was first established, was skeptical of the role of ARPT, the value of social scientists and the capability of some ARPT team members. She was determined to redress the resource imbalance which had been in ARPT's favor. In so doing, she became a rallying figure for others critical of ARPT, most of whom were based at the Central Research Station. The ARPT Research Committee meeting in 1985 was emotionally charged, with open hostility expressed (by some CSRT scientists) towards specific aspects of ARPT's program, as well as to the role of ARPT in general.

1.3. 1986-1987 - Consolidation of ARPT - CSRT Interaction

Since 1986, much effort has been made, especially by ARPT scientists, to improve the level of interaction between ARPT and CSRT. When interviews with CSRT and ARPT scientists for this study were conducted, it was clear that relations between the two sections were generally quite harmonious, with mutual respect expressed on both sides. Greater interaction, both formal and informal, has clearly been taking place, and although there are still differences of opinion and problems with achieving high levels of cooperation, there is now a generally positive attitude on both sides towards improving interaction.

The ARPT Provincial Coordinator in Luapula Province described the development of ARPT-CSRT relations as the "normal process of evolution", in which, as people come to know one another better, they learn to respect each other and want to find out more about each other. A similar view was expressed by a member of the Grain Legume Research Team, who commented that collaboration with ARPT had increased as both teams had matured.

2.0. The Benefits of ARPT - CSRT Interaction

2.1. Flows of Information from CSRT Scientists to ARPT

Information flows from CSRTs to ARPT could be beneficial in the following ways:

- provide specialized advice on particular problems identified in the field, e.g., pests and diseases;
- make suggestions on data collection, e.g., on weed scoring, pest and disease counts;
- give advice, based on previous research, about solutions to problems which can be tested in on-farm trials;
- advice on trial design;
- provide planting material for on-farm trials;
- give comments about technology under test in ARPT on-farm trials;
- assist with the formulation of new and revised recommendations.

The CSRT scientists have had an important impact on ARPT trial treatments and designs through frank discussions and correspondence. Agronomists in all provincial ARPTs were able to cite specific cases where comments from CSRTs had been incorporated into trials. In particular, many useful suggestions have been made about varieties to be included in on-farm trials. Central Province had suggestions about sunflower, maize and soybean varieties from CSRTs. In Eastern Province ARPT has undertaken trials on pigeon pea, a joint trial on maize/bean intercrop, and a trial with new groundnut varieties, following comments from CSRT scientists. In Luapula Province, ARPT requested the plant protection section for assistance with disease identification on beans and wheat. They have also asked the Sunflower Research Team for oil content analysis of the local sunflower varieties. Three CSRTs have provided ARPT in Luapula Province with specific comments about trials and in their letters have also congratulated the team on the work they have been undertaking.

2.2. Flows of Information from ARPT Scientists to CSRTs

Information flows from ARPT to CSRTs could be beneficial in the following ways:

- provide information on farmers' circumstances to help CSRTs set priorities, plan trials and set treatment levels;
- provide information on how CSRT material performs under farmer management;
- assess farmers' varietal preferences, including such features as taste and cooking time;
- supply local germ plasm for possible inclusion in breeding programs;

- provide assistance to implement collaborative trials with CSRTs;
- provide information on how present CSRT recommendations are being adopted by farmers;
- contribute to possible revisions to recommendations.

Fifteen of the 16 CSRT scientists interviewed considered that ARPT had a role to play in helping to plan CSRT work programs. Several scientists from the eight CSRTs represented went on to give examples of how information provided by ARPT had helped them to set priorities and design their trial program.

i) The Maize Team said that information from ARPT on three issues had helped the team's priority setting: the need to develop more flinty types to improve maize storage; the need for a 100-day variety for early food; and the importance of the maize streak virus problem.

ii) The Root and Tuber Team cited an example of a cassava intercropping and land preparation trial they had developed on the basis of information from ARPT in Luapula Province.

iii) The Grain Legume Team said that information from three provincial ARPTs had been incorporated into their agronomic trials, the intercropping work in particular. Feedback on one bean variety had made the team more sensitive to the issues of taste and acceptability. Data on labor allocation has also made the team consider ways of trying to spread the demand for labor during peak periods.

iv) The Groundnut Team learned of the need for a short-season variety for the valley areas from ARPT.

v) The Sunflower Team cited several examples of ARPT influence. The breeding program has reduced the fertilizer level by half in some trials for screening varieties, and they have given greater emphasis to looking for earliness in varieties. The agronomist has also introduced two management levels into his trials.

3.0. Level of Interaction between ARPT and CSRT Scientists

Twelve of the 16 CSRT scientists interviewed thought that the level of collaboration with ARPT was moderate to good and the remainder said that it was limited. Four commented that relations had improved considerably over the last year or so. About a third desired greater collaboration, especially with respect to technology testing.

During the 1985 ARPT Annual Review five working groups were asked to make a list of priority problems facing ARPT. Four out of the five groups listed ARPT-CSRT interaction as a problem area, and these four groups ranked the problem: second, third, seventh and eighth out of twelve (GRZ MAWDd, 1986). At the time when ARPT staff made their ranking, CSRT scientists were voicing quite a lot of criticism of ARPT and the level of collaboration. The ARPT scientists interviewed at the end of 1986 considered that the level of interaction had increased and that ARPT was being accepted as a full section of the Research Branch, with a complementary role to play.

A qualitative assessment of the level of interaction between ARPT and CSRT scientists is presented in Table 46. The assessment is made for the last two phases of ARPT's development and examines the level of interaction for several types of interaction.

Table 46: Assessment of the Level of Interaction between ARPT and CSRTs

	1982-85 Establishment	1986-87 Consolidation
Participation in Surveys	*	*
Planning & Designing Trials	**	***
Collaborative Trials	*	**
Visits to Trials	*	**
Present & Review Results	**	***
Exchange of Data & Reports	*	**
Miscellaneous Mechanisms	**	**

Notes: * Limited interaction
** Moderate interaction
*** Good interaction

4.0. Occasions for ARPT-CSRT Interaction

4.1. Participation in Surveys

The intention when ARPT was established was that CSRT scientists should participate in ARPT informal surveys. In this way ARPT would be able to tap the knowledge of specialists and to ensure that relevant data would be collected to help both ARPT and CSRTs to identify research opportunities and plan trial programs. It was also seen as a way for CSRT staff to get into the field and see for themselves small farmers' problems requiring research attention.

Despite this intention, collaboration has been difficult to achieve. Participation has only taken place on a few occasions. Such collaboration is difficult to arrange because of communication problems with scientists from other research stations, and because it requires a lot of advance planning. Moreover, the ADA(R) has issued no strong directives supporting collaboration in this area, and such activities are not considered to be part of the duties of CSRT scientists. Two of the 4 ARPT provincial coordinators who have experimented with this form of collaboration considered that it was useful, but added that such collaboration has been much easier to arrange with scientists based at the same research stations.

Three CSRT scientists interviewed had been involved in organizing surveys of farmers' production constraints on their particular crops independently from ARPT. They said they had found the experience useful because it helped them to better understand farmers' problems.

An ambitious collaborative project has been planned by scientists from three CSRTs - maize, sorghum, and germ plasm - with scientists from ARPT as well as scientists from UNZA. The aim is for the teams to collect and study local germ plasm in the drought-prone valley areas of Zambia. In addition to the usual objective of including desirable traits from local material into the breeding program, the project intends to collect information on farmers' reasons and preferences for growing different varieties.

4.2. Planning and Designing the Trial Program

Interaction has been quite strong in this area (ref. section 4.II.2.). ARPT has been able to benefit from the advice given by CSRT scientists about the focus of trials, the content of treatments and the design of trials. There has been a high level of interaction and discussion about planning the work programs for CSRTs and especially for ARPT. All of the CSRT scientists interviewed said that they had been consulted by ARPT scientists on the content of ARPT trials, but only 38% had been consulted on the design of trials.

Several important formal and informal mechanisms have facilitated ARPT and CSRT interaction in this area. Most scientists considered that the formal mechanisms, in particular the Commodity Research Review meetings, have been very useful but, in order to cover details, they need to be followed by informal discussions.

4.2.1. Formal Opportunities for Joint Planning

i) ARPT Provincial Committees

The meetings of these committees provide opportunities for the CSRT scientists based in a particular province to hear about the activities and results of the provincial ARPT and make comments about the research programs. There are no other formal meetings at the regional research stations to discuss the technical content of work programs.

ii) Commodity Research Team Review Meetings

These meetings, initiated in 1984 as "Pre-Research Committee meetings", provide a forum for each CSRT to meet as a team to review their previous season's work and plan the work for the next season (ref. section 2.III.2).

ARPT staff are invited to present information on the farmers' problems, the results of trials on the particular crop, and to discuss future research required for addressing identified problems. These meetings are all held consecutively during one week at the Central Research Station. A secretary is appointed from ARPT, who records the highlights of the problems presented as well as the research programs agreed on. These minutes are subsequently presented at the main Research Committee meetings, for the benefit of those unable to attend the CRT Review meeting.

These meetings are generally considered to have been a successful mechanism for interaction. About 70% of CSRT scientists interviewed considered that the CSRT Review meetings were useful and provided an opportunity to hear about farmers' problems. The meetings, by being small, were considered to have improved the level of discussion significantly. However, about 10% still thought that the meetings were too large and preferred to have informal discussions with each team, but recognized that extra time would be needed.

Seventy percent of the ARPT scientists interviewed considered that these meeting provided a useful opportunity for interaction. The ARPT Agronomist in Central Province commented that he had found the

meetings useful and also appreciated the opportunities for informal discussions during tea breaks and intervals between meetings. The ARPT Provincial Coordinator in Luapula considered that the meetings are an important forum for receiving input from CSRTs, but needed to be followed up with informal discussions about the details of trials. He added that the utility of the meetings depended largely on the size of the CSRT program and the experience of the scientists.

Meetings have sometimes had to be cancelled because certain CSRTs, notably those with few staff, have been unable to travel to the Central Research Station. Attendance is also sometimes uneven because the meetings are held at a time when some expatriate scientists are on leave. However, there is little opportunity to change the timing, since the meetings must be held after the trial analysis has been completed and before the Research Committee meetings.

ARPT developed a special format for presenting information or research problems identified at the farm level to CSRT scientists at these meetings. It aimed to define research problems on specific crops in a concise manner so that CSRT scientists would not have to wade through lengthy reports. The format had the following headings:

- CSRT to be involved
- Province
- Location of farming system
- Description of the problem in terms of the system
- Benefits of successful research: number of farmers who would benefit, importance of the crop to those farmers, market potential, projected increased output.

So far only a few ARPTs have used the format. Broader adoption of the format is recommended since it adapts ARPT information to the specific needs and interests of CSRT scientists.

iii) Research Committee meetings

These large public meetings are considered to be much less useful for interactions between ARPT and CSRTs than the CRT Review meetings. Nevertheless, they are theoretically the major planning meetings for each research team. Representatives from each provincial ARPT have not always attended the meetings (ref. section 2.III.2.).

iv) Exchange of Trial Outlines

Detailed Trial Outlines, containing all the information that went into planning and justifying the trial, are written for every trial undertaken (See Appendix IX). The ARPT NC has encouraged the ARPT agronomists to circulate draft versions of the Trial Outlines to scientists from relevant CSRTs to obtain their comments. The ARPT NC has also circulated sets of Trial Outlines to CSRT Team Leaders for comments. However, this has not stimulated much feedback.

Experience indicates that simply circulating Trial Outlines to CSRT scientists without any prior discussion is unlikely to produce any response. It can also result in misunderstandings if the reasons behind the trials are not explained.

4.2.2. Informal Opportunities Joint Planning

Virtually all scientists interviewed considered informal interaction, such as casual conversations and correspondence, to be as important as interaction in formal occasions. It is recognized, however, that while informal interaction is suited to the individualistic operating styles of some scientists, its strength and utility can be undermined by weak communication within a team. A relevant example comes from Luapula province, where the ARPT Provincial Coordinator had close informal interaction with one of the breeders in the Maize CRT. However, when he later came to face criticism from other members of the Maize CRT, he realized that his link with the CRT was highly personalized and that some more formal mechanisms for interaction, such as the CRT Review meetings, were needed to compensate for the lack of communication within the CRT.

Informal interaction has increased in recent years. ARPT has usually initiated such informal contact, accepting that they have been the "newcomers" on the scene. Both groups, however, now frequently call on one another when they are visiting other research stations. Informal contacts also improved when the ARPT NC moved offices to the Central Research Station.

Informal interaction has, as would be expected, been greatest between ARPT and CSRT scientists based at the same research station, since scientists can drop by one another's offices for casual discussions. The scope for such informal interaction can be gauged from the proximity of the research teams shown in Table 47. Informal contacts have also been stronger between ARPT and CSRT scientists working in the same donor project.

Since telephone communication is difficult in Zambia, correspondence has also been an important means of interaction, especially for ARPT agronomists. After ARPT was criticized for not communicating with CSRT scientists about their trial program, some ARPT scientists began to write many more letters to CSRT scientists requesting comments and advice, and memos summarizing these interchanges were sometimes copied to the CARO and ARPT NC.

4.3. Conducting Collaborative ARPT-CSRT Trials

In recent years, all provincial ARPTs have undertaken some trials in collaboration with a total of ten different CSRTs. Both CSRTs and ARPT have taken the initiative to undertake collaborative trials. In Luapula Province, ARPT took the initiative of collecting and assessing local germ plasm of maize and beans, as well as doing exploratory work on vegetables and water control on dambos during the dry season. However, after some time, different CSRTs have come to assist with the design, assessment, supervision and analysis of the experiments. In other cases, such as the groundnuts and grain legumes teams, the CSRTs reached the stage of varietal development when they wanted to expose their new material to farmers' conditions and assessment. They approached ARPT to see if there were any farming systems in which ARPT would be interested in testing the material. In Central Province, the ARPT and CSRT were both interested in studying the current soybean recommendations under farmers' conditions; so they developed and implemented a trial proposal. The Sunflower CSRT has also conducted a large number of on-farm trials and, in those provinces with an ARPT, the two teams have worked hand in hand.

Table 47: Location of CSRTs and ARPTs at Research Stations

Research Station	CSRT	ARPT
Lusaka Province Mt. Makulu, Central Research Station	Maize Sorghum & Millet Wheat Sunflower Weed Control Soils Research Plant Protection Germ Plasm Food Conservation & Storage Biometrics	National Coordinator Rural Sociology Section Nutritional Coordinator Lusaka Province ARPT
Central Province Kabwe Regional Station	Tobacco	Central Province-ARPT
Copperbelt Province Mufulira Regional Station	Tree & Plantation crops (Cropping System)	
Eastern Province Msekera Regional Station	Groundnuts Grain Legumes	Eastern Province ARPT
Luapula Province Mansa Regional Station	Roots & Tubers Rice	Luapula Province ARPT
Northern Province Misamfu Regional Station	Coffee Soil Research (high rainfall)	Northern Province ARPT
Northwestern Province Mutanda Regional Station		Northwestern Province ARPT
Southern Province Mochipapa Regional Station Magoye Regional Station National Irrigation Research Station	Animal husbandry Irrigation Vegetables Farm machinery + Tillage Fiber crops Soybeans	
Western Province Mongu Regional Station		Western Province ARPT

The experience with collaborative trials has generally been very successful, with both sections gaining not only knowledge from the specific trial, but also having a better understanding of the other teams' work.

The move towards collaborative trials has been assisted by several factors. CSRTs have been more interested in collaboration as they have matured and had more technology ready for testing under farmers' conditions. In addition, the donor project structure as well as the location of staff together at the same research station has facilitated informal discussions about joint trials.

4.4. Visits to Trials

The purpose of the field visits is to get CSRT scientists into the field so that they can see how their new technologies are performing under farmers' conditions. The ARPT scientists consider that informal discussions in the field are extremely valuable opportunities for interaction. A smaller proportion of CSRT scientists made the same comment.

Fourteen of the 16 CSRT scientists interviewed, said that they had visited ARPT trials, although 4 had seen only ARPT trials at research stations. There are several different occasions when CSRT scientists have visited ARPT trials;-

a) Since 1984, the ARPT NC has organized a program for CSRT scientists to visit each provincial ARPT. Scientists are invited from all the CSRTs on whose crops the provincial teams are working. Several different procedures have been tried to find the most effective arrangement for these visits.

In 1984, each provincial ARPT agreed on one week when it would be best for the relevant CSRTs to visit. These visits were partially successful but the timing of the visits was not always suitable for each CSRT scientist to see his or her crop at its most critical stage.

In 1985, the CSRTs told the ARPT NC when it would be most convenient for them to see the crops. The problem with this arrangement, however, was that the ARPTs had a succession of visitors which became quite disruptive, especially when the programs fell through at the last moment.

In 1986, the ARPT NC reverted to the original mechanism of scheduling for the convenience of the ARPTs. However, the instructions were handled through the CARO's office and, consequently, a high level of attendance was achieved. Moreover, only a few CSRTs complained that the crops were not at appropriate stages for observation.

To make the visits fully effective, the support of the CARO has been necessary. This has been especially useful to counter the tendency of some CSRTs to send junior team members.

b) A few ARPTs have invited CSRT scientists to attend field days, usually organized primarily for the benefit of extension workers.

c) Some CSRT scientists, when they have been visiting their own trials at regional research stations, have taken the initiative of contacting the ARPT to be shown some of their trials.

d) ARPT scientists are able to see CSRT work during field days held annually at the regional research stations.

No single occasion has been most useful, but the planned CSRT visits and the informal initiatives have both been viewed as helpful. The field visits have often been more productive when planned in advance. This has enabled farmers to be informed of the visit and also allows the team to set time aside. It has also been found essential that every ARPT member, whatever their discipline, should be able to explain the objective of each trial and what has happened during the season. There have been occasions when field visits have been extremely embarrassing for ARPT because team members could not satisfactorily answer questions raised by CSRT scientists, who then left with a negative attitude towards the ARPT and its work.

4.5. Reviewing and Presenting Results

The process of reviewing and presenting the trial results, in general, relies on the same mechanisms used for planning the program (ref. section 4.II.4.2.). However, recently there have been several occasions when ARPT and CSRT scientists have collaborated in presenting results. ARPT was invited to present the results from certain trials at the 1986 Maize and Soils CSRT Research Committee meetings. In 1986, ARPT was also invited to present papers at two international workshops organized by the Sorghum and Millet and Soils Research Teams. A Zambia country paper on maize research and dissemination was prepared jointly by scientists from ARPT, the Maize CSRT, and extension. Another paper on sunflower research was also prepared jointly by scientists from the two sections and presented internationally. These have been good opportunities to work together and to explain the work being undertaken.

4.6. Flow of Data and Exchange of Reports

The provincial ARPTs produce a range of reports, but the most important are the annual reports and specific reports on surveys (ref. section 3.IV.3.4.). All of CSRT scientists interviewed had seen some ARPT reports, particularly the annual reports. 56% said that they had not seen reports of ARPT surveys, and 22% of those who had, had specifically requested the reports. The majority of the scientists interviewed considered that the reports containing agronomic information on their crop were the most useful. However, 44% said that they had found the survey work, describing small farmers' circumstances, useful and 20% gave examples of how such information had influenced their trial program.

Several CSRT scientists expressed disappointment that they had not received more information from ARPT about the problems and constraints of small scale farmers with respect to particular crops. This supports the idea that ARPT should present data on each crop in summary form to make it more accessible to CSRTs (ref. section 3.IV.3.4.). In the cases of groundnuts, sunflower and soybean, ARPT had limited information and the CSRTs had to conduct their own diagnostic surveys.

The problem appears to be, in part, poor distribution of ARPT reports or difficult access to relevant material within the reports. However the problem also stems from ARPT's focus on farmers' priority crops in a system, which means that certain crops, such as groundnuts, have received little attention in the reports.

There were several criticisms that ARPT's data on farmers' problems have been too general and have given too little attention to production constraints. This is related to the length of time that ARPT has been operating in a particular province; the focus of the first surveys have always been more general. The criticism also reflects that some CSRT scientists are still skeptical about the significance which socioeconomic factors have in determining farmers' decisions about technology adoption.

An important reason for CSRTs' dissatisfaction with some of ARPT's data has been the limited discussion between ARPT and CSRT scientists about the kind of information which CSRT scientists would find useful. For example, there has been little collaboration in drawing up formal survey questionnaires.

However, on the positive side, there have been some general requests made by ARPT to CSRTs for guidelines about the kind of information the CSRTs would like ARPT to collect, especially concerning pest, and disease scores. Also, a few CSRTs, such as the Food Conservation and Storage Unit, have approached ARPT staff for advice in drawing up questionnaires. Others, such as the Root and Tubers CSRT, have requested ARPTs to supply specific information on production and farmers' management practices with their crops. ARPT in Eastern Province carried out a survey in order to generate the required information. This supports the idea that more effort should be made by ARPT to simply present the data in summary form for each crop.

A good example of effective information flow, relates to the use of agro-ecological zones. During the 1985 ARPT Annual Review meeting there was discussion about how the boundaries of farming systems, used by ARPT, related to the agro-ecological boundaries used by the CSRTs. Following the meeting, ARPT in Luapula Province requested every CSRT to provide them with information about the boundaries of the agro-ecological zones they were using in planning their research work. This was done so that the team could take these boundaries into consideration in their zoning of the farming systems and in drawing up their trial program. Several CSRTs replied to this request and there was further discussion at an ARPT quarterly staff meeting, when scientists from the Soil Research Team presented the findings of a large project on the use of agro-ecological zones to draw crop suitability maps. Subsequently, copies of all their maps have been provided to each ARPT. ARPT Northern Province used these maps as the starting point for their work on the demarcation of the farming systems in their province.

ARPT scientists have also faced some considerable difficulties in getting access to some of CSRTs previous trial results (ref. section 2.IV.4.1.).

4.7. Miscellaneous Mechanisms for Collaboration

4.7.1. Conducting Analyses

Several CSRTs were asked by different provincial ARPTs to conduct analyses of various pest and disease samples. These requests have all been handled efficiently and have not given the kind of problems encountered in soil sample analysis (ref. section 3.IV.3.3).

The ARPT economists in both Central and Eastern have both assisted CSRTs with some economic analysis of their trial results. Several of the CSRT scientists interviewed, mentioned that they would like to see the ARPT economists doing more economic analysis of CSRT trial results.

4.7.2. Collection of Local Germ Plasm and Provision of Planting Materials

The Provincial ARPTs in Luapula and Western Provinces have collected local germ plasm of maize, beans and cassava for use by the respective CSRTs in their breeding programs. In turn, almost all CRSTs have provided ARPTs with planting material to use in on-farm trials. Both types of activity have provided opportunities to explain the varietal characteristics which should be included in the breeding programs; trying to match farmer preferences with the limitations of plant breeding.

4.7.3. Revision of Research Recommendations

The process for revising research recommendations is far from clear as was explained in section 2.III.3. Nevertheless, in Eastern, Northern and North Western provinces, where attempts have been made to revise provincial recommendations, some discussions have been held between ARPT and certain CSRT scientists.

In the case of Eastern Province, the provincial team made a comprehensive review of the current recommendations and produced new crop memos for the three major farming systems in the province. Lengthy discussions were held with each CSRT during two meetings at the Central Research Station. There was some resentment by CSRT scientists because they had not been consulted, even informally before the meetings. Some disagreed with the revisions suggested, especially since they were based on barely two seasons research. There was a lot of forceful argument but, after the two meetings, only two main areas of disagreement remained unresolved and the CARO made the final decision. In the case of the other two provinces, there has been much more informal discussion between ARPT and CSRT scientists, but it remains to be seen how any differences will be resolved. It appears that the more the CSRT scientists have been involved during the stage of research trials, the fewer the areas of disagreement. Similarly, the more seasons of research undertaken, the easier it has been to make revisions.

4.7.4. Involvement in Variety Release

The procedures for releasing new varieties, through the Variety Release Committee, have recently been changed and, for the first time ARPT, has been included as a voting member. This decision to

include ARPT was only reached after heated debate and after it was agreed that the interests of large scale commercial farmers could be represented by the Commercial Farmers Bureau.

The Committee meets twice a year. In the future, it will include a pre-release stage when there is an opportunity for various organizations, including ARPT, to test end users' acceptance of the new material. By the pre-release stage there is a high probability that the material will be released and made available to farmers. This greater level of certainty provides ARPT with a range of material for testing without the risk that the material will never be available for farmers' use.

4.7.5. Attendance by CSRT Scientists at ARPT Meetings

Some CSRT scientists have been invited, on an ad hoc basis, to participate in the ARPT quarterly and annual review meetings. They have contributed to the discussions on various topics including; the use of agro-ecological zones, the recommendations release procedure, the Variety Release Committee and aspects of soil analysis.

4.7.6. Assignment of one CSRT Scientist to Liaise with ARPT

The Maize and Sunflower CSRTs have each assigned one team member to be responsible for liaising with ARPT. 50% of CSRT scientists interviewed thought that this was a good idea, but only for the large CSRT teams. The danger is that, unless there is very good communication within each CSRT, the information can remain with only a few people and disagreements can later arise from CSRT members who have not been in close contact. On the other hand, if no one is specifically responsible, it is possible that no one will make any effort to interact.

4.7.7. Research Services

Scientists, from both CSRTs and ARPT, have helped each other out in a variety of different ways:

- loaning equipment or assistance for planting, applying herbicide, harvesting and shelling etc.;
- transporting equipment and materials for one another;
- joining together to assist in the training of extension workers.

5.0. Example of Collaboration between ARPT and the Maize Research Team

In order to illustrate the type of interaction that ARPT scientists have had with CSRT scientists, a brief case is presented of ARPT interaction with the Maize Research Team.

Maize is the most important food and cash crop in Zambia. The Maize Research Team (MRT) is based at the Central Research Station and is, with eleven professionals, one of the largest CSRTs. Interaction between ARPT and the MRT has been sustained since 1982, although at times there have been disagreements about ARPT trial designs and results, and differences over priorities.

Since maize is important throughout Zambia, all provincial ARPTs have interacted with the MRT using a wide range of the mechanisms and opportunities outlined above. Scientists in both teams consider that the most useful interactions have been the informal discussions about trials, both in the field and in each others offices, as well as during the Commodity Research Review meetings.

The senior maize breeder has listed three ways in which information from ARPT had been useful in planning his program. It has helped to identify:

- The importance of doing more research on flinty maize types to improve storage;
- The need identified for a 100 day quick variety for early food;
- More detailed information on the incidence of maize streak virus.

There have been several interesting features of the interaction between scientists in different ARPTs and the MRT.

a) Between 1982 and 1985, most of the interaction that ARPT scientists had was with one MRT member, a USAID funded breeder. This breeder was eventually given specific responsibility to liaise with ARPT. The ARPT in Luapula Province had very close cooperation with this breeder, such that the Provincial Coordinator has credited him for the considerable progress ARPT has made in its maize on-farm trials. However, during several meetings in 1985, other members of the MRT complained about the lack of interaction with ARPT and were highly critical of two maize trials undertaken by ARPT in Luapula. This highlights the danger of assigning one person to liaise with ARPT, unless there is effective communication within the CSRT.

b) Another lesson, related to the last point, concerns the importance of ARPT and CSRT scientists meeting in the field to visit and discuss the trials. The senior maize breeder had been critical of the ARPT trials in Luapula Province and had developed a negative attitude towards the ARPT, based on information given at meetings. After he had visited the team's trials in Luapula Province, misunderstandings were clarified and he had more respect for the team and the team's program. He later agreed that ARPT-Luapula should be a model for other provincial ARPTs.

c) In the early years of ARPT, interaction was hindered because the MRT did not have new maize varieties for ARPT to include in on-farm trials. For this reason, the senior maize breeder admitted that he did not make much effort to contact ARPT before 1984. Collaboration has become much more active as the MRT has generated new materials.

d) A related problem was that, until varieties had been released, there was no guarantee that varieties used by ARPT in on-farm trials, would be available for farmers to buy. This caused some problems for the ARPT in Central province because farmers liked some of the varieties they were testing with ARPT and were annoyed the next season when they were told that the varieties would not be released. The introduction of a "pre-release stage" by the Variety Release Committee should help to increase the likelihood that varieties put into on-farm trials will eventually be released.

e) The lack of an agronomist in MRT until late 1985 meant that ARPT was having to do most of the agronomic research that a CSRT agronomist would normally do. This created some tension because ARPTs were testing the new varieties and were sometimes using experimental methods different from those that the breeders would have preferred.

f) The scientists in ARPT Central Province have had a closer relationship with the USAID funded maize breeder than with the other members of the maize team, because they are part of the same donor project. The interaction has been assisted by several formal meetings such as the regular team meetings and other informal occasions which have brought the scientists together. Similarly, their project's stated objectives and job descriptions specifically mention the importance of ARPT-CSRT cooperation.

6.0. Factors Affecting Interactions between ARPT and CSRT Scientists

Examining the experiences of ARPT and CSRT scientists interacting with each other, has indicated that many different factors have contributed to the effectiveness of the interactions.

6.1. Proximity of ARPT and CSRT Scientists

The stationing of certain CSRT scientists at the same research station where ARPT scientists have been based, has definitely increased the frequency of interaction and the total amount of time that they have spent together.

The increased interaction, between scientists based together, has meant that there has been greater opportunity to discuss trial content and design, more collaborative trials and more chance of feedback. However, even when CSRT and ARPT scientists have been based together, they have not always taken full advantage of the opportunities for greater interaction.

Communications by telephone and letter can be very difficult; a letter sent between regional research stations can take between two and three weeks. Travelling by road can also be extremely difficult and, in some cases, CSRT scientists have only been able to visit certain research stations once or twice in a season to see their own trials.

