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Farming Systems Research in West Africa

Proceedings of the West African Farming Systems Research Network Workshop, Dakar, Senegal, 10-14 March 1986

February 1988

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FARMING SYSTEMS RESEARCH IN WEST AFRICA

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Research Network Workshop, Dakar, Senegal,
10-14 March 1986

Editors

George O.I. Abalu, H. Mutsaers, and J. Faye

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FOREWORD

Many African countries, despite their generous endowment with national resources, are going through a very severe food and economic crisis. It is now widely recognized, both by the Africans themselves and outsiders desirous of assisting the continent, that African countries must shift to higher levels of production if they are to successfully emancipate themselves from the crisis.

What has come to be known as the Farming Systems Research (FSR) philosophy and methodology has acquired recognition as being potentially useful for bringing about the desired increases in food and agricultural production in the continent and improving the welfare of the millions of small-scale farmers who now produce the bulk of the agricultural commodities and constitute the majority of the continent's population. FSR assumes that radical changes of the traditional farming systems are neither possible nor desirable, at least in the short run, but that they can be made to evolve over time as new technologies are designed, tested, and extended if found to be appropriate.

FSR takes the emphasis off the traditional criteria for designing and disseminating improved agricultural technology and places it rather on the farmer's reaction to the technology. Agronomists, agricultural economists, and other technical and social scientists all work together to identify farmers' real constraints so that new technologies and research results from the research stations can be adapted more closely to farmers' conditions, needs, and aspirations. At the same time, farmers' priorities for improvements are fed back to researchers at the research station and elsewhere to ensure that national research programmes are aligned more closely to the needs of the farmers and the conditions under which they operate.

This publication describes the proceedings of a workshop organized by the West African Farming Systems Research Network to compare notes on the different experiences acquired in attempts to implement the FSR philosophy and methodology in the West African sub-region. As would be expected, the volume represents a mosaic of FSR experiences in West Africa reflecting considerable variety with regard to the implementation of the philosophy and methodology and the different stages of development of the strategy. However, in reviewing this volume, the reader will be struck by how far FSR has come in the sub-region and the considerable amount of similarity in the problems and experiences originating from all the other member countries of the network.

We hope that this volume of proceedings will be useful to existing and future FSR practitioners throughout the West African sub-region and elsewhere. We also hope that it will facilitate the much-needed process of a movement towards standardization of terminology, methodology of investigation, experimentation and analysis of farming systems and their improvement in West Africa.

We would like to thank all the chairpersons, and rapporteurs of the various plenary and work group sessions for the excellent job they did in recording and providing summaries of the various discussions that took place in the workshop.

Our special thanks and appreciation go to IDRC, Ford Foundation, and GTZ who provided financial support for the workshop without which it would have been impossible to organize it, and permit participation from almost all member countries of the network. Our special thanks also go to GTZ for providing funds to publish this volume of proceedings. The special efforts of Andrew Ker, Bruce Scott, and Rose-Marie Erambert, all of IDRC, in ensuring a successful workshop are also gratefully acknowledged.

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OPENING REMARKS: THE ROLE OF FARMING SYSTEMS RESEARCH IN TRANSFORMING AGRICULTURAL RESEARCH IN WEST AFRICA

By

R. Bruce Scott

I would like to make some observations concerning the importance of this workshop, in general, and specifically the role of farming systems research in transforming agriculture production in the West African region.

We are all familiar with the fact that food production per capita is declining in Sub-Saharan Africa. We are also familiar with the major causes of this development, that is, accelerating population growth rates, which, when combined with rising per capita income has caused a relatively rapid growth in food consumption.

There are of course other factors that are equally important, such as weather and a relatively harsh physical environment. Labour productivity is also low especially during peak periods. Directly related to this is a rapid outmigration of people from the rural areas to urban areas which in turn compounds the labour productivity issue. Furthermore, internal terms of trade have favoured the urban consumer versus the rural producer. It is therefore necessary for governments to try and develop economic policies combining devaluation, tariff reform, and direct pricing policy to reverse this trend. Finally, low production is also a direct function of the physical resources. In most cases, soils are fragile, characterized by low fertility and a low ability to retain moisture.

Given this highly variable situation, it is important to define and determine methods to stabilize production and then examine methods to increase production. Technology has an important role to play, as one of the important inputs into the agricultural systems. And therefore it is important to look at means of developing and strengthening agricultural research systems to be able to develop and deliver technology that is appropriate for the needs of the farming communities of the region. Agricultural research is not the only ingredient however, it is a necessary component in the process of increasing agricultural production, given the fragile environment that I have outlined above.

It is also clear that in a situation of scarce human and financial resources, to be effective, research must be directly focused on the problems of farmers and attempt to solve these problems by developing practical solutions. This requires: (1) a clear understanding of the problems; (2) facilities and expertise to find solutions; and (3) means of communicating results to farmers. These are some of the essential components involved in the Farming Systems Research Process.

In other words, the development of FSR is a mechanism to encourage and ensure that scientists are working on the most important problems facing farmers, and that therefore, in the longer term, the scarce funds available for research will be utilized in a more rational and efficient way. As you all know, the process of FSR also entails some changes and modifications about how one approaches and conducts research. Some of the important principles that must be continuously reinforced are:

1) Continuous contact and communication between the client, in this case the farmer, and the researchers in terms of understanding the physical, social, and economic climate; problem identification; conducting and evaluating the research; and disseminating the results.

2) Because the focus of the research is problem-oriented and not necessarily based on any one discipline, it is as well important that FSR is conducted by multidisciplinary teams of researchers, focused on problem solving.

3) At the same time, FSR is not a substitute for component research, and therefore it is important to ensure that component research continues to be maintained, but that the focus of the activities are geared towards the problems that have been defined in the FSR process.

These concepts are not new and of course familiar to all of you.

The one aspect that I have not yet mentioned, and in many ways is perhaps the most important, is the institutional framework for conducting FSR at the national and regional level. This is an important part of your discussion this week and this workshop will give you an opportunity to not only exchange experiences at the national level, but as well to explore the desirability and means to establish a regional network to ensure that FSR moves forward in a consistent and coordinated fashion in West Africa.

It is important to remind ourselves that FSR is only a method - an approach, a mechanism - that will hopefully enable us to efficiently develop appropriate technology that, when applied by farmers, will lead to increased production.

As I mentioned earlier, agricultural research and the development of technology is not the only factor that will lead to increased production, but it is certainly a very important and necessary input in the agricultural economy of the region.

It is for this reason you yourselves have placed such high priority on the development of FSR, and as well why donors have been convinced to invest funds in the development of this approach.

We certainly will look forward with interest to receiving the recommendations of this important workshop and will continue to place priority and play any possible role in assisting the development of FSR in West Africa.

On behalf of all of us here today, again I would like to extend our thanks to the Ministry of Rural Development and the Institut Senegalais de Recherches Agricoles for accepting to host this workshop. On behalf of the donors, I would like to express a warm welcome to all of the participants and wish them well in their discussions and deliberations this week. I am sure it will be time well spent we certainly look forward to receiving concrete and realistic recommendations.

THE CREATION AND ESTABLISHMENT OF PRODUCTION SYSTEMS RESEARCH IN A NATIONAL AGRICULTURAL RESEARCH INSTITUTE: THE SENEGAL EXPERIENCE

By

Jacques Faye
James Bingen
Etienne Landais

Introduction

Farming Systems Research (FSR) has become very popular throughout West Africa during the last ten years. Senegal pioneered in this type of research, and as such represents a useful case from which to draw lessons for newer FSR programmes elsewhere in the region.

Some of the key features of the Senegal case are the following:

a) The decision to undertake FSR in Senegal arose largely from an evaluation of the results of research programmes and experiences that were specific to the Senegal Agricultural Research Institute (ISRA);

b) The FSR programme was established as part of a major institutional reorganization that created the Department of Production Systems Research and Rural Technology Transfer (FSR Department) and the Macro-Economic Analysis Bureau (BAME);

c) Foreign aid projects and international agricultural research institutes played and continue to play an important role in helping ISRA to carry out its FSR programme throughout the country;

d) Michigan State University (MSU), relying principally on FSR approaches in vogue at several international Agricultural Research Institutes during the late 1970s and early 1980s, has been principally responsible since early 1982 for assisting ISRA in defining the FSR Department and BAME research programmes;

e) The Agrarian Systems Department of the International Center of Agronomic Research for Development (CIRAD) also assisted in launching ISRA's FSR programme.

This paper presents a brief history of agricultural research in Senegal, focusing on events that led to the creation of the FSR Department. The "Djibelor Experience" is subsequently described in detail to illustrate concretely how the FSR Department launched a programme in one region of Senegal. In conclusion, some lessons for researchers and research administrators in West Africa and elsewhere are drawn.

Brief Historical Review of Agricultural Research in Senegal

The Experiment Station at Bambey, established in 1921 to deal with groundnut research in Senegal gradually expanded its research programme during the colonial era to cover the Sudano-Sahelian zone of francophone West Africa. In 1950, the Bambey Station, reflecting its regional role, was renamed the Federal French West Africa Research Center with responsibility for more than ten research stations, only three of which were in Senegal.

After independence in 1960, the Government of Senegal requested that France, the Tropical Agronomic Research Institute (IRAT), and several other French research institutes (IRHO, IEMVT, CTFT, and ORSTOM) manage the country's agricultural research programmes. Additional research stations were built in each major agricultural region (at Sefa, Richard-Toll, Guede, Djibelor) and by the mid-1960s most of Senegal's current research infrastructure was already in place. By this time, much of the basic research leading to improved groundnut varieties, better soil fertilization practices, the use of animal traction, and improved cultivation techniques had been completed. The results of this research still form the base for many of the rainfed agricultural technical packages used in Senegal.

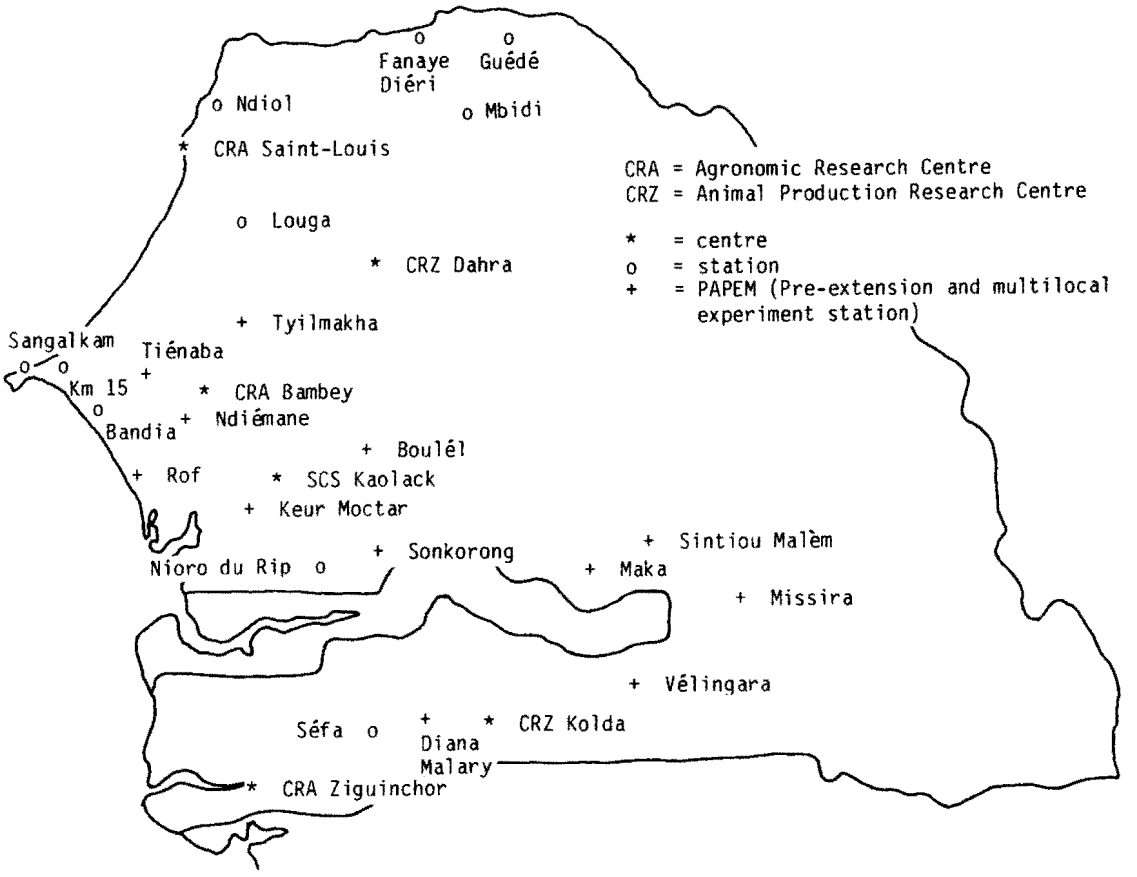
Several substations, with the abbreviation, PAPEMs (Pre-extension and Multilocal Experiment Stations), were also built during the 1960s in order to adapt research programmes to the specific agricultural conditions existing within Senegal's larger agro-ecological regions. Through the PAPEMs, and in order to bring their research activities closer to farmers, researchers began varietal trials near villages and organized station demonstrations and visits for extension personnel and for farmers.

Concern that research must be carried out under farmer's conditions led to the proposal in the early 1960s to create action-research programmes (Actions Regionales Pilotes de Developpement Integral, ARDI) within each agro-ecological zone. Even though ARDIs were never begun, the idea served as the basis for creating the well-known Unites Experimentales.

During its 12 years of existence from 1969 to 1980, the Unites Experimentales programme marked a significant phase in the evolution of agricultural research in Senegal. It helped to gain acceptability for off-station research and it is widely regarded as an early model of FSR in West Africa. It represented a continuation of efforts by researchers to push their trials and experiments off the station and down to the farmer's level under different, specific agro-ecological conditions. The programme also contributed to the integration of socio-economic research into IRAT's and ISRA's research programmes, and to defining agrarian systems research activities of the CIRAD.

The Unites programme was not without its critics. From the beginning, many researchers felt that the Unites did not represent truly scientific research. Extension personnel charged that the programme should have been the responsibility of agricultural extension agencies, and throughout the life of the programme a research-extension link was never made.

In 1975, Senegal nationalized the agricultural research programmes that had been managed separately for almost 15 years by French research institutes. As part of the newly created ISRA, research activities were



* LNERV National Livestock and Veterinary Research Laboratory
* CRODT Oceanographic Research Centre -- Thiaroye
* CDH Horticultural Development Centre
* CNRF National Forest Research Centre

ISRA Research Locations

reorganized into scientific research departments, of which one was a Department of Sociology and Rural Economy, the FSR's Department's predecessor. ISRA's priorities were as follows:

1) to create five regional agricultural research centres in response to the policy to decentralize government programmes and specialized centres for livestock, fisheries, forestry, and horticultural research were also established;

2) to train Senegalese agricultural scientists and to expand socio-economic and off-station research programmes.

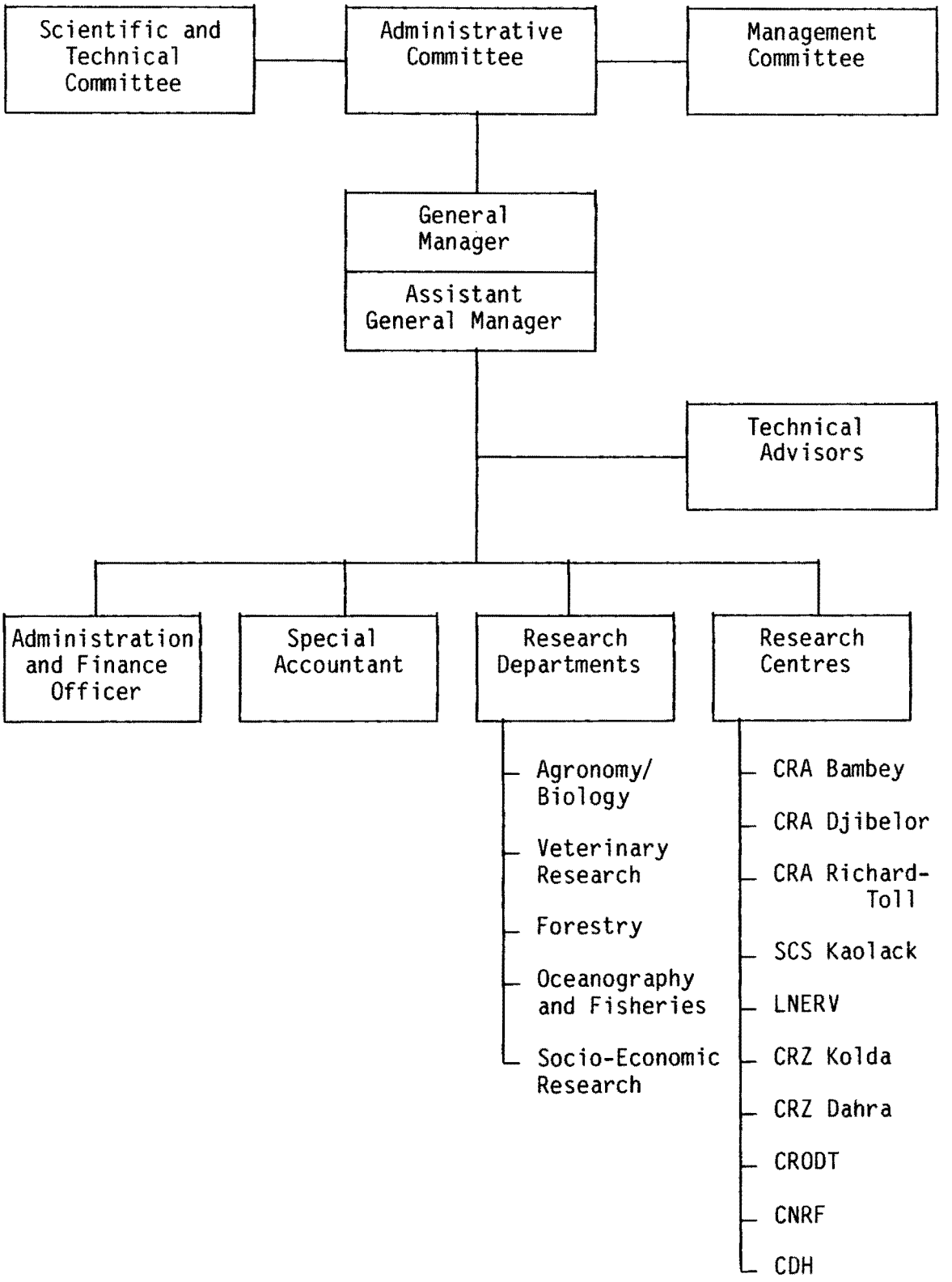
In 1978, the Government prepared a Five-Year (1979-1984) Indicative Research Plan and called upon the World Bank to help define a programme for improving the responsiveness of Senegalese agricultural research to the country's development problems. The Agricultural Research Project that was prepared began in 1982. It is a six-year multilateral project financed by the World Bank, USAID, France, the UN Interim Fund for Science and Technology, and the Government of Senegal. In addition to financing research programmes and infrastructure construction, the project involves a dramatic reorganization of ISRA's scientific and administrative structure. In fact, the speed of planned organizational change has pushed ISRA into the throws of an institutional crisis of considerable magnitude. The financial management system has broken down rather than offering a new beginning, and many old and unresolved problems that have existed since the days of French management have resurfaced.

The project called for the creation of five FSR teams at each regional research centre during the first year, 1982-1983. The FSR Department was also requested to establish a management structure for the subject-matter, or support-research, programmes in agro-climatology, weed control, farm equipment, post-harvest technology, soil fertility, and agricultural hydrology. In reality, the FSR Department was able to begin only three FSR programmes (Djibelor, Kaolack, and St-Louis) over a three-year period, plus a multidisciplinary, sylvopastoral research programme at the Dahra Center for Animal Production Research. Each team is composed of an agronomist, an animal scientist, an economist, and a sociologist. Other disciplines have been added to these "core teams" in response to specific agricultural problems in the varying regions. A multidisciplinary, Dakar-based Central Systems Analysis Group of senior researchers provides scientific support for these teams.

The Macro-Economic Analysis Bureau has also gradually established its programmes since 1982 to cover agricultural policy research on the economics of agricultural production, cereals marketing, agricultural price policy, consumption, international agricultural markets, and food security. These programmes, based in Dakar, Djibelor, Kaolack and St-Louis, are closely coordinated with the activities of each regional FSR Team and are specifically concerned with: cereals marketing in the Groundnut Basin, the Casamance, and the Senegal River Valley; vegetable marketing for Dakar; the economics of agricultural production (for the Lower Casamance, the Southern Sine-Saloum, the Senegal River Valley); and Senegal's food security situation.

ISRA Organization Chart

1975 - 1982



In addition to these research programmes, the FSR Department and BAME manage long- and short-term training for its scientific staff; oversee the introduction and use of microcomputers; assist in the diffusion of the results of agricultural research and in establishing research- extension relationships with rural development agencies. In other words, the FSR/BAME is more than a unit tied to a foreign aid project. Its programmes and activities are an integral part of ISRA's institutional structure.

ISRA is currently renegotiating many aspects of the Agricultural Research Project with the World Bank. Of special concern is the need to create a mechanism for identifying research priorities more clearly and for the more efficient use of the institute's scientific and support personnel. In addition, the current research Departments will become "Directions" or Directorates with both scientific and managerial responsibility for research programmes. The regional research centres will be managed directly by a specific research directorate, instead of operating as line units reporting directly to the ISRA General Manager. The FSR Department will integrate the FSR and BAME programmes and change its name to the Directorate for Agrarian Systems and Agricultural Economics Research. Subject-matter research programmes will be regrouped within a separate research directorate.

The Djibelor (Lower Casamance) Experience

The Lower Casamance area comprises the land surrounding the Delta of the Casamance River and its tributaries. Rice production dominates the low-lying inundated zones that are affected by the infiltration of saltwater; rainfed crops are produced on upland fields.

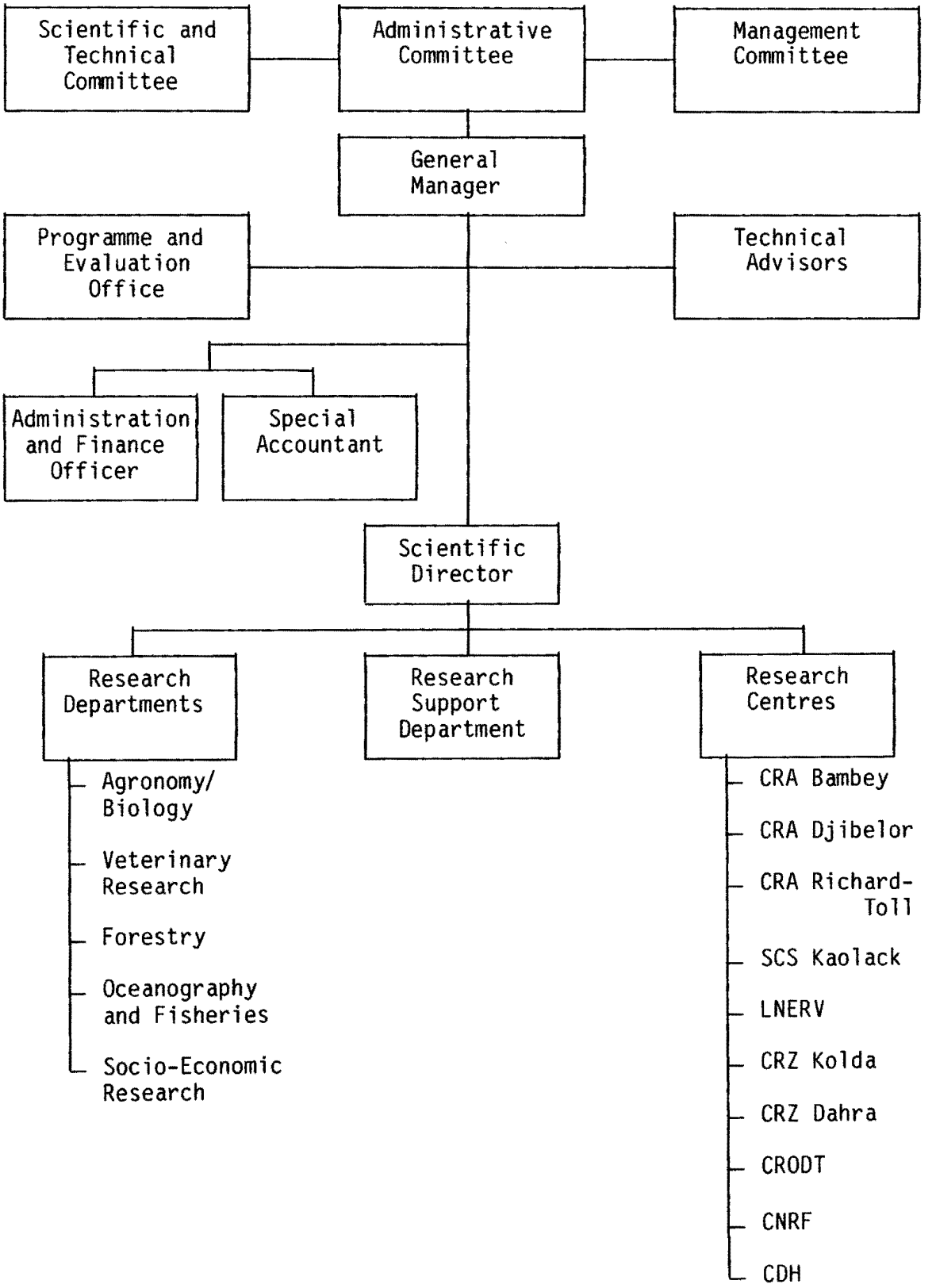
The programme began in March 1982, but staffing the FSR Team has taken place over a two-year period. An expatriate economist and agronomist, and a Senegalese economist started in 1982, while a sociologist joined the Team in 1983. An animal scientist and an agricultural engineer completed the Team in 1984.

The establishment of the programme can be divided into two phases, a pre-diagnostic phase, followed by a phase of diagnostic research, experimentation, and technology transfer. The first phase began by identifying the research area and reviewing previous research and development studies on the Lower Casamance. The area covered by the local agricultural development and extension agency, Projet Integre pour le developpement Agricole de la Casamance (PIDAC), was chosen by the FSR Team as its research area, thereby identifying this agency as the Team's choice of an intermediary for research and technology transfer.

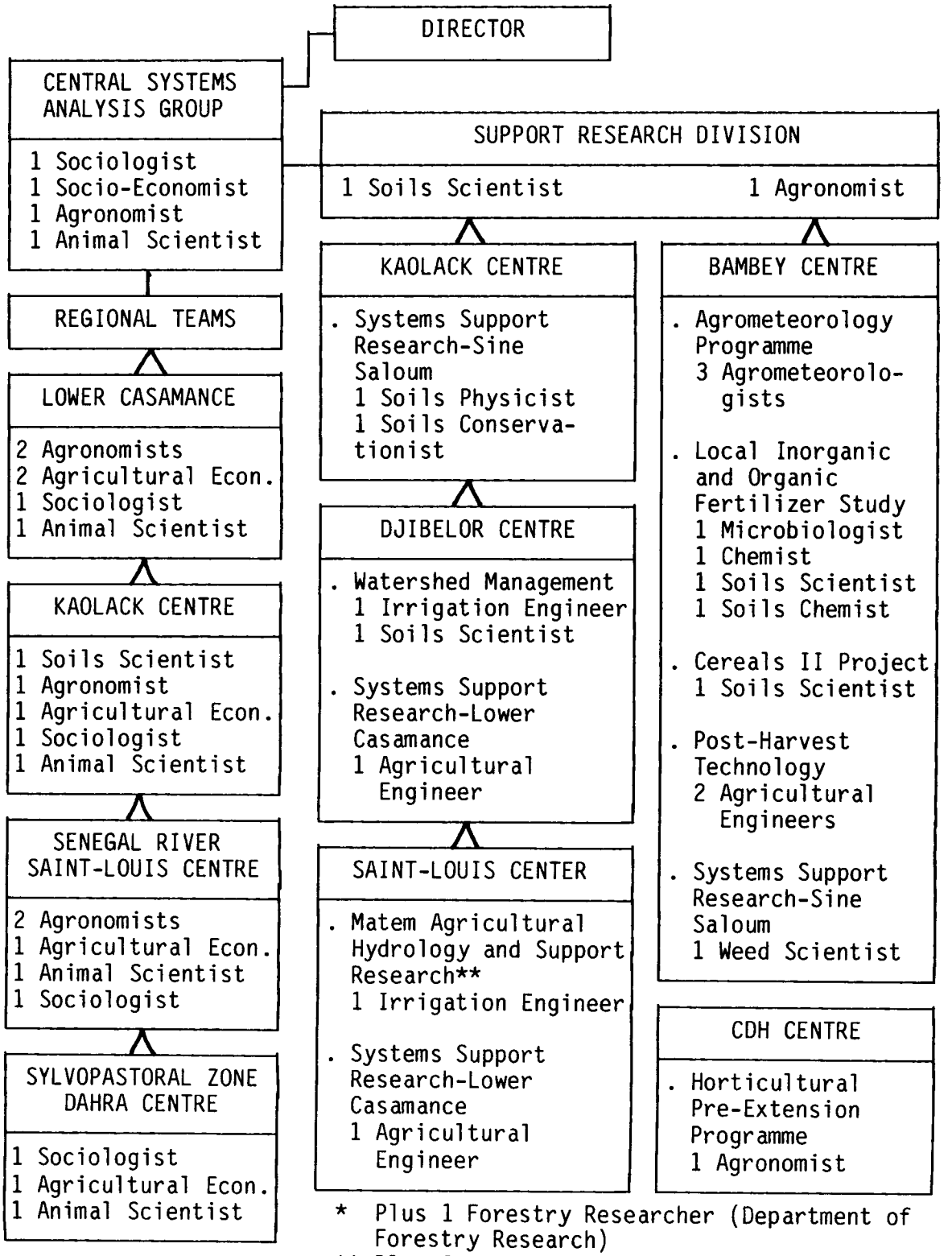
Exploratory surveys were conducted in 35 of the 330 Lower Casamance villages chosen with assistance from PIDAC field agents after bibliographic work that lasted for approximately three months during the first year's dry season. The entire Team participated in these surveys, with occasional assistance from a plant breeder, an entomologist, and soil fertility and commodity specialists.

ISRA's Simplified Organizational Chart

1982 - 1985



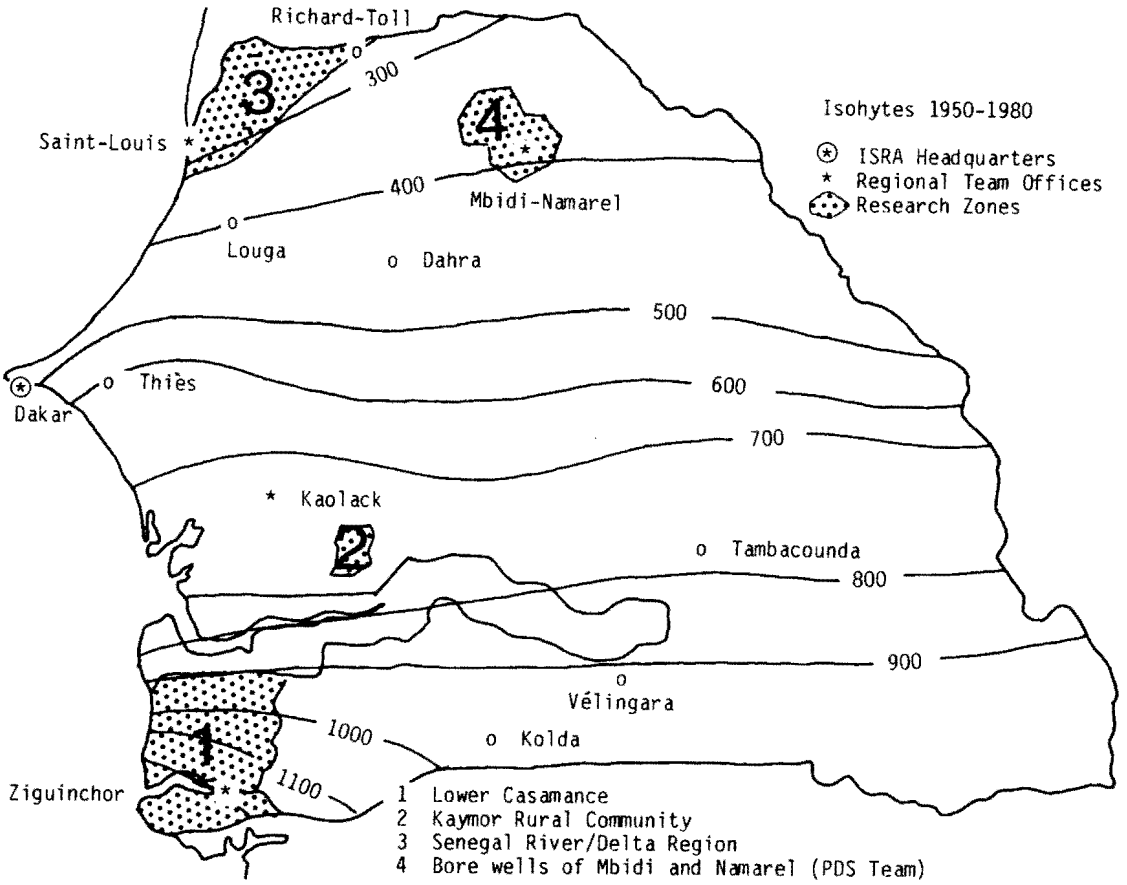
Organizational Chart of the Farming Systems Research Department (1985)



* Plus 1 Forestry Researcher (Department of Forestry Research)

** Plus 2 WARDA Researchers

Location of Programmes of the FSR Department, 1985

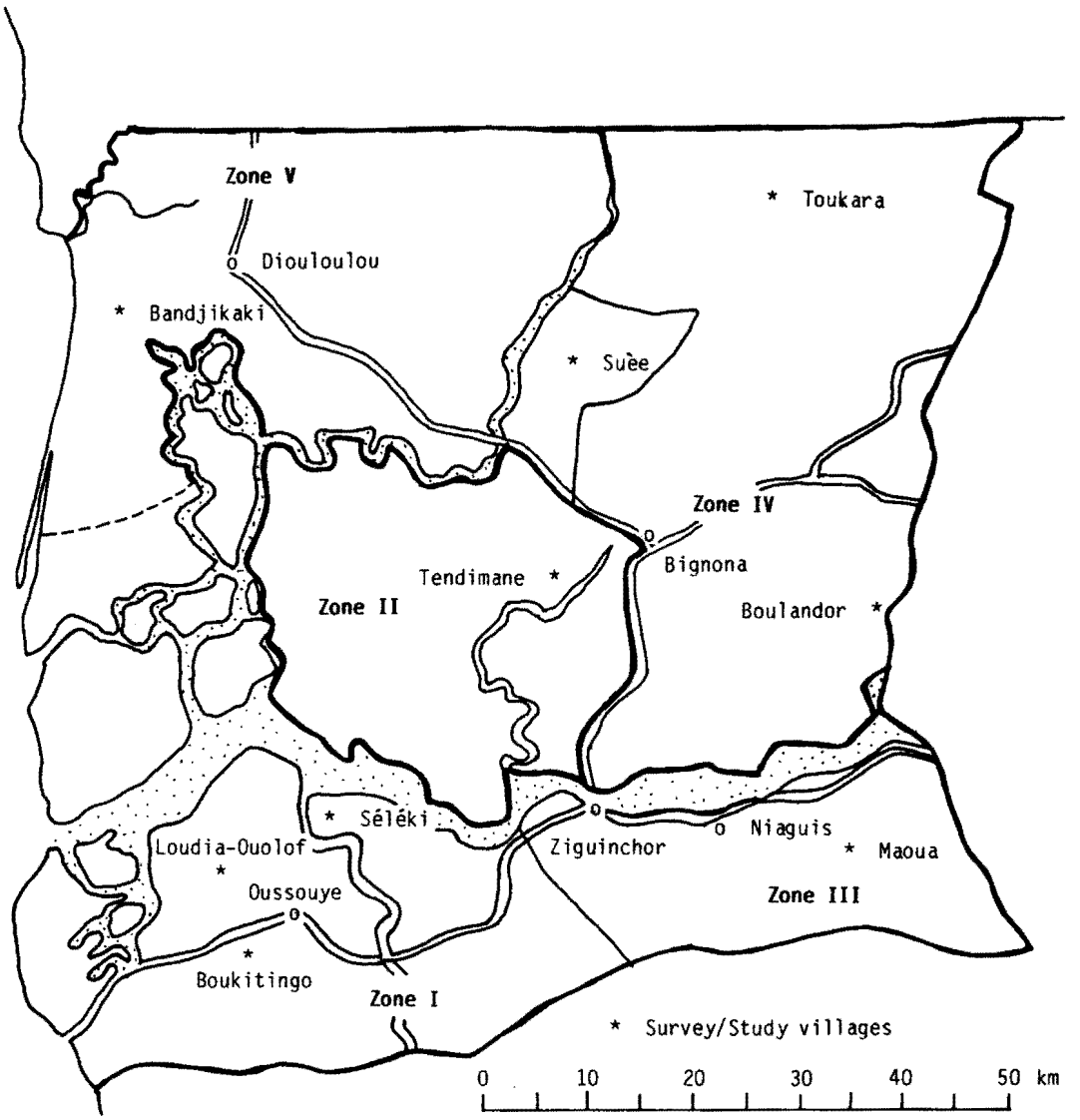


A prepared interview guide was used during these surveys to help direct introductory visits with local government authorities and "interviews" with farmers in their fields. Researchers used group and individual discussions in the village meeting place and in some households to improve their understanding of some problems and to raise issues not addressed in the first field visits. Following each village survey, one Team member prepared the village report to be reviewed and jointly completed by the Team.