6.2. Lack of Technologies Available for Testing from CSRTs

Several CSRTs have had few technologies ready for on-farm testing by ARPT until the last two or three years. Several CSRT scientists interviewed, indicated that they did not initiate interaction with ARPT until they had new varieties ready for testing. Similarly, if the CSRTs had limited technologies, the ARPT scientists had little interest in interaction. The amount of technology any team has had to offer is affected by many factors, including: the finances allocated to the team; the number and experience of scientists in the team; the time the team has been working; and the nature of the problem being worked on.

In those cases where the CSRTs have been weak, ARPT scientists have been faced with the choice of either addressing less important problems or doing some of the CSRT research itself. When ARPT has tried to do some of the research, for example testing a new jab planter with farmers, it has sometimes run into great difficulties and had no specialist team to turn to. Alternatively, when ARPT has done the research on station, it has sometimes been accused by CSRTs of doing too much station research.

6.3. Resource Allocation to CSRTs

A major factor contributing to lack of available technologies has been very limited resources, including manpower, finance and vehicles of some CSRT's. This has slowed technology generation and hindered effective collaboration.

For example, in certain CSRTs, such as the Farm Machinery and Tillage Research Team, there have only been a few, and in some cases, no scientists with whom ARPT could discuss problems. In other cases, although the CSRTs have had scientists and the interest, they have not all had transport or adequate operating expenses to be able to travel to the provinces to meet with ARPT.

For all these reasons, ARPT scientists have come to fully appreciate the importance of having strong CSRTs which are well staffed and funded.

6.4. Disciplinary Composition of CSRTs

Until recently, there have been relatively few agronomists working in the CSRTs, as compared with the number of breeders. This has been due partly to the shortage of agronomists and to the fact that of those who were recruited several were allocated to ARPT. Consequently, there has been comparatively little agronomic research conducted by the CSRTs on the new varieties being released and the responsibility has fallen to ARPT to do some of the work. However, when ARPT agronomists have done some of this research the breeders have not always been satisfied with the treatments and designs being used, as in the case for some of the early work by ARPT on sorghum. The differences between the disciplines did not help relations due to the shortage of agronomists, the majority of ARPT's work has been with varietal improvement. As a result, ARPT has had fewer possible options to work with in solving farmers' problems.

6.5. CSRT Scientists' View of ARPT's Functions

The perceptions that CSRT scientists have of ARPT's role helps to explain certain aspects of the interaction between them. Thirteen of the 16 CSRT scientists interviewed, considered ARPT's primary role to be that of testing technology developed by the CSRTs on farmers' fields. Fourteen considered the secondary role to be providing feedback to the CSRTs from the farm level on the performance of technologies and about the farmers' problems and constraints. Ten CSRT scientists considered that ARPT's third function should be to link research and extension workers.

However, 14 CSRT scientists said that there was a clear distinction between ARPT's work and that of extension. ARPT was perceived to be

doing verification and testing research, while the role of extension was seen to have much more to do with dissemination and teaching about messages, than with the development of messages.

The importance given to the technology testing function, indicates that CSRT scientists are primarily concerned to interact with ARPT to ensure that their technology is taken as soon as possible to many farmers for their reaction. Less importance is attached to the need for ARPT to feed information to CSRTs about farmers' problems and constraints. This means that CSRT scientists are more likely to want to work with ARPT, once they have something to test at farm level, especially if they do not have the manpower to do on-farm trials. Several CSRTs such as maize, sorghum, groundnuts and, to some extent, grain legumes have reached this stage and some of the scientists in these teams indicated that they would like to have greater interaction with ARPT in technology testing. ARPT scientists may increasingly face a clash of interests between their own research priorities for a particular system and the desire of some CSRT scientists to have their varieties tested.

6.6. Factors Affecting the Attitudes of CSRT Scientists towards ARPT

There have been several factors which have affected the attitudes of some CSRT scientists and helped or hindered interaction with ARPT.

6.6.1. Experience with Farming Systems Research

Some CSRT scientists have had previous experience working in or with FSR programs and this has undoubtedly increased their interest in working with ARPT. Others, without such experience but with research programs clearly oriented to the problems of small farmers, are also supportive. Approximately one third of scientists interviewed were in these categories. They were generally supportive of ARPT and had taken initiative to collaborate. This factor would support the ADA(R)'s suggestion that there should be more movement of scientists between CSRTs and ARPT, resulting in greater mutual understanding.

6.6.2. Quality of ARPT Work

From the beginning of ARPT trial work, some CSRT scientists have been critical of the quality of ARPT's trials, many of which have had high coefficients of variance. Some CSRT scientists, simply rejected such results, especially when they were different from the findings of their own trials. The problem was attributed to ARPT's lack of experience with designing and managing on-farm trials. The criticism of their trial results made some ARPT scientists use more conventional trial designs and also made them increase the level of trial supervision.

It was thus surprising to find from the interviews in 1986, that 88% of CSRT scientists interviewed, said that they had no major worries about the reliability of ARPT's trial results. The majority said that they expected that the experimental methods for on-farm trials would be different from those for station trials, and in general they should be simpler. Similarly the majority of scientists were not very worried about high CV's with on-farm trials because many

had also experienced high CV's on trials conducted at research stations. About half thought that the on-farm trial designs could be improved by more consultation with the biometrician and/or relevant CSRT scientists, but only 6% thought that CSRTs should be responsible for designing ARPT's trials.

Several CSRT scientists thought that ARPT was overextended in some provinces and that this had resulted in less than adequate supervision with consequent trial loss and poor quality results. This issue has concerned most ARPT agronomists, and is one of the reasons why several teams have taken steps to tighten the clustering of trial sites, during farmer selection.

6.6.3. Competition for Resources

There was a time when ARPT was deliberately being favored by the ADA(R), in terms of the allocation of manpower and funds. This inevitably created resentment among some CSRTs, especially those with limited resources and consequently hindered interaction. The imbalance has been largely redressed in recent years and the present ADA(R) is securing resources for the remaining resource poor CSRTs.

6.6.4. Attitudes towards Social Scientists

Some of the CSRTs have complained, in the past, that ARPT has been dominated by social scientists, some of whom knew little about agriculture and that this has hindered effective interaction. From the interviews with CSRT scientists, 94% thought that if there could only be one discipline represented in ARPT it should be agronomy. However, 75% considered that there should be an economist in each provincial ARPT, and 56% thought that there should also be sociologists within the team.

About one third of CSRT scientists were unclear about the role of an economist. In some provinces, the ARPT economist has had a low profile, which has contributed to the low level of understanding about the role of the economist and also helped to give greater emphasis to the agronomist. A third thought that the economists could also do some economic analysis for the CSRTs.

Only about a third of the CSRT scientists considered they understood the role of sociologists; they thought sociologists could help them understand farmers' attitudes. The limited understanding of the role that social scientists can play in agricultural research has probably reduced the amount of interaction between ARPT and CSRTs and is an area where more effort is required.

6.7. ARPT Organizational Structure

In the past some CSRT scientists, including the present ADA(R), have been critical of ARPT's view of itself as a separate section of the Research Branch. They considered that the functions of ARPT could have been better performed if they had been integrated into the CSRTs. However, from the interviews, there was almost complete approval with the present structure. 94% of the CSRT scientists considered that the structure is appropriate because it has a whole farm perspective and is able to work with all CSRTs, free of any particular commodity bias. Some CSRT scientists said that if the

functions had been integrated into CSRTs there would have been too much work, the on-farm trial work would have been difficult to supervise, and there would probably have been considerable duplication of effort. Several scientists also mentioned that the present structure help to regionalize the focus of the research program.

6.8. Job Descriptions

Originally the job descriptions for ARPT staff gave little emphasis to interaction with CSRTs but this has changed in recent years. Some of the donor projects, especially those supporting both ARPT and CSRTs, have included interaction between ARPT and CSRT scientists as a specific duty in the job descriptions and this has facilitated interaction.

6.9. Relative Importance of Different Crops

Some CSRT scientists have wanted ARPT to be doing more work on their particular crops, but this has not always been possible when the crops have not been of high priority within the provinces and/or farming systems where ARPT has been working. Thus, for example, there has been little interaction between the ARPTs in Luapula and Northern Provinces and the Cotton and Soybean Research Teams.

6.10. Influence of Donor Support

All the provincial ARPTs and most CSRTs have received some external, donor support, usually in the form of technical assistance personnel and funding. This support has had several implications for the interaction between ARPT and CSRT scientists.

The structure of donor projects has sometimes helped interaction, when the project has supported scientists in both ARPT and CSRTs, as with the USAID funded ZAMARE project in Central Province There have been several formal and informal mechanisms which have facilitated interaction between the expatriate scientists in these teams.

i) In the case of the ZAMARE project there were clear policy guidelines that ARPT and CSRTs must be complementary. The job descriptions for all ZAMARE CSRT scientists listed interaction with ARPT scientists as an important duty. These policy statements have been taken quite seriously because they have been used during project evaluations.

ii) The donor projects have sometimes created additional occasions, both formal and informal, when ARPT and CSRT scientists could interact.

iii) The donor projects have had their own mechanisms for supervision and evaluation and these have helped to highlight the need for such interaction.

The main drawback with such donor influence for interaction, has been the tendency for such interaction to be mainly between project staff, excluding other team members or non funded CSRTs.

6.11. Senior Research Managers Attitude to Interaction

During the period while ARPT was being established, there was relatively little emphasis given to ARPT-CSRT interaction. It was assumed that this would take place naturally. The ADA(R)'s support for ARPT, during that period, somewhat hindered interaction, by the resentment that it created. The question of ARPT-CSRT interaction was raised by the ARPT NC in several ARPT meetings and linkage mechanisms were gradually introduced. However, the issue only became serious for senior research management when a CARO was appointed who was highly critical of ARPT and its activities. The CARO became a focal point of criticism about ARPT and subsequently strongly encouraged both ARPT and CSRT scientists to make maximum use of all the formal mechanisms which had been established for interaction.

6.12. Manpower Factors

In some provincial ARPTs, there have been highly experienced expatriate agronomists who have, relatively quickly, understood the available research data and have drawn up research programs, using their experience of what will or will not work. This level of experience has made them seem to be less interested in interaction with CSRT scientists than other less experienced agronomists.

The rapid turnover of scientists in both teams has been a major hindrance to building strong ARPT-CSRT relations. Rapid turnover has been due partly to the dependence of the Research Branch on expatriate scientists, who have been working on two or three year contracts. However, even Zambian staff have not remained long in any position because many have been sent abroad for post graduate training.

There has been no effective mechanism for new scientists, whether expatriate or Zambian, to be formally introduced to other scientists so that they can discover what everyone is working on within the Research Branch. The ARPT Provincial Coordinator for Luapula said that he had met most of the CSRT scientists by chance and he had not realized who certain senior CSRT scientists were.

Several CSRT scientists made the comment about ARPT-CSRT interaction, that scientists are generally individualists concerned first and foremost, with their own program. Thereafter they might be interested in issues related to scientists of their own discipline and then, possibly, with issues related to other disciplines. This is the result of training and career systems which emphasize disciplinary excellence sometimes at the expense of interdisciplinary cooperation. These comments highlighted the need for there to be formal mechanisms for interaction.

6.13. Hindering Factors

i) On several occasions CSRT scientists have been given too short notice about field visits, meetings and workshops. There has often been insufficient forward planning of such events.

ii) Farmers and ARPT scientists have been frustrated when varieties have not been available for sale after they have performed well in on-farm trials.

iii) Limited access to previous research results has been quite frustrating and has meant that ARPT has sometimes repeated work unnecessarily. The Research Data Base study being undertaken should help to remove this problem.

III. MANAGEMENT OF INTERACTION BETWEEN ARPT AND EXTENSION WORKERS

1.0. Introduction

The structure, staffing and methodology of the Extension Branch (EB) are described in Chapter Two. By way of introduction to this section, it is important to emphasize the high degree of variation in resource allocation, methodological approaches and degree of supervision found in the Extension Branch in different provinces. These have affected both the type and level of interaction with ARPT. A brief examination of extension activities in the three provinces selected as case studies in this study illustrates this variability.

The T&V system has been adopted as the national extension approach in Zambia. However, only in three provinces have sufficient resources been provided to enable this relatively high cost approach to be fully implemented. In Eastern Province, the World Bank Project (EPAD), which is supporting ARPT, was chiefly designed to implement the T&V system and has provided the funds and personnel to do so.

In Luapula Province, there has been no such attempt to support T&V throughout the province. However, FINNIDA has funded an Agricultural Extension Project in Luapula, which has undertaken a range of development activities through the Extension Branch, including; implementing a program of extension demonstrations, holding frequent refresher training courses for extension workers and providing limited amounts of credit to farmers. Although the project has not directly supported the implementation of the T&V system, it has provided the Extension Branch with much needed resources.

In Central Province, the Extension Branch has had only limited funds for implementing the T&V system and external support has been rather piecemeal. Funds have been provided from external donors to implement projects in three areas; one a Maize Development Project, operating in a relatively small area; an Integrated Rural Development Program operating in parts of one district and; the ZAMARE project,which besides supporting research, has also provided funds for motorcycles for extension workers as well as for personnel for research extension liaison, in the form of a RELO.

2.0. Benefits Expected from Interaction Between ARPT and Extension Workers

There has been interest within the Department of Agriculture for a long time to improve the level of interaction between research and extension generally (ref. section 2.II.1.5.). This was an important reason why, in 1977, the ADA(E) was made chairman of the steering committee monitoring the CIMMYT demonstrations (ref. section 3.II.1.1.). The same ADA(E) was the main advocate of the idea to

have Research Extension Liaison Officers working as team members in each provincial ARPT (ref. section 3.II.2.6.). There have been other important decisions made by senior managers in the Extension Branch which have indicated a continued high level of support for the idea that research-extension links need to be strengthened.

Close cooperation between ARPT and extension workers has been considered essential to improve the speed and efficiency of the technology generation and dissemination process. In particular, it has been important for the following reasons:

i) Experienced and trusted extension workers are able to supply information about farmers' problems and elicit farmers' honest opinions about technology being tested in trials.

ii) Extension workers, have better communication skills, which enable them to explain to farmers what ARPT is trying to accomplish. With good communication and trust, farmers are more willing to cooperate with ARPT, in both surveys and trials.

iii) By being involved in surveys conducted by ARPT, extension workers are able to gain a better understanding of how farmers make decisions about technology adoption.

iv) Involving extension workers in the on-farm trials helps to speed up the dissemination process, because they are better able to understand why farmers prefer one technology over another.

The gulf between research and extension workers has narrowed since ARPT was established, but many of the old problems still remain.

3.0. Level of Interaction between ARPT and Extension Workers

Two points should be stressed about the type and amount of interaction between ARPT and extension workers. First, the interaction has been different for the different levels of extension worker. Second, it has been different between extension workers in the Target Areas where ARPT has been working as compared with those where it has not. Although these are both obvious points, they are important to consider when trying to assess the progress achieved across a whole province.

At the most general level, it is clear from interviews with extension, that considerable progress in interaction has been accomplished in those areas where ARPT has been working. Several extension workers, who did not even have a clear understanding of the research being undertaken by ARPT, were enthusiastic about ARPT working in their area. For the first time, they considered that they had a research program working on the needs of their farmers. It appears that ARPT has been perceived as a decentralized research program, over which extension workers consider that they have a level of control, greater than that which they have over the research conducted at the research stations.

3.1. Level of Understanding of the Role of ARPT

The 27 extension workers interviewed generally did not have a detailed understanding of the role of ARPT. However, in broad terms, 63% considered that ARPT's principal role is to conduct on-farm research related to farmers' problems, while seven thought it is to show farmers how to grow crops better or how to grow new crops i.e. the conventional technology transfer view. 11% did not know what ARPT's role is.

It was interesting that 76% of the 17 Subject Matter Specialists (SMSs) interviewed, had a clear understanding of the role of ARPT to conduct research on farmers' problems identified through surveys. Only 50% of the local extension workers saw this as the main objective. The other 50% of local extension workers considered ARPT's work was broadly, that of technology testing. This difference in perception is probably due to the fact that very few LEWs had taken part in helping to formally plan ARPT's work program. (LEWs, include both Block Supervisors and camp level officers).

There was almost unanimous agreement among the extension workers, that there is a difference between the type of research being undertaken by ARPT, as compared with the CSRTs. The main difference is, that farmers are more involved in ARPT's research and, related to this, it was considered that ARPT's trials are simpler, more practical and take less time than those conducted at research stations. It was generally understood that the relationship between ARPT and CSRT scientists involves ARPT testing CSRT technology in on-farm trials.

Interestingly, only 19% of the extension workers interviewed, considered that ARPT's functions explicitly included bridging the gap between research and extension workers.

In general, the LEWs had a better understanding of the specific details of ARPT's program than did the SMSs. Seven of the 10 LEWs were able to give the details of the ARPT trials and on-farm test demonstrations in their area. The SMSs could usually only explain the program in general terms.

3.2. Level of Participation

Table 48 gives a general qualitative assessment of the level of interaction which ARPT has had with extension workers based on the research carried out for this study. Interaction is assessed at five levels; national (headquarters), provincial, district, block and camp. At the camp level, the assessment refers to the interaction between ARPT and camp officers working within the ARPT Target Areas. It is important to note that the assessment has not included the secondment of RELOs and Trial Assistants directly as evidence of involvement but has included them as facilitators of interaction. A five point scale has been used to make the assessment but none of the forty potential opportunities for interaction have been rated as, "Very Good Interaction".

Table 48 shows that there has not been much direct participation by extension workers in ARPT's activities; most direct involvement has

taken place at the camp level. The on-farm test demonstrations have involved Block Supervisors, but these activities have only taken place in Central, Eastern and Luapula provinces.

Provincial and, to a slightly lesser extent, district SMSs consider that they have had good opportunity to participate in planning ARPT's work program, largely through the ARPT Provincial Committees. However, the effectiveness of these committees is questionable. Block and camp level staff consider that they have only very limited involvement in planning ARPT's work.

Generally, the block and camp officers think that they have had good interaction with ARPT to feedback comments about the trials and farmers' problems, through various formal and informal meetings and as part of the T&V system in Eastern province. Provincial and district staff had moderately good feedback.

National level SMSs, based at MAWD headquarters, have had very little interaction with the provincial teams. The interaction which has occurred has concerned the feedback of information from ARPT and some involvement in planning provincial extension demonstrations.

There has been good feedback of ARPT results to provincial SMSs, mainly through reports and ARPT Provincial Committee meetings. There has been somewhat less feedback to district, block and camp staff.

ARPT staff have had good interaction with provincial and district SMSs about planning extension demonstration programs. Similarly, they have collaborated quite closely in extension training programs at which ARPT has been asked to teach technical subjects, as well as explain their work. In this activity there has been slightly better interaction with provincial extension workers than with those at the district, block or camp levels.

4.0. Occasions for Interaction between ARPT and Extension Workers

This section examines the occasions when ARPT and extension workers, at all levels, interact and the particular mechanisms that have been most useful in facilitating effective interaction.

4.1. Participation in ARPT's Activities

4.1.1. Surveys

Extension workers involved in ARPT's surveys have mainly been LEWs, at camp and sometimes block level. Only at camp level has there been moderately good interaction. Extension has had very limited involvement in the design and analysis of surveys.

LEWs have been the principal sources of information used by ARPT scientists, in all provinces, to demarcate the farming systems in each province. In Eastern Province, the information from such an "overview" survey, formed the basis for identifying the research problems and opportunities. During the informal, exploratory surveys, ARPT has used LEWs for introductions to farmers and to act as interpreters. There has, however, been little feedback to LEWs on the results of such surveys.

Table 48 : Level of ARPT Interaction with Extension Workers[1]

LEVEL	Participation in ARPT activities			Involvement in planning ARPTs program	Feedback to ARPT of extension comments on trials&farmer problems	Feedback of results from ARPT	ARPT involvement in planning extension demonstrations	ARPT involvement in extension training
	Surveys	Trials	On-farm tests[2]					
National	-	-	-	-	-	*	*	-
Provincial	*	-	*	***	**	***	***	***
District	*	-	*	**	**	**	***	**
Block	*	*	**	*	***	**	*	**
Camp[3]	**	**	**	*	***	**	*	**

Notes: Scale: - No Interaction
* Very Limited interaction
** Moderately good interaction
*** Good interaction
There is no example of very good interaction.

[1] The information contained in chart 3 is based on an assessment using interviews with 27 extension workers in Central, Eastern and Luapula Provinces and reports from other provinces. The assessment excludes the direct involvement of Research Extension Liaison Officers and Trials Assistants themselves but includes them as facilitators of interaction.

[2] On-farm tests have been conducted only in Central, Eastern, Luapula and Western Provinces.

[3] At camp level the interaction relates to that with Local Extension Workers within the ARPT Target Areas.

During the planning of ARPT, it was anticipated that extension workers would act as enumerators for ARPT surveys. This has, however, rarely happened. Usually ARPT staff themselves have undertaken the enumeration, sometimes using LEWs as interpreters, or they have hired enumerators. ARPT staff generally prefer to enumerate single interview surveys themselves because they can interact with farmers directly and do not have to invest time in training enumerators. ARPT teams have usually hired enumerators for frequent visit surveys. The time commitment is too great for LEWs, especially for those involved in the T&V system with its tight schedule of visits. It is also easier for ARPT to drop unsuitable enumerators when they are hired rather than seconded from extension. The ARPT in Central province tried using LEWs to collect agronomic data from farmers' fields but, because of insufficient training and supervision, the data were very unreliable.

The Trial Assistants have been involved in most surveys and have frequently collected data in the trials. However, most ARPT agronomists are now reluctant to use the TAs, at least during the planting season, to collect data on anything but trials because of time constraints.

Only 15% of SMSs interviewed had been invited to take part in surveys. They indicated that they would like to be involved more often if time permitted.

4.1.2. Trials

Virtually all of ARPT's on-farm trials have been implemented by Trials Assistants, who have been technically seconded from the EB to work full time with ARPT. This has proved to be a very effective mechanism for interaction and, in many cases, PAOs have seconded some of their best staff to work as Trials Assistants. Indeed, so effective have they been, that most ARPT agronomists are reluctant to let the TAs return to extension duties, as was originally intended.

The national, provincial and district SMSs have played no part in implementing the trials. In all provinces, except Eastern Province, block and camp level staff within the ARPT Target Areas, have had a limited and moderately good level of involvement, respectively. The involvement of camp staff has usually taken the form of assisting the TAs in activities such as farmer selection, supervisory visits to collect data and in a few cases planting, fertilizer application and weeding. Seven out of the 10 LEWs interviewed said that they had assisted the TAs in one or more of these activities.

In most cases, the TAs initiated this involvement. A critical factor, determining the level of such cooperation, has been the closeness of the working relationship between the TAs and the LEWs. In a few cases the TAs have become rather arrogant because of their secondment to ARPT and, in other cases, the LEWs have resented the special attention and motorcycles given to the TAs. The majority of LEWs said that they would like to be more closely involved in the TAs activities. However, many said that time constraints had inhibited involvement in the past. One LEW, in Luapula, was sufficiently motivated that he became a TA, when his predecessor left the Department of Agriculture.

Several ARPTs have wanted LEWs to be sufficiently informed about and interested in the ARPT trials in their area such that they could help the TAs when necessary, or substitute when the TAs are sick. Towards this end, ARPT in Central Province invited LEWs to attend the TAs' training sessions during which the next seasons's trials are discussed and TAs are given instructions about their work programs.

In Eastern Province the ARPT agronomist involved extension workers much more because he wanted his trials to be spread over a large number of widely dispersed sites (ref. section 3.III.3.2.). He gave his simplest trials, mainly FM/FI, to block supervisors scattered around the province outside the Target Areas. At first he had approximately 50% of his sites managed by LEWs. However, he lost such a large proportion through lack of supervision that he subsequently reduced the proportion to 30%.

4.1.3. On-farm Test Verifications

On-farm test demonstrations are put on within the Target Areas to disseminate information about technologies which have performed well in on-farm trials so that their adoption by farmers can be monitored. The intention has been that the RELO and LEWs should be fully responsible for monitoring adoption of technology when there is not close supervision by ARPT or the supply of free inputs. Experience with this work is rather limited; only two of the five provincial ARPTs which have reached this stage have had more than one season's experience. The work has centered mainly on conducting demonstrations and monitoring those, rather than farmer adoption.

The provincial and district SMSs have been involved in helping to plan which technologies should proceed to this stage. These discussions have taken place at meetings of the ARPT Provincial Committees. The RELOs have been actively involved in the provinces with RELOs.

Block- and camp-level LEWs have generally had moderately good involvement in the demonstrations, supervising their implementation and recording data, as they would on their normal extension demonstrations. It is still too early to say how effective the involvement will be.

4.2. Involvement in Planning ARPT's Program

There have been good opportunities for provincial and district SMSs to be involved in making decisions about ARPT's work program, but there is doubt about how effective they have been. The most important occasions have been the ARPT Provincial Committee meetings, which 76% of SMSs interviewed had attended.

The SMSs interviewed were divided in their opinions about whether they had really influenced the direction of ARPT's program. About half of them thought that they had influenced the program through the Committees and were able to cite examples of their ideas being incorporated. The other half thought that ARPT had pushed their proposals through with minimal discussion, and the Committees were simply "rubber stamping" the program. Most ARPT scientists did not think that the Committees had influenced their programs

significantly. However, the ARPT scientists generally thought that they had taken the views of extension workers into consideration when drawing up their programs, based on comments made by extension workers during the season.

The LEWs considered that they have had very limited or no involvement in planning ARPT's program. No formal meetings have been held with the LEWs to plan ARPT's program, although there have been various occasions when comments and suggestions about the trial program could be made to ARPT staff. For example, in Luapula Province, meetings have been held in the Target Areas at the end of each season, during which LEWs and farmers could make suggestions for the next season.

4.3. Feedback from Extension Workers to ARPT

There has been moderately good feedback of information from provincial and district SMSs to ARPT about the value of technologies included in trials and about farmers' problems. The main occasions for such feedback have been the annual field days at selected on-farm trial sites, as well as the ARPT Provincial Committee meetings. In the field days, as compared with the committee meetings, the comments are made verbally, and nothing is written down. Consequently, some comments may be forgotten or excluded from the planning procedure.

The feedback of comments and information from LEWs to ARPT has been good. The main occasions have been at field days, a few end-of-season meetings, and informal discussions, either directly with ARPT staff or with the TAs. In Eastern Province the T&V reporting system has proved to be a fairly effective feedback mechanism, bringing problems from LEWs to ARPT's attention through the District Training teams. The feedback has been both written and verbal, and follow-up action is expected to be reported on at subsequent meetings.

The ARPT staff in both Central and Luapula Provinces have said that they consider the field days to be the most effective of all occasions for interacting with LEWs. Most ARPTs now hold separate field days for farmers and extension workers (ref. section 4.I.3.5.). The intention has been to have all the camp staff from the Target Area attending the field days and as many block supervisors from the district as possible. The field days have usually been organized by the RELOs together with the district staff. The field days have entailed visiting selected trial sites where the TA and/or ARPT staff have explained the trials and then asked for comments. In Luapula and Western Provinces, the teams have found it useful to conclude the field days with a formal meeting, where the participants can discuss what they have seen and minutes can be taken. In Central Province, the ARPT staff have tried to increase the participation of block supervisors at field days by showing them the trials before the farmer field days and then having the block supervisors take the farmers around the sites.

In Eastern Province, ARPT has relied much less on field days to get LEW feedback, although block supervisors have organized field days for both the ARPT trials and the extension demonstrations. ARPT has relied more on the T&V reporting system to provide feedback on the program. This is generally regarded, to have been a successful mechanism.

4.4. Feedback of Results from ARPT to Extension Workers

Limited information about ARPT's activities has reached the Senior SMSs at headquarters. They have regularly received copies of ARPT's annual reports and occasionally copies of survey reports. Information has also been presented at the ARPT Research Committee meetings, to which they have been invited.

The feedback of information from ARPT to Provincial SMSs has been good, and almost all of those interviewed expressed satisfaction with the amount of information they had received. ARPT has provided information to SMSs by supplying them with copies of reports and by presenting research results during the ARPT Provincial Committee meetings. The SMSs had generally found the Provincial ARPT annual reports to be the most useful documents. In Eastern Province, the SMSs had used the ARPT reports intensively for compiling the monthly bulletins sent out to each LEW as part of the T&V system. Information about ARPT's activities has also been provided to extension workers, including SMSs, during training sessions organized by ARPT staff.

The flow of information to district SMSs and LEWs has been moderately good. The district staff have received copies of most reports, but most LEWs have received only a few. The LEWs in some provinces have received reports drawing on ARPT data, in the T&V monthly bulletins in Eastern Province and the bi-monthly Research-Extension newsletters produced by the RELOs in Central, Northern and North Western Provinces. There has also been useful feedback to LEWs through some occasional meetings arranged by ARPT to present results or discuss the next season's program. There has also been informal feedback to LEWs from the TAs and from the ARPT staff when they have met extension workers in the field. However, most LEWs complained that there had been insufficient feedback from ARPT.

4.5. Miscellaneous Occasions for Interaction

4.5.1. ARPT Involvement in Planning Extension Demonstrations

In the last three years the Extension Branch has been streamlining its program of demonstrations to make them more relevant to farmers' needs. Until 1986, the demonstrations were planned at MAWD headquarters, but since then they have generally been planned at the provincial level.

With new procedures, the first step is for LEWs to hold meetings with farmers to discuss the problems on which they would like to have demonstrations. These lists are then passed through the district SMSs to the Provincial Crop Husbandry Officer for discussion at a meeting of the ARPT Provincial Committee. There the most appropriate solutions to be put into the demonstrations are identified. These new procedures have been in operation for only one season; so it is still too soon to assess their effectiveness. However, so far, ARPT staff in six provinces have had quite lengthy informal and formal discussions about the demonstrations, mainly with Provincial and district SMSs. The RELOs have played a major role in this activity.

4.5.2. ARPT Involvement in Extension Training

ARPT staff in all provinces have been invited to take part and teach extension staff of all levels in a wide range of in-service training courses. This has provided many opportunities for ARPT to explain the concepts behind ARPT's work as well as the details of the work being undertaken. The subjects taught have varied from explaining the latest crop husbandry recommendations for a province to discussing the technological requirements of female farmers. The RELOs in Central, Northern and North Western Provinces have taken the lead in this work, but all ARPT team members have been involved in teaching. The RELO in Central Province played a major role in organizing extension training and helped to arrange courses on many subjects, including the role of FSR/E, program planning for extension, crop husbandry, animal husbandry, and effective communication skills.

4.5.3. Revision of Provincial Crop Recommendations

The provincial crop recommendations have been revised in Eastern and North Western Province and are in the process of being revised in Northern Province. In the first two provinces the proposed revisions were made by the ARPT agronomists, working with the provincial SMSs. In the case of Northern Province, the RELO approached all the extension workers in the province and requested their opinions about the technical content and format of the present recommendations. The views of CSRT scientists have been sought subsequently.

4.5.4. Production of Newsletters

In Central, Northern and North Western Provinces bi-monthly research-extension newsletters have been produced. A similar newsletter will shortly be produced in Luapula Province. The RELOs have been the editors, sometimes jointly with the Provincial Extension Training Officer. Most provincial and some district SMSs have contributed to the newsletter, as well as ARPT and CSRT scientists. The newsletters have definitely been very useful mechanisms for disseminating information in a quite simple style.

5.0. Factors Influencing ARPT's Interaction with Extension Workers

5.1. Support of Senior Extension Managers

At the extension headquarters there has been considerable support for interaction between ARPT staff and extension workers of all levels. The best examples of this support are the creation of nine RELO posts, the secondment of LEWs to work as full time TAs for ARPT, the decision to hold a national workshop on research-extension linkages, and support for the idea of an extension communications specialist to develop extension training material explaining the FSR concept and how it relates to extension work.

The reasons for this support are partly historical but have been helped by organizational and personal factors (ref. section 3.II.1.1.). The two Assistant Directors of Research and Extension occupy adjacent offices in the Ministry headquarters, and they have considerable formal and informal interaction. As a result, each has

a good understanding of the objectives of the other branch and this has helped them both to work towards a common goal of generating and disseminating relevant technical messages to small-scale farmers.

At the provincial level, the PAOs have sometimes played an important role in encouraging extension workers to cooperate with ARPT. The power and importance of the PAO is quite considerable, which is why some ARPTs have worked very closely with them (ref. section 3.I.7.). Some PAOs have taken a lot of care to find LEWs who would be suitable TAs and have readily replaced those who have proved unsuitable. In Luapula Province the PAO was so concerned to assist ARPT that he not only made appeals to the SMSs to make a special effort to cooperate with ARPT, but he also nominated the Extension Training Officer to work with ARPT as a part-time RELO. Most PAOs have invited ARPT to attend their monthly or quarterly staff meetings and have also encouraged ARPT staff to take part in training extension workers. In a few cases, such as in Luapula Province, the PAOs have requested ARPT's views on specific topics, such as varietal recommendations and new projects proposed for the province. PAOs also assist ARPTs to secure housing.

In some provinces the support of the PAO has been a matter of simply fulfilling a duty which would be undertaken for any section of the Department of Agriculture. However, in four provinces the PAOs have strongly supported the idea of ARPT, because they perceive it as being a research program designed to meet the needs of their local farmers. For example, in Lusaka Province the PAO has promised to help ARPT secure funding when the donor funding comes to an end.

The rate of turnover of PAOs has been quite high in some provinces. Central Province has had five PAOs since ARPT was established. This turnover has hindered the building of long-term relationships between ARPT and particular PAOs.

The personal characteristics of some PAOs have been quite important in determining the amount of support given to ARPT. In one province a young rather domineering PAO regarded ARPT as a competitor and had very little interest in encouraging extension workers to interact with ARPT. He was subsequently replaced by a much older experienced PAO with less interest in career advancement. He took a personal interest in ARPT and was keen that it should succeed. As a result, he encouraged extension workers to cooperate actively with ARPT.

5.2. Research Extension Liaison Officers

In the 4 provinces where there have been full-time RELOs, they have played an important role in explaining ARPT's work to extension workers. Half of the SMSs interviewed considered that the RELOs had contributed significantly to improving the level of interaction between ARPT and extension, as well as generally helping to bridge the gap between research and extension. In provinces without full-time RELOs, there has been increasing pressure for them to be recruited.

Similarly, the ARPT scientists considered that the RELOs have played an important role in improving interaction. In provinces where there have been no RELOs, the ARPT staff have had to allocate time

for interaction with extension, and most agree that time has been insufficient. In Luapula Province, which was without a full-time RELO until mid-1986, the ARPT staff had noticed an improvement within six months of the RELO's arrival.

In spite of the RELOs' comparative success, the post of RELO has been rather unstable and has not been fully accepted by all extension managers and SMSs. The problems stem from 1980, when it was agreed that the RELO post should be an Extension Branch post seconded to the Research Branch (ref. section 3.II.2.6.1.). Consequently, the filling of posts has depended upon the availability of personnel in extension, and transfer of the RELOs in and out of ARPT has been a decision of the Extension Branch, not the Research Branch. Unfortunately, this feature of joint responsibility has been the very source of weakness with the position.

The uncertainty about the position has resulted in several problems. The first has been the delay in recruiting both Zambians and expatriates to fill the RELO positions, again owing, in part, to uncertainties about who was responsible for recruitment. It was also initially believed that RELOs did not need to be recruited until ARPT had new technical messages ready for dissemination.

The second problem has been the uncertainty regarding the RELO's job description, which has been changed twice since the original was produced in 1982. As a result, the RELO's activities have varied from one provincial ARPT to another, depending on the emphasis in each particular province. The RELOs have been involved in an extremely wide range of activities, including planning and implementing on-farm test demonstrations, planning extension demonstrations, holding in-service training courses on a multitude of topics, producing Research-Extension newsletters, organizing field days, discussing revision of provincial recommendations; and preparing extension bulletins for use in the T&V system. The ARPT NC has emphasized the need for RELOs to give greater attention to getting more extension workers to participate in ARPTs surveys and trials and to explaining, in simple terms, the FSR concept and how it affects extension messages.

The RELOs have had the time, transport and finance to support these activities, unlike most SMSs, who have had sizable workloads but very limited resources. The wide-ranging nature of their activities has caused some SMSs, mainly Extension Training Officers (ETOs) and a few Crop Husbandry Officers, to be concerned about the duplication of responsibilities. ETOs identified the potential overlap of activities at the 1985 workshop on research-extension linkages.

A third problem has been whether the RELO should be based with other ARPT team members at the research station or together with the SMSs at the PAO's office. In practice, the RELOs have usually been based with the ARPT staff, and to date this has not created any major problems for them relating to the SMSs. In provinces where RELOs have played more of an extension role, they have preferred to be located at the PAO's offices. When the RELOs have been recruited from among the SMSs within a province, the relations between them have been particularly close.

The issue of the relationship between the National RELO and the ARPT RELOs is not yet clear, mainly because of the variance in terms of reference for the national RELO and the provincial RELOs. Until clearer well-focused terms of reference are drawn up, this uncertainty is bound to continue.

5.3. Trials Assistants

When the Director of Agriculture decided to have LEWs technically seconded to work full time for ARPT, he considered that this field-level involvement was the most important point of contact between research and extension workers (ref. section 3.II.2.6.2.). The use of LEWs as TAs has worked so well that most ARPT agronomists are reluctant for the TAs to return to their extension duties. The matter of how long TAs should be seconded to ARPT is still under review, but it would be a major reversal of the principle of research-extension interaction if the TAs were to become permanent research personnel.

TAs have provided an important link between ARPT and extension field staff. In many cases the LEWs knew the TAs when they were camp officers, and this has helped them to identify closely with the TAs. Housing the TAs in the same communities as the LEWs has also provided many opportunities for informal interaction. In Central Province ARPT has found it useful to invite the LEWs to participate during the TA annual training sessions.

5.4. Influence of Donor Projects

In Central, Eastern and North Western Provinces the donor support to ARPT has been part of larger projects, which have components also supporting the Extension Branch. In Eastern and North Western provinces the projects have provided the manpower and resources to implement the T&V system. An important objective of both projects has been to strengthen the research-extension linkage through ARPT activities. This has meant that the donors have evaluated the project and project staff in terms of the progress made towards accomplishing better interaction. The onus placed on staff, the resources provided and the informal opportunities for interaction between project staff have clearly helped to improve relations between ARPT and extension. However, there has been a tendency for most of the interaction to take place only between project staff.

In Central Province, although the ZAMARE project has not supported the implementation of the T&V system, the project goals strongly emphasized interaction between research and extension and project evaluations have given the issue high priority.

The problem of coordinating different donor projects has arisen in several provinces. In some cases donor projects in the EB have conducted on-farm trials without consulting anyone in ARPT. There have been other projects, working in the same areas as ARPT, which have offered LEWs attractive incentives to put on demonstrations. LEWs have then expected the same incentives from ARPT for any assistance. Strong coordination of such assistance is required.

5.5. Motivation of Extension Workers

Some ARPT staff have blamed the limited interaction with some extension workers on their lack of motivation. When this point has been explored further it seems that several related factors may help to explain the apparent lack of motivation.

5.5.1. Lack of Time

Many of the extension workers interviewed said that they would like to participate more fully in ARPT's activities, but they have not had sufficient time. In addition to their extension activities, extension workers have to deal with a wide range of other tasks, such as assisting farmers with loan applications, collecting crop forecasting information, and keeping farm registers. Undoubtedly most extension workers are very busy, but this is usually at particular times of the year. There are less busy times, even during the growing season.

The PAO in Luapula Province instructed his staff to make time to work with ARPT but with only partial success. Several ARPT staff gave examples of prearranged field trips which extension workers did not show up for, even when transport was provided. More forward planning of ARPT's activities would help to alert extension workers so they could plan ahead. In this respect the use of calendarized protocols for each ARPT activity, as well as more regular attendance at the PAOs staff meetings, could be useful. Job descriptions should also clearly specify that extension workers should allocate time to working with ARPT.

5.5.2. Lack of Understanding

Another general complaint of ARPT staff has been that many extension workers, especially those working outside the Target Areas, do not fully understand what ARPT is doing. This has sometimes resulted in suspicion and mistrust, both of which have been counterproductive to good working relations.

This lack of understanding has arisen in some provinces because there have been too few training occasions for explaining ARPT functions. The absence of RELOs in some provinces has limited the amount of training which could be undertaken.

5.5.3. Lack of Involvement in ARPT's Activities

Several SMSs explained their lack of understanding of ARPT by the fact that they had not been invited to take part in ARPT's surveys and trials. They also thought this had contributed to their limited input into planning ARPT's work program. They assumed that the initiative lay with ARPT to invite them to participate in their activities.

5.5.4. Poor Conditions of Service

Low salaries, limited allowances, lack of transportation and poorly maintained accommodation have all been reported many times in studies of the Extension Branch. These have been given as reasons for many extension workers being demoralized and lacking motivation

(GRZ MAWDa, 1984). ARPT can only help to alleviate these conditions insofar as it might be able to attract external donor support.

5.6. Manpower Factors

Several manpower factors have been mentioned as having influenced the level of interaction between ARPT and extension workers.

5.6.1. Rapid Turnover of Staff

ARPT staff in several provinces complained about the rapid turnover of staff. For example, in Central Province there have been five PAOs since ARPT became fully operational. Moreover, 80% of the LEWs who were interviewed from two camps in Central Province had been based there for no more than six months. Since it takes at least a full season before the extension workers begin to know their area and farmers, it is very disruptive if they are transferred every two or three years. This degree of staff movement has also made it extremely difficult for ARPT staff to build good working relationships with extension workers. The lack of staff continuity has meant that ARPT has had to keep repeating explanations of its program to extension workers.

5.6.2. Education Level

There is a big difference in education level between the LEWs and the ARPT scientists. In some cases this has hindered communication when it has not been openly recognized. Extension training material needs to be developed which will help to explain the FSR concept in simple terms. On a few occasions ARPT professionals have looked down on the LEWs and have not given them sufficient respect, indicating that communication was not being sought.

Although many of the SMSs are graduates at the same level as Research Branch scientists, some of them complained that the scientists consider themselves to be superior to extension workers. One SMS said that even during university training there has been a tendency to revere research and to look down on extension, and how there are "two worlds" within the Department of Agriculture. This general attitude has hindered interaction between research and extension workers for some time.

5.6.3. Training and Orientation of Extension Workers

Most of the training given to extension workers, whether at certificate, diploma or degree level, has been oriented towards commercial farmers, largely because no alternative training materials have been available. Until recently, many of the extension messages have not been wholly appropriate for the small-scale and subsistence farmers which has meant that the LEWs have tended to work more closely with the more commercially oriented farmers. Some LEWs have found it rather strange that ARPT should want to work with the resource-poor subsistence farmers. This difference in client group perception has sometimes hindered communication.

5.7. Extension Approach

In Eastern and North Western Provinces, where the T&V system has been introduced in a quite intensive way, certain aspects of ARPTs interaction with extension workers have been greatly improved. In particular, the two-way flow of information has been very effective; from ARPT to LEWs in the form of extension bulletins, and from LEWs to ARPT through the reporting system and the District Training Teams. However, the T&V managers are reluctant to see Camp Level staff involved in ARPT surveys and trials because it would disturb their regular schedule of farm visits which, unlike trial supervision, are seen as central to the duties of extension staff in a T&V system.

In other provinces, where the T&V system has not been so strictly implemented due to resource constraints, there are still farmer groups with contact farmers to be visited and demonstrations to be conducted, but the level of supervision is much less. In these provinces there is much greater flexibility for LEWs to be involved in ARPT's activities. However, there is no disciplined schedule of meetings to ensure that there is two-way flow of information from ARPT to LEW and back.

5.8. Logistics

The distances between the research stations, where ARPT staff are based, and the extension workers who are scattered around each province, are substantial. Communication of any sort between ARPT scientists and the TAs is difficult enough, and it is even worse for LEWs. In addition, in most provinces the LEWs do not have enough transport or subsistence allowance to be able to travel around to do their extension duties, let alone accompany the TA or other ARPT staff. This is why, apart from a very few training sessions, the LEWs outside the ARPT Target Areas have had much less interaction with ARPT scientists than those within.

5.9. ARPT Provincial Committees

Although these committees have been less successful than had been anticipated, they have nevertheless been moderately important for enabling two-way discussion between ARPT and SMSs. In some cases they have made major decisions about the location of ARPT's activities, and they have helped in the planning process to a limited extent. In general, extension staff have been more satisfied with the utility of the provincial committees than ARPT staff.

5.10. Extension Specializations

Because each SMS has a specialization, some of them have had very little to do with ARPT. Of all the SMSs, there has been most interaction between ARPT and the Extension Training Officers, the Crop Husbandry Officers, and the Farm Management Officers. SMSs dealing with animals, home economics, horticulture, youth and land-use planning have had rather limited interaction. This is partly due to ARPT's crop focus but also to the SMSs having rather narrow interests.

6.0. Conclusion

It is very difficult to summarize the progress made towards effective cooperation between ARPT and extension workers. There has been a high degree of variation, even within one province, and much has depended on interaction between the individuals. Most ARPT scientists have regarded interaction with extension workers as important, but they have generally lacked the time to devote sufficient attention to improving relations, preferring to leave the responsibility with the RELOs. The RELOs have played an important role in improving relations although, in some cases, this has been by means of undertaking conventional extension activities. The SMSs are moderately well informed of ARPT's activities, but they have had negligible involvement in ARPT's surveys, trials and on-farm tests. As a result, they have felt rather ignorant and somewhat indifferent when it came to planning ARPT's programs during the ARPT Provincial Committee meetings. Interaction with LEWs working outside ARPT's Target Areas has been limited, except in Eastern Province. LEWs within the Target Areas have had quite good interaction and involvement in ARPT's activities, largely because of the role played by the TAs. Feedback of comments from LEWs has been quite good, especially where the T&V system has been rigorously implemented, but the LEWs do not consider that they have had any input into planning ARPT's work program.

CHAPTER FIVE

ASSESSMENT OF ARPT'S PERFORMANCE OF KEY OFCOR FUNCTIONS

1.0. Introduction

This chapter examines ARPT's performance of the seven functions the ISNAR study considers to be central to the majority of OFCOR programs. They are described below.

Function 1: support a problem-solving approach within research which is fundamentally oriented to farmers as the primary clients of research.

Function 2: contribute to the application of an inter-disciplinary systems perspective within research.

Function 3: characterize major farming systems and client groups, using agro-ecological and socioeconomic criteria, in order to diagnose priority production problems and identify key opportunities for research, with the objective of improving the productivity and/or stability of those systems.

Function 4: 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.

Function 5: promote farmer participation in research as collaborators, experimenters, testers, evaluators, and disseminators of alternative technologies.

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

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

These functions correspond closely to the objectives originally assigned to ARPT (ref. section 3.I.3). The assessment is based on the research carried out by the study team and the results of a survey conducted with Research Branch staff (see Appendix X for methodology used).

Table 49: Assessment of ARPT Functions (1) (2) (3)

	Function 1		Function 2		Function 3		Function 4		Function 5		Function 6		Function 7	
	Ideal	Actual	Ideal	Actual	Ideal	Actual	Ideal	Actual	Ideal	Actual	Ideal	Actual	Ideal	Actual
ARPT	3.5	3.1	3.4	2.8	3.3	3.1	3.6	3.1	3.2	2.7	3.7	2.8	3.2	2.8
CSRT	3.5	2.8	3.4	2.5	3.5	2.9	3.4	2.8	3.4	2.8	3.6	2.4	3.5	2.8
Total	3.5	2.9	3.4	2.6	3.4	3.0	3.5	3.0	3.3	2.7	3.6	2.6	3.3	2.8
Study Team	3.0	2.0	3.0	2.5	4.0	3.0	4.0	2.5	3.0	2.5	3.0	2.5	3.0	2.5

NOTES:

(1) The assessment is based on interviews with Research Branch Staff: "Ideal" is based on interviews with 17 ARPT staff and 22 from CSRTs
"Actual" is based on interviews with 21 ARPT staff and 25 from CSRTs

(2) Abbreviated definitions of functions:
Function One - Support a problem-solving, farmer-oriented approach to research.
Function Two - Contribute to an interdisciplinary approach within research.
Function Three - Characterize farming systems and diagnose production problems.
Function Four - Adapt technologies through on-farm trials under farmers' conditions.
Function Five - Promote farmer participation in research.
Function Six - Provide feedback of farmers' problems to CSRT scientists.
Function Seven - Promote collaboration with extension and development agencies.

(3) Scale used for rating:
1 = Not important
2 = Moderately important
3 = Very important
4 = Critically important

Table 49 summarizes the conclusions of the analysis. The functions are assessed both in terms of their ideal importance (i.e., the perceived importance that the function should have within the research system) and their actual importance as indicated by their current level of performance.

The study team considered that functions 3 and 4, related to characterization and technology adaptation, have been the most important for ARPT in ideal terms. In terms of actual importance, the study team considered that ARPT has assigned highest priority to and made the most progress in performing function 3. Less progress has been made in function 4. Function 1, concerned with supporting a problem-solving approach and client orientation within the Research Branch, was considered to have been least successfully performed. The other functions, all of which the study team considered to be very important in ideal terms, were considered to have been between moderately to very important in actual implementation.

The aggregate survey responses of 39 ARPT and CSRT scientists indicate that they considered each of the seven functions to be at least very important in ideal terms. Function 6, concerned with providing feedback from farm-level research to CSRT scientists, received the highest rating in ideal importance by both ARPT and CSRT scientists. This function, however, received one of the lowest rankings in actual performance. Functions 5 and 7, relating to farmer participation and linkages with extension, received the lowest ranking in ideal importance.

There were some interesting differences in the assessments of importance made by ARPT and CSRT scientists. In general, the ARPT scientists ranked the actual importance of almost all of the seven functions higher than the CSRT scientists. More specifically, CSRT scientists ranked the ideal importance of functions 3, 5, and 7, relating to characterization, farmer participation, and linkages with extension, higher than ARPT scientists. In contrast, ARPT scientists perceived the ideal importance of the function of technology adaptation, function 4, to be higher than did the CSRT scientists, and they also ranked their actual performance of this function higher. The largest difference in assessment of actual performance was in the feedback function, function 6, which ARPT scientists perceived to have had a higher level of actual importance than CSRT scientists. CSRT scientists considered that the actual importance of the feedback function, as reflected in performance, had been the lowest of all seven functions.

In the following sections, the performance of each function is reviewed in detail, and evidence is given to substantiate the assessments. The key organizational and managerial factors influencing the performance of each function are also analyzed.

2.0. Assessment of ARPT's Performance of Function 1

2.1. Definition of Function 1

The first OFCOR function is for ARPT to support a problem-solving approach which is fundamentally oriented to farmers as the primary

clients of research. The critical feature of this function is that ARPT should be helping the Research Branch to ensure that all research is focused on priority problems of client farmers.

2.2. Relative Importance of Function 1

The study team viewed this function as very important in ideal terms and considered that moderate progress has been made in implementing function 1. ARPT has fostered a stronger client orientation within the Research Branch, particularly with respect to small-scale farmers. CSRT scientists have gradually come to recognize the need for better information on farmers' problems, and the role that ARPT can play in generating this information as well as in involving farmers more fully in the research process.

According to the results of the survey on ARPT's functions, both ARPT and CSRT scientists considered this function "ideally" to be very important (Table 49). However, neither ARPT nor CSRT scientists considered that this function, as actually performed, had reached the "ideal" level (Table 49). ARPT scientists considered that slightly better progress had been made with implementing the function than did CSRT scientists.

2.3. Evidence to Support the Assessment of Performance

The information in this section relates to how ARPT and its activities have helped the Research Branch, as a whole, to promote a problem-solving client-oriented approach towards small-scale farmers.

2.3.1. The Role of Farmers in the Research Process

CSRT scientists consider that ARPT has primary responsibility for on-farm research and for feeding relevant information back to station-based research. Nevertheless, there has been a growing interest among scientists in several CSRTs to undertake both surveys and on-farm trials. Scientists from 4 out of the 8 CSRTs represented in the interviews had conducted farmer surveys in order to have a better understanding of the production constraints facing farmers in their particular crops. Scientists from these CSRTs have also undertaken on-farm trials to test their new varieties under farmers conditions.

Most of the CSRT on-farm trials, however, have not been preceded by surveys to identify farmers' research priorities. Rather, they have been technology tests, in which it is assumed farmers' priorities are the same as those of scientists. Most scientists still see farmers more as passive recipients of research than as active clients whose own priorities form the basis of research priority setting.

2.3.2. ARPT as a Promoter of a Stronger Client Orientation

It was clear from the interviews with CSRTs and senior research managers that the complementary role of ARPT within the Research Branch, focusing on the needs of small-scale farmers, has in recent years been largely accepted.

The Director of Agriculture, when interviewed for this study, said that he thought ARPT had helped most scientists in the Research Branch to have a better understanding of the problems of small-scale farmers. Likening ARPT to "the railway sleeper, upon which the Research Branch rests", he considered that ARPT has helped to integrate the work of all the CSRTs because it cuts across them all.

Interviews with the CSRT scientists were also quite positive. Ninety-four percent of CSRT scientists considered that ARPT should have a role in helping to plan CSRT research programs, and 6 CSRTs gave examples of how information generated by ARPT had helped to either shape trial designs or set priorities. Yet, virtually all CSRT scientists considered that ARPT's primary role should be to test technology, and the identification of farmers' priority problems was, in most cases, assigned secondary importance. It is, nonetheless, important to recognize the potential feedback function that ARPT can play through testing CSRT technology and reporting on farmers' other priorities as part of the trial results (ref. section 5.7.3.).

2.3.3. Incorporation of Farmers' Priorities into CSRT Trials through Discussions with ARPT

Representatives of 5 out of the 8 CSRTs interviewed gave examples of how information provided by ARPT about farmers' circumstances helped them to set research priorities and design their trial programs. These included examples of preferred varietal characteristics, fertilizer levels appropriate for both agronomy and breeding trials, and specific treatments in agronomy trials (ref. section 4.II.3.).

2.3.4. Criteria used for Assessing Trials

ARPT has used several criteria for assessing the results of trials, including both biometric and economic analysis. The biometric analysis has included yield assessments and environmental stability analysis. Economic assessment has included partial budget analysis and an assessment of the returns to capital and labor. The riskiness of some trials has also been assessed by conducting minimum returns analysis.

Most CSRTs have principally used yield as the assessment criteria, but some scientists have conducted stability analysis. A few teams have asked ARPT to provide an economic assessment of some of their previous results. During interviews, several scientists said that they would like ARPT to provide more support with economic analysis of trial results.

2.4. Key Factors Affecting the Performance of Function 1

2.4.1. Policy Emphasis on Small-scale Farmers

This has been an important factor facilitating the performance of function 1. Beginning in the mid-1970s, there was concern within MAWD that small-scale farmers had long been neglected and that more should be done to help them to increase production. In response, many development projects targeted at this sector were initiated. This policy environment stimulated and supported senior research managers' initiatives to implement ARPT (ref. section 3.II.1.1).

2.4.2. Support of Senior Research Managers

The commitment of a core group of senior Zambian research managers in both the Research and Extension Branches to increasing the relevance of the research program for the small-scale farmers was an important factor facilitating the performance of this function (ref. section 3.II.1.2). Their support was very influential in creating a favorable environment for the establishment of ARPT and for focusing attention on long-neglected traditional crops important for small scale farmers, such as sorghum, millet, cassava, sweet potatoes and beans.

2.4.3. Role of ARPT National Coordinator

The ARPT NC played a key role in promoting the complementary role of ARPT within the Research Branch and in developing mechanisms for disseminating information from ARPT and stimulating discussion between scientists in ARPT and CSRTs. This has been an important factor in contributing to the promotion of a stronger client orientation towards small-scale farmers through the Research Branch.

2.4.4. Dissemination of Farm-level Information by ARPT

Although the distribution of ARPT reports has not been totally satisfactory, CSRTs have used ARPT information about farmers' problems gathered through formal and informal meetings in planning their research programs (ref. section 4.II.4. and 5.7.3.). This sharing of information has been an important factor supporting the performance of this function.

2.4.5. CSRT Field Visits to ARPT programs

This has been an important factor in helping to build a stronger client orientation among CSRT scientists. Field visits have tended to give CSRT scientists more confidence in ARPTs diagnosis of farmers' problems and their evaluation of possible technological solutions. The case study on ARPT collaboration with the maize CSRT is a good example of the positive impact field visits can have on the performance of this function (ref. section 4.II.4).

2.4.6. Encouragement for Scientists to Interact with Farmers

This has been a factor of negligible importance. Rewards for scientists are not tied to interaction with farmers. However, in spite of this lack of explicit encouragement, there has been quite a lot of interaction. A more formal reward system encouraging scientists to address farmers' priority needs would strengthen the performance of Function 1.

2.4.7. ARPT Rural Sociology Section

The establishment of the ARPT Rural Sociology Section has been a moderately important factor in helping ARPT focus attention within the Research Branch on the priority needs of small-scale farmers.

3.0. Assessment of ARPT's Performance of Function 2

3.1. Definition of Function 2

The assessment of the second OFCOR function refers to the extent to which ARPT has contributed to the application of an interdisciplinary systems perspective within research.

3.2. Relative Importance of Function 2

Information collected during this study indicates that there is a rather inconsistent picture of how well the function has been performed. In general, however, it appears that within both ARPT and the Research Branch, as a whole, there has been a moderate to good level of interdisciplinary cooperation.

The results of the survey of functions indicated that scientists from both ARPT and CSRTs viewed this function as very important in ideal terms (Table 49).

However, both groups of scientists considered that the actual importance of this function had been substantially below the "ideal". The difference between "ideal" and "actual" importance was the second largest, out of the seven functions (Table 49). CSRT scientists, in particular, did not think that ARPT had performed the function as well as desired. The independent assessment of the study team concurred with the survey results.

3.3. Evidence to Support the Assessment of Performance

3.3.1. Importance Attached to Different Disciplines

ARPT scientists placed a high priority on interdisciplinary research. All ARPT scientists interviewed considered that the essential disciplines required for ARPT were agronomy, economics and extension. Only a small proportion considered that they had sufficient understanding of the disciplines of other team members to be able to undertake their work. Similarly, virtually all of the ARPT scientists interviewed considered that other team members appreciated the contribution of their particular discipline. In Luapula Province, for example, both the agronomists and economists recognized that they lacked the skills of a professional extension specialist. They recognized that relations with extension workers had improved considerably with the placement of a full-time RELO.

Most ARPT scientists interviewed recognized the contribution a rural sociologist could make to the team's work, but only 1 of the 3 teams considered it necessary to have a full-time sociologist working in the team.

Several ARPT scientists suggested that the team could benefit from the contribution of other disciplinary specialists, such as a nutritionist, a livestock specialist, or a plant protection specialist, a point also made by the ADA(R).

Some of the CSRTs have complained in the past that ARPT has been dominated by social scientists. From the interviews with CSRT scientists, 94% thought that if there could only be one discipline

represented in ARPT it should be agronomy. However, 75% considered that there should be an economist in each provincial ARPT, and 56% thought that there should also be sociologists within the national team. There was some uncertainty, however, about the nature of the contribution made by both economists and rural sociologists. In some provinces the ARPT economist has had a low profile, which has contributed to the limited understanding about the role of the economist, and this also helped to give greater emphasis to the agronomist.