With the results from this first phase, the Team used three criteria for defining five agricultural zones or situations within the Lower Casamance: (1) the division of labor; (2) the relative proportion of the area in rainfed crops as opposed to irrigated crops; and (3) the extent of animal traction use. The Team also identified the priority research questions for more detailed study and determined the technologies to use for experiments and tests in each zone.

In each delineated zone, two representative villages were chosen for the formal survey sample. From a compound (concession) census in these ten villages, a random sample of 125 compounds, including 230 households, was drawn for an agro-socioeconomic survey. This sample was reduced to 80 compounds of 150 households in 1985 to concentrate on target group households and to prepare recommendations by zone and by target group.

Lower Casamance Agricultural Zones
(ISRA, Production Systems Team, Djibélor, 1985)



The second phase of the research programme started during the 1982 rainy (growing) season and has comprised two closely related components: formal surveys and agronomic trials.

Formal surveys

Formal surveys were used to verify, refine, and quantify information obtained during the exploratory surveys. They are carried out by village-based interviewers using pre-coded questionnaires. The surveys include a household demographic census, field and plot identification, a resource inventory, and a survey of cultivation activities from soil preparation through harvest. For this latter survey, labour time was registered at the end of each activity period by type of cultivation practice, by crop and by type of equipment used. These surveys have provided a better idea of the level of household resources, of the

agricultural labour calendar and constraints by zone, the cropping calendar, the farmers' agricultural practices, and the level of production and the distribution of different crops.

In 1984, an economic survey and input-output study was added for a sub-sample of 30 representative households. Four sociological research studies were also started in early 1984: (1) the social organization and typology of agricultural households; (2) land tenure; (3) migration, including attention to its impact on agrarian systems; and (4) off-farm activities. A combination of survey instruments including participant observation, a structured questionnaire, and a genealogical survey has been used in these studies. With the arrival of an animal scientist and an agricultural engineer, diagnostic surveys on livestock production and animal traction were undertaken. In 1985, experiments with oxen-drawn equipment, in animal health, and in the use of manure on cereal crops (grazing, composting, etc.) were also completed.

Agronomic trials

Agronomic trials were run from 1982 through 1984 to address four principal questions as follows:

1) Cropping intensification through fertilizer and herbicide use and different varieties of maize and rice.

2) Diversification with different varieties of sorghum, millet, cowpeas, sweet potatoes, and cocoyam.

3) The recuperation of abandoned land involving trials on saline soils.

4) The use of residual moisture through the production of sweet potatoes following the rice harvest in low-lying areas.

In addition, two types of "systems" trials were designed to evaluate and propose new cultivation practices in comparison with actual practices. These trials addressed: (1) the technical effectiveness of proposed practices in terms of production, labour time, and the use of marginal areas, and (2) the adaptability of new practices in terms of seeding and harvesting dates, weed control, fertilization level, and the farmers' limited resource capabilities.

On-station systems trials, which differ from standard on-station trials only in their underlying logic and objectives, were prepared to address the question of technical effectiveness. On-farm trials, managed directly by farmers with the aid of a field assistant, were exploratory or orientative and had few, if any, repetitions. The fertilizer and varietal trials, for example, used two repetitions, but were conducted on fairly large plots (500-1000 m^2). However, rainfed and irrigated rice trials were run on small plots of 30 m^2.

The trial results were assessed in discussions with peasants and through standard statistical analyses. Depending on the evaluation, some trials were modified for management directly by farmers on larger areas, or for continued testing by the Team.

Since 1982, the Lower Casamance Team has annually revised the overall survey and trials programme. In part, these changes reflect the broadening of the research perspective as new researchers from different disciplines have joined the team; each year's research results also suggest changes. After almost four years of research, the Team appears to be entering another phase of research.

Following discussions with the Central Systems Analysis Group (CSAG) in late 1984 on the Team's research methodology, an internal programme review of the Team's objectives and programme was started in early 1985. The Central Systems Analysis Group and two external consultant missions assisted in this review, which led to important modifications in the 1985 research programme and to proposed changes for 1986.

The zonal boundaries were adjusted and a more representative sample of villages from each zone was identified. Plot-level and household surveys were significantly reduced to permit more detailed data analysis and a more specific study of the constraints on the adoption of new, proposed technology. Additional protocols with other ISRA researchers at the Center were also prepared to include research on agricultural policy. Finally, the Team is enlarging its analytic focus from the household to producers' groups, the village land area (terroir), the watershed, and even to the level of the agrarian system.

The Team's overall research perspective is changing as well. The 1982 surveys and studies showed that farmers had rapidly expanded rainfed crop production in response to 10 years of increasingly uncertain irrigated agricultural production. The timely development of an on-station field for rainfed crop trials has helped to understand this evolution. More recently, and in response to farmers' interest in small, earthen salt-water intrusion dams, the Team is shifting its orientation towards irrigated rice. As a result, the Team's overall research programme now reflects a more complete analysis of the problems along the topographical sequence from the rainfed uplands to the inundated rice fields.

The Link Between Farming Systems, Commodity, and Subject-Matter Research Programmes

Prior to the creation of the Djibelor Farming Systems Program, commodity researchers at the Djibelor Center worked essentially on various aspects of rice production in the Casamance: varietal improvement; physiology; weed and insect control; fertilization; and cultivation practices, including the use of animal and motor-powered equipment. Researchers principally conducted on-station trials and managed a network of controlled trials under farmers' conditions. With financing from the USAID Lower Casamance Project, an economist started economic surveys of vegetable crop marketing in early 1982. Additional financing from the USAID PL 480-Title III programme permitted the establishment of a Watershed Management Program in 1983 composed of an irrigation engineer, an agronomist and specialists in fisheries and rice fertilization.

Most commodity and subject-matter researchers at Djibelor were associated with the FSR Team's exploratory surveys. The commodity researchers did not, however, modify their programmes in response to problems identified during the exploratory diagnosis. They viewed the systems programme more as a competitor or threat than a contribution to their research.

Similarly, the FSR Department as a whole met staunch resistance from "non-systems" researchers. Considerable hostility emerged from the animal production and health department, which harboured the unfounded fear of losing control over its off-station research programmes and management of the two livestock research centres at Kolda and Dahra. In fact, the climate of opposition and hostility reached such a level that in July 1982 the FSR Department was summoned before a general meeting of ISRA scientists and administrators to present and justify its research approach, its programme of work, and the calendar for establishing the Team programmes. During this meeting, the Department was attacked for not taking existing research results into consideration, for repeating research that had already been done, and for seeking to reorient all research programmes and thereby create a "super" research department. Fundamentally, the criticisms were not directed to the systems approach or methods. The Department instead was serving as a lightening rod for the hostility of many researchers towards the Agricultural Research Project. The FSR Department's ability to attract new financial and technical support also made it an envious target susceptible to attack.

From the beginning, the viewpoint of the FSR Department concerning the relationship between commodity and systems programmes has been very clear. Instead of capturing other programmes, the Department invited commodity researchers in rice, maize, millet, sorghum, sweet potatoes, cowpeas, and cocoyam to assist in the FSR trials without sacrificing their own off-station commodity work. Researchers were invited to accompany the systems team during its field work and to discuss their experiences together. They were also encouraged to incorporate many of the identified constraints or priorities into their on-station work.

Even within FSR Department and BAME, subject-matter or disciplinary research is encouraged. The agricultural machinery specialist at Djibelor, for example, has completed a census of equipment and a study of the role of local blacksmiths. He also collaborates with the animal scientist on a study of credit for equipment and spare parts, and with the Watershed Management irrigation engineer on methods for desalinizing croplands and for preparing irrigated rice fields with animal-drawn equipment. The BAME economist working on vegetable crop marketing, too, has collaborated with the Systems Team on a study of the food situation in 10 villages, parallel to another study of cereals marketing in the Casamance Region.

Equally significant, the irrigation engineer has always worked closely with the Systems Team agronomist and in 1985, the rice team also began to collaborate on watershed problems. This "expanded" Watershed Team is now involved in six areas: three where farmers have built small, earthen saltwater intrusion dams, and three with more capital-intensive structures. This team jointly defines its trials, surveys,

and follow-up work and it is expected that their work will encourage more coordination among the other Djibelor research programmes.

In addition to linking the Departmental research programmes with those of other departments, the FSR Department has organized several training workshops between 1984 and 1986 to bring together researchers from different departments and agents from several regional development agencies. These have included training workshops on Production Systems Research Orientation, Micro-computers in Agricultural Research, Agronomic Research under Farmers' Conditions, and Methodology of Livestock Research in Sub-Saharan Africa.

Since 1984, the Department has promoted the idea of multi-year, regional scientific programming, including the participation of the regional development agencies in the planning process. FSR provides a useful planning and programming tool for agricultural research. It can facilitate planning in response to observed needs and constraints, as well as help to define priorities for on-station programmes. In the context of scarce human and financial resources, the diagnosis of farm level constraints and the development of new technology at this level could be an efficient way to identify both on- and off-station research priorities within the context of a coherent regional programme. Such a role for FSR, however, continues to be resisted by the entrenched interests surrounding on-station and laboratory research.

Linkages Between Research and Extension

The need for a close relationship between agricultural research and extension programmes has been debated in Senegal for over 25 years. At independence, the "promotion of Research-Development" was a pillar of the government's rural development policy for the 1960s. Thirteen years later, in 1973 and on the eve of the creation of ISRA, the issue was still alive when the Minister of Rural Development convened a national conference to discuss the effective use of research results in agricultural production programmes. Charges and countercharges continue to fly between researchers who are criticized for non-adaptive, ivory tower research and "developers" (agricultural production and extension personnel) who are charged with a narrow-minded, productionist orientation at the expense of addressing farmer problems and interests.

Most recommendations for closing the gap between research and extension concern improving communications and contacts between research and extension personnel. Under the Agricultural Research Project, each Production Systems Team was to include a researcher/agricultural extension specialist who would fill a joint ISRA-Extension position within each Regional Development Agency. The job of this specialist was: to manage all farm-level tests and trials prepared by production systems and commodity researchers in collaboration with the extension agency; to train extension personnel in the use of new technology; and to ensure that researchers were aware of farmer reactions and farm-level constraints.

Both ISRA and the Regional Development agencies were unconvinced of the need for the full-time secondment of a researcher. Moreover, ISRA did not have personnel qualified to fill the position and, faced with a restrictive ceiling on its personnel, preferred to assign researchers exclusively to ISRA research programmes.

In place of the research/extension specialist position, ISRA proposed joint protocol agreements as the means to institutionalize the research-extension relationship in Senegal's major agricultural regions. ISRA and the Societé pour la Mise en Valeur de la Casamance (SOMIVAC) signed such a protocol in 1983. Under this Agreement, an ISRA-SOMIVAC Liaison Unit was created as the contact and communication institution between researchers and extension agents. During the first year of discussions under the Unit's auspices, SOMIVAC agreed to assist the FSR Team in defining agricultural zones for the Lower Casamance and in preparing a joint plan of work for watershed management in the mangrove swamp inlets (bolongs). The Liaison Unit's performance at the end of 1983 was judged by both ISRA and SOMIVAC to be far short of expectations. Managers and planners from SOMIVAC rather than field and technical extension personnel attended the few meetings that were held; and the Unit's meetings rarely arrived at concrete conclusions or led to specific, coordinated activities.

In order to improve the effectiveness of the Unit, ISRA and SOMIVAC created seven, small subject-matter technical working groups in June 1984 to design specific and joint research-extension activities focusing on priority topics and problems in rice breeding, animal traction and equipment, land use, animal production, seed multiplication, socio-economic (production systems) studies and surveys, and agricultural inputs and agricultural policy. The principal, jointly designed programmes include: farmer-managed rice variety trials; tests using sweet potatoes as a sequential crop to irrigated rice in selected areas; and the monitoring of the desalinization process in two zones that have been recently protected by small salt-water intrusion dams. Other joint activities for 1985/86 include a follow-up study of the use of groundnut seeders for rice, joint Research-Extension visits to rice seed multiplication farms and an analysis of PIDAC's special credit programme among selected producers' groups (Groupement de Producteurs).

Training has also been an important component of the ISRA-SOMIVAC relationship since 1984, and SOMIVAC and PIDAC personnel have participated in all the Department Workshops noted earlier. Furthermore, in response to an interest by USAID/Dakar to reorient their activities in the Lower Casamance towards the problems of salt-water intrusion control and mangrove swamp watershed management, the Liaison Unit organized a June 1985 roundtable discussion of salt-water intrusion dams in the Casamance.

Under the protocol agreement, the ISRA-SOMIVAC relationship in the Lower Casamance has evolved through joint or coordinated research activities and studies, training, and discussions and review of regional rural development policy. SOMIVAC's acceptance of the agricultural zones delimited by the Djibelor FSR Team represents an important step towards closing the Research-Extension gap in Casamance. The PIDAC extension programme now includes themes or recommendations for

intensified cropping that were proposed by the FSR Team: associated cropping with maize and cowpeas, and the sequential cropping of rice and sweet potatoes.

Major challenges have yet to be overcome in this Research-Extension experiment. Extension agents and those working directly with peasant-farmers are still only marginally involved in the Liaison Unit, and an effective means to include farmers' representatives (from producers' groups, cooperatives, or village organizations) in the Liaison Unit has not been found. Furthermore, the interactive process of the Liaison Unit must spread beyond the local level to both regional and national policy-makers. Both ISRA and SOMIVAC need to reach out with the news and results of their joint programmes. The ultimate test of a successful Research-Extension relationship is, of course, increased agricultural production and improved rural welfare. Meanwhile, the Liaison Unit can make a significant contribution to agricultural development by calling the attention of policy-makers to the important accomplishments and effectiveness of programmes designed on the basis of farmer-defined problems.

Budgeting, Personnel and Training

Problems associated with ISRA's financial management and scientific personnel policies have been more difficult for the FSR Department to deal with than the logistic and management problems associated with establishing a systems research programme.

Overall, the FSR Department's programmes have had adequate annual financing, but researchers have not obtained sufficient funds when required. ISRA's inability to ensure timely budget support is linked to several factors. The government's budget commitment to ISRA does not cover the salary costs for Senegalese personnel and it is less in relative terms than that accorded by the government to the French research institutes during their 15-year period of directing Senegalese agricultural research. Consequently, most of the investment and operating costs for agricultural research are covered by outside financing.

ISRA currently receives financial and technical assistance from over 50 separate projects, more than 15 of which directly support the FSR Department and BAME. Some research programmes, in fact, have as many as five or six different sources of financing. An extremely complex budgeting system has been developed to manage these multiple sources of financial support. The Senegal public accounting procedures require separate accounts by programme, by source of financing, and by unit of disbursement. Added to this, each donor agency required ISRA to follow its own, separate accounting system. To date, ISRA has been unable to manage the many complex financial and accounting systems. Consequently, there continues to be significant delays in disbursements and the institute finds itself plagued by an on-going budget crisis.

ISRA's dependence upon donor-financed projects also makes the continuing search for financial support and the maintenance of good relations with multiple donor agencies and consultants an important,

time-consuming part of the job of senior ISRA research administrators and scientists. USAID, for example, provides most of the Department's and BAME's financial support. This support, however, is channelled through four separate projects, each with its own manager. Under these conditions, it is extremely difficult to undertake long-term planning with a measure of internal programme coherence among the many research activities and multiple sources of financing.

Recruiting and keeping an adequately trained and experienced scientific and technical staff is no less serious a problem. At independence, Senegal, like most African governments, accorded low priority to agricultural research or to training national research scientists. When ISRA was established in 1975, there were scarcely ten Senegalese researchers in the Institute (or just about one-tenth the current number of national scientists). While training is stated as an important ISRA priority, no ISRA training plan for scientists or for technicians has been prepared. Moreover, instead of gaining valuable research experience, the few, higher-trained Senegalese researchers have assumed administrative positions, thereby leaving many research programmes largely in the hands of expatriate scientists.

In 1980, ISRA initiated a massive recruitment and training campaign. Twenty of the FSR Department's twenty-seven Senegalese researchers were hired between 1982 and 1986. Three of these were sent to France for advanced studies (DEA) and eight were sent to the US for M.Sc. degrees. Consequently, most of the FSR Department and BAME researchers, while highly motivated, are inexperienced. In addition, the few senior and experienced ISRA researchers have little time to give critical scientific guidance to younger researchers. Even with nine French (CIRAD) and five American (MSU) researchers on the Department and BAME staff, several outside consultant missions are required annually to advise on programme direction and activities.

It will take several years for ISRA to build a trained cadre of scientific and technical personnel. Meanwhile, the salary and advancement scales will require restructuring if ISRA hopes to retain its professional staff.

Conclusion

After only 11 years, ISRA is still a very young institution, struggling with all the unresolved problems common to a young agency. Of most critical importance is ISRA's ability to learn from its difficulties and mistakes. This paper seeks to contribute to this learning process by focusing on the institutional rather than methodological questions surrounding production systems research in Senegal.

ISRA may have been overly ambitious in creating a separate FSR Department with the same administrative and scientific standing as the other, older research departments. Because this new Department began with the mandate to identify research problems and evaluate technical solutions at the farm level, it immediately upset the Institute's organizational and scientific structure. Non-FSR researchers rejected the legitimacy of the Department's role in programming and evaluation.

It represented a threat to their autonomy, and some even felt that the Department wanted to control all of ISRA's agricultural research programmes.

The creation of a new, FSR Department also accentuated ISRA's budgetary stress. The projects which financed the creation of the FSR Department and BAME channelled additional resources into ISRA, but the Institute must, more than ever before, be rigorously selective in defining its research priorities and concentrate its resources on a few select programmes. The financial management crisis and the animosities generated by the creation of the FSR Department, however, often confuse the fundamental administrative and policy issues.

A comparison of ISRA's experience with those of other institutes in West Africa that have chosen a more gradual approach to implementing FSR would be valuable at this point. It could be useful, for example to review a case in which an FSR programme was started within an existing scientific research unit. ISRA's experience illustrates vividly the problems which will arise eventually in the implementation of any FSR programme. As such, this experience can help others to identify and resolve problems in other programmes before they achieve crisis proportions.

Some FSR Department researchers still doubt the need for a separate farming systems research department. They argue that FSR is not a scientific discipline, but an approach and a research concern that should be shared by all of ISRA's researchers and departments. From this perspective, all research programmes should be oriented towards farmer problems; limiting the approach to one department only reduces its contribution to development. During the design phase of the Agricultural Research Project, for example, many argued for the establishment of a senior, multidisciplinary headquarters Team which would report to the ISRA Scientific Director and would be responsible for technical support to the field FSR Teams. The latter would, in turn, be managed within a research department, such as crops or livestock.