3.3.2. Interdisciplinary Collaboration in ARPT's Activities

a) The economist has usually taken the principal role in the identification of farming systems or "zoning", with the agronomists participating to a limited extent. In Lusaka and Western Provinces, the teams also consulted the rural sociologist.

b) Collaboration by different disciplines in ARPT's surveys has depended on the kind of survey being conducted. In the initial diagnostic surveys, both in informal/exploratory and formal/verification surveys, there has generally been a high level of collaboration, although the economists have usually taken the lead. Rural sociologists have also participated. In addition, a few CSRT scientists have also been invited to take part in these surveys, and their contribution has been considered to have been useful.

The more narrowly focused surveys have generally been undertaken by only one disciplinary specialist. For example, agronomists in Central, Luapula, Lusaka and Western Province worked alone in collecting a range of data on agronomic variables from farmers. Similarly, economists have undertaken a range of surveys, largely on their own, such as frequent visit surveys of resource flows, household sample censuses, and case studies on labor constraints. Several of these focused surveys were suggested by members of other disciplines, however. For example, the agronomist in Eastern Province encouraged the economist to investigate production of sweet potatoes, and in Central Province the team requested a special sociological study to be undertaken on non-economic factors affecting decision making in maize production.

c) All disciplines participate in planning the provincial team's research program, although the agronomists have usually presented the first set of proposals. Teams have used several formal mechanisms to ensure participation of all disciplines in developing the team's research program (ref. section 3.IV.2.1. and 5.3.4.1).

The process of preparing the 1985/86 ARPT Annual Report in Luapula Province provides a good example of interdisciplinary cooperation within the team. The agronomists first completed the statistical analysis of trial results. They then handed these over to the economist and RELO for socioeconomic analysis. After all the analysis was completed, the team met to discuss the results and generate proposals for the next season. On the basis of these discussions, the agronomists developed a detailed trial program which was subsequently reviewed in a second team meeting.

Scientists from other disciplines within the CSRTs have had the opportunity to contribute to planning ARPT's program during the Commodity Review Meetings (ref. section 4.II.4.2.1).

d) The selection of farmers and sites for trials has tended, until recently, to be undertaken by the agronomists. However, in the last two years, with the greater emphasis on selecting representative farmers, other team members, and sometimes sociologists, have been more involved (ref. section 4.I.3.1.).

e) Agronomists have been primarily responsible for the implementation of the trials, although other team members have helped out during the busy periods. In Eastern Province, the agronomist has given the economist responsibility for supervising a set of trials in one of the Target Areas, thereby reducing the agronomist's work load and increasing the economist's understanding of the trial program. This has helped to improve interdisciplinary collaboration.

f) More recently, ARPT and CSRT scientists have conducted collaborative trials and have presented joint papers at international meetings.

3.3.3. Impact of Interdisciplinary Cooperation

The impact of interdisciplinary collaboration on the definition of ARPT research programs is very clear from the case studies of the 3 ARPT provincial teams (ref. section 3.III). The research programs have been designed to address constraints, both biological and socioeconomic, identified through diagnostic surveys. In all three provinces, for example, the teams are addressing problems of labor shortages at peak periods and scarcity of cash for purchased inputs, as well as more traditional agronomic constraints to production.

On a more specific level, a good indication of the degree of interaction between different disciplines in ARPT is the level of understanding that each team member has had of the program of other disciplines. ARPT scientists interviewed could explain the broad features of the program for each discipline. They said that they would only have problems if they were asked to go into the details of other disciplines' work programs. There have been some embarrassing situations, however, especially in the early years, when ARPT economists could not adequately explain the trials to visiting CSRT scientists.

Few concrete examples emerged from the interviews of ways in which specific research programs had been changed as a result of comments made by other disciplines. This probably reflects the informal interaction among team members. Nevertheless, in Luapula Province all team members agree that the findings of the nutritionist motivated the team to give greater attention to nutrition issues in both trials and survey work. In addition, a survey by a sociologist finally persuaded the team in Luapula Province to drastically reduce the number of trials undertaken on rice. The economist in Luapula Province cited two examples in which he had influenced the agronomist's program: the use of groundnuts as an intercrop and the value of double cropping.

CSRT scientists have also had quite an important impact on ARPT trial treatments and designs (ref. sections 4.II.3, 4.II.4, and 5.7.3.1).

3.3.4. Disciplinary Breadth of ARPT Scientists

The Zambians have virtually all been recruited as new graduates straight from the university, which means that they have had only first-degree training. However, the B.Sc. degree program in agricultural science at the University of Zambia requires undergraduates to study a large number of different subjects, including economics and rural sociology, before they specialize in their final year.

Among the expatriate scientists in ARPT there has been a moderate amount of disciplinary breadth. In Central Province, one agronomist did a minor in geography during his M.Sc., and another had specialized in plant breeding during his M.Sc. In Luapula Province, the agronomist also had a prior specialization in plant breeding. The agronomist in Eastern Province had some training in economics and extension. All had substantial prior experience working with small-farm agriculture, either in Latin America or Africa. None of the economists in these teams had prior training in the biological sciences.

3.3.5. Use of Socioeconomic Criteria for Assessing Trials

Virtually no pre-screening analysis of any type has been undertaken of trials, including socioeconomic. However, ex post economic analysis has been carried out for a large proportion of ARPT's trials. These have usually consisted of partial budget analysis, returns to resources and minimum returns analysis. Few CSRT scientists undertake economic analysis of their trial results, but one third of the CSRT scientists interviewed expressed interest in having ARPT economists undertake socioeconomic analysis of their results.

3.3.6. Priority Given to Interdisciplinary Collaboration

Both the CSRTs and ARPT are organized on multidisciplinary basis. This does not mean, of course, that interdisciplinary cooperation has actually taken place. Until recently many of the CSRTs consisted of one discipline, usually either a breeder or an agronomist. Even in ARPT, some teams (eg., Eastern and Lusaka Provinces) have had only one discipline represented for significant periods of time. Experience with interdisciplinary research is, therefore, comparatively new for many scientists in the Research Branch.

The reward system does not explicitly encourage scientists to take initiative in interdisciplinary collaboration. Senior research managers have had to stimulate interdisciplinary cooperation, particularly between ARPT and CSRT scientists, by means of forceful directives, as with CSRT field visits to provincial ARPT programs, and formal mechanisms for interaction, as in the case of the Commodity Research Review meetings (ref. section 4.II.4.2.1). In the last two years, however, there has been much more spontaneous interaction, as ARPT's role has become better understood and as the CSRTs have had technologies for testing and the resources to interact effectively.

3.4. Key Factors Affecting the Performance of Function 2

3.4.1. Factors Affecting Interdisciplinary Interaction within ARPT

i) Formal management mechanisms

The management of interdisciplinary cooperation, especially within ARPT, has been only moderately successful. There have been few incentives for collaboration or penalties for working in isolation. Nevertheless, ARPT has developed several mechanisms which have facilitated interaction between ARPT team members. These have been important factors affecting the performance of Function 2. These mechanisms are reviewed below.

a) Regular team meetings. Most provincial ARPTs have regular quarterly or monthly team meetings to monitor progress and discuss the work programs of both the team and individual team members. Most provincial teams have also held formal annual meetings to prepare the program of work for the next season. This has been an important factor stimulating interdisciplinary cooperation.

b) Preparation of the annual report. In most provincial teams, all disciplines have contributed to the process of writing the annual reports. This has been considered a moderately important integrating mechanism. However, in a few provinces, such as Eastern, the work has tended to be divided and interdisciplinary discussion has been minimal.

c) Preparation of trial outlines. Involvement of all disciplines in the preparation of Trial Outlines has proven to be a useful mechanism for stimulating interaction among different disciplines.

d) Circulation file system. In two provinces ARPT has introduced a circulation file system so that all in-coming and out-going correspondence and reports are circulated to all team members. This has helped to keep all team members current on team activities. This has been a moderately important factor influencing team building and the performance of this function.

ii) Informal mechanisms

a) Open-plan office. In Luapula Province, all team members work in one very large, open-plan office. This has increased informal communication between team members and has been an important factor influencing interdisciplinary cooperation.

b) Common living and work base. Having ARPT professional staff based together at the research station has been a very important factor facilitating interdisciplinary cooperation. It has increased informal contact, both for work and social interaction. Where one team member has been located elsewhere, as in the case of the RELO in Eastern Province, the other team members have had much less understanding of that team member's work.

iii) Manpower factors

a) Missing discipline. In teams where one discipline has been missing from the team for an extended period of time, it has been very difficult for the new discipline to establish an effective input into planning the team's research program, the direction of which may have been set several years before. This problem has also been faced by the sociologists, who started working with most provincial teams several years after they were established. This has been a very important factor inhibiting effective interdisciplinary interaction. Consequently, ARPT is now trying to ensure that the remaining teams are established with the full complement of disciplines.

b) Rapid staff turnover. This is an important factor affecting the performance of function 2. ARPT has learned that it should minimize the movement of staff among teams. Staff transfers tend to disrupt team building and collegial interaction. Furthermore, it takes time for the individuals transferred to settle into the new team and contribute effectively to the research program. The short-term contracts of expatriate personnel also disrupt team building and impede the development of effective interdisciplinary interaction among team members.

c) Recruitment of experienced staff. It is evident from ARPTs' experience that if team members are to collaborate on an equal footing they must respect one another. Research experience is key to gaining such respect. On the other hand, in teams where one member has had disproportionately more experience than other members, these individuals have tended to become overconfident and rather isolated, thereby reducing collaboration with other disciplines. Relatively equivalent research experience is considered to be an important factor influencing the performance of function 2.

d) Clear delineation of responsibilities. With the introduction of rural sociologists into the team, it was necessary to distinguish clearly between the work to be undertaken within the team by the economist and the sociologist. After some conflicts resulting from ambiguity in roles and responsibilities, the job descriptions for both disciplines were rewritten, highlighting the responsibilities of each discipline and the areas of collaboration (see Appendix VII). This has been a moderately important factor influencing interdisciplinary cooperation.

iv) Donor project structure

Within most donor projects there has been more frequent interaction between the expatriate donor-funded personnel than between expatriate and Zambian personnel. Formal mechanisms, such as project planning meetings, and informal and social mechanisms, have stimulated interaction. This has been an important factor in encouraging interdisciplinary cooperation among the expatriate staff. It has sometimes created a division between expatriate and Zambian team members, however.

v) Team management

A management approach within provincial ARPTs which encourages participation by all team members in decisions about administrative matters and resource use has been an important factor in fostering team spirit and, consequently, collegial interaction. It has helped to avoid problems which have arisen in some provinces where Zambian team members have grown discontent because they considered that all major decisions about the program, finance, and transport facilities were under the control of expatriates. Such a situation has clearly discouraged interaction between team members, whatever their discipline.

3.4.2. Key Factors Affecting Interaction Between ARPT and CSRTs Scientists

The key factors affecting the level of cooperation between scientists in ARPT and the CSRTs is discussed at length under the assessment of functions 4 and 6. The main mechanisms facilitating interaction have been:

a) CSRT field visits to provincial ARPT trials;
b) Commodity Research Review meetings;
c) collaborative trials;
d) promptings from senior research managers;
e) preparation and discussion of Trial Outlines;
f) joint presentations at workshops and conferences.

4.0. Assessment of ARPT's Performance of Function 3

4.1. Definition of Function 3

Function 3 relates to ARPT's role in characterizing major farming systems and client groups, using agro-ecological and socioeconomic criteria, in order to diagnose priority production problems as well as identify key opportunities for research.

4.2. Relative Importance of Function 3

The information collected during this study indicates that ARPT has made good progress in performing this function. ARPT has generated substantial information about the different farming systems in Zambia, and this information has served as the basis for identifying research priorities. As was clear from the 3 case studies of provincial teams, the clarity of the teams' understanding of different target groups of farmers and their research needs has generally improved over time and has helped to sharpen the focus of the trial program (ref. section 3.III). There has been less progress in effectively disseminating this information among CSRT scientists.

Both the ARPT and CSRT scientists considered function 3 to be very important in ideal terms (Table 49). However, in the survey, both groups of scientists, but especially those in CSRTs, considered that "actual" importance, as evidenced by performance, had been below the "ideal". The study team considered this function to be critical for ARPT in ideal terms, but thought that in actual experience it had only been very important.

4.3. Evidence to Support the Assessment of Performance

4.3.1. Identification of Farming Systems

All but one of the seven the provincial teams have identified the different farming systems found within each province. The teams have collected information about the main characteristics of farming activities, mainly from interviewing local extension workers and a few key informant farmers, and they have used this information to "zone" or demarcate the different farming systems. Each province has produced a report which describes the principal features of each system, including maps delineating their geographic boundaries (ref. section 3.I.5.i.).

In two provinces the team has been sufficiently concerned about having accurate definitions of the farming systems that "rezoning" surveys have been undertaken.

The "zoning" reports have not been used to set research priorities, but surveys, which have focused in more depth on these identified target groups, have clearly been used to identify research priorities.

4.3.2. Research Priorities Based on Farm Surveys

From the three provincial case studies (ref. section 3.III. and Appendix VIII), it is clear that ARPT has conducted a large number of farm surveys. The surveys have collected data on both the agro-ecological and socioeconomic circumstances facing farmers. They have been of various types, including informal, verification, frequent visit, participant observation, household sample frames, anthropometric measurements and agronomic observations. The findings of the surveys have frequently been used as the basis for setting research priorities. This is best illustrated by the fact that both the Trial Outlines and the ARPT Provincial Annual Reports relate each trial to a set of circumstances and problems faced by a specific group of farmers.

The case studies clearly illustrate this tight interaction between farm-level diagnosis and design of the research program to meet identified constraints (ref. section 3.III.). An additional good example comes from Lusaka Province, where ARPT is working in a plateau system. Surveys identified that maize is planted late and receives insufficient fertilizer and minimal weeding because of farmers' cash and labor constraints. The team has responded by conducting trials aimed at finding shorter-duration maize varieties for later planting and identifying alternative crops to maize, such as soybean, sunflower and sorghum, which could give better returns to farmers' limited resources than late-planted maize.

ARPT has also attempted to meet the specific needs of sub-groups within farming systems. As an example, in both Eastern and Northern Provinces, surveys identified that within broadly homogeneous farming systems there were some isolated areas where farmers were growing beans as an important cash crop. In both provinces the ARPT scientists decided to place one of the trial clusters in these areas so that the needs of those specific groups of farmers could be included.

In addition to specific farm surveys conducted by different members of ARPT, the teams' research program has also been shaped by farmers' comments and casual field observations made by the agronomists.

4.3.3. Improved Understanding of Target Farmers Over Time

In most provinces ARPT has increased its understanding of the characteristics, constraints and priorities of the farming systems over time. One way has been through surveys specifically undertaken to check the validity of the original "zoning" or systems demarcation, as was done in Central Province (ref. section 3.III.2.) and is planned for Luapula Province.

But generally speaking, the longer the team has been working in an area, the greater has been the team's level of understanding of farmers. One of the clearest examples comes from Luapula Province where, through surveys carried out by the nutritionist, the economist and the sociologist, the research program has become much more sharply focused on the priority needs of farmers over the past few years (ref. section 3.III.4.2.).

Several other examples illustrate how ARPT has improved its understanding of target farmers over time and responded to changes in the farming system. In Serenje District of Central Province, when the team thought that sunflower production had increased due to the establishment of an oil expelling plant in the vicinity, they undertook a survey of sunflower production to determine how the dynamics of the system had changed. The team subsequently gave greater attention to sunflower in its trial program. In Eastern Province, when sunflower production declined dramatically, ARPT conducted a survey to determine the reasons for the decline. In Luapula Province, an intercropping trial was originally targeted at subsistence farmers in the Mabumba Target Area. However, later, on the basis of survey findings and farmers' comments, the focus was changed to the small-scale commercial farmers because their single cropping practices were found to put them at greater nutritional risk than subsistence farmers.

4.3.4. Dissemination of Information about Farming Systems

It is clear that ARPT has collected a lot of information about both the agro-ecological and socioeconomic characteristics of farmers and has used this understanding to identify research priorities for different farming systems. However, the dissemination of information to CSRT scientists about the characteristics of the different farming systems and identified production constraints has not been as effective.

Most of the CSRT scientists interviewed complained that they had seen little information from ARPT other than occasional annual reports. CSRT scientists have requested more information, especially on agronomic aspects of crop production. Scientists from four CSRTs have undertaken surveys themselves to collect such information because it was not available from ARPT. ARPT has recognized this problem, and formal and informal mechanisms have been developed to improve information flow (ref. section 5.7.3.2 and 4.II.4.6).

4.3.5. Farmer Selection

The weakest aspect of ARPT's characterization of farming systems has been the selection of representative farmers. ARPT has not used sufficiently rigorous farmer selection methods. Selection has been open to biases from extension workers and prominent members within communities. As a result, there has been a tendency for more wealthy, innovative and male farmers to be selected. In the last two years, ARPT has taken steps to rectify the situation. No specific procedure for farmer selection has yet been formally agreed on, but there is a consensus that the more rigorous methods should be used (ref. section 4.I.3.1.)

4.4. Key Factors Affecting the Performance of Function 3

4.4.1. Recruitment of Experienced Economists

The presence of an economist within the team from the start has been a very important factor influencing the effective performance of this function. Furthermore, prior experience of conducting diagnostic surveys with subsistence-oriented farmers has also been found to be essential.

4.4.2. Methodological Issues

Several weaknesses in the characterization of farming systems have arisen from the methodology used. The "CIMMYT methodology" gave undue emphasis to the role of extension workers as informants during the "zoning" phase and in the selection of farmers to be interviewed during informal surveys. ARPT now considers that farmers should play a greater role during "zoning", particularly in more subsistence-oriented provinces, and that more rigorous and systematic methods should be used to select collaborating farmers at all stages of the research process.

ARPT has also given priority to using informal survey techniques to enable them to rapidly focus on priority problems in the systems. However, there has been a tendency to move rapidly into conducting trials, sometimes before accurate system description has been completed. Many agronomists and economists are now spending more time collecting detailed information in order to more fully understand identified problems before initiating a major trial program.

4.4.3. ARPT Rural Sociology Section

The establishment of the ARPT Rural Sociology Section has been an important factor facilitating the performance of function 3. The section has played an important role in helping ARPT in the identification of farmers' social characteristics. They have also provided advice to the team about different aspects of conducting farm surveys, most especially on the procedures for farmer selection. The section considers that the most effective involvement has been through direct participation in surveys together with provincial teams (ref. section 3.II.2.6.3.).

4.4.4. ARPT Nutrition Coordinator

It is clear from the experience of ARPT in Luapula Province that the team's understanding of the problems of subsistence households greatly improved through their interaction with the nutritionist (ref. section 3.II.2.6.4.). It remains to be seen whether the ARPT Nutrition Coordinator, who is based at the Central Research Station, will be able to have the same impact in other provinces. This has been a moderately important factor affecting the performance of this function.

4.4.5. ARPT Program Review Mechanisms

An important factor supporting characterization has been the format of the ARPT Provincial Annual Reports, which has required the team to: 1) consider whether their working hypotheses for a given farming system have changed as a result of the work undertaken during the season; and 2) to review survey findings and farmers' comments, to see whether they support a trial continuing, and if so whether any modifications should be made to the trial design.

A second moderately important factor has been the preparation of Trial Outlines. In the Trial Outlines the team has had to justify each trial in terms of its relevance to identified farmers' problems. This has helped to sharpen the hypotheses being tested in the trials, and requires the criteria by which the trial will be assessed to be made explicit.

5.0 Assessment of ARPT's Performance of Function 4

5.1. Definition of Function 4

This function refers to ARPT's role in adapting technology and/or contributing to the development of alternative technologies by conducting experiments under farmers' conditions.

5.2. Relative Importance of Function 4

The study team considers that ARPT has made good progress with implementing this function, especially when the large number of on-farm trials undertaken by ARPT are taken into account. However, certain aspects of the function have so far been achieved only moderately well. For example, ARPT has made only limited use of Farmer Managed/Farmer Implemented Trials. Thus, overall, the performance level has been assessed as moderate to good.

In the survey, Research Branch scientists indicated that they viewed this function as very important in ideal terms (Table 49). ARPT scientists rated it as being the most important function in ideal terms. As with all the other functions, "actual" importance of this function was perceived as below the "ideal" (Table 49). However, ARPT scientists considered that it had been one of the functions having the greatest importance, CSRT scientists perceived the actual importance as somewhat less.

5.3. Evidence to Support the Assessment of Performance

5.3.1. Emphasis on On-farm Trials

ARPT has conducted a large number of on-farm trials in all of the provinces in which it has been working. Table 43 shows that on-farm trials increased significantly from 1981/82 to 1985/86, as did the number of farmers involved in the trial program.

Table 43 reveals another important feature of ARPT's trial program: the team has also had an active station-based research program. On average, about 40% of ARPT trials have been on-station, although in most provinces this proportion has declined over time. ARPT provincial teams have had to do a significant amount of adaptive agronomic research on-station, especially during their first years in a province.

Many of the technologies received from the CSRTs, especially varieties, have been very new and have been subjected to limited agronomic research. Some CSRTs have not had agronomists to test basic biological relationships in association with management practices. Most ARPT agronomists have consequently wanted to identify the most appropriate management practices before taking the technologies to the farm for testing. Several provincial ARPTs, recognizing the need to initiate on-farm work at the earliest opportunity, have conducted trials on-station as well as on-farm. This approach has shown that treatments which give results on-station do not necessarily hold on-farm.

A second reason for ARPT's large on-station trial program is that, until recently, some CSRTs have had few new technologies ready for on-farm testing and adaptation (ref. section. 4.II.6.2). ARPT has, therefore, helped to conduct some of the required station-based research and has initiated efforts to contribute to the development of new technologies relevant to constraints identified in their regions.

For example, in North Western Province, which has been neglected by research in the past, ARPT staff have helped to establish a new research station and are assisting CSRTs with a large number of basic trials relevant to the needs of the province. In Luapula Province, research on the potential of dambos (areas of residual moisture) for early food production during the dry season had received virtually no previous research attention in the past. Now, after the ARPT agronomist initiated an ambitious research program and a series of seminars on dambos, several CSRTs have taken over aspects of the program (ref. section 3.III. 4.).

As agronomists have been increasingly incorporated into CSRTs and as collaboration and information exchange between ARPT and CSRT scientists has improved, the need for ARPT to do station research has declined.

Table 43 also shows that the number of farmer-managed trials, although still quite limited, increased from 2 in 1982/83 to 19 in 1985/86. This trend is also a result of the relative newness of many of the technologies emanating from CSRTs. ARPT agronomists

have needed to first examine whether the biological relationships identified on-station still hold under the farmers' environment. As their confidence in the technology has increased, so too has the number of trials managed by farmers.

5.3.2. Evolution of On-farm Trials

The description of the trial programs in the three case studies and the technology vignettes, in particular, provide good evidence of an evolving focus and progressive understanding of diagnosed problems and potential solutions in trial programs of provincial ARPT teams (ref. section 3.III and Appendix VIII). It is clear that the scientists have systematically built upon the results and conclusions of each previous season's work.

The growing proportion of farmer-managed trials also reflects progress in technology development, from problem diagnosis and design of solutions to the eventual testing of technologies under farmers' management conditions.

Another source of evidence has been the way in which comments made by farmers have been used to modify ARPT's trial program (ref. section 4.I.1.1.).

5.3.3. Representativeness of Trial Farmers

Lack of representativeness of trial farmers has been a problem inhibiting ARPT's performance of this function. Social and economic biases have tended to influence the selection of trial farmers. While many of ARPT's trials have been designed to solve problems of farmers with limited labor and capital resources, many of the cooperating trial farmers have had more resources and have been more innovative than the average farmer within the farming system. In addition, until recently most trial farmers have been men, in spite of the large proportion of female headed households in some areas where ARPT works (ref. section 4.I.3.1.).

The issue of farmer selection has been generally recognized as an area needing improvement within ARPT, especially as programs have evolved more towards farmer-managed/farmer-implemented trials. In the past, the team underestimated the importance as well as the difficulties in selecting representative farmers. Agronomists were largely responsible for farmer selection, and they did not use any systematic procedures for choosing them. Most teams have recently introduced more rigorous methods of farmer selection (ref. section 4.I.3.1.).

5.3.4. ARPT Use of CSRT Technologies in On-farm Trials

Although there have been some weaknesses in interaction, in recent years ARPT scientists have actively consulted CSRT scientists for information and material to be included in on-farm trials (ref. sections 4.II.3). All of the CSRT scientists interviewed had been consulted by ARPT scientists. Furthermore, all ARPTs have collaborated with a total of 10 CSRTs in trials of mutual interest.

In general, CSRTs have responded as far as possible to requests from ARPT for new technology, and interaction has increased as CSRTs have had more technology available for adaptive research on-farm.

5.3.5. Influence of On-farm Trial Results on CSRT Research

There is only limited information to suggest that ARPT's on-farm trials have so far had any significant affect on the research programs of CSRTs. In a few areas information from ARPT, mainly survey data, has been used by some CSRTs to design trials. The implementation of some collaborative trials indicates a move in this direction (ref. section 4.II.4.3).

5.3.6. New Recommendations Based on On-farm Research Results

New recommendations have been issued in two provinces, Eastern and North Western. The initiatives to revise the recommendations came, in part, from projects which needed relevant messages to take to farmers with the introduction of the T&V system. In North Western Province, the revised recommendations resulted from a critical review of previous research results; they have not so far been the result of on-farm trial results. In Eastern Province, revised recommendations for the three principal farming systems were based on careful scrutiny of available research data and also the results of two seasons of on-farm trials by ARPT. ARPT scientists have also played a role in helping to plan the extension demonstrations conducted throughout each province.

5.4. Key Factors Affecting the Performance of Function 4

5.4.1. Availability of Technologies from CSRTs

The availability of technologies has obviously been a very important factor influencing the ability of ARPT to perform the adaptive research function. Lack of technologies in the early years slowed progress, but the level of interaction between ARPT and CSRTs has increased considerably as CSRTs have had more technologies ready for adaptive research (ref. section 4.II.6.2.). When new plant material has become available, CSRTs have become more interested in working with ARPT in order to see how their material performs under diverse farmer conditions. Similarly, ARPT scientists have had greater incentives to consult and collaborate with CSRT scientists. This increased interaction has strengthened the performance of the adaptive research function.

5.4.2. Resource Allocation to CSRT

The shortage of both human and financial resources for some CSRTs has been a very important negative factor affecting the performance of this function. It has inhibited the ability of the CSRTs to produce technologies for use in on-farm trials and has limited opportunities for interaction with ARPT. A common solution to the shortage of resources has been for almost all research teams to rely on external donor support.

5.4.3. Experience of ARPT Agronomists

This has been an important factor influencing the rate of progress in this function. Some of the ARPT agronomists have had considerable experience, which has given them a high level of confidence in both identifying problems and designing potential solutions. It has also enabled them to move more quickly into on-farm trials and recommendations.

5.4.4. Specialized Training

The National Coordinator's emphasis on in-service training to buildup ARPT staffs' skills in on-farm adaptive research methods (ref. sections 3.II.2.5. and 3.IV.6.5.4.) has been a very important factor influencing the performance of this function. By 1986, 78% of the ARPT scientists had received specialized training in on-farm research methods. This has strengthened adaptive research capacities of the team and has been especially important for many of the Zambian scientists who were recruited directly from the university with limited field experience.

5.4.5. Trial program Review Mechanisms

Several programming and review mechanisms have had an important positive impact on the performance of the adaptive research function (ref. section 2.IV.2.).

i) Preparation of ARPT Provincial Annual Reports. The format has required the team to consider whether their working hypotheses have changed in response to emerging research results and to evaluate the need to continue or modify the trial in light of farmers' comments. Annual Reports have also been an important mechanism for keeping CSRTs informed of research progress in their specific commodities. ARPT has generally been up to date in its annual reports.

ii) Preparation of Trial Outlines. This has helped to ensure that each trial has been justified in terms of constraints diagnosed at the farm-level and that previous research results have been reviewed. This format has encouraged ARPT scientists to actively consult CSRT scientists. Trial Outlines have also been circulated to CSRT scientists for comments, as a means of strengthening ARPT research, but little response has been received.

iii) ARPT quarterly staff meetings. These have provided an important opportunity for ARPT provincial teams to share experiences and critically review each other's research. This has been important for developing and refining methods for adaptive research and for strengthening the general research capacities within the team as a whole.

5.4.6. Recommendation Review Procedure

The ambiguity of the procedure for revising research recommendations has made it possible for ARPT, and virtually any other organization, to be able to revise research recommendations. However, this same ambiguity has also at times caused tensions with CSRTs (ref. section 2.III.3.). This factor has had only limited impact on the performance of the adaptive research function, but clarification of the procedure could facilitate the production of recommendations emerging from adaptive research at the provincial level.

5.4.7. ARPT Rural Sociology Section

The Rural Sociology Section has played an important role in drawing attention to the need for more rigor in selection of representative

farmers. Farmer representativeness is an important factor influencing the quality of adaptive research, particularly with respect to farmer-managed trials and on-farm tests at the later stages of technology development (ref. section 4.I.3.1.). This has been a moderately important factor influencing the performance of this function.

5.4.3. Improved Opportunities for Interaction between ARPT and CSRT Scientists

This has been a very important factor strengthening the performance of the adaptive research function. Several key mechanisms have been established to improve interaction between ARPT and CSRT scientists (ref. section 4.II.4). The two most important for the performance of function 4 have been:

a) Commodity review meetings. These provide an efficient and rapid means for ARPT scientists to communicate their needs for technologies to CSRT scientists and to learn about emergent research results and technologies ready for on-farm adaptive research. The majority of ARPT and CSRT scientists interviewed had found these meetings very useful for strengthening interaction and collaboration (ref. sections 5.7.4.7. and 4.II.4).

b) CSRT field visits to ARPT programs. Interaction at the field level has been an important factor strengthening ARPT's research and in stimulating CSRT commitment to supporting ARPT's research with advice, specialized knowledge, and new technologies (ref. section 4.II.4.).