A priori, one path is not preferred over another. The choice depends upon a research institute's capacity to identify and resolve its problems. This capacity resides essentially in the capabilities, concerns, and commitment of the senior scientists and administrators, and among the researchers and technicians.

The second major lesson to be drawn from the ISRA experience is that the Agricultural Research Project significantly overestimated ISRA's capacity to undertake the changes required during the short life of the project. The Department's senior researchers cannot and could not adequately advise and guide the many new researchers and technicians whose mission was to launch the three FSR Teams during the past four years. Expatriate technical assistants have helped, but are no substitute for national researchers and technicians during the long, tedious, and intense on-the-ground training period required to develop a good research scientist.

Third, training cannot be limited to systems research disciplines, but must include commodity research. In the current vogue of FSR, it is

often overlooked that systems researchers do not create new technology. It is created by scientists carrying out commodity research in the areas of soil fertility, plant breeding, and agricultural equipment, among others.

Thus, a central question confronting African agricultural research institutes is not how to introduce a farming systems approach or department into a research structure, but how to get the research institution as a whole to evolve towards an approach that is sensitive to farmers' problems. The Lower Casamance experience illustrates a step in this direction through its effort to link research programmes with the activities and concerns of the regional extension agency. Even in this case, no mechanism exists to encourage farmer participation in agricultural research and policy-making; nor does an organization exist for transmitting farmer-level concerns to regional and national policy-makers. Unfortunately, in the short-run, it is difficult to conceive of how farmer organizations in Senegal might serve more effectively in defining research programmes and priorities. On the other hand, Senegal's and Africa's continuing agrarian crisis may alert some policy-makers to the highly critical role that agricultural research plays in achieving food security and eliminating famine.

The ISRA-FSR experience has not generated any innovations in FSR methodology. This experience adds little to the currently available literature on farming systems research. The ISRA case, however, does permit reflection on the adequacy of FSR as commonly conceived to deal with the complex problems of agricultural development in Senegal and throughout Sub-Saharan Africa.

FSR is oriented almost exclusively to farm-level production systems. Given the problems of environmental degradation and the loss of physical resources that have occurred in Sahelian Africa over the last 10-15 years, issues such as erosion, deforestation, and drought, at other levels of concern (watershed, village domain, agricultural zone) merit critical and analytic inquiry without sacrificing a concern with farm-level problems. Furthermore, these agricultural and environmental issues cannot be thoroughly understood without including an analysis of the structure and influence of the village community, producer, and cooperative associations. The rapid withdrawal of Senegalese governmental agencies from agricultural development, credit, input supply, and extension programmes in favour of "local self-reliance" suggests that FSR programmes should give more attention to the role of local organizations in agricultural development.

In other words, most FSR programmes give minimal attention to agricultural policy questions. Perhaps this reflects the widespread use of the FSR methods and concepts developed by the International Research Institutes to respond to specific, crop-related problems. The FSR Department and BAME, in becoming a single unit for agrarian systems and agricultural economics research, is taking the first step towards linking micro and macro perspectives in agricultural research. Each FSR programme is also taking steps to incorporate a broader perspective in its research activities. In other words, despite the complex, frustrating, and unresolved institutional problems discussed in this paper, ISRA strives to pioneer in agricultural research.

IMPLEMENTATION OF A FARMING SYSTEMS RESEARCH STRATEGY: THE CASE OF NIGERIA

By

G.O.I. Abalu

Introduction

Nigeria's agricultural research system has undergone a considerable number of changes since its inception in 1893 when a single Department of Forestry and Agriculture was given responsibility for all agricultural research in the country. By 1912, agricultural research was operating in two separate zones, north and south. The amalgamation of the southern and northern parts of Nigeria in 1921 once more brought agricultural research under a single umbrella of the Nigerian Department of Agriculture.

By the early 1950s, major political changes resulted in the creation of three regional governments in Nigeria, each with its own ministry of agriculture and agricultural research division. The northern-based research division in Samaru became the agricultural research centre for the northern region while the southern-based research division at Moor Plantation, Ibadan, served the agricultural research needs of the western region. A new agricultural research division was established at Umudike to serve the needs of the eastern region.

In addition, a number of West African regional research institutes for commodities such as cocoa, oil palm, rice, maize, and stored products operated research units and sub-stations in Nigeria. By 1964, after several of the West African countries had obtained their independence, these research units and sub-stations were converted into commodity-based research institutes.

Following the recommendations of an FAO special study on Nigeria's agricultural development, a Federal Ministry of Agriculture and Natural Resources was established in 1965 and charged with the supervision of agricultural research throughout the country. Recommendations from UNESCO later led to the establishment of a National Council for Science and Technology (NCST) in 1970 with a provision for the establishment of a sub-council on agricultural research. The Agricultural Research Council of Nigeria (ARCN) was established in 1971 and charged with, among other functions, the design and implementation of policies and

priorities for research and training in the agricultural sciences. As a result, the regional agricultural research centres and the commodity-based research institutes were reconstituted into full-fledged research institutes while other new ones were created bringing the total to 18, the current number of research institutes in the country working principally on purely agricultural matters. There are, however, two other research institutes which, with a different mandate, nonetheless undertake research with considerable agricultural content. A list of these research institutes is presented in Table 1.

In 1975, the principal agricultural research institutes were brought under the umbrella of the ARCN for coordination and general management. A body called the National Science and Technology

Table 1. National Research Institutes in Nigeria

Institutes	Station headquarters	Year of origin	Year of formal establishment
Food Crops			
Institute for Agric. Research (IAR)	Samaru, Kaduna State	1924	1962
National Cereals Res. Inst. (NCRI)	Ibadan, Oyo State	1975	1975
Nat. Root Crops Res. Inst. (NRCRI)	Umudike, Imo State	1923	1975
Nat. Inst. for Hort. Res. (NIHORT)	Idi-Ishin, Oyo State	1975	1975
Inst. of Agric. Res. & Training (IAR&T)	Ibadan, Oyo State	1956	1962
Tree Crops			
Cocoa Res. Inst. of Nigeria (CRIN)	Gambari, Oyo State	1944	1964
Nig. Inst. for Oil Palm Res. (NIFOR)	Benin, Bendel State	1951	1964
Rubber Res. Inst. of Nig. (RRIN)	Iyanomo, Bendel State	1961	1975
Forestry Res. Inst. of Nig. (FRIN)	Ibadan, Oyo	n.a.*	1975

(continued)

Table 1. (continued)

Institutes	Station headquarters	Year of origin	Year of formal establishment
Livestock			
Nat. Vet. Research Inst. (NVRI)	Vom, Plateau State	1924	1975
Nat. Animal Prod. Res. Inst. (NAPRI)	Shika, Kaduna State	1927	1975
Nig. Inst. for Trypanosomiasis Res. (NITR)	Kaduna, Kaduna State	1947	1975
Leather Res. Inst. of Nig. (LERIN)	Zaria, Kaduna State	1964	1975
Fisheries			
Lake Chad Research Inst. (LCRI)**	Mechoun Fatori, Borno	1960	1975
Kainji Lake Research Inst. (KLRI)**	New Bussa, Kwara State	n.a.	1975
Nig. Inst. for Oceanography and Marine Research (NIOMR)	Lagos, Federal Territory	1975	1975
General Services			
Agricultural Extension and Research Liaison Services (AERLS)	Samaru, Kaduna State	1922	1975
Nigerian Stored Products Research Institute (NSPRI)	Lagos, Federal Territory	1948	1977
Federal Institute of Industrial Research (FIIR)**	Lagos, Lagos State	1955	1977
Projects Development Agency (PRODA)***	Enugu, Anambra State	n.a.	1971

*n.a. = information not available.

**Research institutes dealing mostly with fisheries but also engaged in food crops and livestock research.

***Non-agricultural research institutes with a large agricultural content.

Development Agency (NSTDA) was established in 1977 following the advent of a new government and the NCST and the ARNC were abolished. Research in all fields was now to be coordinated and managed by this body. A new government was to again abolish the NSTDA and replace it with a Federal Ministry of Science and Technology (FMST) in 1980, which up until today is responsible for the coordination and management of agricultural research institutes in the country.

The Origin of FSR in Nigeria

In 1983, the Director of Agricultural Sciences of the Federal Ministry of Science and Technology, in a key note address at an on-farm research training workshop, commented as follows:

> "...for many years I have personally toyed with what may be termed a mad idea. I have wondered if it would not be wise for our scientists to reduce normal research for a year or two and concentrate their efforts on the problems of bridging the gap between experimental and farmers' yields."

The Director was only thinking aloud about the problem of how best to incorporate Farming Systems Research (FSR) into the national agricultural system. To this effect, the ministry had already taken the following actions:

a) In 1981, it directed that all research institutes concerned with food production should evolve a Farming Systems Research Programme.

b) In 1982, it organized a training workshop on Farming Systems Research for the researchers in these institutes.

c) In 1983, it appointed a National Coordinator for Farming Systems Research in the country.

Although the interest of the Federal Ministry of Science and Technology on how best to bring a farming systems perspective into the functions of the national agricultural research system was only surfacing at this time and some of the national research institutes were being exposed to the idea for the first time, the concept itself was not new in Nigeria. As early as 1958, researchers at the then research division in Samaru were already talking "Farming Systems Research." A few years later, Norman's pioneer work in the area of socio-economic surveys was asking the same questions which many new FSR converts are still asking today.

Over the years, however, each of the major national agricultural research institutes has responded in different ways to the ministry's call for changes that would ensure that the expected contributions of a farming systems perspective can be utilized to improve upon their established research systems.

The Implementation of FSR in Nigeria

Before the directive from the Federal Ministry of Science and Technology that each of the principal food crops research institutes in the country should incorporate a farming systems research programme into their respective systems, the responsibility for existing farming systems research activities varied widely from institute to institute. These ranged from a separate FSR programme working side by side with other commodity-based research programmes, to a separate division within a research department mainly responsible for socio-economic research and/or extension and technology delivery, to institutes with no FSR activities at all.

The situation at the Institute for Agricultural Research (IAR), Samaru, which today possesses one of the more advanced FSR programmes in the country is used in the rest of this section to illustrate the evolution of a relatively successful FSR programme within a national agricultural research institute. Other agricultural institutes in the country such as the National Root Crops research Institute (NRCRI), and the National Cereals Research Institute (NCRI) do also have fairly successful FSR programmes and the use of the development experiences of the FSR programme at IAR as an illustration of FSR development in Nigeria is not meant to under-rate the good work of the FSR researchers in these institutes.

The focus of research at IAR has evolved gradually from multi-disciplinary undertakings to interdisciplinary endeavours. In this respect, four distinct but interrelated stages can be identified.

Multidisciplinary research

Before the establishment of IAR, research was mainly concentrated on technical problems, i.e., on the physical and biological aspects of farm problems within a multidisciplinary framework with little or no coordination between the technical scientists and with a conspicuous absence of the social science disciplines related to agriculture. An almost similar situation continued after the establishment of IAR in 1962 until 1965 when the Rural Economy Research Unit (RERU) was established.

RERU and interdisciplinary research at IAR

In the IAR set-up, research was mainly organized on a department basis which served as a nucleus for both teaching (for the Faculty of Agriculture) and research (for IAR). Staffing and funding both from the Faculty and IAR (which incidentally came from different sources) were merged at the departmental level. Research priorities were mainly determined by the departments concerned while coordination and cooperation between the physical, biological, and social scientists was limited and was mainly confined within the boundaries of individual disciplines. However, interdisciplinary focus was not completely absent, but was provided in the form of an umbrella by the governing bodies of the Institute, namely the Board of Governors, and the Professional and Academic Board. Research programmes were drawn up by

sub-committees of the Professional and Academic Board which were mainly organized on crop basis. These committees were interdisciplinary in orientation and encouraged an interdisciplinary approach to the solution of farm problems.

RERU (later the Agricultural Economics and Rural Sociology Department) was represented in all the above research committees, and this helped to provide a social science perspective to the understanding of the technical problems confronting each research committee. In addition, this unit particularly used an interdisciplinary approach in its research programme, drawing on the disciplines of rural sociology, geography, and agricultural economics. However, the active involvement of the technical scientists on the research programmes of the Department and RERU was not adequately realized. This was a serious gap which needed to be filled in the future.

Research reorganization at IAR

In 1975, ABU was federalized. Correspondingly, a new statute for IAR stressing the need for a Farming Systems Research perspective defined the present role of IAR as follows:

> "To conduct research into the development of farming systems which involve crops of the savanna ecological zones and result in the maintenance or in improvement of the soil resources, and especially in the production and products of sorghum, millet, maize, wheat and barley; cowpeas and soybeans (in coordination with other institutes); groundnut and sesame and other oilseeds of economic importance; cotton and other vegetable fibre of economic importance; tree and horticultural crops and shall in particular conduct research into...the technical, social and economic integration of cultivation of the crops into farming systems in different ecological zones and their impact on the economy."

Thus the new statute provided the necessary framework to reorganize and revitalize research on interdisciplinary lines by removing the institute from a rigid departmental structure to a more dynamic programme structure. The necessary interdisciplinary communication between programmes was achieved through Research Review Committees (RRC's) identified for each programme. Each programme is headed by a Leader and the RRC which he presides over comprises at least a breeder, an agronomist, a soil scientist, a crop protectionist, an agricultural engineer, an agricultural economist/rural sociologist, and an extension specialist. Attendance of RRC meetings is open to all IAR research staff. The RRC prepares research projects for the approval of the Professional and Academic Board and draws up research plans which reflect the priorities prescribed by the Governors. Specifically, the major roles of each RRC include:

1) Serving as a forum to receive and review research proposals and offer advice and feedback in relation to research projects.

2) Determining research priorities, particularly in relation to needs and available funds.

3) Monitoring, documenting, and evaluating the progress of all approved research projects.

4) Undertaking and participating in such activities that would promote, accelerate, and project the aims and achievements of the programme.

5) Seeking approaches that would forge effective links with similar programmes at other institutions to the overall interest of IAR.

6) Reviewing and drawing up short- and long-term policy guidelines for the programmes.

7) Any other matters that the Director of the Institute may from time to time require of each committee.

The administrative and organizational charts of IAR and its FSR Programme are presented in Figures 1 and 2.

The Farming Systems Research (FSR) Programme

The FSR programme is one of the five major programmes of IAR with a strong interdisciplinary orientation. In addition to the RRC which ensures the interdisciplinary participation of the research staff, the FSR programme encourages an active participation of technical scientists, farmers, and ministry officials in the process of articulating farmers' technical and human needs at the political level, government interests at the strategic research planning level, and the interest of programme and institute researchers at the programme formulation level.

A major proportion of the projects undertaken during the last two years was headed by technical scientists but social scientists' participation in them was equally rigorous and vice versa. FSR as presently carried out in the programme can be grouped into three broad but interrelated areas. The descriptive (general survey) type of FSR aimed principally at identifying farming constraints, the prescriptive (up-stream or on-station) type of FSR which aims at testing possible systems into which productive technologies can be fitted, and the interactive (down-stream or on-farm) type of FSR in which the farmer contributes to the evaluation and further improvements of the prospective technologies and the resulting improved system. The FSR programme has evolved considerably over time reflecting increasing acceptance by other researchers in IAR of its central usefulness and relevance for their own work. The sub-programme, project, and sub-project structure of the institute's FSR programme for the 1986/87 cropping season is as follows:

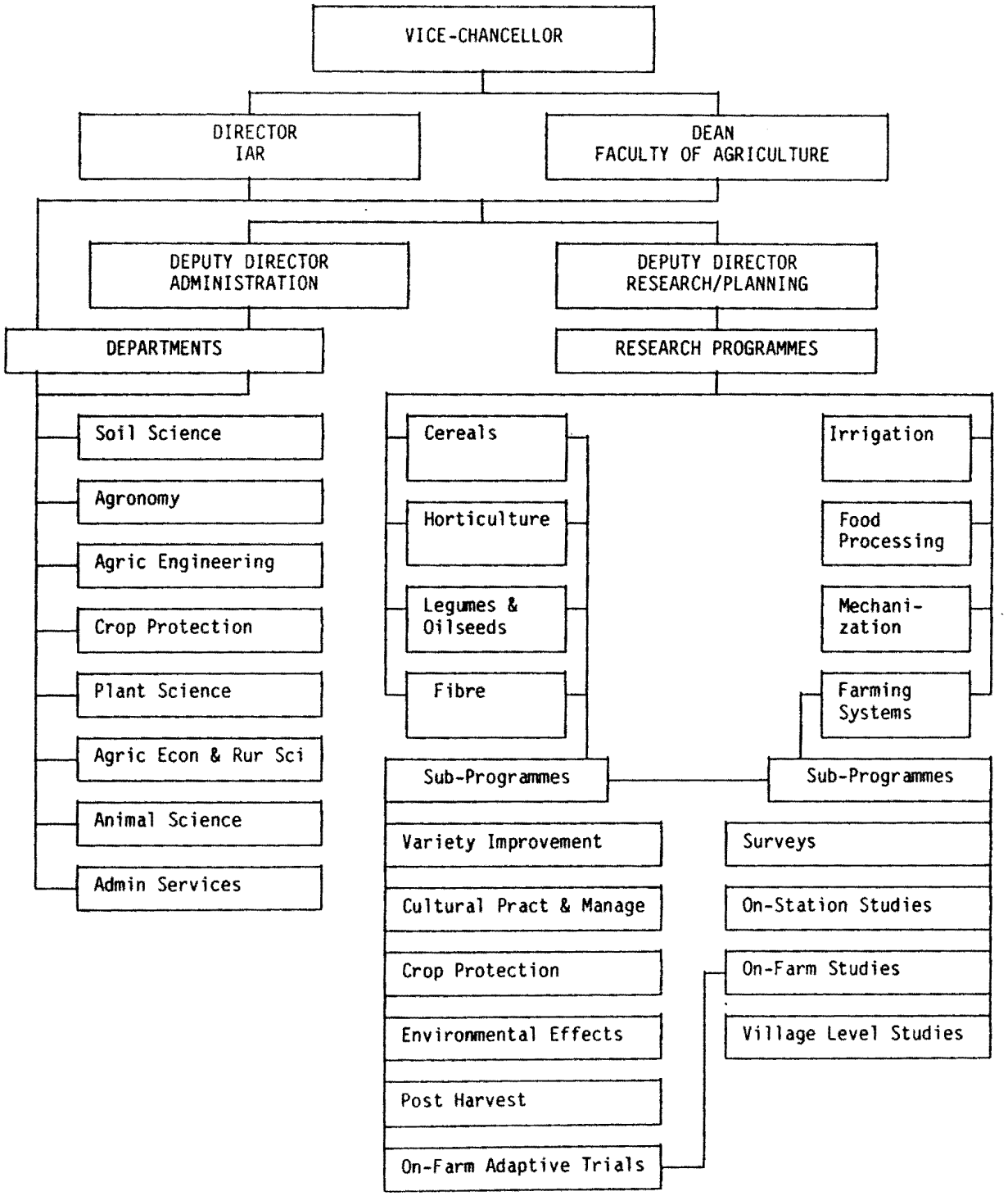


Fig. 1. Administration and research organization at the Institute for Agricultural Research, Samaru, Zaria.