5.4.9. CSRT Scientists' View of ARPT's Functions

Most CSRT scientists interviewed saw ARPT's primary role as testing CSRT technology on-farm (ref. section .II.6.5). Yet, the testing function is only one aspect of adaptive research, and CSRT's emphasis on this aspect could potentially lead to a clash of priorities between those of ARPT derived from farm-level diagnosis and those of CSRT scientists anxious to have their materials tested. Although this conflict has not yet developed, it is important for ARPT to retain control over its own research agenda, relying on advice, but not directives, from CSRTs.

6.0. Assessment of ARPT's Performance of Function 5

6.1. Definition of Function 5

This function refers to ARPT's role in promoting farmer participation in research as collaborators, experimenters, testers and evaluators of alternative technologies.

6.2. Relative Importance of Function 5

The performance of this function has varied quite considerably, both over time and between different provinces. Table 45 indicates that some aspects of farmer collaboration have been performed quite well, while others have not. Based on the three case studies, the study team assessed the level of performance as between moderate and good, just slightly lower than the assessments made by scientists responding to the survey (Table 49).

Research Branch scientists considered that the promotion of farmer participation should ideally be a very important function of ARPT. Both groups recognized that ARPT has not succeeded in achieving the "ideal" level of importance. "Actual" importance was rated as being between moderate and very important. It is interesting to note that CSRT scientists ranked the function higher in ideal and actual importance than ARPT scientists.

6.3. Evidence To Support the Assessment of Performance

It is necessary to examine several different areas of ARPT's collaboration with farmers to support the assessment that ARPT has achieved a moderate to good level of performance in this function (ref. section 4.I.2.). The areas where ARPT has performed best have been in the identification of research problems through a range of different types of surveys with farmers and in obtaining farmers' comments on trials and incorporating them into the trial program. Less progress has been made by ARPT in selecting representative farmers, involving farmers in planning trials, and in feeding results back to farmers.

The level of performance has generally improved over time, and the assessment attempts to take this into account. Many specific examples of interaction are given in chapter 4, section I.

6.3.1. Farmer Selection

In order for interaction between ARPT and farmers to be meaningful, it is essential that farmers selected to take part in either surveys or trials be representative of the farming system. Unfortunately, ARPT has tended to select farmers who are relatively wealthy, progressive and male. This problem has been recognized in recent years. Several provincial teams have instituted major changes in their procedures for selecting farmers in order to redress this situation (ref. section 4.I.3.1.).

6.3.2. Farmers' Understanding the Role of ARPT

Farmers have tended to have only a rudimentary understanding of the purpose of ARPT (ref. sections 4.I.1.2 and 4.I.3.2). They have had difficulties in distinguishing the difference between the work of ARPT and extension workers. Occasionally, this lack of understanding has reduced the farmers' willingness to collaborate with ARPT and to provide useful comments, as for example, in Luapula Province (ref. section 4.I.3.2).

Collaborating farmers have generally been able to explain the purpose of trials in broad terms. However, the predominance of researcher-managed trials has made it difficult for farmers to develop a detailed understanding of the trial program. For example, few farmers, in the three provinces studied could explain the treatments of trials managed by the agronomists, and most tended to have only a general understanding of the purpose of the trials. When asked what they had learned from the trials, the farmers' responses related more to the management of the trials than to the objectives of the different treatments. Most farmers, however, considered that they had gained new knowledge about farming techniques and, of course, had benefited from the produce from the trials.

6.3.3. Planning and Commenting on ARPT Program

Very few of the farmers interviewed considered that they had had any input into planning ARPT's trial program (ref. section 4.I.2.3.). There have been very few formal occasions when the farmers could discuss the trial program before the season.

However, ARPT scientists in all provinces have made good progress in obtaining farmers' comments about technologies, at various points during each season. Examples of how farmers' comments have influenced the trial program are given in section 4.I.1.1. Positive assessments have encouraged scientists to proceed from trial work to more widespread on-farm test demonstrations, as with maize in five provinces. Negative assessments have brought about modifications or abandonment of specific trials.

Several different mechanisms have been experimented with to obtain the farmers' comments about the trials, indicating a concern to improve the level and quality of farmer involvement (ref. section 4.I.2.5.).

6.3.4. Direct Participation by Farmers in ARPT's Activities

Farmers have participated actively in many of ARPT's activities, although with varying degrees of intensity (Table 45).

Farmers have rarely participated in the demarcation of the farming systems. However, they have participated frequently in a wide range of surveys undertaken by ARPT. This has been one of the strongest areas of ARPT's collaboration with farmers (ref. section 4.I.2.2). The surveys have been essential for ARPT in developing research focus and priorities for its trial program. This is well demonstrated by the Luapula Province case study (ref. section 3.III.4.2.1.).

The surveys have also helped explain why farmers have not widely adopted certain previous recommendations. The team has quantified the importance of varietal problems such as maize streak virus, maize storage qualities, bird damage on sorghum, and acidity on groundnuts. In Lusaka Province the team demonstrated with quantitative data the economic disadvantages of the current extension recommendation that ox cultivators should plant maize by hand. In both Eastern and Western Provinces, ARPT verified that the recommendation to apply fertilizer at planting time was not optimal for resource-poor farmers planting maize on light soils. It was more time consuming and risky in drought-prone areas than the alternative practice used by many farmers, of applying basal and top dressing together. ARPT has also generated a lot of information on labor and capital constraints through surveys to explain farmer practices and current technology constraints (ref. provincial case studies, section 3.III.).

In its surveys, the team has not made much use of farmers' indigenous technical knowledge, although some provincial teams have used farmers' own units of measurement.

Farmers have had a moderate level of involvement in the ARPT on-farm trials (ref. section 4.I.2.4). Until recently ARPT has relied heavily on researcher-managed trials (ref. section 3.IV.8.2). In

the 1985/86 season approximately 30% of the ARPT trials were farmer managed, while 30% were researcher/farmer implemented, and 40% were researcher managed/researcher implemented (Table 43). Farmers have had little involvement in the RM/RI trials, either in terms of physical input or the assessment of the results. In RM/FI trials, farmers have contributed not only their land but most of the labor as well. Although experience with the FM/FI trials has been rather limited, farmer participation has been greater, both in terms of implementation and the importance attached to their comments.

Unlike the feedback of comments from farmers to ARPT, where progress has been substantial, there has been only limited success in feeding ARPT's findings back to farmers (ref. section 4.I.2.5 and 4.I.2.6). In most provinces the responsibility has been left to the TAs, who have often not received full analysis and explanation of the trial results.

6.3.5. Farmers as a Source of Local Plant Material

In three provinces, ARPT staff have collected germ plasm of local varieties preferred by farmers. This material, on beans, cassava, and maize, has been made available to the CSRT scientists for inclusion in their breeding programs.

6.4. Key Factors Affecting the Performance of Function 5

Various organizational and managerial factors have significantly influenced the various aspects of ARPT's collaboration with farmers.

6.4.1. Involvement of Local Leaders

The involvement of both traditional and political leaders has been a moderately important factor in improving the level of farmers' participation in ARPT's activities (ref. section 4.I.3.4). They have helped explain the role of ARPT, and their presence at meetings has given legitimacy to the team and encouraged farmers to participate fully and to comment more openly. In Luapula Province, local leaders have also helped to defuse tensions which arose when some farmers had overly high expectations about the level of support and inputs ARPT would provide (ref. section 3.III.4.1.2).

6.4.2. Organization of Farmer Field Days

Changes in the organization of farmer field days has been an important factor improving farmer participation in ARPT research (ref. section 4.I.3.5). After several years of experimentation, most teams now consider that field days for farmers should be organized separately from those for extension workers and other visitors. Farmers speak more freely in the smaller groups. Experience from Central and Luapula Provinces also indicates that visits to trial sites in small groups encourage greater discussion. Interaction has also been better when trial farmers take the lead in explaining the trials. There is general consensus that discussion should always be held in the vernacular.

6.4.3. End-of-season Meetings

Although experience is limited, ARPT in Luapula Province has found that end-of-season meetings with trial farmers, extension workers and local leaders have been very effective for both feeding trial results back to farmers and also for obtaining farmers' comments to be included in the next season's program (ref. section 4.I.2.5.).

6.4.4. Opportunities for Informal Discussion

Informal interaction with farmers in the field has been an important factor facilitating the performance of this function. Several agronomists in ARPT consider that the best occasions for obtaining farmers' comments are when they meet farmers in the field. Most team members, including TAs, attempt to contact farmers each time they visit the trials, which farmers have appreciated. Regular visits by scientists to trial sites throughout the season is, obviously, a prerequisite for such informal interaction with farmers.

6.4.5. Staffing of Provincial Teams

The presence of economists and RELOs in the provincial teams is a very important factor influencing the level and nature of farmer participation (ref. section 4.I.3.10.1.).

6.4.6. ARPT Rural Sociology Section

The establishment of the ARPT Rural Sociology Section and the posting of rural sociologists to work with provincial teams has increased team members' awareness of several important social factors influencing technology use and adoption as well as the need for improving methods of farmer selection (ref. sections 3.II.2.6.3. and 4.I.3.7). This has been an important factor in improving ARPT interaction with farmers.

6.4.7. Trials Assistants Based in Farming Communities

Having TAs experienced in extension work living in the same community with farmers has been an important factor facilitating farmer participation (ref. section 4.I.3.6). TAs have learned a lot about farmers' problems and their opinions about the trials. However, there have been problems ensuring that TAs pass on all the information to the other team members. Sometimes the TAs have not recorded the comments in trial logbooks, or their verbal comments to agronomists have been forgotten (ref. section 3.IV.8.3.2.).

6.4.8. Implications of Methodology Employed

The "CIMMYT methodology" taught during the in-country training program did not give high priority to farmer participation, beyond the minimum involved in surveys and on-farm trials. The approach has allowed some researchers to carry out on-farm trials with little farmer involvement, while being able to justify the trial program on the basis of survey results.

6.4.9. Training and Visit Extension System

In Eastern Province, where the T&V system has been fully introduced, ARPT has benefited from the effective two-way flow of information with farmers through extension workers. This has been a very important factor stimulating farmer involvement in the research process (ref. section 4.III.5.7).

6.4.10. Farmer Selection

Lack of attention to the selection of representative farmers has been an important factor in reducing the quality of farmer participation in research (ref. section 4.I.3.1). Recognizing this weakness, ARPT has recently devoted significant attention to developing more vigorous methods for selecting trial farmers to ensure that they are interacting with farmers representative of the community as a whole.

6.4.11. Size and Dispersion of the Trial program

Many agronomists have recognized that an important factor hindering their interaction with farmers has been the large numbers of scattered trial sites. As a result, several provincial teams have begun to cluster trials (ref. sections 4.I.3.8 and 3.IV.8.2).

6.4.12. Complexity of Trials

Farmers have had a greater level of understanding of trials with simple designs. This has been a moderately important factor influencing communication between farmers and ARPT (ref. section 4.I.3.3).

6.4.13. Research Managers

Research managers, including the ARPT NC, have kept the issue of collaboration with farmers at the forefront of ARPT's agenda. Several workshops and discussions have been organized with this in mind. This has been an important factor stimulating researchers to more fully involve farmers.

6.4.14. ARPT Annual Report

The format requires the team to include farmers' comments about each trial (ref. section 3.IV.3.4).

7.0. Assessment of ARPT's Performance of Function 6

7.1. Definition of Function 6

This function refers to ARPT's role in providing feedback to the research priority-setting, planning and programming process so that CSRT and ARPT research are integrated into a coherent research effort focused on farmers' priority needs.

7.2. Relative Importance of Function 6

The study team considers that ARPT's performance of this function has been moderate to good (Table 49). It is important to stress, however, that performance of the feedback function has improved in

recent years as the level of interaction and collaboration between ARPT and CSRTs has increased, and ARPT's position within the Research Branch has gradually come to be understood and accepted (ref. section 4.II.3., Table 46).

The findings of the survey of the 7 functions indicate that scientists in the Research Branch consider this function to be of highest priority. The average ranking of ideal importance was between very important and critically important (Table 49). However, it is also important to note that the interviews with CSRT scientists indicated clearly that most place highest priority on feedback from ARPT with respect to on-farm testing of technologies. Feedback from farm-level diagnosis and problem identification is of secondary importance (ref. section 4.II.6.5).

Despite its ideal importance, both CSRT and ARPT scientists considered that in this function it had been least important in actual terms, as indicated by current performance (Table 49), although ARPT scientists ranked its actual importance higher than did CSRT scientists. The study team's assessment agreed closely with the results of the survey (Table 49).

7.3. Evidence to Support the Assessment of Performance

Much of the evidence to support this assessment has been presented in the section managing the interaction between CSRT and ARPT scientists in chapter 4 (ref. section 4.II.). The information presented below highlights the main features of ARPT's feedback interaction with CSRTs.

7.3.1. Reviewing Results and Setting Research Priorities

Several important formal and informal occasions have been established for ARPT and CSRT scientists to come together to review trial results and to plan their research programs (ref. section 4.II.4.2.). These have not been simply "talking shops". They have led to fruitful and productive exchange of ideas and information and, although there is no mechanism to ensure that decisions taken are actually implemented, they have produced some concrete results (ref. sections 4.II.2.2. and 4.II.4.2).

Both ARPT and CSRT scientists consider that they can and, in some cases already have, benefitted from this interaction. Ninety-four percent of CSRT scientists interviewed thought that ARPT has had, or should have, a role in helping to plan CSRT research programs. More than a third were able to give specific examples of how information from ARPT had helped them to set priorities or design trials (ref. section 4.II.2.2.). Several provincial ARPTs have also been able to confirm through farm-level research that the existing research priorities of some CSRTs are on target.

The CSRT scientists have also had quite an important impact on ARPT trial treatments and designs (ref. section 4.II.2.1). ARPT scientists had shown considerable interest in the latest information from the CSRT scientists, especially with reference to new varieties for inclusion in on-farm trials. This is not surprising, given their dependence on CSRTs for new technologies. They have also collaborated actively by testing new CSRT technologies on-farm (ref. section 4.II.4.3).

7.3.2. Exchange of Data and Reports

Although all the CSRT scientists interviewed had seen at least some ARPT reports, usually the ARPT annual reports, there was little evidence that they had actively used information from ARPT reports to determine research priorities or plan their programs (ref. section 4.II.4.6). Most information from ARPT which CSRT scientists considered to be relevant and useful to their specific research programs appears to have been transmitted verbally. This underscores the need for regular opportunities for interaction and discussion, even though this type of information exchange is more costly than written reports.

Very few of ARPT's reports have had specific sections targeted at the interests of particular CSRT scientists. Moreover, the formats ARPT has used for presenting information have apparently tended not to suit the information needs of CSRT scientists. Despite these problems, there has been little discussion of the data requirements of CSRTs. This indicates a need for ARPT to devote more attention to presenting written information in a form that is meaningful and useful to CSRT scientists.

ARPT scientists have also had some problems in obtaining results of previous CSRT trials, which is why ARPT initiated the Research Data Base study (ref. section 2.IV.4.).

7.3.3. Participation by CSRT Scientists in ARPT's Activities

i) Surveys

There has been very little participation by CSRT scientists in ARPT surveys (Table 46). Nonetheless, when collaboration has occurred, ARPT staff have found it useful. There have also been a few examples of ARPT scientists assisting in CSRT surveys, as in the case of the Food Storage survey.

ii) Collaborative Trials

Provincial ARPTs have, in recent years, collaborated with 10 CSRTs in conducting trials of mutual interest to both teams. The initiative for these collaborative trials has been taken by both teams, and responsibility for management has varied, although in most cases it has rested with ARPT. The joint discussions, visits and assessments of these trials have been extremely valuable in breaking down barriers between the scientists (ref. section 4.II.4.3. and 4.II.4.4.). On several occasions ARPT and CSRT scientists have jointly presented results from collaborative research at national and international workshops.

7.4. Key Factors Affecting the Performance of Function 6

Several key factors have influenced ARPT's performance of this function.

7.4.1. Availability of Technologies From CSRTs

The availability of technologies from CSRTs ready for use in adaptive research trials has been a very important factor facilitating the performance of this function. As CSRTs have

developed new materials and technology, they have become more interested in collaborating with ARPT in order to have them tested on-farm. Feedback from this testing has had an influence on the direction of CSRT research programs, as both the technology vignettes in the provincial case studies and the analysis of collaboration with the maize CSRT clearly demonstrate (ref. sections 3.III. and 4.II.5).

7.4.2. Resource Allocation to CSRTs

Availability of resources to CSRTs for field visits and attendance at meetings has been a very important factor influencing the strength of the feedback function (ref. section 4.II.6.3.). Given the importance of verbal exchange, support of these activities is crucial for strengthening feedback and effective ARPT-CSRT interaction.

7.4.3. The Role of Senior Research Managers

The strong support of the CARO for interaction and collaboration between ARPT and CSRT scientists in the last two years has been a very important factor facilitating the performance of the feedback function. The CARO has even issued directives indicating that CSRT scientists must participate in the field visits to provincial ARPTs, as well as organize Commodity Research Review meetings to which ARPT are invited (ref. section 4.I.6.11.).

7.4.4. CSRT Scientists' View of ARPT's Functions

This has been a very important factor influencing the performance of function 6. Most CSRT scientists interviewed (88%) viewed ARPT's role of providing feedback to CSRTs as secondary to the technology testing role (ref. section 4.II.6.5.). It appears that while CSRT scientists are very interested in receiving feedback on the performance of their technologies on-farm, they are less interested in the feedback of information from the field-level diagnosis of farmers' problems. This has constrained the full implementation of the feedback function. Effective feedback from testing may open the door for wider usage of ARPT information by CSRTs, but this will need to be monitored closely.

7.4.5. Proximity of ARPT and CSRT Scientists

When ARPT and CSRT scientists are based at the same research station, interaction has clearly increased (ref. section 4.I.6.1.). This informal and regular interaction appears to have been an important factor facilitating the performance of the feedback function. The change of the ARPT NC's offices from MAWD headquarters to the Central Research Station has also helped strengthen interaction with CSRTs as well as the feedback function (ref. section 3.II.2.6.6).

7.4.6. Influence of Donor Project Organization

When a project has supported scientists in both ARPT and CSRTs, interaction and collaboration have been strengthened (ref. section. 4.II.6.10). As the USAID-funded ZAMARE project in Central Province and the World Bank-funded project in Eastern Province demonstrate,

this has been an important factor facilitating the performance of function 6 (ref. section 3.III). The danger, however, is that the benefits of increased interaction have tended to be largely restricted to expatriate project members.

7.4.7. Improved Opportunities for Interaction

The formal mechanisms established for facilitating interaction between ARPT and CSRT scientists have been very important factors enhancing the performance of the feedback function. The most important for improving feedback have been:

1) the Commodity Research Review meetings (ref. section 4.II.4.2); and

2) CSRT field visits to ARPT programs (ref. section 4.II.4.4)

Both of these have provided a forum for focused discussion and exchange of information and ideas. The provincial case studies (ref. section 3.III) and the analysis of ARPT collaboration with the maize CSRT (ref. section 4.II.5) illustrate the utility of these two mechanisms.

7.4.8. Lack of Involvement of CSRT Scientists in ARPT Surveys

The limited involvement of CSRT scientists in ARPT's diagnostic surveys (ref. section 4.II.4.1.) has probably hindered the full implementation of the feedback function. Greater CSRT participation in diagnostic surveys would help to legitimize ARPT's constraint diagnoses and to build CSRT commitment to seeking solutions to farmers' priority problems.

7.4.9. Manpower Factors

Various manpower factors have affected the level of interaction between CSRT and ARPT scientists (ref. sections 4.II.6.6 and 4.II.6.12). Those that have had a particularly important bearing on the performance of the feedback function are:

i) rapid staff turnover (especially with expatriates), which has disrupted the development of solid collaborative relationships among CSRT and ARPT scientists;

ii) CSRT scientists' experience with FSR concepts and programs; CSRT scientists with more experience with FSR have been much more open to the feedback function;

iii) research experience of ARPT staff; CSRT scientists have been receptive to feedback from ARPT scientists who have clearly demonstrated their competence as field researchers (ref. section 4.II.6.6);

iv) limited orientation for new scientists joining the Research Branch.

7.4.10. Job Descriptions

The new emphasis given to interaction with CSRT scientists in job descriptions of ARPT staff has been a moderately important factor facilitating the feedback function (ref. section 4.II.6.8).

7.4.11. Recommendation Release Procedure

The ambiguity in the procedure for revising and developing research recommendations has caused some conflicts between ARPT and CSRT scientists (ref. section 4.II.4.7). The resulting tension has somewhat impeded the effective performance of the feedback function.

7.4.12. Lack of Forward Planning

Lack of forward planning has been a moderately important factor hindering the performance of the feedback function. On several occasions both ARPT and CSRT scientists have given insufficient notice about meetings, field visits, and workshops, and consequently attendance has been reduced.

7.4.13. ARPT Involvement in the Variety Release Committee

This is a recent development (ref. section 4.II.4.7) and, thus, has had limited influence on the performance of the feedback function. However, it is expected that this will be an important mechanism for improving feedback.

8.0. Assessment of ARPT's Performance of Function 7

8.1. Definition of Function 7

This function refers to ARPT's role in linking research with extension and development agencies, in order to improve efficiency of the technology generation and transfer process.

8.2. Relative Importance of Function 7

The linkage role with extension was a specific objective assigned to ARPT from its establishment (ref. section 3.I.3.).

The performance of this function has been the most difficult to assess because there have been several different types of collaboration, with five different levels of extension workers, as well as variations between six provinces (ref. section 4.III.3.). Table 48 indicates some aspects of this variation, based on an assessment of the ARPT-extension linkage in the three case study provinces.

In the survey, Research Branch scientists indicated that they considered the function to be very important, in ideal terms, with CSRT scientists ranking it higher than ARPT scientists (Table 49). The "actual" importance, as indicated by performance, was perceived to be between moderate and very important by both groups of scientists. This assessment is quite close to that of the study team (Table 49).

8.3. Evidence to Support the Assessment of Function 7

8.3.1. Understanding of ARPT's Role by Extension Workers and Development Agencies

Most extension workers interviewed did not have a detailed understanding of the role of ARPT, but most did understand that its primary function was to conduct on-farm research related to farmers' problems (ref. section 4.III.3.1.). Most of the SMSs clearly understood that ARPT was to conduct research on problems identified through farm-level diagnosis, while only half of the LEWs understood this objective. The other half viewed ARPT's work as primarily technology testing.

Almost all saw a clear distinction between the types of research carried out by CSRT and ARPT, primarily because ARPT had involved farmers much more in its research. It was generally understood that the relationship between ARPT and CSRT involves ARPT testing CSRT technology on-farm. Only 20% viewed the role of bridging the gap between research and extension explicitly as ARPT's responsibility.

Most considered that ARPT had been conducting research on problems relevant to farmers' circumstances and were expecting that improved recommendations would result from the work.

Only a few representatives of development agencies were interviewed. Most had no specific expectations of ARPT, but some anticipated that ARPT would eventually provide new messages for farmers, which the projects could incorporate into their programs.

8.3.2. Involvement By Extension Workers and Development Agencies in Planning ARPT's Program

The Provincial ARPT Committees have provided the principal opportunity for provincial and district SMSs to contribute to planning ARPT's work program (ref. sections 3.IV.2.1. and 4.III.4.2.). About half of the SMSs interviewed thought that, through the committees, they had been able to influence the direction of the ARPT program and could cite examples of when their ideas had been incorporated. The other half thought that ARPT had pushed their proposals through with minimal discussion, and that the committees were simply "rubber stamping" the program.

In general, extension staff viewed the effectiveness of the committees as a linkage mechanism more favorably than the ARPT scientists interviewed. ARPT scientists, in general, considered that they had relied on more informal mechanisms for feedback in drawing up their programs, primarily through incorporating comments made by extension workers during the season. The LEWs had had no formal involvement in planning ARPT's program (ref. section 4.III.4.2.).

In several provinces ARPT has invited representatives of several development agencies and planning organizations to take part in the ARPT Provincial Committee meetings (3.I.6.4.). Their actual involvement in planning ARPT's program has been quite limited, however.

8.3.3. Involvement of Extension Workers in ARPT's Activities

i) Participation in ARPT's surveys

Camp-level extension workers have been involved to a moderate degree in ARPT's surveys (ref. section 4.III.4.1 and Table 48). LEWs have provided most of the information used by ARPT teams to demarcate the various farming systems. During the informal exploratory surveys ARPT has also relied on LEWs as interpreters and for introductions to farmers. ARPT teams have not provided feedback to LEWs on the survey results, however. The TAs have also been actively involved in most surveys.

ii) On-farm trials

Extension workers' involvement in implementing ARPT trials has been very limited, except in the Target Areas, where it has been moderately good (Table 48). The Trials Assistants, formally seconded from extension to ARPT, have been responsible for implementing virtually all of ARPT's on-farm trials (ref. section 3.II.2.6.2.). Camp staff in the Target Areas have assisted the TAs in farmer selection, supervisory visits to collect data and, occasionally, in trial operations.

Eastern Province is the exception (ref. section 3.III.3). Here the agronomist wanted to spread his trials over a large number of widely dispersed sites. He gave his simplest trials to block supervisors scattered around the province, outside the Target Areas. This was not very successful; a large number of trials were lost from lack of supervision. He has, subsequently, reduced his reliance on extension workers to supervise and implement trials.

iii) Comments from extension workers to ARPT

There has been moderately good feedback of information from provincial and district SMSs to ARPT about the value of technologies included in trials and about farmers' problems (ref. section 4.III.4.3. and Table 48). The main occasions for feedback have been during the annual field days and at the ARPT Provincial Committee meetings.

The feedback of comments and information from LEWs to ARPT has been stronger (ref. section 4.III.4.3. and Table 48). The main occasions have been at field days, a few end of season meetings, and informal discussions in the field with ARPT scientists and TAs. In both Central and Luapula Provinces, the ARPT staff consider field days to have been the most effective occasion for interacting with LEWs (ref. section 4.III.4.3.). In Luapula and Western Provinces, the teams have found it useful to conclude the field days with a formal meeting, at which people discuss what they have seen and minutes can be taken.

In Eastern Province, ARPT has relied more on the T&V reporting system to provide feedback on the program. This is generally regarded by both ARPT and extension workers to have been a successful mechanism.

iv) On-farm test verifications

Experience with this work is limited because only five provincial ARPTs have reached this stage. The work has centered mainly on conducting demonstrations and monitoring them, rather than farmer adoption (ref. section 4.III.4.1). In provinces where RELOs have been posted, they have assumed principal responsibility for this activity.

Through the ARPT Provincial Committees, provincial and district SMSs have helped to plan which technologies should proceed to this stage. Block- and camp-level LEWs have been involved in the demonstrations by supervising their implementation and recording data (Table 46). It is still too early to say how effective this involvement will be.

v) Revision of provincial crop recommendations

Provincial SMSs and extension workers have been quite actively involved in ARPT's efforts to revise provincial crop recommendations in three provinces (ref. section 4.III.4.5).

8.3.4. Dissemination of Results by ARPT to Extension and Development Agencies

Limited information about ARPT's activities has reached the Senior SMSs at headquarters. Feedback from ARPT to provincial SMSs has been good, and almost all of those interviewed expressed satisfaction with the amount of information received (ref. section 4.III.4.4. and Table 48).

The flow of information to district SMSs and LEWs has been only moderately good (Table 48). District staff have received most reports, but LEWs rarely have. LEWs in some provinces, however, have received reports based on ARPT data, such as in the T&V monthly bulletins and the RELO's bi-monthly Research-Extension newsletters. There has also been some informal feedback to LEWs, but most LEWs complained that feedback from ARPT has been insufficient (ref. section 4.III.4.4.).

8.3.5. Contribution by ARPT to Planning and Development Agencies

Although involvement has been limited (ref. section 3.I.6.4.), there have been a few interesting examples of collaboration.

In Luapula and Lusaka Provinces, ARPT has been involved in helping design the provincial agricultural development plans as part of the preparations for the Fourth National Development Plan. In Central Province the team has been included in a committee responsible for planning the agricultural development activities in the District.

In Eastern Province the team has used trial results in its efforts to encourage the input supply agencies and senior civil servants to ensure the supply of a certain type of fertilizer, "X" compound, to the province. They also succeeded in persuading the Lint Company of Zambia to include fertilizer in its credit package to farmers. Unfortunately, LINTCO did not have sufficient resources to implement the recommendation in the 1986/87 season.

In Luapula Province, ARPT has had particularly close links with two development projects. With FINNIDA's Agricultural Extension Project, ARPT has participated in several extension training workshops and has helped with planning the content of the demonstrations. ARPT has, in turn, received considerable logistic support from the project in the form of finance, transport, fuel, and spare parts.

ARPT has also responded to the needs of the Integrated Rural Development Program (IDRP) which is helping District Councils to plan their rural development activities more effectively and is providing some financial assistance to implement planned activities. ARPT actually moved into the Mabo Target Area to support IDRP work in that area (ref. section 3.III.4.1.2.). Both of these development projects have representatives on the ARPT Provincial Research Steering Committee.

In Central Province, ARPT has collaborated with IRDP, which had introduced a sunflower oil expeller. This has had a remarkable impact on sunflower production, shifting emphasis away from maize. In response, the IRDP and ARPT have collaborated with the Sunflower CSRT to draw up a program of research and development for the area.

8.4. Key Factors Affecting the Performance of Function 7

This section summarizes points which are made in greater detail in section 4.III.5.

8.4.1. Support of Senior Extension Managers

Senior managers in extension headquarters have given considerable support to interaction between ARPT staff and extension workers at all levels. This has been a very important factor in facilitating the performance of this function (ref. section 4.III.5.1). The clearest results of this commitment were the creation of 9 RELO posts, the secondment of LEWs to work as full-time TAs for ARPT, and the decision to hold a national workshop on research-extension linkages.

8.4.2. Research Extension Liaison Officers

RELOs have played an important role in the performance of this linkage function (ref. sections 3.II.2.6 and 4.III.5.2.). In the 4 provinces where there have been full-time RELOs, they have played a major role in making ARPT's work better known among extension workers and have generally helped to bridge the gap between research and extension. In provinces without RELOs there has been increasing pressure to recruit them.

8.4.3. Trials Assistants

The Director of Agriculture, in seconding LEWS to ARPT to work as TAs, viewed this field-level involvement as the most important point of contact between research and extension workers (ref. sections 3.II.2.6. and 4.III.5.3). TAs have, indeed, been very important in maintaining both formal and informal linkages with local extension workers, particularly in their Target Areas.

ARPT scientists have depended heavily on the TAs for the management of on-farm trials and related data collection. In fact, the TAs have worked out so well that most ARPT agronomists are reluctant for them to return to their extension duties. However, it would be a major reversal of the principal of research-extension interaction if the TAs were to become permanent research personnel.

8.4.4. ARPT Provincial Committees

Although these committees have not been as effective as had been anticipated, they have nevertheless been a moderately important factor influencing the quality of ARPT-extension linkages (ref. section 4.III.5.9). In some cases, such as Luapula Province, they have played a larger role and have even made major decisions about the location of ARPT's activities.

8.4.5. Donor Project Structure

The structure of donor projects has had an important influence on the level of interaction between ARPT and extension workers. Projects that have supported both extension services and ARPT have provided resources to extension workers and stressed the importance of cooperation among all project staff (ref. section 4.III.5.4.). The good interaction between ARPT and extension in Eastern Province illustrates the benefits from this common organizational affiliation (ref. section 3.III.3.).

8.4.6. Extension Approach

A very important factor affecting ARPT and extension linkages has been the extension approach employed in the province (ref. sections 3.III.3 and 4.III.5.7.). The T&V system has improved certain aspects of ARPT's interaction with extension workers considerably; in particular, the two-way flow of information between LEWs and ARPT through monthly bulletins and the formal reporting system.

8.4.7. Workload of Extension Workers

Many of the extension workers interviewed were interested in participating more fully in ARPT activities but had not had sufficient time. In addition to their extension activities, LEWs have to deal with many other tasks, such as assisting farmers with loan applications, collecting crop forecasting information, keeping farm registers, etc. This has been a moderately important factor inhibiting the successful performance of this function.

8.4.8. Manpower Factors

Several manpower factors have influenced the level of interaction between ARPT and extension workers (ref. section 4.III.5.6.).

i) Rapid turnover of extension staff

This has been an important inhibiting factor. Rapid turnover of staff disrupts the development of collaborative relationships.

ii) Education level

The large difference in education level between the LEWs and ARPT scientists has inhibited effective communication. Some ARPT staff have not given this adequate consideration. It has not been a major factor influencing the performance of the linkage function, however.

iii) Poor conditions of service for extension

Poor conditions of service demoralize extension workers. Limited allowances and lack of transport also inhibit their mobility, and thus their ability to interact with ARPT. This has been a moderately important factor impeding interactions with ARPT (ref. section 4.III.5.5.).

iv) Training and orientation of extension workers

The training and orientation of extension workers has led them to work more closely with commercially oriented farmers. ARPTs emphasis on a different client group has sometimes caused confusion and hindered communication. This has only had limited importance for the performance of the function, however.

8.4.9. Extension Workers Lack of Understanding of ARPT

Many ARPT staff complained that extension workers, especially outside the Target Areas, do not fully understand ARPTs work. This has sometimes resulted in suspicion and mistrust, both of which have hindered good working relations (ref. section 4.III.5.5.).

Several SMSs reported that their lack of understanding of ARPT's role and work derived from their lack of involvement in ARPT activities. They had not been invited to take part in ARPT's surveys and trials and assumed that the initiative lay with ARPT. This has been an important factor impeding the effective performance of this function.

8.4.10. Logistics

The considerable distances between the research stations, where ARPT staff are based, and extension workers scattered around each province, has been an important factor inhibiting effective communication.

8.4.11. Lack of Formal Mechanisms for Interaction Between ARPT, Planners, and Development Agencies

There have been no formal mechanisms for facilitating interaction between ARPT scientists and planners or development agencies, apart from the ARPT Provincial Committee meetings and one or two ad hoc planning meetings. Most interaction has been through informal contacts. This has clearly limited effective interaction.

9.0. Summary of Key Factors Affecting ARPT's Performance of the OFCOR Functions

Table 50 summarizes the key factors which have affected ARPT's performance of the seven OFCOR functions. The key determining

Table 50: Key Factors Affecting the Performance of OFCOR Functions

	Functions						
	1	2	3	4	5	6	7
I. Policy Factors							
Policy emphasis on small-scale farmers	2	-	-	-	1	-	-
Support of senior managers	3	3	-	-	3	3	3
II. Organizational Factors							
ARPT National Coordinator	2	1	-	-	2	2	1
ARPT Sociology Section	1	-	2	2	2	-	1
RELOs	-	-	-	-	2	-	2
Extension workers as ARPT Trials Assistants	-	-	1	3	2	-	2
ARPT Nutrition Coordinator	-	-	2	-	-	-	-
ARPT staff based together	-	3	2	-	-	-	-
ARPT staff sharing office	-	2	-	-	-	-	-
ARPT & CSRT scientists based together at stations	1	-	-	2	-	2	-
Donor project structure	-	2	-	2	-	2	2
Extension system (T&V)	-	-	-	-	3	-	3
Extension involvement with ARPT	-	-	-	-	-	-	2
III. Manpower Management Factors							
Full complement of staff in teams	2	3	3	-	3	2	3
Continuity of staff	-	2	-	2	-	2	2
High quality of staff	2	1	3	3	-	3	-
Clear job descriptions	-	1	-	-	-	1	-
Specialized training in FSR	-	2	3	1	3	2	-
Perception of ARPT's function	1	-	-	1	1	3	1
CSRT scientists' experience with FSR	-	-	-	-	-	2	-
Excessive work load for extension workers	-	-	-	1	-	-	1
IV. Resource Management Factors							
Limited resources allocated to CSRTs	-	1	-	3	-	3	-
Limited resources allocated for extension	-	-	-	-	-	-	2
Large number of widely dispersed trials	-	-	-	3	2	1	-

	Functions						
	1	2	3	4	5	6	7
V. Linkage Management Factors							
Intra ARPT Links							
Regular team programming and review meetings	-	2	1	2	-	-	-
Provincial team management encouraging participation by all teams	-	2	-	-	-	-	-
ARPT Farmer Links							
Role of local leaders	-	-	-	-	1	-	-
Field day organization	-	-	1	-	2	-	2
End-of-season meetings	-	-	1	-	2	-	1
Informal discussions with farmers	-	-	1	-	2	-	-
Farmer comments included in ARPT Annual Report	-	-	-	1	1	-	-
ARPT-CSRT Links							
CSRT field visits to ARPT	2	3	-	3	-	3	-
Collaborative trials between ARPT & CSRT	1	2	-	2	-	2	-
Availability of technologies for on-farm work	-	-	-	3	-	3	2
VI. Planning, Programming and Review Factors							
CSRT Review Meetings	2	2	-	3	-	3	-
Preparation & exchange of trial outlines	-	1	1	2	-	1	-
Preparation of annual report	2	1	2	1	-	1	-
ARPT Provincial Committee	-	-	-	1	-	-	1
Lack of forward planning	1	-	-	1	-	1	-
VII. Methodological Factors							
Methodology employed by ARPT	-	2	2	2	2	2	2
Farmer selection methods	-	-	2	2	2	-	-
Complexity of trials	-	-	-	1	1	-	-

Notes:

Scale: 1 = Moderately important
2 = Important
3 = Very important

factors have been grouped into seven categories; policy, organizational, manpower management, resource management, linkage management, planning programming and review, and methodological

factors. The study team has scored each factor using a scale of 1 to 4, in ascending order of importance. The ranking is based on situations where particular factors have been important; the factor may not have had a global impact on ARPT. For example, the T&V system has been ranked as 4 (very important) because, on the basis of the specific experience in Eastern Province, it has been crucial, even though. The factors are scored against the functions on which they have had greatest influence, as discussed in Chapter 5. Therefore, although many factors are only scored against one or two functions, it does not mean that they have had no influence on other functions.

CHAPTER SIX

RECOMMENDATIONS FOR STRENGTHENING THE ORGANIZATION AND MANAGEMENT OF ARPT

Introduction

The following recommendations address the problems identified in Chapters 3, 4, and 5.

1.0. Organization of ARPT

1.1. To rectify the bias towards crop research two adaptive livestock specialists should be recruited to work in ARPT and advise all provincial teams. Their approach should be similar to that used in the initial phases of the sociology and nutrition investigations; i.e., initially their work should identify appropriate methods, approaches, and institutional issues relating to adaptive livestock research.

1.2. It is strongly recommended that all RELOs be based at the regional research stations, together with other ARPT staff, in order to help the team-building process and strengthen the RELO position.

1.3. The experience of incorporating the nutritional perspective in Luapula province was very positive. It is therefore important to assess the impact of the Nutrition Coordinator on ARPT's work in all provinces. Attention should be given to the difficulties encountered by ARPT in collaborating with nutritionists in existing organizations, to help determine the possible need for a nutritionist on a permanent basis.

1.4. Indications are that some regional sociologists are having problems with integrating effectively into the work of all provincial teams in each region. This should be investigated and closely monitored.

2.0. Coordination of ARPT

2.1. In an attempt to reduce dependence on donor support, the ARPT NC should make increased efforts to secure long-term funding from Government for provincial teams. These should include provincial as well as national financial allocations.

2.2. The ARPT NC should channel more information about small-scale farmers' conditions to national-level policy

makers. This will help to ensure that policy makers and planners have a greater understanding of farmers' needs and are able to plan appropriate investments.

2.3. To ensure that the National Coordinator has sufficient time to provide leadership in program development and technical supervision of ARPT, he/she should be assigned a full-time administrative assistant.

3.0. Supervision of ARPT

3.1. Provincial ARPTs should hold regular team meetings, at least once each fortnight, to review progress on the work program, major administrative matters, etc. These meetings will facilitate team building and will increase each team member's level of understanding of the team's work program. The Officer-in-Charge of the research station should also be invited to these meetings.

3.2. There should be only one steering committee for research and extension in each province, which should be called the Provincial Research and Extension Committee (PRECO). The committee would be responsible for reviewing all research undertaken in a province, not only that of ARPT. It is intended that some of the problems of the ARPT Provincial Committees will be reduced by broadening the scope of research covered by the committees. They would meet at least three times each year and would have the following functions:

- to review the results of ARPT and CSRT research;
- discuss the next season's research program for ARPT and CSRTs, as it relates to provincial problems;
- organize visits to ARPT and CSRT trials;
- discuss the technical content of provincial extension demonstrations;
- review provincial research recommendations.

These committees would feed priorities back to the National Agricultural Research and Extension Committee.

4.0. Program Development

4.1. The quarterly ARPT meetings were identified as important mechanisms for program development and the building of research capacities. It is strongly recommended that these meetings continue.

4.2. Twice a year the ARPT scientists should meet on a disciplinary basis to discuss the issues concerning each discipline. This recommendation has arisen from several team members, both agronomists and economists, who consider that certain issues can best be discussed with others from the same discipline. These meetings would be held at the time of quarterly or annual ARPT staff meetings. Written reports of discussions should be prepared, distributed, and discussed at the next ARPT quarterly staff meeting.

4.3. Sufficient provincial ARPT quarterly reports should be printed to enable each team to receive a copy. This will help all ARPT staff to follow the progress in each provincial team on matters pertaining to work programs, administrative and personnel issues. This is considered important because such matters are now discussed only between individual provincial teams and the ARPT NC.

5.0. Program Planning

5.1. Provincial ARPTs should set clear priorities within their work programs, based on careful pre-screening. These priorities can be referred to if it is necessary to reduce the size of the program, for example when only limited resources have been allocated to a team.

5.2. Provincial ARPTs should place greater emphasis on interdisciplinary development and review of their annual work program. This exercise should involve all team members.

5.3. A work program protocol should be introduced for all team activities, not just trials. The protocol, discussed in 1986 at the ARPT Annual Review, would include sections listing the different people/disciplines who would be involved, when they would be expected to participate, and what their contribution would be. The protocol should facilitate forward planning and encourage greater interaction between different disciplines, both within ARPT and between ARPT and other organizations.

5.4. Trials Assistants, who have the most interaction with farmers, should be systematically integrated into the planning process. This was identified as a weak link in the communication between farmers and ARPT scientists. Researchers should meet with the TAs when the research results are reviewed and when the program is being formulated. This will facilitate team building, improve the feedback of comments about the trials, and improve the quality of information supplied by TAs to farmers.

5.5. More time needs to be spent by the provincial teams discussing the work program with farmers and extension workers, in order to involve them more fully in ARPT's work.

5.6. As the team begins to release recommendations, greater attention should be given to monitoring the extent to which recommended technologies have been adopted by farmers.

6.0. Management of Data Analysis Reporting and Dissemination of Information

6.1. ARPT annual reports, although not perfect, have been effective mechanisms for disseminating the results of ARPTs research throughout the Research Branch as a whole. It is recommended that the timely production of reports continue.

6.2. Access to research information has been hampered, however, by the shortage of research reports. There is urgent need for both ARPT and CSRTs to produce more copies of their reports to ensure that they can supply each other with research results well into the future.

6.3. There have been difficulties with disseminating research results between research teams. Several recommendations are made to improve the situation.

i) All provincial ARPTs and CSRTs should produce distribution lists for their documents. These lists should be circulated to as many teams and organizations as possible to find out who would like to receive copies of the teams' reports. Copies of team reports should then be sent out systematically, using the distribution lists. Extension workers should be included on these lists. The ARPT National Coordinator should facilitate effective dissemination of provincial annual reports as required.

ii) All research teams should produce updated publication lists every year and attach them to their annual reports. Copies of all the reports should be sent to the Mount Makulu library, and copies of all research data should be sent to the biometrician.

iii) The Research Branch Trial Data Base should be completed and computerized as soon as possible.

6.4. ARPT scientists should make greater use of the microcomputers, which have been recently installed, to help them more rapidly analyze, retrieve, and disseminate the considerable amounts of data which have been and are continuing to be collected. In-service training courses in the use of microcomputers and various software packages should continue to be emphasized.

6.5. To make greater use of the data collected already, provincial ARPTs should allocate more time to report writing and to presenting data from previous surveys and trials.

6.6. Several CSRT scientists have been critical of the type of information presented by ARPT, and steps should be taken to rectify this and thereby improve ARPT's feedback function to CSRTs. It is recommended that:

i) ARPT scientists should continue to request CSRTs to indicate the type of information about farmers' circumstances which would be useful to them and how they would like to see it presented. Social scientists, in particular, should tailor reports to CSRT scientists' needs. It is recommended that a special session be dedicated to this topic at an ARPT quarterly meeting in the near future. Representatives of CSRTs should be invited.

ii) Crop profiles, which highlight the details of farmers' practices on each crop in particular farming systems, have been prepared by a few provincial teams, and CSRT scientists

have found them useful. It is recommended that all ARPTs should prepare crop profiles from existing data and circulate them to CSRTs.

7.0. Management of Administration

Most of the administrative problems facing ARPT are faced by other research teams and other sections in MAWD and require major changes in Government procedures and regulations. However, one change which could be feasible follows.

7.1. The ARPT Provincial Coordinators should delegate the administrative tasks between all team members, thereby reducing the time spent by any one team member on administration. This would also facilitate team building, by involving other team members in decision making.

8.0. Management of Donor Support to ARPT

8.1. Technical assistance personnel have had, on occasions, three or four organizations to which they were responsible. This has resulted in considerable confusion and time wasting. It is recommended that donor project documents and job descriptions of technical assistance personnel should simplify the channels of accountability and reporting requirements for technical assistance personnel. If these are clearly specified before personnel arrive, the coordination of donor support will be greatly facilitated.

8.2. The ARPT NC should be more involved in the final selection of technical assistance personnel. This will increase the probability of recruiting candidates who have experience in Farming Systems Research and working with resource-poor farmers in developing countries, and who are interested in teamwork and building national research capacity. These have been found to be essential criteria for the effective contribution of technical assistance personnel to ARPT's research objectives and program.

8.3. To avoid Zambian remaining "perpetual counterparts", technical assistance personnel should be phased out as soon as experienced Zambians are available. In the interim, greater efforts should be made to ensure sufficient overlap between technical assistance personnel and Zambian counterparts so that the full benefits of the training role are realized.

8.4. Some donor projects have had regulations limiting the use of certain project facilities to technical assistance personnel, and this has hindered the process of team building. Attempts should be made during negotiations between Zambian and donor country representatives to minimize project regulations which restrict Zambian team members from access to project resources.

9.0. Management of Manpower in ARPT

9.1. The position of social scientists within the Research Branch continues to be ambiguous because most ARPT social scientists have not been officially appointed to the Ministry. To ensure the stable development and full institutionalization of ARPT, it is strongly recommended that posts for social scientists (rural sociologists and agricultural economists) be seriously considered for formal establishment within the Research Branch.

9.2. ARPT, in common with other research teams, has had a number of scientists who have served as Officers-in-Charge of research stations. This has reduced the amount of time that such officers have been able to devote to their professional duties. It is recommended that the Research Branch should aim to have full-time Officers-in-Charge and avoid using scientists from research teams.

9.3. It appears that CSRT scientists who have had some experience with working in FSR projects have had a better understanding of ARPT's work and have been more interested in collaboration than those who have not. It is therefore recommended that agronomists working in CSRTs should be encouraged to work for a period of years within ARPT and vice versa. Through such a system, ARPT agronomists will have a better understanding of the constraints of station research, and CSRT agronomists will better understand the objectives and constraints of on-farm research. This would help to foster mutual understanding and stronger collaboration between ARPT and CSRT scientists.

9.4. Evidence from the experiences of ARPT indicates that scientists with training and/or experience in more than one discipline are more interested in and capable of working as part of interdisciplinary teams. Disciplinary breadth should, therefore, be emphasized in training and should be included as a criterion when screening candidates for positions in ARPT.

9.5. Economists within ARPT should be encouraged to be responsible for conducting a limited number of on-farm trials. On the basis of experience, this measure should increase the economists' understanding of technical issues concerning trials and, partly as a result, should also increase interdisciplinary cooperation within ARPT.

9.6. To ensure that each provincial ARPT has a full complement of staff, the RELOs for the remaining provinces should be recruited as soon as possible.

9.7. Efforts should be made to ensure that while Zambian ARPT team members are away on long-term training, at least one scientist of the same discipline should remain within the team, thereby keeping the full complement of disciplines. This will help to sustain the characterization of farming systems and interdisciplinary cooperation.

9.8. On several occasions provincial team members have had difficulties explaining aspects of their teams' program for which they have not been directly responsible. This has been particularly embarrassing for the individuals concerned. This situation has usually arisen because, in some teams, team members have been assigned responsibility for particular Target Areas, which has meant that they have only limited awareness of what is happening in other Target Areas. Although such assignments help with delegation of responsibility, it is important that team members visit all Target Areas and maintain a basic understanding of the program being undertaken.

9.9. Provincial ARPTs should place greater emphasis on training of TAs and on involving them fully in the research process. In a situation of more limited resources it will be essential that the TAs can operate effectively, with limited supervision, in the field.

9.10. To improve team building within provincial ARPTs, attempts should be made by technical assistance personnel to give greater responsibility to Zambian staff for their work programs and encourage all team members to be more involved in decision making. This should not lead to abdication of responsibility for supervision, but rather should be replaced by a spirit of "learning by doing" which, by definition, includes the potential to make mistakes.

9.11. The Regional FSR Training Workshops held at the University of Zimbabwe and organized jointly with CIMMYT have been useful in providing new ARPT staff with the basic concepts and methods of FSR. It is recommended that new staff should continue to attend these workshops, including RELOs. In addition, in-service training should be provided to ARPT staff in the following subjects: use of microcomputers and appropriate software, monitoring and evaluation, agricultural statistics for on-farm experimentation, nutrition, livestock, and agroforestry.

9.12. Many Zambian scientists have complained about the poor promotion prospects within the Research Branch. The Research Branch should continue to pressurize, through MAWD, to make the positions of Senior Research Officers secure, which would act as a career incentive to many scientists.

9.13. Although the turnover of scientists in the Research Branch has not been very rapid, the transfer of staff and the absence of staff while on overseas training indicate the problems that can occur when there is no continuity of staff. It has been difficult to both sustain research programs and to build relations between research teams. It is recommended that research managers should minimize staff transfers as much as possible in an attempt to encourage staff continuity.

9.14. ARPT should continue to encourage and assist the School of Agricultural Sciences at the University of Zambia to introduce a course on "An interdisciplinary approach to

agricultural development." This would enable more Zambian graduates joining the Research Branch to appreciate the reasons for interdisciplinary cooperation and have skills in FSR.

10.0. Management of Financial Resources in ARPT

10.1. To keep ARPT costs to a minimum, it is recommended that the team should continue to look at methods and ways of reducing costs. These include:
i) reducing distances between trial sites, especially by means of tighter clustering of trial sites;
ii) strengthening capacities of Trial Assistants so that they can operate effectively with less frequent supervision by researchers;
iii) coordinating vehicle use with other team members and with others outside the team;
iv) buying 25% vehicle spare parts with each vehicle.

10.2. To help reduce the vulnerability of funding it will be necessary for ARPT to diversify its sources of funds. This may involve using external donors in the short term, and making use of donor counterpart funding from commodity sales. However, the team must make a greater effort to secure larger allocations from Government, not only from MAWD allocations but also through provincial allocations, such as the provincial research allocations.

10.3. To reduce ARPT's financial vulnerability, the team should continue to place GRZ funds in project bank accounts after donors have left. Such accounts help to spread out late releases of funds, unlike Government accounts, which are closed at the end of each fiscal year.

10.4. The provincial teams should prepare for reduced financial allocations and establish priorities in their work programs in such a way that financial cuts affect them as little as possible.

11.0. Management of Field Operations

11.1. ARPT should continue the movement towards tighter trial clustering to improve trial management and to reduce expenditures, in both human and financial resources. Trials should be within reasonable biking or walking distance from the TA's house.

11.2. ARPT should provide stores for Trials Assistants if they are presently having to store trial inputs in their houses.

11.3. Provincial teams should keep two bicycles on standby for use by TAs when motorcycles break down.

11.4. Provincial teams should maintain large stocks of fuel, oil, spare parts, trial requisites, etc., to minimize delays to field work caused by shortages of such items. This would also minimize the amount of time and effort spent purchasing the items.

12.0. Management of Farmer Participation in ARPT's Activities

12.1. To improve the representativeness of farmers selected to participate in both surveys and trials, it is recommended that provincial teams should introduce more rigorous methods of farmer selection using information on household characteristics. The continued input by the ARPT Rural Sociology Section in this area is crucial. Similarly, ARPT quarterly meetings should continue to focus on this issue so that provincial ARPTs can exchange and review each other's experiences in strengthening this aspect of their on-farm research program.

12.2. It is recommended that ARPT should spend more time explaining its role and objectives to farmers, emphasizing the importance of their comments about technology being tested. It appears from interviews that some collaborating farmers have only a limited understanding of the purpose of ARPT's work. This has led some farmers to unrealistic expectations of what ARPT would provide them with, such as credit and free inputs. In such situations, not only has there been disappointment, but generally the level of discussion has been limited. The research process is difficult to explain, and the ARPT Sociology Section should provide assistance in identifying local terminology which could help in such explanations.

12.3. It is recommended that more teams should hold meetings with farmers at the end of each season to present trial results and discuss the next season's trials. It is surprising that there has been little discussion with farmers about the content of trials. While it is recognized that farmers will have difficulties in understanding the range of technical solutions to a particular problem, nevertheless, for FM/FI trials, more time should be spent explaining the technical options available a obtaining farmers' opinions. The ARPT Rural Sociology Section should take a lead role in this.

12.4. In order to increase the level of participation by farmers in ARPT's activities, it is recommended that attempts should be made on a pilot basis to establish permanent farmer groups/panels. Experience from neighboring countries indicates that permanent groups/panels of farmers have helped to increase the level of commitment of farmers participating in research, in contrast to ad hoc meetings with farmers, such as at field days. The groups would act to represent farmers and would participate in most of ARPT's activities and be involved in discussions with the team throughout each season. The ARPT Rural Sociology Section should make proposals as to how this should be implemented.

12.5. Efforts to involve local leaders more fully in ARPT's activities should be strengthened. In the cases where local leaders, both traditional and political, have been involved in ARPT's activities, they have played a positive role, by encouraging the local communities to participate in and comment readily about ARPT's activities.

12.6. Provincial ARPTs should make greater efforts to ensure that Trials Assistants record farmers' comments about trials on a regular basis. Trials Assistants have tended to pass information orally to the agronomists. This has meant that the number and accuracy of farmers' comments has sometimes been affected by the memories of both the TA and agronomist. These comments must be used when writing the annual reports.

12.7. It appears that there is greater feedback and discussion from farmers when small field days are organized for farmers only, and when farmers take the lead in presenting the findings of trials. It is recommended that more encouragement should be given to farmers to present findings and help to organize ARPT farmer field days. The ARPT staff should only step in when the farmers are unable to answer questions.

13.0. Management of Interaction between ARPT and CSRT Scientists

13.1. Collaboration between ARPT and CSRTs in survey work needs to be strengthened. CSRT scientists should be more actively involved in ARPT diagnostic and monitoring surveys. Experience from other countries has demonstrated that this is an excellent means to stimulate effective collaboration and to ensure that information collected through surveys meets the needs of both ARPT and CSRT scientists. ARPT should also take a more active role in supporting CSRTs in their own surveys.

13.2. Collaborative trials have proven to be a good mechanism for interaction and effective collaboration between ARPT and CSRTs. They should continue to be encouraged, and ARPT researchers should actively seek such opportunities.

13.3. Two mechanisms have proven to be effective for building stronger collaboration between CSRTs and ARPT.

i) Commodity Research Team Review meetings. These have been very important because they have involved only a small number of scientists from ARPT discussing research priorities, programs, and results with scientists from particular CSRTs.

ii) CSRT visits to provincial ARPTs. Senior and junior scientists should make these visits, because it is essential that ARPT and CSRT scientists meet and discuss in the field.

ARPT should continue to actively use and support these two linkage mechanisms. Similarly, senior research managers need to continue to reinforce the importance of these research activities and assume responsibility for making sure that they are fully exploited. In both cases they have been implemented more successfully after clear directives have been issued by senior research managers.

13.4. To focus research priorities of all research teams on local problems it is recommended that the Commodity Research Team Review meetings could be usefully reorganized so discussion would focus on the research needs of the four main agro-ecological zones. In this way ARPTs and CSRTs working in a particular agro-ecological zone would meet to decide on the priorities for on-farm and station research for the zone.

13.5. ARPT scientists have sometimes had good communication with one scientist in a CSRT, but other members of the same CSRT have been unaware of the discussions. It is recommended that all research teams should have regular team meetings to facilitate communication. This is important especially for those CSRTs which have nominated one scientist to liaise with ARPT, to ensure that all team members are aware of what has been discussed.

13.6. Scientists in both ARPT and CSRTs have had difficulties in obtaining one another's reports. More copies should be produced and greater effort made to distribute reports. In addition, ARPT should systematically use the format developed for presenting information on specific research problems to scientists at the CSRT review meetings.

13.7. The ARPT work program protocol being recommended would help CSRT scientists to know where and when ARPT scientists want their services and would help them with their forward planning. Its use should be encouraged.

13.8. It is recognized that if CSRTs do not have adequate funding, they are unable to develop new technologies and cannot travel to assist ARPT. Maximum efforts should be made to ensure that all CSRTs are adequately funded and staffed with the necessary disciplines.

13.9. Many CSRT scientists do not fully understand the contribution social scientists can make to research. It is recommended that ARPT economists and sociologists discuss with the CSRT scientists the kinds of data about farmers' circumstances which they would find useful. The economists should also assist CSRTs by undertaking economic analysis of their trial results.

13.10. Transfers of agronomists between ARPT and CSRTs would help to increase understanding of the perspectives and problems that each team faces.

13.11. Some donor project documents and job descriptions for technical assistance personnel have clearly emphasized the importance of scientists in both ARPT and CSRTs collaborating fully with each other. This has even been used as a criterion for evaluating the performance of projects and individual scientists. It is recommended that emphasis on the importance of collaboration should be included in all donor projects and job descriptions. The job descriptions of all scientists in the Research Branch should emphasize the need for interaction between ARPT and CSRT.

13.12. There has been no effective procedure for ensuring that new scientists are introduced to other scientists, and they have not been informed of the structure, operations, and procedures of the Research Branch. As a result it has taken some scientists, especially those not based at the Central Research Station, a long time to discover who is working on what. To improve interaction between scientists and to familiarize new scientists with the workings of the Research Branch, it is recommended that there should be a systematic orientation procedure.

14.0. Management of Interaction between ARPT and Extension Workers

14.1. To ensure that each provincial ARPT has a full complement of staff, the RELOs for the remaining provinces should be recruited as soon as possible. RELOs should be based with the ARPT provincial team to ensure effective interaction and team building.

14.2. To assist with the full integration of the RELO position it is recommended that the position of National RELO should be filled as soon as possible. The National RELO would help to clarify some of the confusion that surrounds the RELO position in relation to other SMSs.