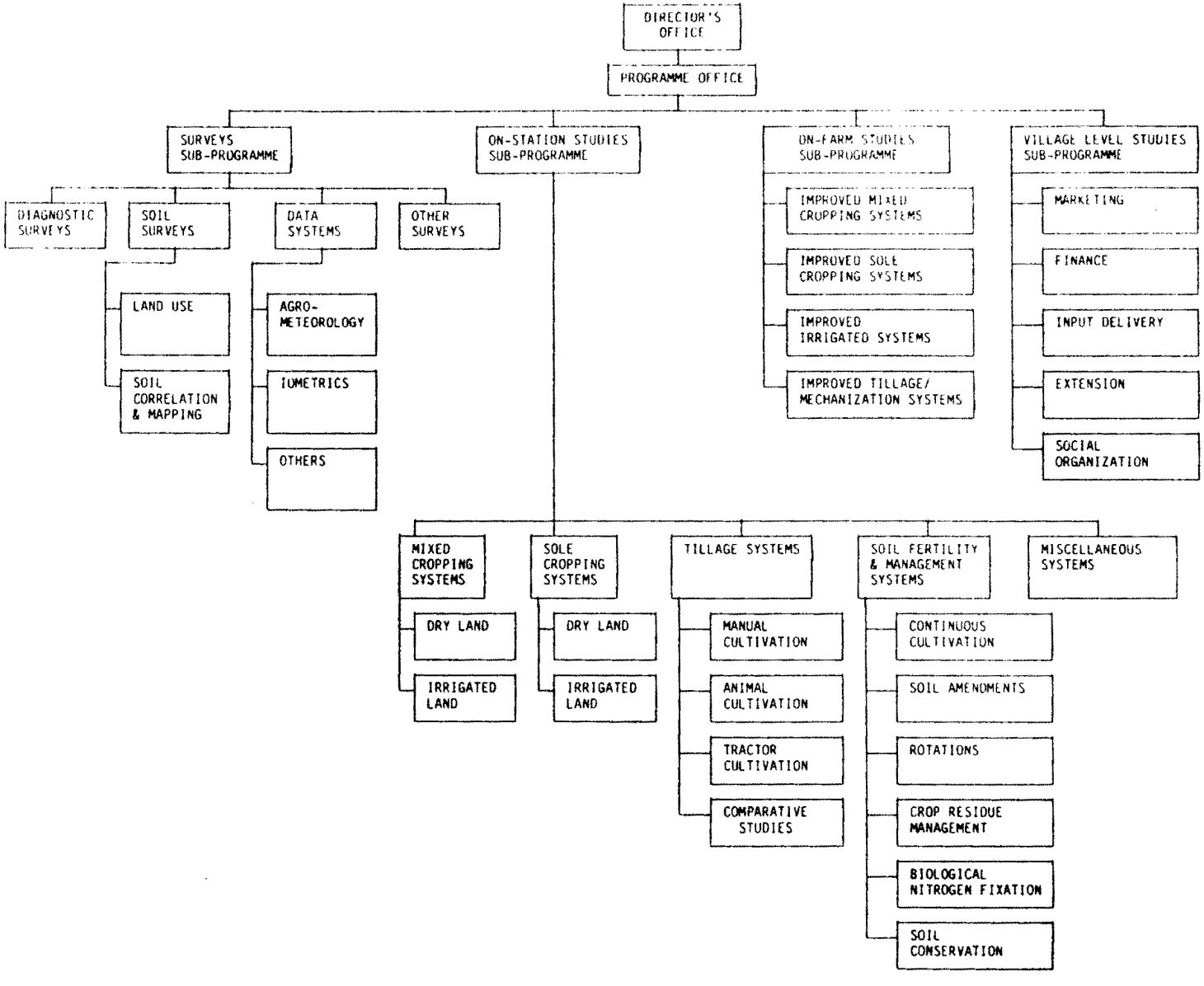


Fig. 2. Organizational structure of the Farming Systems Research Programme of the Institute for Agricultural Research.

1) SURVEYS SUB-PROGRAMME

Projects

a) Diagnostic Surveys

b) Soil Surveys

Sub-projects

i) Land Use
ii) Soil Correlation and Mapping

c) Data Systems

Sub-projects

i) Agro-Meteorology
ii) Biometrics
iii) Others

d) Other Surveys

2) ON-STATION STUDIES SUB-PROGRAMME

Projects

a) Mixed Cropping Systems

Sub-projects

i) Rainfed Agriculture
ii) Irrigated Agriculture

b) Sole Cropping Systems

Sub-projects

i) Rainfed Agriculture
ii) Irrigated Agriculture

c) Tillage Systems

Sub-projects

i) Manual Cultivation
ii) Animal Cultivation
iii) Tractor Cultivation
iv) Comparative Studies

d) Soil Fertility and Management Systems

Sub-projects

i) Continuous Cultivation
ii) Soil Amendments
iii) Rotations
iv) Crop Residue Management
v) Biological Nitrogen Fixation
vi) Soil Conservation

e) Miscellaneous Systems

3) ON-FARM STUDIES SUB-PROGRAMME

Projects

a) Testing Improved Mixed Cropping Systems
b) Testing Improved Sole Cropping Systems
c) Testing Improved Tillage/Mechanization Systems

4) VILLAGE-LEVEL STUDIES SUB-PROGRAMME

Projects

a) Marketing
b) Finance
c) Input Delivery
d) Extension
e) Social Organization

There are presently over 50 different projects and sub-projects being carried out in the programme under the above sub-programme structure. Most of these projects are carried out by interdisciplinary teams comprising technical and social scientists.

The overall objective of the FSR programme is to generate knowledge concerning the farmer, his farm, and the total environment in which he works and lives as a system of interdependent parts with a view to evolving improved agricultural technologies which alleviate his important constraints and enable him to increase his production and improve upon his welfare and meet the nation's food and agricultural production targets.

This broad objective is being achieved by means of the following set of procedures:

1) Identify the constraints operating to limit output of a particular farming system in the area of responsibility of the Institute, usually no larger than the size of a Local Government Area (LGA).

2) Evaluate, on the basis of existing information, possible technologies which might overcome the most important constraint(s) of farmers in that area.

3) Test, usually on farmers' fields, those technologies which appear to be appropriate and then either:

- reject the technologies and try something else, or
- modify them and try again, or
- accept them and propose the necessary institutional, social, and policy actions to facilitate their adoption (extension, input delivery, marketing, social organization, etc.).

4) Assist in hooking up the successful technologies into on-going Agricultural Development Efforts in the area to achieve mass production.

5) Assist in monitoring the adoption process and either:

- continue to modify the technology as necessary, or
- be prepared to try something else if, despite the existing on-farm research results, the technology is not widely adopted, or
- identify and propose solutions for the next most important constraint if the technology is being adopted.

Each of the sub-programme and project areas is at a different stage of development and impact. The research activities in each area are discussed below.

Surveys sub-programme

The projects in this sub-programme are concerned mainly with identifying the key constraints and problems that obtain in the environment in which farmers operate. The projects are aimed at providing researchers in the programme in particular and the Institute in general with a basis for designing solutions to "real" and "identified" problems rather than "assumed" problems.

Diagnostic surveys project: Diagnostic surveys represent a simple and relatively quick method of identifying key constraints and problems that operate in a defined area and which are responsible for preventing farmers in the area from increasing their agricultural production to required levels and improving their welfare in the process. In IAR, these surveys are usually carried out very quickly lasting anywhere from a few weeks to a few months but certainly with a duration not exceeding one year, with the over-riding aim of quickly gathering information about farming problems and constraints in an area by visiting and talking to farmers right on their farms and in their homes.

The research activities in this project area are based on a classification of the cropping systems under the jurisdiction of IAR into zonal and intra-zonal systems.

In this regard, zonal systems are defined as all those cropping systems which are largely determined by climatic factors, and therefore exist over large areas, usually oriented parallel to the rainfall or

ecological zones, although not necessarily coinciding with their accepted boundaries. The intra-zonal systems are more location-specific.

Among the zonal systems (Table 2), a distinction is made between fallow systems and permanent cropping. The former is defined as systems where farmers either perceive a fallow period as being essential to the systems as they have traditionally practised it or where farmers choose periodically to crop fallow land when this is freely available. The permanent cropping systems are those where farmers either choose or are forced to crop most of the land every year. It is important to note that this distinction is based on farmer practice and not on the proportion of land which is cultivated.

For the purpose of this classification, the most important crop is not viewed as necessarily the one occupying the greatest land area. The problems of defining land area by crop have not been satisfactorily solved for land predominantly cropped to mixtures. It is therefore better to rely on the perception of the typical farmer who knows for which crop he feels the greatest obligation to supply enough for his family, the one to which he will give preference when his labour supply is inadequate or when a disastrous cropping season appears to be developing.

The inter-zonal cropping systems, on the other hand, are distinctive cropping systems which exist within the broad zonal systems, usually associated with some geomorphological feature, strong ethic preference, or a "modern" agricultural development.

So far, diagnostic surveys have been completed for the millet-dominated cropping systems of the northernmost parts of the country and the yam-dominated cropping systems of the middle belt. The results of Norman's socio-economic surveys of the Sudan savanna area are being used as a proxy for the sorghum-dominated cropping systems. A survey of irrigated cropping systems (to be funded by Ford Foundation) is also underway.

Table 2. IAR's Diagnostic Survey Project classification of cropping systems of northern Nigeria

Land use pattern	1. Fallow systems	2. Permanent cropping
Most important crop		
1. Yam	1.1 Fallow systems with yam	2.1 Not important
2. Sorghum	1.2 Fallow systems with sorghum	2.2 Permanent cropping with sorghum
3. Gero (early millet)	1.3 Not important	2.3 Permanent cropping with millet

From the on-set, the FSR programme was convinced that the cost and time spent on these surveys would only be justified if the results could be utilized to improve agricultural research at IAR. The survey approach was therefore anchored around the central philosophy of the FSR programme. This philosophy assumes that radical changes of the farming system are neither possible nor desirable in the short term but that the existing traditional small-holder farming system can be encouraged to evolve over time as new technologies are tested and extended if found to be appropriate. The word "appropriate" needs some definition because it rather takes the emphasis off the traditional criteria of evaluating technologies - ecological adaptation and economic viability - and places it rather on the farmer's reaction to the technology.

For a new variety of a food crop, acceptability is very important. However, the stability of output of the technology in the face of climatic and pest hazards, low fertility, and sub-optimal management in real-farm situations should also always be considered. The non-availability of labour at the critical time required by a new technology could also constrain its adoption. For some technologies, the capacity of the farmer to handle it may be the limiting constraint. For instance, there would be little future in advocating high-volume spray technologies in areas where water sources are very dispersed. Technologies which depend on devices which are not robust and cannot be repaired in the village are unlikely to be easily extended. Nor can illiterate farmers be expected to handle technologies where very precise dosage is required unless that dosage can be standardized and a simple means of measuring it made available.

The point is not to suggest that the traditional criteria of ecological adaptation and economic viability are no longer valid; they are certainly necessary but not sufficient conditions for adoption. The FSR programme takes the position that far less is known about the appropriateness of most technologies and that this therefore is the area of research most likely to pay dividends at the current state of knowledge. This approach implies on-farm evaluation to monitor output and costs under real farm conditions and to get farmer reaction to any proposed technology.

Soil survey project: Activities in this project area are directed at classifying, describing, and mapping the soils of northern Nigeria at reconnaissance level in order to provide the much-needed information for proper land use planning. Attention is also increasingly being focused on detailed and semi-detailed soil surveys and land use plans designed to provide a basis for advising state governments, private sector entrepreneurs, and farmers on the best use of land. These plans would also provide a basis for the selection of sites suitable for the various agricultural development activities being planned for the country.

Data systems project: The primary objectives of the Data Systems Project are:

1) Provision of a data storage base;

2) Provision of environmental data support to aid the interpretation of field research as well as provision of historical and probable future trends of climate elements of importance to agriculture;

3) The development and adaptation of statistical packages and their use as an analytical tool for solving agricultural problems.

As at now, the research activities in this project area include:

1) Routine collection of weather data at IAR stations and linkage with the various weather measuring agencies across the northern States of Nigeria;

2) The design and development of alternative methods of data collection and retrieval for use in the on-station and on-farm research sub-programmes;

3) Assessment of variable soil and climatic parameters as primary inputs into the modelling of crop production in northern Nigeria.

On-station studies sub-programme

Studies carried out in this sub-programme are designed primarily to examine the range of strategies that are thought to be relevant in removing the constraints identified by projects in the diagnostic studies sub-programme as well as other constraints which may have made themselves known through other processes.

Improved mixed cropping systems project: Priority for the improvement of important crop mixtures of interest to the Institute is being given to the testing of inputs which are not traditional in mixed crop farming systems such as new varieties, fertilizers, and herbicides. The project area is no longer interested in demonstrating the superiority of mixed cropping systems over their sole crop equivalents. There is already abundant information on this. In general, improvement efforts are being focused on two-crop mixtures except for herbicides where it is important to ascertain whether or not farmers could successfully add minor crops to the basic mixture as well as in cases where interactive testing of packages clearly indicated a farmer preference for a third crop to be added.

The following eight priority mixtures are now being emphasized at Samaru:

1) millet-sorghum
2) maize-sorghum
3) maize-cotton
4) maize-cowpea
5) maize-soybean
6) maize-groundnut
7) sorghum-groundnut
8) sorghum-cowpea

For each of these mixtures, the primary aim is to work towards or improve the "package" to be offered for or subjected to on-farm

testing. Proposals for work on other mixtures are not necessarily precluded but would need to be very fully justified to be initiated.

For the drier Kano area, the four priority mixtures are as follows:

1) millet-sorghum
2) millet-groundnut
3) millet-cowpea
4) sorghum-groundnut

Improved sole cropping systems: Not very much research is being carried out on the improvement of sole cropping systems at the moment. However, there are plans to develop studies involving rotation and crop sequences. In this regard, emphasis will be placed on integrated approaches to crop cultivation and management which encompasses the whole growing season. It should, however, be pointed out that the main objective of each of the commodity-based research programmes of the Institute is to develop improved sole crop packages for their principal crops. It would therefore be necessary to work closely with researchers in the commodity-based programmes.

Tillage systems: The development of appropriate improved tillage systems is also of considerable importance to the programme. There are a number of problem areas here which are yet to be solved. Research activities in this project area are being directed at the following:

1) The influence of tillage on soil chemical and biological properties (termites, earthworms, and microbes).

2) Results so far show that deep tillage does not give significant yield increase above zero or reduced tillage. However, it is uncertain if deep tillage carried out once in several years could be more beneficial (i.e., how frequently should deep tillage be done?).

3) What is the minimum tillage requirement for different crops?

4) The benefits of dry tillage operations over early season cultivation and the usable implements for dry season tillage operation.

5) Testing of strip or zonal tillage (cultivation of crop rows only) as a means of improving infiltration and soil moisture conservation in cultivated soils.

6) Soil, water, and nutrient losses under different tillage systems.

7) The inclusion of time of planting as a variable in tillage research. In this respect, no tillage may be advantageous but this needs to be investigated.

8) Fertilizer response under different tillage systems with particular reference to the methods of application.

9) The behaviour of light-textured soils of the northern Guinea savanna under different tillage treatments compared to medium textured soils.

Other systems: Research into cultural practices and weed management systems are also receiving attention in the programme particularly because, in the past, cultivation for land preparation received considerable attention while little note was taken of the effects on subsequent weed growth. The weed scientists have made an important contribution in evaluating herbicides for use on tractor-prepared seedbeds and some work has been done on post-sowing tillage for weed control. Efforts are now underway to integrate these components into a cultivation and weed management system for the principal types of cultivation practices currently used in northern Nigeria.

On-farm studies sub-programme

This sub-programme concerns itself primarily with evaluating promising strategies arising from the work of researchers in the on-station studies sub-programme, other programmes of the Institute and other research institutes in and outside the country. Research in the sub-programme is designed to test recommendations originating from all these sources. Particularly, attention is paid to those recommendations and strategies which may be useful in removing the constraints faced by farmers under the jurisdiction of the Institute. It is expected that by removing these constraints, desirable and acceptable changes would be produced in the existing farming in the area.

The recommendations and improvements being subjected to evaluation are usually arrived at as a result of an evaluation of the range of constraints and problems actually facing farmers. In other words, the studies are based on previous or on-going research efforts in the design stage in the on-station sub-programme.

The ten research projects being proposed in this sub-programme during the 1986/87 cropping season can be classified into three types as follows:

1) Researcher managed and executed
2) Researcher managed and farmer executed
3) Farmer managed and executed

These ten projects all involve improved crop mixtures, unique sole cropping systems such as the production of hybrid maize by group farmers organized into blocks, and improved mechanization tillage, and storage systems. All of these projects focus on the testing of immediate solutions for specific local problems and conditions on the basis of an understanding of the farming systems and their constraints.

Village-level studies sub-programme

The purpose of research in this sub-programme is to understand the social organization of production at the village and farm levels as well as how the operation of institutional services promotes or constrains production. It is on the basis of this understanding of the

relationships between social and production structures and institutions that useful knowledge would be gained on how to design appropriate strategies to ensure widespread adoption of improvements in the farming systems.

The studies are principally aimed at identifying institutional and social constraints operating in the farming system in an area and finding solutions to these constraints. The results of the studies are, therefore, meant to provide information to policy-makers, managers of service institutions and infrastructures, and other administrative representatives who are in a position to initiate the institutional and structural reforms which are considered necessary for the successful adoption of improved farming systems. In this regard, prototype institutional and social arrangements are being experimented with, initially on a small scale, and the results and implications of these results submitted to the appropriate authorities for more widespread use. However, it is not quite obvious, yet, how key elements of information from this sub-programme should be transmitted to those who are responsible for formulating policies and agricultural plans. For example, future research plans in this sub-programme call for different extension methods, input delivery systems, and credit schemes to be subjected to experimentation with the aim of evolving an appropriate set for the prevailing circumstances and situations faced by different types of farmers in different zones, yet it is not yet clear how and in what form the research results will be made available to the government.

Intra- and inter-programme linkages

FSR, if properly implemented, should involve a dynamic process of linkages and feedback among the sub-programmes and projects of the FSR programme itself, between the FSR programme and other research programmes in the institute, and between the FSR programme and other research institutes in the country. There exists a functioning linkage and feedback system in the FSR programme at IAR in the sense that knowledge obtained from the surveys sub-programme usually informs the activities of the on-station sub-programme. However, due to lack of funds, the results from the several diagnostic surveys that have been conducted in the programme so far have not really been formally followed up by way of appropriate and purposeful on-station and on-farm studies as called for in the programme's operating set of procedures. In a few cases, however, the results of the surveys have been passed on to some of the World Bank-financed Agricultural Development Projects operating in the area where they were conducted. This has often taken the form of informal and personal contacts between IAR researchers and the on-farm adaptive research team of these projects.

Linkages between the FSR programme and the other IAR programmes is obtained through FSR representation in the Research Review Committee of each of the other programmes. Furthermore, on-farm adaptive trials involving the principal crops of these programmes are located and carried out within each of their programmes. These are continuous trials involving, at any time, the most up-to-date improved packages that can be assembled each cropping season for the crops under consideration. They usually start as ex-ante trials and are used to

establish and maintain a direct link between the crop-based programmes and on-farm studies sub-programme of the FSR programme.

Despite initial apprehension, most researchers have now come to accept the usefulness and relevance of the FSR programme to their own programme. This has been helped considerably by the way research is organized at IAR. Disciplinary staff from departments share their individual time among the various programmes of the Institute. This has helped considerably in forcing the researchers to appreciate the usefulness of the FSR approach. Furthermore, the evolution of FSR at IAR was self-induced, gradual, and long term, thus preventing the usual animosities associated with sudden and unknown changes.

Farming Systems Research at the National Level

In 1983, the Federal Ministry of Science and Technology created nine Nationally Coordinated Research Projects (NCRP) of which Farming Systems was one (Table 3). They were each given token start up funds and charged with the following functions:

1) mobilize the scientific manpower in different national research institutes and universities and promote synergistic interaction among them in order to maximize their scientific productivity;

2) focus on the key production constraints in respective crops and influence the research priorities in cooperating institutes;

3) design an interdisciplinary approach to problem-solving research by involving various cooperators, amplifying the initiatives of each cooperator and net-working the efforts of the institutes;

4) organize an imaginative multi-locational testing system which samples the environmental variation to better extent than can be possible at any other institute;

5) establish effective communication with the development wings and ensure that the coordinated test results form the basis for the consensus on recommendation of technology appropriate to the major production sites;

6) foster a dynamic communication among cooperators at all levels, i.e., those involved in the generation, testing, and promotion of technology; such that least time is taken in applying the needed correctives to the research strategies and in exploitation of the available technology; and

7) avoid the emergence of conflicting and thereby confusing recommendations, a situation that could easily arise when isolated and uncoordinated research is pursued in different institutes.

Table 3. Nationally coordinated research projects in Nigeria

Commodity	National coordinator	Discipline of specialization of coordinator	Location of coordinator
Sorghum	Dr. A.B. Obilana	Breeding	IAR, Samaru
Maize	Dr. J.M. Fajemisin	Pathologist	IITA, Ibadan
Rice	Dr. S.O. Fagade	Agronomist	NCRI, Ibadan
Cassava	Dr. J.E. Okeke	Soil Science	NRCRI, Umuahia
Cowpeas	Dr. M.I. Ezueh	Entomologist	NRCRI, Umuahia
Soybeans	Dr. C.O. Oyekan	Pathologist	IAR&T, Ibadan
Sugarcane	Dr. R.O. Fadayaome	Breeding	Sugar Res. Inst., Ilorin
Farming Systems	Prof. G.O.I. Abalu	Economist	IAR, Samaru
Small Ruminant	Dr. I.F. Adu	Animal Nutrition	NAPRI, Shika, Zaria

After some initial uncertainty on how to best utilize the initial grant of approximately N50,000.00 allocated to the NCRP on Farming Systems, a decision was taken to divide the amount among the principal food crops research institutes to complement their on-going FSR activities, most of which were already experiencing funding difficulties.

These funds were allocated to the four research institutes which are now operating functioning FSR programmes - the Institute of Agricultural Research and Training (IAR&T) at Ibadan, the National Cereals Research Institute (NCRI) at Badeggi, the Institute for Agricultural Research (IAR) at Samaru, and the National Root Crops Research Institute (NRCRI) at Umudike.

The research institutes with relatively new FSR programmes (IAR&T, NCRI, and NRCRI) also received assistance from IITA and the Federal Agricultural Coordinating Unit (FACU) in executing a number of diagnostic surveys in selected ADP areas followed by on-farm trials. This newly acquired FSR capacity in these research institutes coupled with existing FSR capacity at IAR marked the emergence of a peer group of scientists throughout the nation committed to the institutionalization of the FSR strategy within their respective national research institutes.

These researchers are located in the National Agricultural Research Institutes, the World Bank-financed Agricultural Development Projects, and the International Institute of Tropical Agriculture (IITA) at Ibadan. There is presently, however, considerable overlap with regard to the appropriate roles and functions of these researchers and the several institutions they represent in the development of FSR in the country.

In the interim, to help improve the flow of FSR information among this new breed of researchers as a means of improving the FSR methodology and to assist in the achievement of the objectives of the Nationally Coordinated Farming Systems Research Project, the Federal Ministry of Science and Technology sought outside assistance (from Ford Foundation) for the creation of a Nigerian National Farming Systems Research Network.

The network would be run by a Steering Committee comprising a national coordinator, a representative from each of the participating research institutes (who would also serve as the coordinator of zones allocated to their institutes), one representative from the Ministry of Agriculture and the Ministry of Science and Technology, and a representative of the Farming Systems Programme at IITA. The secretariat of the network would serve as a hub for receiving and disseminating FSR information throughout the country, organize national and zonal workshops, and publish a periodic newsletter on research issues and activities relevant to FSR in Nigeria. The secretariat would also develop and maintain linkages with international and regional networks such as the West African Farming Systems Research Network (WAFSRN).

For 1986, plans have been drawn for coordinated trials focused on the improvement of the two most important cropping systems (in all cases, these have involved mixed cropping systems) in each of the five zones into which the country has been divided. These studies together with normally funded projects in each institute's FSR programmes would form the basis of the networking activities in the country. In addition, the Ford Foundation grant also provides core funds for direct network supported FSR on socio-economic issues spinning off from the various adaptive trials.

FSR and National Agricultural Development

If it is accepted that FSR's strength as a useful research strategy lies in its potential for making available to the majority of farmers appropriate biological and economic information on which they should base their crop and livestock production patterns, then it would be inconceivable to expect these farmers to benefit from the technologies so generated without appropriate linkages between the FSR process and on-going national agricultural development and planning processes.

In Nigeria, the Federal Department of Agriculture and Rural Development under the Ministry of Agriculture, Water Resources, and Rural Development is charged with the functions of agricultural development and planning in the country. It is also responsible for the

generation and transfer of technology and support to agricultural production campaigns throughout the country. Specifically, the ministry's activities include the following:

1) Plant quarantine service which has a key role in the introduction of germplasm for crops research;

2) National seed service - which oversees the multiplication and distribution of seed and certifies the seed production by public and private agencies;

3) National Accelerated Food Production Programme (NAFPP) which has the responsibility of promoting new crop production technology among farmers. There were two other campaigns - the Operation Feed the Nation and the Green Revolution Committee - which played a similar role, but have been phased out;

4) Agricultural Development Projects (ADPs): These are area-development projects, partly financed by loans from the IBRD and are engaged in providing various services to farmers such as fertilizer and seed distribution, credit, marketing, etc., in order to promote agriculture in project areas and to enable it to serve as a demonstration for contiguous areas;

5) River Basin Authorities: They are autonomous parastatal rural development organizations with the object of harnessing surface water resources for irrigated farming and rural (and exceptionally urban) water supply. Agriculture is an important component in them, although the scope of these authorities is much broader - i.e., power generation, development of feeder roads, etc.

Obviously, proper and formal linkages between these activities and the FSR set up in the country is most critical not only for ensuring the needed impact from the national FSR effort but also for satisfying the distinctive needs of FSR.

Presently, there is very little or no linkage between FSR programmes in the country and the institutions responsible for the agricultural activities enumerated above. One of the main reasons for this lack of appropriate linkages is the bureaucratic barriers that separate the research and development components of technology generation by research programmes of National Agricultural Research Institutes that come under the Ministry of Science and Technology and the users of the research results who are under the control of the Ministry of Agriculture. As a result, there is as of now very little cooperation and coordination between the activities of these two ministries.

It is not clear whether the Agricultural Development Projects have ended up building full-scale FSR schemes complete with Diagnostic, On-station, and On-farm components into their activities as a result of or in order to cope with this problem. The end result is that while the FSR programmes of the research institutes are rendered operationally

inactive as a result of lack of funds, several of these projects carry out superficial FSR activities which they are not equipped to do and which are unlikely to have much impact.

It is, however, hoped that when fully functioning, the National Farming Systems Research Network would help to alleviate some of these problems through its networking activities.

Financing FSR

Compared to traditional research, whose physical requirements and cost needs are fairly well known, the distinctive needs and cost of FSR are still not well understood and accepted in the country. FSR funding requirements include large plots on research station farms, equipments, vehicles, logistic support in the form of improved seed, fertilizers, and protection chemicals, and adequate recurrent funding to ensure continuity for the entire FSR process.

Because the institutionalization of FSR programmes in the various research institutes has not obliterated the need for traditional research, the FSR programmes have had to compete with other programmes for available funds. In the face of a dwindling overall funding situation for agricultural research, the various FSR programmes throughout the country have had to, in most cases, fight for their very survival with other research programmes.

Because the operating costs of FSR, particularly since it involves field work, logistic support, and considerable travel, will of necessity be higher than those for traditional research, these FSR programmes have mostly been fighting losing battles. Most of these FSR programmes require new investments in the form of field vehicles for transportation to widely dispersed project villages, motor-cycles for field enumerators who must travel to farms which are frequently located along unmotorable roads, as well as a group of well-trained and competent scientists. Consequently, for successful implementation, the funds needed for these FSR programmes must of necessity come from new sources as it is very unlikely that enough funds can be diverted from other existing programmes as the ministry is currently doing.

Furthermore, the funding procedures of the ministry have been counter-productive with regard to the development of a purposeful research strategy. With the exception of the insignificant allocations to the NCRPs, the ministry funds agricultural research in the country by lump sum direct allocations to research institutes rather than on the basis of achieving prescribed research objectives. In other words, it funds IAR, NCRI, etc., rather than a sorghum programme, a maize programme, a small farmer tool development programme, or an FSR programme for the country, just to name a few examples. The inadequate allocations to the research institutes end up being shared among various programmes usually on an equal basis or in proportion to the "fighting power" of the various Programme Leaders. This represents perhaps one of most serious shortcomings in the funding of research by the Federal Ministry of Science and Technology.

Conclusion

A vast amount of agricultural research has been carried out at Nigerian agricultural research institutes to generate new technologies and practices that would increase the output on farms and improve the welfare of farmers. However, the impact that these research institutes have so far made on the agricultural development of the country has been limited, because despite all their efforts, farmer practices still lag seriously behind those obtained at the research institutes.

There is now growing concern in the country about this gap and the Nigerian government is determined to reduce or eliminate it. This has resulted in renewed interest in Farming Systems Research as a promising research philosophy and strategy for achieving this objective. To this end, Farming Systems Research processes are being encouraged at all the major national food crops research institutes in the country. These research institutes are being encouraged to reorganize their existing research processes so as to create a research capacity capable of developing new technologies which can be readily adopted by the majority of Nigerian farmers.

The experiences from Nigeria would suggest that the conceptual focus of FSR as a research strategy is not a dream but a reality. The most crucial question, however, is whether the government's commitment to Farming Systems Research as the best way of improving the relevance of research work at its national research institutes can be translated into action by way of administrative and financial support or whether the commitment is just a fad, which like all fads, will die a natural death.

There is also the real danger that the financial and management problems being encountered in the process of developing a farming systems research capability in the country, may, if not properly addressed, result in researchers engaging only in academic exchanges without any possibility of getting out into the field to demonstrate the potential of this innovative research process. True, farming systems research cannot be a panacea for all problems of agricultural development in the country. It does, however, provide an opportunity for farmers to articulate their felt needs and for these needs to influence the technology development process.

One area that needs improvement is in the allocation and distribution of funds to the numerous bodies presently interested in carrying out FSR in the country. As of now, chunks of funds from a variety of sources are available to the National Agricultural Research Institutes, the World Bank-financed Agricultural Development Projects, the Faculties of Agriculture at National Universities, and the International Research Centres such as IITA, ICRISAT, and SAFGRAD. Lack of proper consultation and coordination in the allocation and distribution of these funds has often led to wasteful duplication of efforts and ineffective utilization of available FSR manpower.

FARMING SYSTEMS RESEARCH IN MALI: A CASE-STUDY OF THE MALI-SOUTH ZONE

By

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Introduction

The idea of establishing a Farming Systems Research (FSR) programme came about in Mali as a result of the recognition of the need to find a more effective means of transmitting the findings of thematic research to the peasant sector, or, where such transmission was already accomplished, to determine the reasons for the rejection of the research findings by the peasants, and thus help to bring about a reorientation of such programmes in the country with a view to rendering them more relevant to the needs of Malian farmers and breeders.

In fact, certain results, technically viable and reliable in the in-station context as they may be, had never been hailed by those for whom they were intended with the type of enthusiasm they seemed to warrant. Along parallel lines, the notion of agricultural development centred around cash crops has evolved over time and there was need for this notion to give way to a more overall vision (integrated development) which takes account, not only of different theoretical approaches, but also of the producer as a person.

All of the above led Malian researchers to see the inevitable need to move out of the station (a privileged situation on all counts) and into real farming conditions, for the following purposes:

1) to get to know the peasant terrain;

2) to work alongside the peasant farmer to help him identify his aims and priorities and their order of importance;

3) to try out, alongside the farmer and in his own fields, the technical solutions most likely to solve the problems which have been identified;

4) to return to the station armed with more relevant research topics, springing directly out of the farming environment, thus rendering research more effective; and

5) to indicate, to developers, planners, and decision-makers, ways and means of defining a development strategy for a given zone.

On examination of the above objectives, it becomes clear that the task is a tough and complex one. This leads us directly to one of the most fundamental notions of the approach, namely its multidisciplinary characteristic. Without getting involved at this point in the multi- versus the interdisciplinary debate, which anyway is of little interest, it is obvious that the essential factor, as soon as one is no longer dealing with the simple plot or field but a complete farming system, becomes centred around teamwork.

It is nevertheless true that the systems approach can only be understood as complementary to, and not a substitute for, thematic research. The advantage of the systems approach is that it is comprehensive in nature, and therefore necessarily multidisciplinary.

Agricultural Research in Mali

Agricultural research in Mali has gone through various stages since independence, especially with regard to food crops, cotton and jute fibres.

Two main phases can be distinguished as follows:

1) From 1962 to 1977, research on these crops was in the hands of two French institutes, namely the IRAT and the IRCT, by agreement with the Malian government;

2) After 1977, national research institutions were established to take care of the sectors in question.

It should be noted, however, that right from the start the overall coordination of programmes, including the 1962-77 period, was carried out by the Institute of Rural Economics (IER) set up in 1960.

The institutional framework

Up to 1981, the bulk of agricultural research programmes in the wider sense (including, besides agriculture, livestock, forestry, and fisheries) was handled singly by IER.

Set up in 1960, under the Ministry of Agriculture, the institute has been responsible for research, evaluation, and conceptualization, and also acts as coordinator and permanent liaison office between the various service organizations and bodies responsible for research, publications, and the organization and evaluation of agricultural development programmes.

Prior to the setting up of the National Institute of Research in Zootechnology and Hydrobiology (INRFH) in 1981, the IER carried out its functions through the following divisions:

1) Division of Agronomic Research (DRA)
2) Division of Zootechnical Research (DRZ)
3) Division of Forestry and Hydrobiological Research (DRFH)
4) Division of Technical Studies (DET)
5) Division of Planning and Evaluation (DPE)
6) Division of Documentation and Implementation (DDI)

The setting up of the Division of Farming Systems Research (DRSPR) in 1979 brought the number of divisions to eight, a situation which continued up to 1981, when the DRZ and the DRFH broke away to form the INRFH under the Ministry of Rural Development. The activities of the various divisions of the IER are inspired and supervised by a Director General and his assistant.

Programming of agronomic research

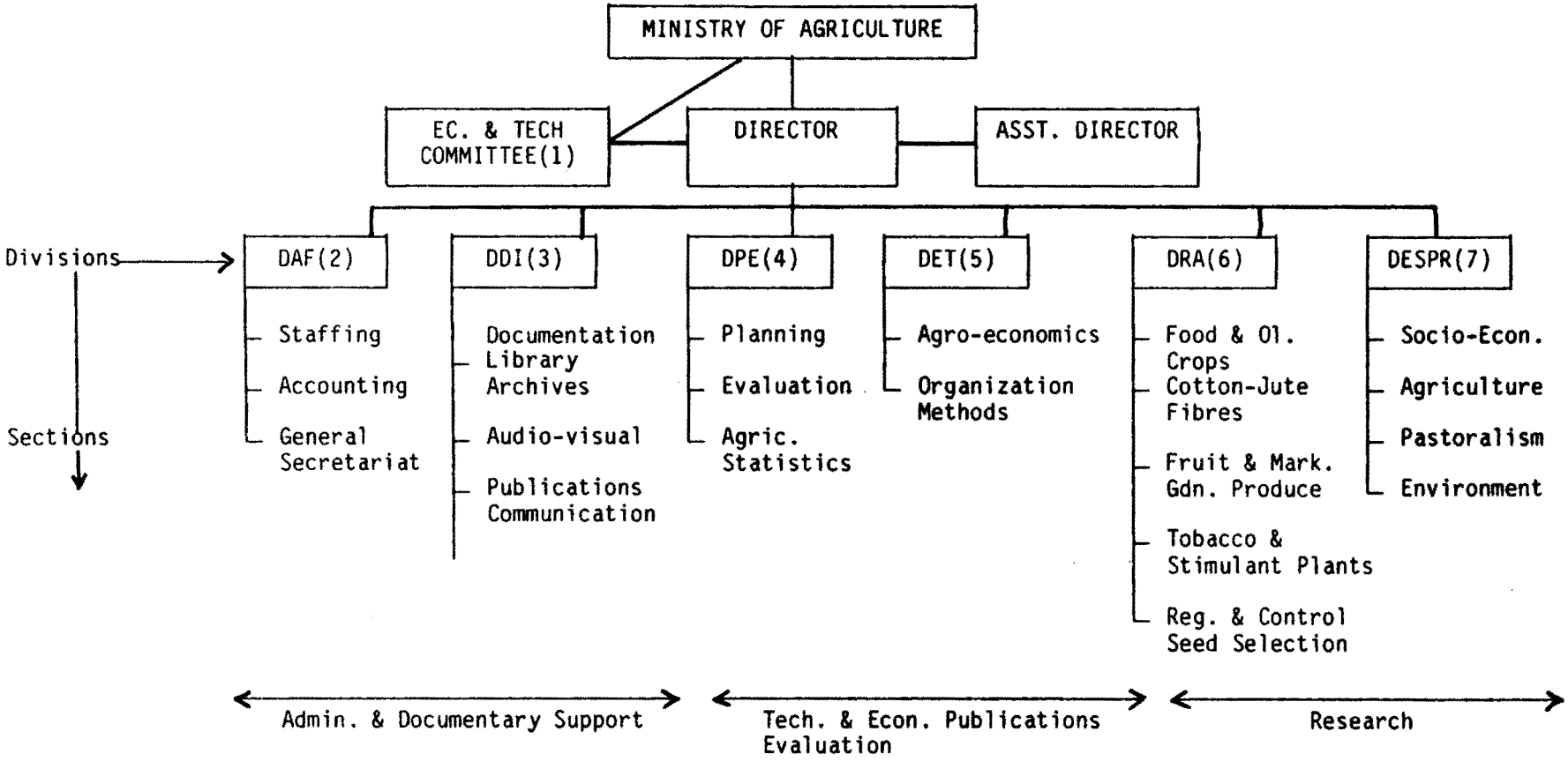
Prior to the withdrawal of the DRZ and the DRFH, which, of course, necessitated the amendment of the IER statutes, the programming of all agronomic research had been carried out by the National Committee for Agronomic Research (CNRA). This programme orientation body met annually. It was later replaced by a Committee of Science and Technology, which meets every two years. The Committee of Science and Technology brings together specialists in research, development, and planning, as well as representatives of all political and administrative bodies concerned with rural development, and also representatives of neighbouring countries and regional and international institutions.