14.3. The RELO job description has been changed twice since the post was created, and it is recommended that the job description and channel of accountability for the RELOs should be clarified as soon as possible.

14.4. To facilitate interaction, the job descriptions for extension staff, especially district and provincial SMSs, should include the need for collaboration with ARPT.

14.5. In several provinces ARPT staff have been actively involved in training extension workers on the role of ARPT, the farming systems perspective, and the findings of their research. This work should be expanded to all provincial teams.

14.6. It is recommended that the farming systems perspective should be incorporated into the training of extension workers of all levels. The concepts of farming systems, target groups of farmers, and even working with more subsistence-oriented households will be unusual for many extension workers. Such training would improve extension workers' understanding of ARPT's work and, thus, the level of collaboration.

14.7. Training material on the farming systems perspective should be prepared to support the training described in 14.6.

14.8. The chief and senior SMSs at headquarters are not able to keep track of the work of all provincial ARPTs. It is recommended that they accompany the CSRT scientists from the Central Research Station when they make their annual field visits to each provincial ARPT.

14.9. Provincial SMSs (notably the Crop Husbandry Officer, Farm Management Officer, Land Use Planning Officer, and Extension Training Officer) should take part in ARPT surveys and in helping with trial implementation. Some have commented that they have had only limited interest in helping to plan ARPT's program because they have little idea what the work is about. The SMSs will need to allocate time for being involved in this work, and ARPT will have to make greater efforts to invite them in good time. The Provincial Research and Extension Committees should become more effective as a result.

14.10. To improve the dissemination of the season's results and to discuss the next season's trial proposals, ARPT should arrange to have a meeting with the local extension workers at the end of each season.

14.11. Local extension workers should be invited to attend the Trial Assistants training session held at the start of each season. Participation in the training sessions would increase their interaction with TAs and would improve the local extension workers' understanding of the trial program.

14.12. SMSs at the district level and local extension workers said that they had received little information about the results of ARPTs work. More reports should be sent to the district SMSs and to the local extension workers, especially those in the ARPT Target Areas.

14.13. The research/extension newsletters produced with ARPT assistance have been well received by all extension workers, and provincial ARPTs should continue to encourage and promote their use.

14.14. Attempts should be made to review and, if necessary, revise the provincial crop memos in all provinces. ARPT should collect the opinions of all extension staff, as well as CSRT scientists, on the appropriateness of the present recommendations.

14.15. The ARPT Provincial Coordinators should be invited to attend the PAOs' monthly/bi-monthly staff meeting, where this is not already occurring. They should brief the meetings on ARPT's activities in the province.

14.16. There has been much confusion about the procedure for revising and releasing research recommendations. It is recommended that senior research managers should review the procedure and produce guidelines.

15.0. Management of Interaction between ARPT, Policy Makers, and Development Agencies

15.1. The Technical Planning Committee formally met at MAWD headquarters to review and advise on all new agricultural projects. There were several representatives from the Research Branch on the committee. Unfortunately, the committee ceased to function several years ago. It is

recommended that the committee should be re-established and should use the stages of the project cycle as its agenda. As a member of this committee, the ARPT NC would be able to provide information to planners on farmers' technological needs. The committee would be an appropriate forum for raising issues related to institutional and infrastructural problems being faced in specific farming systems.

15.2. To improve the level of interaction between ARPT and provincial planners it is recommended that Representatives from the Provincial Planning Units and other development agencies should attend the ARPT Provincial Committee meetings. They should be asked to help determine the parameters within which ARPT should be working regarding the level of infrastructure and agricultural services within the Target Areas.

15.3. ARPT should attempt to have the provincial farming systems adopted as the unit for provincial agricultural planning. Maps of the farming systems should be prepared, together with a report explaining the potential of each system. The implications for agricultural planning within each system should be highlighted.

15.4. ARPT should make its findings better known among planners by distributing more copies of its reports to planners and policy makers at both the provincial and national level.

APPENDIX I

ASSESSMENT OF THE EFFECTIVENESS OF RESEARCH TOURS AND PROVINCIAL EXPERIMENTAL COMMITTEES

The provincial research tours and the Provincial Experimental Committee meetings (PEXCOs) were supposed to enable scientists to interact with extension workers and farmers in order to assess the extent to which research recommendations were being adopted, and to identify farmers' problems requiring research. In this way they were central to the mechanism for planning the research program.

The provincial research tours were made up of a group from headquarters, usually made up of one senior research manager, a chief or senior SMS, and one or two scientists from the Central Research Station. A different group would visit each province. In each province the group from Lusaka would be joined by scientists and the O-i-C from the Regional Research Station, the PAO, most SMSs and local extension staff from whichever districts were included on the tour. A total of 15 to 20 officers would usually undertake these tours.

The research tour program was arranged by the PAO and DAOs, and usually lasted three days. During this time the group would visit farmers in two or three districts. PAOs placed high priority on these tours because they and their staff were on display to supervisors from Lusaka. The tours provided valuable opportunities for PAOs and provincial SMSs to raise many issues with their supervisors, who usually were too busy give much time to such issues.

The Provincial Experimental Committees (PEXCOs) held formal meetings at the Regional Research Stations in every province each year, at the conclusion of the provincial research tours. The PEXCOs were chaired by the PAO and were attended by all who had been on the provincial tour, as well as all provincial SMSs, DAOs, a few farmers and heads of relevant organizations within the province, e.g., Namboard, Cooperative Unions. The meetings would discuss the findings of the research tour and any other problems from other districts, before the results of the previous season's trial results were presented.

The Commodity Coordinators were then supposed to scrutinize the reports of the provincial tours and the PEXCO minutes so they could incorporate any problems into their research programs. The Research Committee meetings would discuss the PEXCO minutes but usually few research problems were noted, and those that were mentioned would often be dealt with verbally by the coordinators. As a result, very few trial programs were initiated as a result of the findings of the tours and PEXCOs.

However, the tours and PEXCOs were widely considered to be ineffective as the means for planning relevant research for small scale farmers. There were several problems, including:

i) The farmers visited were often not representative of the farming community because local extension workers wanted to impress their supervisors from Lusaka, and so the tours tended to visit the more successful farmers in each district.

ii) There was never enough time on the tours to visit more than a few farmers. As a result, even if a problem was identified, it was never known how widespread the problem was. The time was also too short for a proper diagnosis to be made.

iii) The main problem with the PEXCOs was that most time was spent discussing institutional problems, such as the lack of credit, inputs, and late payment of farmers. Only a relatively small amount of time was spent discussing farmers' technical problems. This is reflected in the minutes of such meetings.

Although the tours and PEXCOs served a useful purpose in getting scientists to interact with extension workers in the field, they did not effectively help to formulate the research program. In 1982 the tours and PEXCOs were discontinued, partly because of a shortage of funds but also because the Director of Agriculture and ADA(R) were not satisfied with the results.

APPENDIX II

PROBLEMS WITH INTERPRETING RESEARCH EXPENDITURE DATA

The following problems relate to the data presented in the Tables 8-12, 38-42 and Table I in this appendix.

i) Personal remuneration

The figures shown in Tables 8,I and 12, but not 10, include the salaries of all Zambian civil servants within the Research Branch, but donor-funded personnel are excluded. The figures available showing a breakdown of salaries for each research team are not available. The figures in all three tables exclude salaries and supplements paid to expatriate staff on donor projects. In Tables 38-41, the salaries of ARPT professional staff, both expatriate and Zambian, have been estimated, because actual figures are not available.

ii) Operating costs

In Table 8 and I the figures for operating expenses are incomplete because they exclude the operating costs which have often been included in the donor capital projects. In some cases, such as the teams mentioned in Tables 10 and 38-41, the donor projects have contained virtually 100% operating costs.

iii) Capital Projects

a) In Table I figures of expenditure for some CSRTs cannot be broken down.

b) Data on expenditure by some donors are not available, which means that expenditures by some research teams, presented in Tables I and 8 as capital projects, are underestimated. In some cases, the donor support for research teams has been incorporated as part of large development projects, and no breakdown of funds has been available. In other cases, the figures for donor projects have simply been overlooked, in part, perhaps, because some of the projects have project bank accounts which, while subject to Government regulations, have tended to be audited less rigorously.

c) Some donor projects presented in Table I have supported several CSRTs, but where no breakdowns have been available, the figures have been presented as single projects.

- The Research/Extension Project (ZAMARE) has supported ARPT in Central Province, soybean, maize, and sunflower CRTs.
- Agricultural Sector Support program (SIDA) has supported ARPT in Luapula, maize, vegetable and sorghum and millet CRTs.

- National Oilseeds Development Program has supported groundnuts, sunflower and soybean CRTs.
- Eastern Province Agricultural Development Project has supported ARPT in Eastern Province, Grain Legumes and Groundnuts CRTs.

d) Some capital projects in Tables I, 8 and 9 have included large elements of production.

e) In Tables I, 8, 10 and 12, the value of capital payments in some donor-supported research teams are underestimated because some figures do not include foreign exchange payments made abroad for items such as vehicles and equipment.

iv) Expenditure by the Ministry of Agriculture

Over the last ten years there have been quite large changes in the MAWD budget, which help to explain the large fluctuations shown in Tables I, 8 and 12. These have been due to two factors.

i) Over the period the Government has provided large subsidies to cover the handling of fertilizer and maize, to cover price differentials for maize and fertilizer and to cover the losses of various parastatal marketing organizations. These substantial subsidies have been included as part of MAWD's recurrent budget. It has been Government policy to try to reduce the level of these subsidies. In 1982, the subsidies amounted to K119,649,000, or 81% of the total MAWD recurrent budget, while in 1984 the subsidies amounted to K17,161,000, or 43% of MAWD's recurrent budget. This means that a large proportion of the MAWD recurrent budget is not used for either personal emoluments or operating expenses.

ii) The MAWD has been reorganized twice between 1976 and 1985. In 1977, the Department of Water Affairs was transferred to another ministry and the Departments for Lands and Surveys were transferred to MAWD. In 1979, the process was reversed. The total MAWD budgets reflect these changes.

Table I: RESEARCH BRANCH EXPENDITURE 1976-1985 ('000 Kwacha in 1980 Prices)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
I. RESEARCH BRANCH RECURRENT COSTS										
Personal emoluments (1)	1,401	1,584	1,366	1,251	1,192	1,246	1,620	1,691	1,399	1,150
Total operating costs	1,093	673	556	457	704	484	329	307	230	319
Total Research recurrent costs	2,495	2,256	1,922	1,708	1,896	1,730	1,949	1,998	1,629	1,470
II. RESEARCH BRANCH CAPITAL COSTS (2)										
Wheat Research/Production Project	458	178	184	208	99	268	91	103	77	3
Mount Makulu Central Research Station	155	151	88	53	74	-	66	31	10	37
National Irrigation Research Station	314	261	114	56	29	10	23	19	16	-
Animal Husbandry Research	81	42	60	22	35	-	-	27	5	-
Phytosanitary Services	34	36	27	22	21	20	12	5	-	-
Farm Machinery Research Unit	9	10	14	6	8	10	8	6	-	-
Seed Production Project	49	128	304	630	486	140	326	79	237	190
Munkumpu Irrigation Research Station	-	-	21	23	10	2	-	-	-	-
Cereals Research Team	-	-	41	31	148	-	-	-	-	-
Vegetable Research Team	-	-	4	9	11	13	11	3	-	-
China/Zambia Rice Project	-	-	97	176	219	189	185	131	44	-
Mouldy Maize Research Project	-	-	11	22	32	70	22	-	-	-
Stored Products Research Team	-	-	2	7	52	23	46	9	-	-
National Oilseeds Development Program (3)	-	-	89	60	153	95	117	29	20	-
Weed Control Research Program	-	-	28	11	39	28	18	-	-	-
Tuber Research Team	-	-	-	-	22	33	28	20	6	-
Soil Productivity Research Team	-	-	-	-	16	35	16	13	-	-
Coffee Research	-	-	-	-	48	41	76	93	18	-
Adaptive Research Planning Team (Lusaka and Western)	-	-	-	-	-	25	82	147	93	83
Research/Extension Project (ZAMARE)(4)	-	-	-	-	-	13	1,042	76	698	229
Tree Crop Research	-	-	-	-	-	-	-	21	10	-
Agricultural Sector Support Program (SIDA)(5)	-	-	-	-	-	-	-	57	293	243
Eastern Province Agricultural Development Project (6)	-	-	-	-	-	-	184	299	288	285
Regional research stations (7)	261	272	293	156	269	227	103	74	42	44
Total Research capital costs	1,361	1,079	1,374	1,491	1,713	1,251	2,454	1,240	1,857	1,113
Total Research Branch recurrent and capital costs	3,856	3,335	3,296	3,199	3,669	2,980	4,403	3,238	3,486	2,583
III. TOTAL MINISTRY OF AGRICULTURE COSTS										
Total Ministry of Agriculture recurrent costs	127,293	116,143	70,076	133,166	225,011	115,014	148,405	55,214	93,713	18,632
Total Ministry of Agriculture capital costs	19,428	16,854	70,976	17,115	20,767	15,865	19,843	20,748	13,872	18,400
Total Ministry of Agriculture recurrent and capital costs	146,721	132,997	89,775	150,312	245,778	130,878	168,248	75,961	53,584	37,032

(Table I continues on following page.)

Table I (continued): RESEARCH BRANCH EXPENDITURE 1976–1985 (percent)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Personal emoluments as % of research recurrent	56	70	71	73	63	72	83	85	86	78
Personal emoluments as % of research recurrent and capital	36	47	41	39	32	42	37	52	40	45
Operating costs as % of personal emoluments	78	42	41	37	59	39	20	18	16	28
Operating costs as % of research recurrent and capital	28	20	17	14	19	16	7	9	7	12
Capital as % of research recurrent and capital	35	32	42	46	47	42	56	38	53	43
Research recurrent as % of research recurrent and capital	65	68	58	53	52	58	44	62	47	57
Research capital as % of MAWD capital	7.0	6.4	1.9	8.7	8.5	7.9	12.4	6.0	13.4	6.1
Research recurrent as % of MAWD recurrent costs	2.0	1.9	2.7	1.3	0.8	1.5	1.3	3.6	4.1	7.9
Research recurrent and capital as % of MAWD recurrent and capital	2.6	2.5	3.7	2.1	1.5	2.3	2.6	4.3	6.5	7.0

Notes:
1. Salaries of expatriate staff are not included in the personal emoluments.
2. Not all research teams are included under the capital projects.
3. National Oilseed Development Program includes support for research on groundnuts, soyabeans and sunflower.
4. Research/Extension Project (ZAMARE) includes support for ARPT in central province, maize microbiology, soybean and sunflower research.
5. Agric. Sector Support Program includes support for ARPT in Luapula Province, maize, vegetables, pasture crops and sorghum and millet research.
6. Eastern Province Agricultural Development Project includes support for ARPT in Eastern Province, grain legumes and groundnut agronomy.
7. Regional Res. Stations. These allocations are made from the Provincial Agricultural Officers' votes, mainly for maintenance of the res. stations.

Sources:
— Financial Reports 1976 - 1985
— Central Research Station accounts

APPENDIX III

PROBLEMS WITH INTERPRETING RESEARCH BRANCH MANPOWER DATA

The following points relate to the data presented in Tables 13-18.

i) The data for all three years - 1977, 1982 and 1986 - represent the situation that existed on the 30th June in each year. This means that if someone joined the Research Branch in July, he/she would not be shown in that year's figures.

ii) In the case of some research teams, scientists worked in the Research Branch for a few years which are not represented by the three years selected in this survey. However, the numbers of people involved are not significant.

iii) In 1977, the Commodity and Specialist Research Teams had not been fully established and thus, in some cases, no attempt has been made to break the manpower down by research team. In Table 13, the general agronomists were and are working for several research teams. In Table 14, the technical staff, indicated as working with the general agronomists, would have been working at regional research stations for several teams.

iv) Information available on certain topics, notably scientists' education level, was rather patchy, and some estimates have been used for the sake of completeness.

v) A few points should be made about the figures for particular research teams.

a) Data for the Wheat Research Team in 1977 and 1982 do not include the CIDA expatriate personnel, who were quite numerous.

b) Data for the Soil Research Team include personnel in soil physics, soil productivity, soil advisory, microbiology, agricultural chemistry and headquarters staff for the soil survey unit.

c) The Seed Control and Certification Institute was separated from the Research Branch in 1986. Prior to this the Seed Service was included on the establishment of the Research Branch.

vi) A few of the plant protection scientists are included under the Commodity Research Teams for which they work full time.

vii) Most Officers-in-Charge of research stations are also members of research teams and are included in the data under their respective research teams.

APPENDIX IV

LIST OF CONSULTANTS ASSISTING WITH THE ESTABLISHMENT OF ARPT

In summary, the list includes the following:

Dr.M.P. Collinson	-	CIMMYT Regional Economist
Dr.D. Norman	-	Professor of Agricultural Economics, KSU
Dr.J. Jiggins	-	Then Research Fellow, Rural Development Studies Bureau, UNZA
Dr.R. Kirkby	-	Then Agricultural Officer, IDRC, Kenya
Dr.G. Banta	-	Then Agricultural Officer, IDRC, Thailand
Mr.B. Luijquist	-	Then Nutrition Advisor, SIDA
Dr.D.M. Warren	-	Then Team Leader, ZATPID project, Lusaka
Dr.C. Lightfoot	-	Then Agronomist on FFSAIP, project, Botswana
Dr.L. Harrington	-	Then CIMMYT Training Economist, Mexico
Mr.E. Shumba	-	Agronomist with FSR Unit of Research and Specialist Services, Zimbabwe.

APPENDIX V

RESEARCH BRANCH STAFF ASSESSMENT OF RESEARCH ORGANIZATION

In 1984 an Agricultural Research Resource Assessment (ARRA) was conducted in the countries of the Southern African Development Coordination Conference (SADCC), including Zambia. As part of the study, 15 research scientists were interviewed about their views on the problems facing agricultural research organizations in Zambia. The results of that survey are reproduced below.

Table II - Research Staff Assessment of Problems Facing Research Organizations

Problems/Criteria	
Budget:	
Consistency of support	3.9
Level of funding	4.5
Release of funds	4.3
Foreign Exchange Difficulties:	
For purchase of parts	4.1
For purchase of equipment	4.3
For purchase of books/journals	3.3
For purchase of special supplies	4.2
Senior Staff:	
Lack of training opportunities	2.4
Lack of interest in further training	1.3
Lack of experience/background	2.7
Lack of motivation	2.8
Lack of leadership	2.8
Junior Staff:	
Lack of training opportunities	3.2
Lack of interest in further training	1.6
Lack of experience	2.9
Lack of motivation	3.0
Support Staff:	
Lack of training opportunities	3.9
Lack of interest in further training	1.9
Lack of experience	2.4
Lack of motivation	2.8
Conference/Meeting Rooms:	
Number of conference rooms	2.3
Capacity of conference rooms	2.6
Adequacy of conference rooms	3.1
Laboratories:	
Number of laboratories	2.9
Capacity of laboratories	3.6
Adequacy of laboratories	3.9

Offices:	
Number	3.1
Capacity	2.3
Adequacy	2.4
Equipment:	
Insufficient number/obsolescence	4.5
Lack of repair/maintenance	4.7
Funds for essential equipment	4.7
Transportation:	
Budget for operations	4.4
Availability/access	3.6
Maintenance/care	4.1
Number of vehicles/bicycles	4.2
Staff Housing:	
Number of houses	4.5
Adequacy of houses	3.6
Salary Scales/Levels:	
Not sufficient to hold staff	4.3
Competition from the private sector	4.6
Promotion System:	
Promotion schedule	4.2
Rewards for superior service	4.3
Staff evaluation procedure	4.2
Other Benefits:	
Leaves of absence schedule	1.5
Health benefits	2.9
Retirement benefits	3.1
Overall Average	3.5

Notes: Seriousness of problems/criteria: 1 = not serious, 5 = very serious.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

APPENDIX VI

CONTRIBUTION OF RURAL SOCIOLOGY TO ARPT

This appendix relies heavily on several unpublished documents prepared by the ARPT Senior Rural Sociologist and a paper prepared in conjunction with the ARPT NC (Kean and Sutherland, 1984)

I. Specialist Areas More Appropriately Dealt With by Sociologists

In the process of technology generation, rural sociology can effectively contribute by assisting technical scientists and economists in identifying and focusing on points in the farming system where technical interventions are likely to be favorably received by farming communities. This implies anticipating which parts of the farming system are most likely to be resistant to change due to social and cultural factors. Specifically this involves the following tasks:

1. Provide a social profile of the community selected for on-farm research. This should contain a description of the communities' main residential and productive groupings, local arrangements for the administration of land tenure and local political institutions.

2. Pinpoint and describe those farming operations normally performed by individuals, as distinct from those involving cooperation, making a distinction between inter- and intra-household cooperation. This includes both cooperative labor arrangements and hiring, loaning or sharing of equipment.

3. Describe the distribution of resources (land, labor, draft power, cash) between households and larger groups within the community, emphasizing both inequality and equality of ownership/access.

4. In a situation of ethnic diversity and/or a high level of social stratification, describe reciprocal and dependent relationships, both long- and short-term, between different groups within the community.

5. Description of the risk aversion strategies within the existing farming system. This should be done with the particular emphasis on aversion to specialization (in crops, varieties or methods) and with attention to current levels of cash and labor inputs.

6. Assist in assessing the level and distribution of cash in the system; the times when cash is most plentiful and the existing level of cash invested in particular operations.

7. Record the farmers' ideas about the valued qualities of particular crops, varieties, and methods within the system, and generally maximize the use of farmers' knowledge in setting research priorities and planning the design of on-farm trials.

8. Identify the appropriate times, places and methods for getting full community participation in the pre-screening and evaluation of new technologies.

II. Sociological Involvement in ARPT's Methodological Sequence

With regard to the existing methodological sequence of FSR employed by ARPT, the following are suggestions and recommendations for the ARPT Rural Sociology Section's contribution to improving the sequence's effectiveness when implemented by a team of multidisciplinary specialists.

Zoning/Target Grouping: Assist with assembling background information, especially on settlement patterns, local political structure, land tenure, kinship systems and ethnic composition. Help to identify key informants in the area, and devise an interview strategy which minimizes extension worker bias. Identify a means of establishing if female headed households should be treated as a separate target group. Use of secondary sources to prepare a sociological profile for each province.

Survey: Discuss background information and secondary literature with other team members, pointing to social factors which might require special attention during survey work. Help to select a representative "target area" for survey, and plan the best way to select farmers for informal interview. Participate as a full team member during the informal survey. In the formal survey, advise on and assist with a sampling frame and review draft questionnaires, making comments and suggestions where necessary. Assist with the analysis and interpretation of survey results as requested. Advise team on how best to access and utilize indigenous knowledge in system description. Help to ensure that target areas are representative of domains from a socioeconomic viewpoint.

Research Priorities: Participate in discussion on research priorities and comment on experiment proposals. Suggest non-economic criteria to consider during the pre-screening of particular technical options. Suggest ways of incorporating farmers more fully into the pre-screening process. Help to anticipate the likely social consequences of technologies under consideration.

On-farm Trials: Assist with the selection of a "target area" and suitable typical cooperating farmers to host experiments. Devise methods for maximizing farmer participation in on-farm trials, especially in the design and evaluation of adaptive trials.

On-farm-Tests: Assist the RELO in devising a strategy for selecting the most suitable testing and demonstration sites, and for monitoring farmer reactions and adoption patterns. In particular, assist with the identification of local leaders and communication channels through utilizing an understanding of the local social

structure and culture. In all this, make use of the literature on adoption studies to aid the selection of test sites, monitoring criteria, and the identification of appropriate communication channels for extension.

Recommendation Formulation and Release: Assist the RELO in planning and writing for the dissemination of new technical messages throughout a domain. Help to ensure that local units of measurement (volume, space, time) are incorporated into the formulation of technical messages arising from ARPT trials. Point to any social, cultural and political factors which vary across the domain sufficiently to suggest the need for locally specific approaches for extension workers operating T and V at the camp level.

III. "Non - Economic" Subject Areas not Usually Fully Covered in the Farming Systems Approach

1. Question the Simplifying Assumption of Agricultural Economic Analysis in Regard to Household Labor Allocation

The importance of the division of labor by age, sex and marital status within rural households. The extent to which age, sex and marital status regulate labor in agricultural production with particular emphasis on peak labor periods and competition between agricultural and non-agricultural cash-earning opportunities.

2. Bring in the Importance of Inter-household Processes

Kinship as an institutional factor regulating agricultural labor and access to land, livestock, equipment and markets. The ways in which the ties of marriage, descent and filiation, which extend beyond the household, intervene either positively or negatively in the allocation of labor during the peak periods in the acquisition and consolidation of different kinds of rights in land and livestock, in the sharing of agricultural equipment, and the distribution and marketing of agricultural produce.

3. Religion/Ethnicity in Relation to Productive Specialization and Access to Land and Equipment

The extent to which religion or ethnicity are factors which intervene in the organization of agriculture, including specialization in crops and agricultural operations, access to land for cash cropping or pasture, cooperation in the purchase of scarce inputs, sharing of expensive equipment, and the informal marketing of produce.

4. Land Tenure and Technological Intervention

The influence of local land tenure systems on technology involving changes such as an expansion of hectarage, an extension of the period of cultivation, an improvement or alteration of existing holdings, or a more "rationalized" pattern of land holding and administration.

5. Settlement Patterns and Local Political Organization

The way that settlement and local political institutions influence access to land and the regulation of farming activities, particularly in relation to proposed changes in cropping systems and animal husbandry, which implies changes in settlement patterns.

6. Technology Adoption and the Speed and Probability of Cultural Change

Processes of social and cultural change which facilitate or increase the scale of technology adoption. Ways of evaluating the lifespan of a new technology in relation to the time necessary for the cultural adjustments implied in the new technology (assuming the economic benefits are constant).

7. The Social Context of Food Processing and Storage

The implications of new varieties or new food crops for food processing within the household: palatability, cooking time, processing requirements, storage requirements.

8. Correcting Male Bias in FSR programs

Discussion of ways in which a male-dominated profession can develop a survey and experimental program which recognizes the importance of women in small-scale agriculture and involves women more fully in the on-farm research process.

9. Rural-urban Migration

Ways of assessing the importance of rural-urban migration for household labor, cash management, and investment patterns.

10. Social Impact of Technology

Evaluating and pre-screening the social acceptability of new agricultural technology in relation to equity considerations and long-term social and economic implications.

11. Indigenous Knowledge

The place of indigenous technical and social knowledge in farming systems research.

12. Local History of Agricultural Development

The way in which local historical experiences of development, particularly agricultural development, are likely to influence the responses of farmers interviewed during surveys, selected as cooperators for trials, and involved in technical pre-screening and trial evaluation.

APPENDIX VII

JOB DESCRIPTION, FARMING SYSTEMS ECONOMIST, ADAPTIVE RESEARCH PLANNING TEAM

GENERAL BACKGROUND

The farming systems economist will work within the Adaptive Research Planning Team (ARPT) of the Research Branch of the Department of Agriculture, MAWD. ARPT brings together social and biological scientists to provide a socioeconomic and "farming systems" input into the national agricultural research program, with particular emphasis on helping small-scale farmers. The provincially based ARPT teams are comprised of a Farming Systems Agronomist, Economist, Research Extension Liaison Officer, and a Regional Sociologist who carry out survey work and conduct on-farm trials to identify problems and test technical solutions among targeted groups of farmers in each province. The ARPT complements the work of the Commodity and Specialist Research Teams (CSRTs) by providing information on farmers' problems which can be used to plan station-based commodity research and by providing feedback on the performance of technologies developed by CSRTs when tested under farmers' conditions. The methodology used is based on the CIMMYT approach, but this approach is being broadened and modified to suit local conditions in Zambia's nine provinces.

DUTIES

The effectiveness of ARPT depends upon continual interdisciplinary interaction between different members of the team. It is imperative that the economist understands the perspective of other team members and seeks their full involvement when carrying out the duties specified below. It is equally important that the economist actively encourages cooperation with CSRT scientists, ARPTs in other provinces, extension workers and other personnel who play a critical role in technology generation and adoption. This is to ensure a sense of belonging not only to the Provincial Team but also to the national ARPT and Research and Extension Branches.

1. ZONING

To participate in the zoning of farming systems with emphasis on assessing resource availability and patterns; production patterns for farm and off-farm activities, e.g., livestock, fishing, hunting, crafts, migrant labor remittances, etc.; formal and informal marketing systems (input purchases and output sales); and different levels of commercialization. This to be done by literature review and interviews with key informants.

2. PROBLEM IDENTIFICATION

To participate in informal and formal surveys in conjunction with the ARPT agronomist, RELO, sociologist and other relevant officers (e.g., CSRT scientists, extension specialists, etc.), giving special attention to the following topics:-

a. Overall farm outputs end use and value.

b. Farmer resources, intra and extra household division and flows; allocation to agricultural and non-agricultural enterprises and costs of production of respective enterprises and returns to resources.

c. Assess local, formal, and informal marketing channels and opportunities

d. Assess production aversion strategies for different groups of farmers.

e. Assess seasonal variations and long-term system trends in production and consumption.

3. PRE-SCREENING PROBLEMS AND RESEARCH POSSIBILITIES

To participate with other team members in identifying priority areas for attention and actions including:

a. On-farm trials by ARPT.

b. Areas requiring additional economic data collection.

c. Areas for further CSRT research.

d. Areas for attention by agricultural support services, e.g., extension, input supply and marketing agencies, credit organizations, provincial planning units, etc.