Since 1975, specialized technical commissions have been set up, whose fundamental task is to do the groundwork for the general meetings of the CNRA and the CST. As technical bodies, they bring together principally researchers and extension workers and are responsible for compiling summaries of various projects to be put before the general meeting. It should be noted that these technical commissions are formed and named in accordance with major agricultural concerns such as food and oleaginous crops, cotton and jute fibres, fruit and market-garden produce, etc. They thus reflect the very form of organization of agricultural research in Mali.

Organization, technology generation, and extension

The various IER divisions are sub-divided into sections, which in turn are broken down into various research groups. This type of structure means heavy specialization of researchers in a specific crop and/or area, leading to a somewhat blinkered and compartmentalized approach.

Research is carried out in central stations (Sotuba, Kogoni, N'Tarla), in research bases (PAR), and in on-going experimentation bases (PEP). It is further refined and brought to completion in a multi-locational experimentation network, before reaching the pre-extension and extension stages. This scheme, while allowing for variation of the



(1) Scientific and Technical Committee (National Committee for Agronomic Research)
(2) Administrative and Financial Division
(3) Division of Documentation and Information
(4) Planning and Evaluation Division
(5) Division of Technical Publications
(6) Division of Agronomical Research
(7) Division of Farming Systems Research

Fig. 1. Organigramme of the Institute of Rural Economics.

physical environment (climate, soil, etc.), does not allow, to the same extent, for variation at the human level.

To conclude this section, the following points can be made:

1) the approach is largely sectorial, leading to extreme over-specialization;

2) the actual user, the farmer himself, does not participate in any way in the creation of technical innovations;

3) this type of research does not lend itself well to the regional approach, in which the planning authorities are especially interested;

4) to remedy the situation, and breach the gaps in the above set-up, it was decided that a structure should be adopted which would:

   a) enable peasant-farmers to participate in a general way in the research process,
   b) integrate the various activities and examine the process of agricultural exploitation as a coherent whole,
   c) improve the flow of information in both directions.

Evolution of agronomic research

The efficiency of every research system must be gauged in terms of its contribution to the achievement of development objectives.

In order to achieve its multiple objectives, agronomic research in Mali has gone through a number of different phases, each corresponding to different stages in terms of accommodating the problems involved. Each stage has been accompanied by a reorientation of research structures.

Up until recently, agricultural research was almost always carried out in accordance with the classic scheme of technology generation and extension, i.e., going from the station to the peasant's field by way of the research base (PAR) and, in some cases, the on-going experimentation base (PEP), and multi-locational experimentation. This approach is characterized mainly by its component nature (seed variety, fertilization, crop protection) and its concentration, for the most part, on a single crop, or even a specific aspect of a single crop.

In this way, some outstanding results have been obtained, especially in cotton, rice, etc., some of which have been consequently adopted by the farmers. On the other hand, this approach, while necessary, fails to take account of the "peasant farming strategy." By implication, it completely neglects all constraints emanating from the socio-economic environment (price, commercialization, land tenure problems, etc.). Moreover, this approach does not allow the "system" to be grasped as a whole, nor does it allow for any distinction between different types of farmers (with different problems).

Thus, national agronomic research, geared towards anticipating the answers to questions not yet asked, has generated a host of results whose transfer to the real agricultural production scene could at best be only partial. This was essentially due to the following factors:

1) the very nature of the classic formula of technology generation and extension whose only contact with the farmer or breeder was by way of the extension service;

2) the highly component approach to agricultural problems leading, at best, to incomplete results which in turn could not automatically be slotted into a coherent pre-existing structure;

3) the researchers' extreme ignorance of the real farming world (and of the peasant);

4) the consequent irrelevance of some of the research programmes, both in form and content.

It is a sad fact that the wholesale transfer of results obtained in a different situation is not the answer to the agricultural problems of our peasant farmers on account of the wide range of variables involved in terms of the technical situation (physical environment) and our farmers' production objectives (human factor). Hence the extreme importance of formulating the correct scheme for our own particular situation, capable of taking account of our own realities on all planes - physical, human, and institutional.

Such considerations must be taken all the more seriously in a country like Mali, where the inadequate supply of experienced researchers and of material and financial resources, along with the lack of perspective of national research structures make it impossible to bridge the gap between "research" and "extension services." This in turn has been a stumbling block in the implementation of most innovations. The conclusion has been reached that it is essential to find ways and means of bridging this gap between researchers and development personnel on the one hand and farmers on the other, through the improved flow of information in both directions.

At the present stage of its evolution, the focus of agricultural research in Mali is on the following:

1) the need to programme research according to the agro-climatic situation, an approach which favours the regionalization of research objectives according to production options;

2) the need to take into account the knowledge and aspirations of the farmers themselves, in the interests of more harmonious development, as well as the overwhelming need for closer links between thematic research, systems research, and development, mainly through the setting in motion of mechanisms adapted not only to institutions but also to people.

The Systems Approach and Agricultural Research

The historical background

A number of factors militated in favour of systems research in Mali, both in terms of development and research.

In terms of Development, the previous approach, centred around cash crops (cotton, groundnuts, etc.) has given way to a more integrated approach embracing all the crops of a given zone, and also taking into account factors such as health care, education, hydraulics, road and track construction, etc.

In terms of Research, it was simultaneously recognized that a review of procedures was necessary, for various reasons, some of which are listed below:

1) the farmers and breeders' refusal to adopt certain technical innovations (varieties, farming techniques, etc.) despite the fact that these had been proved reliable by research;

2) the irrelevance of certain research topics, due to the researchers' ignorance of the farming world, and especially of the farmer or breeder himself, and of his limitations and aspirations;

3) the exclusively component research approach with its corollary, the focus on "exclusively intensive" techniques, regardless of whether their application was compatible with the various policies available to producers;

4) the disregard for variables connected with both the physical and human environments, which led to the assumption that every "answer" put forward was equally valid for all agro-socio-economic situations or zones.

Thus, in the face of so much explicit and implicit evidence, the National Committee for Agronomical Research adopted a recommendation for a more overall approach aimed at:

1) enabling researchers to leave their stations and get to know rural conditions and more especially the producer;

2) providing a better idea of real potentialities and basic limitations;

3) improving the procedure for programming research topics to ensure their relevance to the various conditions, and gearing agricultural research in general towards subjects related to real needs experienced on the land itself.

Thus, two conferences were organized in Bamako, in November 1976 and February-March 1978, respectively. These conferences, which brought together scientists from neighbouring countries and from national and

international institutions, were aimed at helping the Institute of Rural Economics to build up a methodology that benefitted from the experience of others.

As a result of the conferences, it was possible to draw up a five-year programme for Mali in July 1977, with the aid of a task-force led by Professor D. Norman. This task-force, in conjunction with the Malian authorities, proposed Southern Mali (Mali-South) as the take-off zone for the "systems" team, for the following reasons:

1) this zone, being very accessible from all parts of the country, afforded an example of an agriculture in full mutation, in a relatively favourable climatic context;

2) the zone was relatively well endowed with research facilities;

3) given the existence of the CMDT (Compagnie Malienne de Developpement des Textiles), the task-force foresaw a solid possibility that future development would be enhanced by this relatively well-structured enterprise.

Organization of farming systems research

The option of making farming systems research a division of IER was quickly seized upon in order to allow it to develop and take all the required initiatives in line with its multidisciplinary aims.

From the time it was set up in 1979 to 1985, the division handled two projects, both based at Sikasso and operating in the Mali-South zone. One was funded jointly by Mali and the Netherlands, the other by USAID, IDRC, Ford Foundation, and the Government of Mali.

Since May 1985, when a USAID-funded project took off in the OHV zone (Operation Upper Niger Valley), the division has undertaken a redeployment exercise with the fundamental aim of forming a separate team for every ecological zone.

Indeed, for several years now, systems research, as part of the Malian food strategy, has been granted privileged status. In addition, the completion and publication in the near future of documentation on agro-ecological zoning carried out by the PIRT (Land Resources Inventory Project) under the auspices of the CESA (Food Strategy Study and Follow-up Committee) will make it possible to order priorities in terms of potentialities.

Research Methodology

The methodology applied in the Mali-South zone is not radically different from that found in the literature on the subject, especially as regards the various phases:

1) descriptive (diagnostic) phase
2) conceptualization

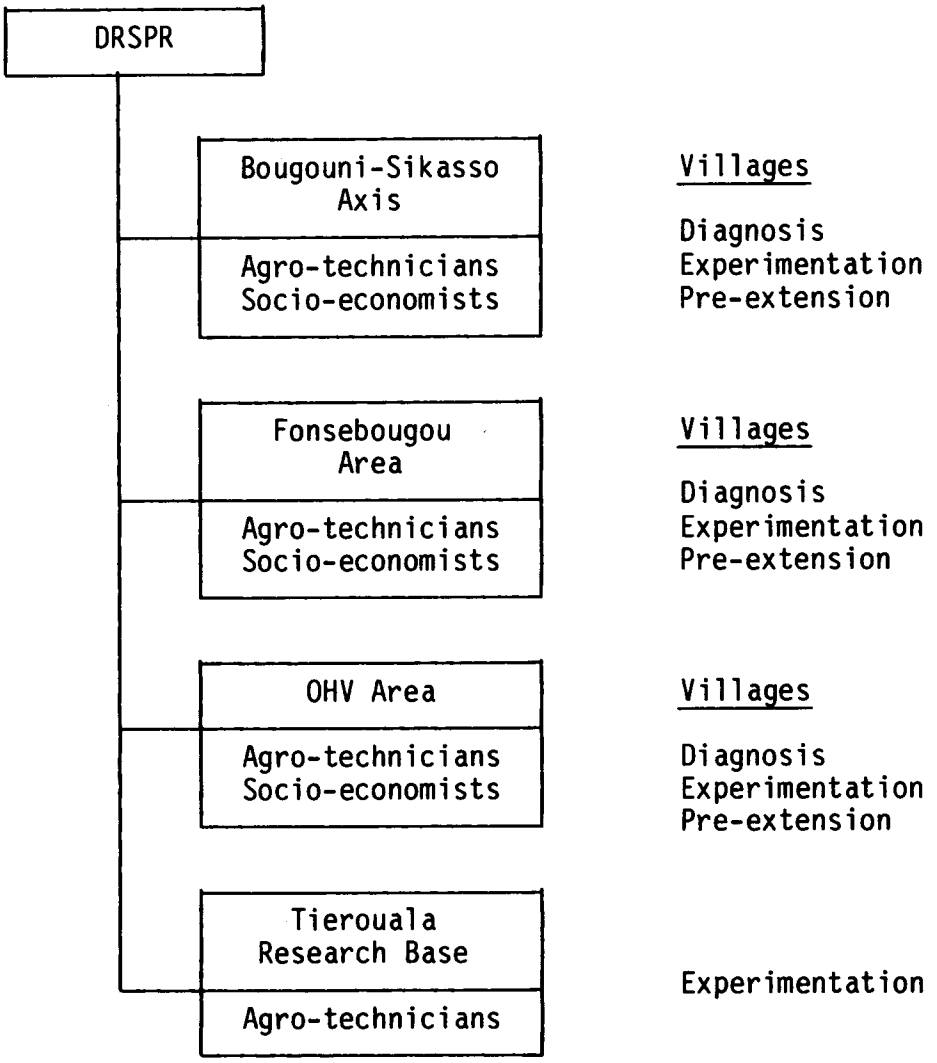


Fig. 2. Organigramme of the DRSPR.

3) experimentation
4) extension

However, in practice, the teams located in this zone have shown a good deal of flexibility and pragmatism in response to prevailing conditions, considering that it is not always possible to draw a clear line between the various phases.

Choice of environment

The choice of environment operates at several levels: region (Mali-South), village, and finally farm.

Regional level

The choice of the Mali-South zone was determined by the following factors in the combined interests of both research and extension services:

1) obvious agricultural possibilities;
2) great variability in physical and human terms;
3) good linkages;
4) existence of other research structures.

Village level

Villages were selected on two different bases, according to which of the two projects was involved.

Fonsebougou Area: (Funded by Netherlands and Mali): In 1977, the CMDT was invited to propose three sites meeting the following criteria:

1) ¾ of the villages sharing the same soil, of what might be called medium level production, equipment, etc.;

2) accessible in all seasons;

3) not too far from the team's base;

4) where market-gardening and rice cultivation are not of prime importance (the team being more interested in rain-fed crops).

The Bougouni-Sikasso Axis: Here, the villages were selected rationally from an initial sample of 450 villages, on criteria of demography, equipment, cotton production, and accessibility. The final selection of three villages was made on the following bases:

1) advanced (80% of the farms mechanized);

2) intermediate (50-60% of the farms equipped with animal traction);

3) basic (90% of the farms cultivated manually).

It should be noted that the village was considered as the operation base because of its decisive influence in the management of the land, exchanges of labour, and other factors of prime importance in the functioning of a farm.

Analysis and diagnosis of production systems

The farmers with the highest performance level have always served as models for others in most development strategies. On the other hand, we are aware that, given equal potential, two farms can yield different results. Indeed, while it may be true that the physical aspect determines the potential of a given farm, it is the human factor which, to a large extent, determines the actual output (technical level, choice of crops, priorities, organizational and managerial capacity, etc.).

In the case of the Mali-South zone, after an exhaustive inventory, a directory of farms according to type was drawn up, following what were considered to be relevant criteria which would make it possible to establish priorities. Thus two basic types were distinguishable, one of which might be termed simplified, and suitable for research purposes.

The classification made it possible to:

1) take account of the diversity of farms in terms of structure and results;

2) assess the relationship between the use of means and factors of production and yields;

3) recognize the farmer's production options, through the choices he makes;

4) identify certain bottle-necks which could be tackled at the experimentation or extension levels.

In fact, the analysis of the system would be incomplete without reference to the introduction of certain "new techniques" in order to assess the reaction of the system to such innovations.

Experimentation and extension services

As regards experimentation and extension services, the DRSPR has to date set in motion a whole set of activities involving, in varying degrees, farmers, extension workers, and researchers. These include trials, test demonstrations, pre-extension campaigns, and organized tours. For the present purpose, we would like to focus on those discussed below.

Trials

These are usually conceived, carried out, managed, and financed by the research body, in line with the preoccupations of the agronomist and the statistician. They are, therefore, limited in number at the village level. They, however, afford an opportunity for the station researchers and the "systems" team to meet at the village level.

Tests

In our situation, tests are used to compare experimental variables and they are meant to serve as substitutes for the average farm sizes. The farmer takes part in the identification and implementation of the tests (selection of plots, provision of labour, etc.) under the supervision of senior staff and researchers.

The newly introduced factor (variety, fertilizer, etc.) is, at the initial stage, the responsibility of the research body. The harvest, in its entirety, belongs to the peasant.

Demonstrations

These are carried out in cases where the technological innovations concerned have already been sufficiently tested in similar situations for the results to be more or less predictable.

The technological package is introduced and carried out under the supervision of the researcher, in order to stick to the precise requirements of the innovations.

Organized tours are arranged to these demonstrations, with a view to sensitizing the visitors.

Pre-extension activities

These constitute the final stage of the tests and demonstrations under peasant management in an institutional setting (they include peasant responsibility for all inputs formerly provided by the research body), thus reducing the role of the research body to a minimum.

Tours

The organization of group tours operates on two levels. At the first level, there are tours of the experimental projects of a given locality by the peasants of that area and at the second level, there are tours by the peasants of a given village to the fields and projects of another village.

In both cases, it has been observed that:

1) peasants of the same village often do not have a clear idea of the techniques used by their fellow-villagers;

2) peasants usually have no difficulty in explaining to their colleagues the justification for the use of a given technique, its advantages and disadvantages, hence their greater powers of persuasion than those of the researcher or the administrator.

In general, the peasants were more inspired by experiments carried out in their neighbour's field than by those carried out in research stations.

Achievements and Prospects of "Systems" Research in Mali

Achievements

The research projects carried out in the Mali-South zone have, among other things, contributed to the articulation of a number of ideas concerning the concept of the Research-Development connection and the development of awareness of certain burning development issues. These contributions have had a considerable influence both on conceptualization of the problem and on the popularization of certain practices. The training of a body of Malian senior staff in the area is perhaps the most noteworthy achievement of all.

In terms of conceptualization, the so-called homogeneity of the Mali-South zone (on both the physical and socio-cultural levels) has been exposed as quite false. This discovery has in turn raised doubts, among both researchers and development agents alike, concerning the possibility of a single all-purpose recipe for the problems of the zone. The same applies to the notion of the peasant farmer himself. In fact, until quite recently, all farmers were looked upon as identical,

in terms of both constraints and possibilities. Those who could not manage to follow along were consequently written off as recalcitrant or rebellious.

In the light of all of the above, researchers and development experts have had to review their strategy with a view to achieve regionalization based on agro-ecological zoning, and to modelling future activities in terms of the target groups. Systems research, moreover, has led to a much higher level of awareness with regard to those aspects related to the management of natural resources: the battle against erosion, improved control of surface water, better management of pastureland, reafforestation, etc.

It should be noted that the increase in the use of agricultural equipment, the heavy pressure on pasture as a result of the considerable increase in the size of village heads, the excessive felling of timber have led to such a degree of exhaustion of certain lands that the future of certain crops will be in jeopardy if urgent steps are not taken. This awareness has come about, thanks to an approach which takes into account not only the individual farm but the village land in general.