4. TRIAL-RELATED WORK

Assist other team members in the following activities:

a. Pre-screen technical solutions using economic analysis, i.e., net benefit analysis, rates of return, and expected economic impact on the system.

b. Trial design.

c. Farmer selection.

d. Plan and implement a program of data collection which will be used to assess and evaluate the on-farm trials, taking into account the existing information available on the following:

i) Resource endowment and allocation, including flows within and between households.

ii) Costs of production for crop under study under farmer practice compared with other crops/economic activities.

iii) Total output of the crops under study compared with the value (food and/or market) of other crops/enterprises.

iv) Returns to limiting resources (e.g., labor and cash), by crop and by operation, for major enterprises.

v) Changes in resource requirements and the impact of the new technology on other components in the current system.

vi) Net benefits and returns to labor and cash of the new technology.

vii) Assess the new technology's compatibility with farmers' risk aversion strategies.

viii) Quantification of other economic costs and benefits when necessary.

e. Participate with other team members in monitoring and recording farmer assessment of new technologies.

f. Assist with implementation of the trial program.

g. End-of-season economic analysis of trials using data collected/available listed under 3d.

h. Assist CSRT scientists with economic analysis of past and present research results relevant to systems under study.

5. RECOMMENDATION AND ADOPTION-RELATED ACTIVITIES

a. Analyze economic implications of present research recommendations.

b. Participate with other team members to ensure that relevant economic information is incorporated into new recommendations.

c. Monitor the economic impact and assist the RELO to monitor the adoption of released recommendations for farming systems and target groups.

ORGANIZATIONAL AND MANAGERIAL ARRANGEMENTS

The farming systems economist will report to the ARPT Provincial Coordinator, who in turn reports to the National Coordinator and Chief Agricultural Research Officer. He or she will submit quarterly and annual work programs and quarterly and annual reports for discussion with the ARPT National Coordinator at quarterly and annual review meetings. Specified formats have been developed and are to be used for these work programs and reports. Separate reports will have to be submitted to the National Coordinator on any special case studies done during the year by the farming systems economist.

The farming systems economist will submit all reports to the appropriate Provincial ARPT committee for discussions and comments. The role and occasions when this committee meets is explained elsewhere.

JOB DESCRIPTION, FARMING SYSTEMS SOCIOLOGIST (REGION 1) ADAPTIVE RESEARCH PLANNING TEAM

GENERAL BACKGROUND

The sociologist for Region 1 will work within the Adaptive Research Planning Team (ARPT) of the Research Branch of the Department of Agriculture, MAWD. ARPT brings together social and biological scientists to provide a socioeconomic and "farming systems" input into the national agricultural research program, with particular emphasis on helping small-scale farmers. The provincially based ARPT teams are comprised of a Farming Systems Agronomist, Economist, and Research Extension Liaison Officer, who carry out survey work and conduct on-farm trials to identify problems and test technical solutions among targeted groups of farmers in each province. The ARPT complements the work of the Commodity and Specialist Research Teams (CSRTs) by providing information on farmer's problems which can be used to plan station-based commodity research and by providing feedback on the performance of technologies developed by CSRTs when tested under farmers' conditions. The methodology used is based on the CIMMYT approach, but this approach is being broadened and modified to suit local conditions in Zambia's nine provinces.

The sociological input into ARPT is currently organized on a regional basis. Zambia is divided into four regions, incorporating nine provinces as follows: Region 1, Northern and Luapula Provinces; Region 2, Central, Copperbelt and the East of North Western Provinces; Region 3, Western and the West of North Western Provinces; and Region 4, Lusaka, Southern and Eastern Provinces.

The sociologist has a key role to play in broadening and modifying the CIMMYT methodology, both by contributing to the effectiveness of existing activities and by carrying out specific activities not included in the CIMMYT sequence. Of particular importance in Region 1 is the fuller inclusion of women and gender differences into the adaptive research process. In both Northern and Luapula Provinces women play the major role in food production and processing, and female headed households comprise a significant minority of the rural population (30-40%). The involvement of women is not an isolated activity, but one which can be effectively tackled by taking into account the position of women within the local community and kinship organization. These three aspects - women, community, and kinship - have been largely neglected in previous adaptive research. But, these factors, along with a range of other sociological variables are crucial when dealing with the improvement of subsistence farming systems with technologies which relate to storage and processing as well as production, and which involve cash investment and/or cooperation between households. Improved storage structures and methods, new food crops, agroforestry, and the introduction of animal draft are all technologies which require the consideration of local gender and community arrangements and structures before they can be successfully tested, evaluated and disseminated through the local extension service in a way that benefits poorer (including female headed) households.

DUTIES

The effectiveness of ARPT depends upon continual interdisciplinary interaction between different members of the team.

It is imperative that the sociologist understands the perspective of other team members and seeks their full involvement when carrying out the duties specified below. It is equally important that the sociologist actively encourages cooperation with CSRT scientists, ARPTs in other provinces, extension workers and other personnel who play a critical role in technology generation and adoption. This is to ensure a sense of belonging, not only to the provincial team, but also to the national ARPT and Research and Extension Branches.

1. ZONING

Participate in the zoning of farming systems with emphasis on assessing important customary influences such as land tenure arrangements, ethnic composition, kinship systems, local socio-political institutions, gender, social stratification, patron-client/debt relations, customary exchange and barter mechanisms, labor migration and other major sociological influences. This to be done by literature review and interviews with key informants, and special attention to selecting key informants in rural areas.

2. PROBLEM IDENTIFICATION

To participate in informal and formal surveys in conjunction with the ARPT agronomist, RELO economist, and other relevant officers (e.g., CSRT scientists, extension specialists, etc.), giving special attention to the following :-

a. Sampling methods and strategies.

b. Questionnaire and survey checklist design and interviewing strategies.

c. Sociological variables which influence patterns of decision making and resource allocation in the farming systems under study such as:

- Community structure, including demographic structure, political structure, and residence patterns;
- Inter-household relations and kinship structure, including rules of descent, residence, inheritance, and marriage;
- Intra-household relations and rules and practices relating to age, gender, genealogical rank and the pattern/s of household developmental cycles;
- Land tenure arrangements;
- Indigenous agricultural knowledge and how this can be accessed;
- Non-economic aspects of risk aversion
- Sociological causes and effects of different levels of commercialization

3. PRE-SCREENING PROBLEMS AND TRIAL POSSIBILITIES

a. On-farm trials by ARPT.

b. Areas requiring further sociological data collection.

c. Areas for further CSRT research.

d. Areas for attention by agricultural support services, e.g., extension, input supply and marketing agencies, credit organizations, provincial planning units, etc.

4. TRIAL-RELATED WORK

Assist other team members in the following activities:

a. Pre-screen technical solutions for social compatibility and impact on the system.

b. Trial design taking into account farmer's experimentation methods.

c. Reduce and assess biases in farmer selection in relation to an understanding and analysis of the local community structure in selected target areas.

d. Plan and implement a program of data collection which will be used to assess and evaluate the on-farm trials, taking into account existing information available to avoid replication of data collection. This program should pay attention to the following:-

   i) Community structure, family structure, and local social institutions as these relate to intra and inter household relations.

   ii) Cooperating household's position within the community.

   iii) Mechanisms of resource allocation and mobilization, with particular emphasis on non-economic factors.

   iv) The acceptability of new varieties/technologies in relation to taste and color preferences, and processing, cooking and storage qualities.

   v) The compatibility of the new technology with risk aversion strategies.

   vi) Response of the farmer to the new technology in relation to household and community priorities, including the potential social effects on equality/inequality and the creation of dependent groups for resource supply.

e. Participate with other team members in monitoring and recording farmer assessment of new technologies.

f. Assist with implementation of the trial program.

g. End-of-season assessment of trials using data collected under 3d

5. RECOMMENDATION AND ADOPTION RELATED ACTIVITIES

a. Analyze the social implications of present research recommendations.

b. Participate with other team members to ensure that relevant social related information (such as indigenous units of measuring distance, volume and time, and cultural values and expectations relating to particular operations) are incorporated into new recommendations and associated extension methods.

c. Monitor the social impact and assist the RELO to monitor the adoption of released recommendations for farming systems and target groups.

ORGANIZATIONAL AND MANAGERIAL ARRANGEMENTS

The farming systems sociologist will report to the ARPT Provincial Coordinator where he or she is based who in turn reports to the National Coordinator and Chief Agricultural Research Officer. He or she will submit quarterly and annual work programs and quarterly and annual reports for discussion with the ARPT National Coordinator at quarterly and annual review meetings. Specified formats have been developed and are to be used for these work programs and reports. Separate reports will have to be submitted to the National Coordinator on any special case studies undertaken during the year by the farming systems sociologist.

The farming systems sociologist will also submit all reports to the appropriate Provincial ARPT committee for discussions and comments. The role and occasions when this committee meets is explained elsewhere.

In view of the regional nature of the position, when covering more than one province, the farming systems sociologist will also send copies of all work programs and reports to the other provincial coordinator/s implicated, and be prepared to meet and discuss these as necessary, e.g., during meetings with the National ARPT Coordinator and the ARPT rural sociology coordinator (for as long as the latter position is required).

APPENDIX VIII

ARPT WORK PROGRAM 1978-1986

I. ARPT - CENTRAL PROVINCE WORK PROGRAM

1978 CIMMYT undertook formal survey in RD2, Serenje District as demonstration of adaptive research planning procedures.

1979 CIMMYT undertook zoning exercise to identify the farming systems in Central Province as part of a demonstration of research planning procedures.

1981/82 SEASON

Trial Program

Kabwe Regional Research Station

- Assessment of maize varieties when planted at different dates and under typical small farm management.
- Maize-bean mixed cropping.

Serenje Target Area (Recommendation Domain 2)

- Maize-bean mixed cropping.
- Fertilizer level and weeding date interactions.

1982/83 SEASON

Survey Program

- Informal survey in RD 3, Mkushi District
- Labor use study in RD 3, Mkushi District
- Informal survey in RD 5, Kabwe Rural District
- Formal survey in RD 5, Kabwe Rural District

Trial program

Kabwe Regional Research Station

- Maize-bean mixed cropping.
- Fertilizer level and weeding date interaction.
- An assessment of Furadan seed dressing, minimum tillage planting, delayed basal dressing application and early top dressing as means of increasing productivity of Serenje farmers.
- Evaluation of Gesaprim and Primagram herbicides for zero-tilled maize.

Mkushi Target Area (Recommendation Domain 4)

- Exploratory trial to establish order of importance of factors causing stand reduction in hybrid maize.
- The immediate and residual effect of two cash crops (hybrid maize and sunflower) grown in two rotations with groundnuts the following season.
- Evaluation of long, intermediate and short maturing maize varieties of several planting dates for small-scale commercial farmers.
- Evaluation of Gesaprim and Primagram herbicides for zero-tilled maize.

Serenje Target Area - RD 2

- An assessment of Furadan seed dressing, minimum tillage planting, delayed basal dressing application and early top dressing as means of increasing productivity of Serenje farmers.
- Fertilizer level and weeding date interactions.
- Maize-bean mixed cropping.

1983/84 SEASON

Survey Program

- Formal survey in RD 3, Mkushi District.
- Second year of labor use study.
- Agronomic data on 3 crops collected by extension workers and TAs.

Trial Program

Kabwe Regional Research Station

- Evaluation of Gesaprim, Primagram and Gramoxone herbicides for zero-tilled maize.
- Exploratory study on commercial sorghum varieties, planting dates and fertilization.
- Evaluation of 10 chickpea (CICER ARIETINUM) varieties.

Mkushi Target Area - RD 4

- The immediate and residual effect of lime at three rates on groundnuts and two cash crops (hybrid maize and sunflower) grown in two croppings over a three year period.
- Evaluation of Gesaprim, Primagram and Gramoxone herbicides for zero-tilled maize.
- Exploratory study on planting method and fertilization of local (traditional) sorghum.
- Exploratory study on commercial sorghum varieties, planting dates and fertilization.

Kabwe Rural Target Area - RD 5

- Evaluation of nitrogen and phosphorus for early and late planted commercial maize.
- Exploratory study comparing sunflower varieties, planting methods and fertilization rates.
- Exploratory study on the placement of basal fertilizer in maize at two rates of applications with and without lime.
- Verification study for fertilizer placement, timing, and insect control in maize.

Serenje Target Area - RD 2

- Exploratory study on bean varieties, fertilization, and insect control.
- Evaluation of nitrogen and phosphorus for early and late planted commercial maize.
- Verification study for the timing and placement of basal fertilizer on maize in relation to the timing of weeding and top dressing fertilization.

1984/85 SEASON

Survey Program

- Agronomic data collection from 8 farms in each RD collected by Trial Assistants.
- Formal survey of female headed households in all three Target Areas.

Trial Program

Kabwe Regional Research Station

- Evaluation of herbicide for zero-tilled maize.

Mkushi Target Area

- Evaluation of herbicides for zero-tilled maize.
- The immediate and residual effect of lime at three rates on groundnuts and two cash crops (hybrid maize and sunflower) grown in two cropping systems over a three-year period.
- An on-farm evaluation of sorghum varieties with and without fertilizer.

Kabwe Rural Target Area - RD 5

- Evaluation of sunflower varieties, planting methods, and planting dates.
- An evaluation of the timing and placement of basal fertilizer in maize at two levels of residual lime.
- Exploratory study comparing soybean varieties, limestone rates and fertilizer rates of application.
- A comparative analysis of inter-row cultivation with oxen, herbicide application, and the use of hand hoes for weed control in maize.

Serenje Target Area - RD 2

- Verification study on the timing of weeding and top dressing fertilization in maize.
- Evaluation of sunflower varieties, planting methods, and planting dates.

1985/86 SEASON

Survey Program

- Informal survey in RD 2, Serenje District to verify if original hypotheses still correct.

- Data collection for whole farm budget analysis in RD 3, Mkushi District.
- Comparative study of maize production in the three RDs, using ARPT trial farmers.

Trial Program

Mkushi Target Area - RD 4

- An on-farm evaluation of pearl millet and finger millet varieties with and without fertilizer.
- An on-farm evaluation of sorghum varieties with and without fertilizer.
- A comparison of weed control techniques for hybrid maize.
- Test demonstration for zero-Tillage maize production.

Kabwe Rural Target Area - RD 5

- An evaluation of sunflower varieties, planting methods and planting dates.
- A comparative analysis of inter-row cultivation with oxen, herbicide application and the use of hand hoes for weed control in maize.
- An evaluation of five soybean planting techniques.

Kabwe Rural Target Area

- Maize varieties demonstration.
- Soybean demonstration with and without lime.

Serenje Target Area - RD 2

- Factorial study of three bean varieties with and without applied fertilizer and seed treatment.
- An evaluation of sunflower varieties, planting methods, and planting dates.
- An on-farm evaluation of pearl millet and finger millet varieties with and without fertilizer.
- Weeding and top dressing maize at 20cm demonstration.

II. ARPT EASTERN PROVINCE - WORK PROGRAM

1982/83 SEASON

Survey Program

- Overview survey to demarcate farming systems in Eastern Province.
- Informal Survey of Manjanja Area.

Trial Program

Eastern Plateau Farming System

On-Station Trials

- Maize management trial.
- Maize weeding trial.
- Maize field factor trial.
- Live mulch trial (North) (Mwase).

On-Farm Trials

- Maize fertilizer trials for value/cost/ratio assessment.
- Sunflower variety/fertilizer trial (North and South).
- Finger millet variety test (North).
- Shorter duration maize variety trials (North and South).

Luangwa/Chama Farming System

On-Farm Trials

- Finger millet variety test.
- Sorghum variety test.

On-Station Trials

- Rice fertilizer trial (Kapilingizia).
- Rice variety trial (Kapilingizia).

1983/84 SEASON

Survey Program

- Informal Survey of Luangwa (Chama) farming system.

Trial Program

Eastern Plateau Farming System

On-Station Trials

- Maize management trial.
- Maize weeding trial.
- Intercropping trial with maize and groundnuts.
- Maize field factor trial.
- Residual nitrogen rotation trial.
- Live mulch trial (solution screening) (North) (Mwase).
- Sorghum intercropping trial.

On-Farm Trials

- Shorter duration maize variety trial (North/South).
- Maize fertilizer trial for value/cost ratio assessment (South).
- Cotton fertilizer trial (South/North).
- Sunflower planting date/thinning trial (North/South).
- Bean exploratory trial (South).
- Finger millet test (North).

Luangwa/Chama Farming System

On-Farm Trials

- Finger millet test.
- Sorghum variety fertilizer test.

On-Station Trials

- Rice variety (level trial) trial (Kapilingizia).
- Rice planting method trial (levels trial).
- Rice fertilizer trial (Kapilingizia).

1984/85 SEASON

Survey Program

- Informal Survey of Eastern Plateau South Farming System.
- Heterogeneity survey of the Eastern Plateau North Farming System.
- Case study of labor allocation in the peak weeding/planting period.

Trial Program

Eastern Plateau Farming System

On-Station Trials

- Maize management trial.
- Maize weeding trial.
- Maize field factor trial.
- Residual nitrogen rotation trial.
- Finger millet variety trial.
- Striga control trial.

On-Farm Trials

- Sunflower planting thinning trial (South).
- Cotton fertilizer trial (South/North).
- Live mulch trial (North) (Mwase).
- Bean exploratory trial (North and South).
- Shorter duration maize variety trial (North/South).
- Shorter duration maize hybrid trial (North/South).
- Soybean fertilizer trial (South).
- Rice variety trial (South) (Kafumbwe).
- Sorghum/maize/soybean intercropping (North) (Masumba).

Luangwa/Chama Farming System

On-Farm Trials

- Shorter duration maize variety trial.
- Shorter duration maize variety trial.
- Soybean fertilizer trial.
- Rice fertilizer trial (Katangalika).
- Rice planting method trial.
- Finger millet variety trial.
- Rice variety trial (Chikando).

1985/86 SEASON

Survey Program

- Dimba garden survey.
- Sunflower/hybrid maize production trends survey.
- Sweet potato exploratory survey.

Trial Program

Eastern Plateau Farming System

On-Station Trials

- Maize field factor trial.
- Maize management trial.
- Residual nitrogen rotation trial.
- Live mulch trial (solution screening) (North).

On-Farm Trials

- Maize weeding trial (ox cultivation) (South).
- Maize weeding trial (hoe cultivation) (South).
- Striga suppression trial (South).
- Bean exploratory trial (North/South).
- Maize variety trial (North/South).
- Shorter duration maize hybrid trial (North/South).
- Sunflower thinning trial (South).
- Soybean fertilizer trial (South).
- Rice variety trials (South).
- Rice planting methods trial (South).
- Finger millet variety trial.
- Striga control trial.

Luangwa/Chama Farming System

- Maize variety trial.
- Maize hybrid trial.
- Rice variety trial.
- Finger millet variety trial.
- Soybean fertilizer trial.
- Rice planting method trial.

III. ARPT LUAPULA PROVINCE - WORK PROGRAM

1982/83 SEASON

Survey Program

- Zoning of Luapula Province farming systems.
- Labor use survey in Mabumba.

Trial Program

Mabumba Target Area (Recommendation Domain 4)

- Investigation in potential improvement in local maize agronomy.
- Fertilizer trial on local groundnut varieties.
- Improvement in local beans cultivation methodology.
- A comparison of improved cassava material with farmers' own material.

Luapula Regional Research Station

- Response of maize to fertilizer applications up to the lima recommendations.

- Response of different bean populations to application of fertilizer.
- Bean storage trial.
- Two observation trials on local bean phenotypes.

1983/84 SEASON

Survey Program

- Formal survey in RD7, Mukunta Target Area.
- Rice Survey in RD7.
- Labor data collection in RD4, Mabumba Target Area and RD7 Mukunta Target Area.
- Informal survey in RD2, Samfya South/Mabo Target Area at request of IRDP-LP.
- Several nutrition surveys in both Mabumba TA and Mukunta TA.
- Study in Mabumba Target Area of the farmers concept of ARPT after some problems of cooperation.

Trial Program

Mabumba Target Area (Recommendation Domain 4)

- Maize variety response trial.
- Finger millet planting and intercropping method trial.
- Seed dressing trial on local beans.
- A comparison of improved cassava material with farmers' own material.
- Bean seed storage.

Mukunta Target Area (Recommendation Domain 7)

- Exploratory trial to improve rice cultivation

Regional Research Station

- Observation trial in local selection of maize.
- Maize/bean intercropping trial.
- Exploratory trial on intercropping on dambos during the rainy season.
- Observation trial on a collection of local bean phenotypes.
- Bean seed storage trial.
- On-station dambo trial during the dry season.

1984/85 SEASON

Survey Program

- Sample frame in Mukunta Target Area.
- Relationship between fishing and farming in Mukunta Target Area.
- Selective sample frame in RD2, Mabo Target Area.

Trial Program

Mabumba Target Area (Recommendation Domain 4)

- On-farm response trial in hybrid maize.
- Adaptive verification trial in Maize.
- Bean verification trial.

Mukunta Target Area (Recommendation Domain 7)

- Rice variety trial.
- Exploratory trial on weed control in rice.
- Adaptive trial in rice harvesting method.
- Observation cassava trial under intensive cropping system.

Luapula Regional Research Station

- Observation trial in local selection of maize.
- Exploratory fertilizer trial on finger millet.

Dry Season Trial Program at Luapula Regional Research Station

- National chickpea trial.
- Zero tillage trial.
- Variety trials for dambo soil.
- Vegetables observation trial.
- First legume trial.
- Potatoes tillage trial.
- Potatoes factorial trial.
- Wheat drainage observation.
- Triticale variety trial.
- Oil seeds observation trial.
- Maize boron observation trial.
- Wheat variety trial.
- Wheat fertilizer observation trial.
- Maize fertilizer observation trial.
- Sunflower variety trial.
- Exploratory maize factorial trial.
- Peas fertilizer trial.

Mabo Target Area (Recommendation Domain 2) Dry Season Trials

- First legumes observation trial.
- Second legume trial.
- Variety trials for dambo soils.
- Maize boron observation trial.

1985/86 SEASON

Survey Program

- Two intensive frequent visit labor surveys in Mukunta TA and Mabo TA.
- Nutrition baseline surveys in Mukunta and Mabo Target Areas.
- Sample frame census in Mabumba TA.

Trial Program

Mabumba Target Area (Recommendation Domain)

- Intercropping trial maize/groundnuts/soybeans/beans.
- Groundnut/maize rotation trial.
- Beans verification trial.
- Maize/fertilizer management trial.

Mukunta Target Area (Recommendation Domain 7)

- On-farm rice variety trial.
- Exploratory trial in weed control of rice.
- Adaptive trial in rice harvesting method.
- Observation cassava trial under intensive cropping system.
- On-farm sunflower variety and planting date trial.

Mabo Target Area (Recommendation Domain 2)

- On-farm rice variety trial.
- Sunflower management trial.
- Maize variety trial.
- Intercropping trial: Maize/groundnuts/soybeans and beans.

Regional Research Station

- Fertilization practices on maize.
- Observation oats trial.
- Fertilizer trial on finger millet.
- Observation tillage trial.

APPENDIX IX

EXAMPLE OF TRIAL OUTLINE

ARPT-Central Province 1983/84 Trial Program

1. Master Number: 3612

2. Title:

   Verification study for the timing and placement of basal fertilizer on maize in relation to the timing of weeding and top dressing fertilization.

3. Location:

   6 farms in Tradition Recommendation Domain 2 (Serenje District, Central Province).

4. Agricultural System:

   A formal survey conducted in 1978 TRD 2 showed that 95% of the traditional and small-scale commercial farmers use basal fertilizer and 93% apply top dressing fertilizer to their maize. This reflects the need for chemical fertilizers on the degraded soils of the area, as well as the fact that farmers recognize that hybrid maize requires fertilizer. In the cropping system in TRD 2, maize is rarely planted on virgin land. It usually follows finger millet, which is itself a heavy feeder. The average amount of capital invested in fertilizer purchases in 1978 was K55 per farm. Two thirds of the maize acreage received one bag each of basal and top dressing fertilizer per acre, which is well below the recommended rate of application. The timing of top dressing application was related to weeding, with 56% of the maize receiving top dressing after the maize crop was 70cm in height. Weed competition was apparently increased by maize fertilization, because fertilized acreage was weeded earlier and more frequently than unfertilized. Although labor is one of the limiting constraints in the system, very little labor-saving equipment is used (15% of the farmers owned oxen and ploughs, while 28% hired tractors and ploughs). Given the shifting cultivation pattern of the cropping system, fertilizer use reduced overall labor demand by decreasing the frequency of clearing new land, which is highly labor intensive.

5. Justification:

   The formal survey showed that even though farmers recognize the need to apply fertilizer to their hybrid maize crop, their capital is limited (i.e. they are forced to apply lower than

optimal rates) and there is a labor bottleneck in the November to January period, which forces them to weed and top dress the first planting very late. Farmers must choose between increasing their planted area or weeding earlier plantings. Most decide to continue planting because this gives higher returns to scarce labor. Over the last two seasons ARPT-CP has concentrated on improving maize husbandry practices within the labor and cash constraints of the target group of farmers. Since the majority of farmers can only weed once, ARPT-CP trials showed that weeding earlier (when the maize plants are 20cm high) increased yields 17% and that significant net benefits result from using the recommended rates of fertilizer. This study seeks to complement these earlier trials with information on optimal timing and placement of basal fertilizer. The current farmer practice will be compared to the recommended practice and other options that might better fit the farmers' circumstances.

6. Treatments:

a) Basal at planting and at root level; top dressing at 60cm; weeding at 60cm. (Farmer practice).
b) Same as above except for weeding at 20cm. (Recommended practice).
c) Basal at 20cm and at root level; top dressing at 20cm; weeding at 20cm.
d) Basal at 20cm and on surface; top dressing at 20cm; weeding at 20cm.
e) Basal at 20cm and at root level; top dressing at 60cm; weeding at 20cm.
f) Basal at 20cm on surface; top dressing at 60cm; weeding at 20cm.

7. Experimental Design:

Randomized Complete Block Design with 1 rep/site (farm) at a total of 6 sites. Plot sizes will be 4.5 x 10.0 cm = 45.0cm. Trial size will be 12 x 29m = 348 m2/farm.

8. Criteria for Evaluation:

Soil analyses.
Plant stand at emergence and harvest.
Pest incidence.
Yield.
Labor inputs.
Economic net benefits/treatment.

9. Treatment Comparisons for Main Effects:

Placement of basal application	Trt e x Trt f
	Trt c x Trt d
Timing of basal application	Trt b x Trt e
Timing of top dressing	Trt c x Trt e
Timing of weeding	Trt a x Trt b

10. Literature:

Several earlier experiments within the Research Branch have provided sufficient base of information to allow ARPT-CP to advance this experiment into the verification stage of on-farm research. The placement and timing of basal application was studied in experiments MN 1154/3 and MN 1153, showing significant advantages to early basal application. The timing of top dressing applications was studied in experiments MN 1153/3, MN 1620, MN 1503, and MN 1620/2, again showing that split applications of nitrogen significantly affect maize yields under conditions of high rainfall. The timing of weeding in relation to fertilizer application was studied in experiment MN 3224 in TRD 2 for two seasons, showing that a single weeding of maize is more effective when the maize plants are 20cm in height as compared to 60cm. However, if the farmer has sufficient labor, two weedings at 20 and 60cm would improve yields if recommended rates of fertilizer were used.

11. Duration:

One cropping season for maize.

12. Management:

a) Land preparation will be by hand.
b) Row spacing will be 75cm with 25cm between plants in the row.
c) The experiment will be planted in November after the first heavy rains.
d) Fertilizer rates will be held as non-experimental variables and all plots will receive basal and top dressing at the standard rate of 250 kg of "D"/ha and 250 kg of Urea/ha respectively.
e) Materials required: 4.5 kg SR52 maize seed
40.5 kg Compound "D" fertilizer
40.5 kg Urea

13. Staff Involved:

J. Nshindano, K. Chanda, R. Hudgens, A. Harms, C. Chabala.

APPENDIX X

METHODOLOGY USED TO PRODUCE THE ZAMBIA OFCOR CASE STUDY

There were six stages in the production of the Zambia case study.

Stage one was the collection and analysis of secondary data needed to complete the numerous sections in the guidelines provided by ISNAR. Many reports, minutes and files were examined in order to make use of the considerable extant data, going back to before ARPT was established. Particular attention was given during this stage to compiling time series data sets on manpower and expenditure in the Research Branch, using records at the Central Research Station. A specific background paper was also commissioned during this stage to obtain the perspective of an original decision maker who had been involved in establishing ARPT.

Stage two was the preparation of profiles of the three provinces - Central, Eastern and Luapula - which had been selected for specific attention in the study. The role of these provincial profiles was not originally certain, but largely because of their size it was realized that they should be seen as intermediate products to be drawn upon when preparing the main report. As a result, they were written in a rather rough-and-ready-manner. These provincial profiles were distributed to the staff in the three provincial ARPTs for their comments. There was some overlap in time between this stage and stage three.

Stage three was the collection of data from all the key participants, including those in the three sub-case study provinces. Data were collected by means of informal interviews, using survey guidelines, with the following participants:

Participant	Lusaka & Research HQ	Central Province	Eastern Province	Luapula Province
Research Managers	3	-	-	-
ARPT Scientists	1	6	2	5
Trials Assistants	-	2	2	4
CSRT Scientists	6	1	7	2
PAO and Provincial SMSs	-	5	9	3
Local Extension Workers	-	6	3	1
Farmers	-	4	7	2
Planners/Service Orgs	2	-	3	3

Stage four of the study was the distribution of a formal questionnaire to all Research Branch scientists. In the questionnaire the scientists were asked to rank the ideal and actual performance of the seven OFCOR functions by ARPT, using a scale of 1 to 4. Although questionnaires were distributed to all research teams, only 39 scientists responded; 17 from ARPT and 22 from CSRTs.

Stage five was the preparation of the draft report. This was sent to three principal and four secondary reviewers for their comments. The draft report was also discussed during the second study workshop held at ISNAR.

Stage six was the preparation of the final report for publishing.

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