With regard to crops, the combination of sorghum and maize is a common practice in the southern part of the zone. According to our observations and the results obtained, it is evident that, far from being an archaic practice, this combination was a perfectly valid strategy for certain categories of farmers. The attention of thematic research and the CMDT has been drawn to this fact, and at present this combination is an integral part of the research programmes.

The most outstanding achievement of the Research-Development set-up was the radical change it brought about in the "dialogue" between researchers, extension workers, and peasants. Research is no longer necessarily required to go through administration in order to reach the farmer. Thus, a better understanding of the constraints and needs of the production sector by researchers has made it possible to align programmes more closely with realities. In Mali, we now have combined meetings, even technical coordination committees, bringing together Boards of Development and Research to examine, independently of the regular technical committees, the problems of a particular zone. This, in our opinion, constitutes a major step towards the regionalization of research programmes.

Prospects

The future of Farming Systems Research in Mali is closely related to the fate of component research. At present, ideas are developing rapidly and, generally speaking, the regionalization of programmes is much more a problem of means than a question of political will. In like vein, the publication in the near future of a map of the various ecological zones should facilitate the establishment of national priorities for research and development.

As of now, arrangements are under way for the setting-up of multi-disciplinary teams for each zone, taking into account both means (human, financial, and material) and priorities. In this light, one team has

been in the Upper Niger Valley (OHV) zone since May 1985, with financing for ten years obtained through USAID. The extension of this project to the Mopti zone on the same terms is planned for five years after the take-off of the OHV zone.

Finally, discussions are under way for the setting-up of a team for the Office du Niger zone. After a prospecting mission by a multi-disciplinary team, a draft proposal to this effect was submitted to the board of the company.

It is also planned to publish an internal review within the framework of the main project financed by USAID, as well as to set up a large-scale training programme for all levels of workers. All of the above will no doubt help to motivate researchers and to create a more favourable climate for scientific discussion.

One of the priority tasks for systems research in Mali will undoubtedly continue to be training, especially the training of organizers and peasants. At present, some difficulty is being experienced in recovering, with the appropriate educational tool, all the information accumulated by the research body. To deal with this problem, it is imperative that researchers equip themselves with adequate means, by drawing on the appropriate techniques as well as the available expertise in the fields of training and communication.

Conclusion

The Farming Systems Research set-up established in the CMDT zone clearly shows that it came as an answer to the needs of both Research and Development. It brought to light the following points:

1) that Research had insufficient knowledge of the environment and of the people for whom the results were intended;

2) that the farmers, in possession of a valuable body of empirical knowledge, could and should be associated with their own development at all levels, including that of research;

3) finally, that the researcher could speak a language which the peasant could understand, without necessarily falling back on the services of the extension worker.

This situation in Mali allowed for a re-examination of certain received ideas, as well as certain of our own practices, notably the idea of the absolute validity of certain research results. Thus researchers would appear to have realized that it was better to start with the existing set-up and modify it, rather than cast doubt on the entire system. In actual fact, it is the acceptance by the farmer/breeder of the FSR techniques and methods which is the only real gauge of success in this respect.

An equally important aspect, on which all researchers are agreed, is that the "production" of technical innovations is not sufficient in

itself to set in motion any real process of development. Upstream, and even more importantly downstream, there must be an all-out development policy applauding, and giving its blessing to the adoption of, the said technical innovations. This implies that these would have been worked out against the back-drop of a coherent and consistent agricultural policy endorsed by planners and "developers" and fully in touch with the peasant world.

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A FRAMEWORK FOR ASSESSING FARMING SYSTEM ACTIVITIES IN NATIONAL SETTINGS IN WEST AFRICA: WITH SPECIAL REFERENCE TO SENEGAL, NIGERIA, AND MALI

By

D.C. Baker and D.W. Norman

Introduction

As was indicated in the introductory material circulated about this workshop, there is a great deal of location specificity in terms of how FSR is undertaken in West Africa. The organization and strategies of FSR programmes in each country have been influenced greatly by the historical background of agricultural research in the area, the mandate of the institutions in which they are located, and available resources. As a prelude to discussion of the Senegal, Nigeria, and Mali background papers, we were asked to compare FSR programme organization and strategies with respect to the following topics:

1) Linkages between farming systems research (FSR) and component research (on-station research).

2) Linkages between research and development (including extension) activities.

3) Problems of sequencing FSR field activities and roles of the various disciplines involved in FSR.

4) Problems of involving donor agencies in FSR activities.

Rather than spending a great deal of time on a comparative discussion on the country experiences, we have tried to highlight recurring themes which might provide a framework for evaluating the country experiences.

Before looking at the four topics assigned to us, we would like to start by presenting a definitional section so that participants at the workshop are aware of our own characterization of approaches to FSR. We appreciate there are currently many approaches used in different countries and that the plethora of alternative experiences and conceptualizations of FSR sometimes hinders communication. However, it is obvious that fundamentally there is a great deal of common ground as

to what farming systems activities really mean. We then give a brief historical perspective on FSR in West Africa, highlighting differences between the anglophone approach as developed in Nigeria and the francophone approach pioneered in Senegal. Also a brief review is given of institutionalization issues since, in essence, how the problems or issues assigned for consideration in this paper are dealt with will relate to what type of institutionalization is being adopted and the degree to which it has progressed. These sections then lead into a more detailed discussion of the topics assigned to this paper.

Approaches to Farming Systems Research

The primary objective of FSR is to improve the well-being of individual farming families by increasing the overall productivity of the farming system in the context of both private and societal goals, given the constraints and potentials imposed by determinants of the existing farming system. It is generally agreed that Farming Systems Research consists of two thrusts towards increased productivity:

1) The development and dissemination of relevant improved technologies and practices.

2) The implementation of appropriate policy and support systems to create opportunities for improved production systems and to provide conditions conducive to the adoption of technologies already available.

Conceptually, at least, the vital interface between relevant technologies and relevant policy support systems is recognized in FSR. In practice over the last decade, however, the term Farming Systems Research has usually referred to the development and dissemination of relevant improved technologies through on-farm research. Thus, one of the key continuing issues when assessing country experiences is the balance between technology improvement and policy and support systems improvement. This is a particularly relevant issue now since some donor agencies, those supporting many of the FSR projects in West Africa, are beginning to ask themselves whether policy analysis, institution building, and infrastructure should not be receiving more attention relative to technology research.

Another notion related to evaluating country experiences with FSR is the definition of minimal requirements for research to be considered FSR. Clearly FSR must entail on-farm research but on-farm research per se is not necessarily FSR. For example, in many African countries, multi-location component testing was carried out on farmers' fields before and after regional sub-stations were established. We would not consider this to be FSR. More common than the case of non-FSR technical research, however, is the history of non-FSR social science research throughout Africa. Richards (No Date), Berry (1983), and others have identified numerous significant studies on African farming systems by anthropologists, geographers, and some agricultural economists which predate Farming Systems Research. While these studies are retrospectively being called FSR by some observers, most lacked a technical

perspective and the emphasis on identifying means of improving farm productivity which we consider a sine qua non of FSR.

We recognize that there is little to be gained in debating whether a research activity is FSR or not. Rather, we raise this definitional issue because the interpretation of what is considered to be FSR greatly influences the issues to be discussed in this paper, such as relationships to component researchers and development agencies. We would characterize the mainstream of FSR research in the following manner.

1) The farming family - or more refined units of consumption or production - are given centre stage as the consumers of improved production technologies. FSR involves an emphasis on farmers' priorities and tapping the "body of knowledge" possessed by farmers.

2) The farm as a whole and the social organizational context of farming are viewed in a comprehensive manner and the choice of priorities for research reflects initial study of the whole farming system.

3) Research focuses on production sub-systems but the connections with other sub-systems are recognized and evaluation of research results explicitly takes into account linkages between sub-systems. In fact, a common feature of FSR is an emphasis on exploiting complementary and supplementary relationships in farm systems. Nevertheless, as long as the concept of the whole farm and its environment is preserved some factors determining the farming system generally are treated as parameters.

4) FSR requires use of an interdisciplinary or, at least, a multidisciplinary approach.

5) FSR is viewed as a dynamic and iterative, problem-solving process which complements experiment station-based agricultural research and contributes to the improved effectiveness of both commodity research and development agency (particularly extension) activities.

To the extent a research programme deviates from this "mainstream" characterization, it may still be considered FSR but implications obtain for relationships with component research and development agencies, sequencing, and the roles of disciplines. For example, in FSR focused on problems related to nutritional deficiencies rather than low resource productivity, agronomists might play a lesser role than otherwise and linkages with development agencies might be stronger than with component biological researchers.

Even within the sub-set of on-farm research activities using a farming systems perspective, debates have arisen over the breadth and scope of approaches to FSR, or what might be called "FSR strategy." Collinson has suggested FSR strategies can be summarized as FSR "in the large," "in the small," and "with a pre-determined focus" (Norman and Collinson, 1986). It is important to understand these alternatives and

their implications for FSR coordination, linkages, and institutionalization.

FSR "in the large" treats all system parameters as potentially variable in a wide ranging search for improvement. It is perhaps analogous to the development of a new farming system which uses the technological "state of the arts" to model what could be done in a particular situation with existing know-how. It is not particularly complex in concept but extremely complex in implementation. In essence, it departs from the incremental change spirit of FSR. The "themes lourdes" of the "Unites Experimentales" in Senegal might be considered FSR "in-the-large." Alternatively, one might posit a situation in which there was not even a predisposition to address production problems as opposed to consumption, education, migration, or other issues affecting farmer welfare.

Both FSR "in the small" and FSR "with a pre-determined focus" recognize that small farmers evolve from their existing situation in steps. The content and scale of these steps must necessarily be compatible with farmer resource endowments, their risk ceilings, and their management capabilities. Both seek a focus within the system which identifies potential development steps. Because both recognize the step by step development process in small farming and both seek to identify steps in technology, there has been confusion between the two. The difference is that FSR "in the small" arrives at a focus within the system in the course of diagnosis, while FSR "with a pre-determined focus" moves into the system to research an enterprise, or one facet of an enterprise, looking for improvements within that focus, which are compatible with the whole farming system. The two approaches have implications for institutionalization, which are discussed below.

A final definitional issue relating the topics to be discussed below is how the FSR process is conceptualized. About ten years ago at a meeting in Mali (IER, 1977), it was agreed that conceptually there are four distinct farming systems research processes, which are referred to as stages of research.

1) The descriptive or diagnostic stage in which the actual farming system is examined in the context of the "total" environment to determine the constraints farmers face and to ascertain potential flexibility in the farming system in terms of timing, slack resources, etc. An effort is also made to understand goals and motivation of farmers that may affect their efforts to improve the farming system.

2) The design or planning stage in which a range of strategies is identified that are thought to be relevant in dealing with the constraints delineated in the descriptive or diagnostic stage either through breaking them (more difficult) or avoiding them by exploiting flexibility in the farming system (easier). At this stage, heavy reliance is placed on obtaining information from the "body of knowledge." This "body of knowledge" is derived from experiment station-based, researcher managed and implemented type trials (RM-RI) off the experiment station, and knowledge obtained from the farmers themselves. This

stage in essence involves ex ante evaluation from the viewpoint of:

(a) Technical feasibility - whether the physical transferability of technical relationships established elsewhere is valid and thereby contributes to the solution.

(b) Economic viability - whether the proposed solution is economically viable in the local situation of the farming family.

(c) Social acceptability - whether the proposed solution is likely to be acceptable to the farming family.

3) The testing stage in which the most promising strategies identified at the design stage are evaluated under local farmer conditions. This stage usually consists of two steps:

(a) Researcher managed but farmer implemented tests (RM-FI) to establish whether transferred technical relationships are altered by farmers' management of non-treatment variables.

(b) Farmer managed and implemented (FM-FI) type tests when the teams are confident that relationships will hold but need to evaluate the proposed technologies under local socio-economic circumstances.

Where transferred technical relationships appear likely to be distorted by differences in local natural conditions, researcher managed and implemented (RM-RI) experiments will be a prerequisite to the subsequent RM-FI and FM-FI stages, and may be undertaken by the FSR team.

4) The recommendation and dissemination stage in which the strategies identified and screened during the design and testing stages are implemented.

In the ten years since these stages were identified, many alternative characterizations of the FSR process have been proposed. Many schemes are based on specific activities, such as specifying recommendation domains or carrying out a rapid rural appraisal survey, leading to on-farm experimentation, etc. Other representations of FSR stages take a research system perspective and therefore include categories such as on-station and off-station research - as is the case in Nigeria. We view most of these representations of FSR stages as being complementary to the initial elaboration of FSR conceptual stages.

Over the years, though, a key issue has arisen with respect to the conceptualization of the FSR process which is important for FSR in national programmes. It has become clear in practice that FSR cannot be viewed as a uni-directional problem solving methodology. Diagnosis, problem identification, and the design of strategies are on-going processes and there simply are not clear boundaries between the various stages or conceptual processes of FSR. This might seem obvious to most

FSR practitioners but we have observed over the years that many national research programmes still are predicated on the belief that improved technologies start at experiment stations, then move to extension and then to farmers. The common role of FSR in a national context is to insert screening and on-farm testing of technologies between station research and extension. Within the context of FSR programmes, we also have seen much evidence of directional thinking. For example, there is prevailing expectation, particularly among those with limited experience, that diagnosis takes place, leading to design and testing, and hopefully to dissemination.

Continued directional thinking with respect to both national research programmes and FSR processes has created an atmosphere which enables research and development activities to continue in relative isolation from each other. Those FSR programmes which view the stages of FSR as processes which from the beginning go on simultaneously - albeit with differing emphases over time - are likely to have much different types of linkages with component researchers and with development agencies, not to mention with farmers. In this vein, the growing interest in "farmer-back-to-farmer" approaches and farmer participation seems to reflect understanding of the need to move away from directional thinking relative to the sequencing of FSR activities.

Historical Context of FSR

It is apparent that the historical context has an influential bearing on the approach used to conduct FSR activities. The body of knowledge about existing farming systems and progress made on breeding, agronomic and animal husbandry component research are major determinants of FSR team activities. Moreover, institutional rigidities make it difficult to completely change the way in which programmes have been undertaken in the past.

When reviewing the background of FSR in West Africa, it is easy to dichotomize between what Fresco (1985) called the anglophone and francophone approaches to FSR. Fresco's widely cited paper comparing anglophone and francophone FSR made many points worthy of particular emphasis. For example, she found that FSR in francophone countries has often been more closely associated with development agencies. This, at least on paper, has had a number of consequences. For example, national or regional policy issues have been more likely to receive more emphasis in francophone than anglophone countries. Moreover, according to Fresco, past and current FSR activities in francophone countries have constituted an integral part of the long-term country-wide rural development effort, while in anglophone countries FSR activities have been primarily concerned with the adaptation of existing agricultural research to provide technology relevant to low resource, low external input farmers. As a result, the links with on-station or component technology research have generally been stronger in anglophone countries while linkages with extension/development agencies have tended to be stronger in francophone countries.

Fresco (1985), and others such as Eicher and Baker (1982), has further emphasized that social scientists have played substantially different roles in francophone and anglophone countries. Economists working in francophone Africa generally focused on household and development dynamics, particularly the evolution of traditional community organizations in the face of their incorporation into world markets and in response to population growth. Interest in settlement patterns and the evolution of land use was stimulated by the relatively greater role played by geographers in francophone countries. In the International Agricultural Research Centres (IARCs), upon which Fresco bases her comparison, social science inputs have been dominated by micro economists with neo-classical training and an orientation towards production economics.

In Table 1 is presented information on general differences between the anglophone and francophone approaches based on a table originally produced by Fresco. Although all the workshop participants may not agree with it, we have included it to perhaps put later discussions in perspective and to stimulate additional thinking on the subject.

We might note that Fresco's paper and the growing consensus on differences between anglophone and francophone FSR have largely been based on a comparison of the francophone research approach followed in the French initiated research institutes (particularly ORSTOM and IRAT) or a few well-known experiments such as the Unites Experimentales in Senegal and the anglophone approach pioneered at the IARCs. Such comparisons may overstate the differences in national experiences with FSR in countries such as Mali, Nigeria, and Senegal when viewed from a

Table 1. Anglophone and francophone approaches to FSR compared

Characteristic	Anglophone	Francophone
Linkages with:		
- Component Research	Stronger	Weaker
- Development Activities/Extension	Weaker	Stronger
- Policy	Weaker	Stronger
FSR Team Composition:		
- Agronomist	Same	Same
- Animal Scientist	Same	Same
- Agricultural Economist	Stronger	Weaker
- Sociologist	Weaker	Stronger
Participation of the Farmer:		
- RM-RI	Weaker	Stronger
- RM-FI	Same	Same
- FM-FI	Stronger	Weaker

more distant perspective. From a Botswana viewpoint and perhaps many other African countries with small research establishments and less agro-climatic diversity, there appear to be more similarities in the historical context for farming systems research in Nigeria and Senegal, for example, than there are differences.

1) In both countries, component research was initiated long in advance of FSR in research institutes or universities established by colonial governments. Most of these research organizations were oriented towards transforming agricultural production and increasing profitability primarily in export sectors. Linkages with farmers were almost non-existent, except for limited interactions due to multi-local trials, for example, in Senegal. Nevertheless by independence, there was an increasing orientation towards food crops in both countries, a growing interest in understanding real farmer circumstances, and a wealth of agronomic research which provided a firm basis for formulating FS interventions.

2) In both countries, interdisciplinary research generally referred to technical research organized along commodity lines. The former West African French research institutes which were nationalized or regionalized during the post-independence period each had mandates for particular commodities. In Nigeria, national agricultural research was also organized along crop and livestock lines and, particularly after federalization, each research institute was assigned responsibility for specific crops or animals. Even in universities such as ABU, interdepartmental research programmes were developed along commodity lines. Only beginning in the mid 1960s did interdisciplinary research in both countries begin to refer to cooperation of social scientists with the various technical disciplines.

3) Both countries were the focal point of early donor funding and the level of donor funding has continued to be substantial. Both the British and Americans were playing a major role in Nigeria during the early 1960s and the French chose Senegal as the centre of their African research and development programmes during the post-independence period.

4) Both countries had valuable experiences with FSR beginning in the late 1960s, before FSR was identified as a specific research and development approach. The Unites Experimentales programme in Senegal which lasted from 1968 to 1980 is now universally recognized as one of the earliest attempts at FSR within the context of a developing country national programme. The programme was based on the notion of concentrated development within a well-defined geographical area and entailed promotion of packages - some of which (themes lourdes) were designed from the top-down to transform production systems. Still, through the programme, many recommendations were developed or modified and research and extension personnel were brought into closer contact with farmers and with each other. Fresco (1985) goes so far as to say that

generation of recommendations for the extension service became a top priority. In Nigeria, attempts at FSR were initiated by researchers at the Institute for Agricultural Research at Ahmadu Bello University during the early 1970s following a series of village level studies carried out by social scientists during the second half of the 1960s. IAR researchers were able to forge an interdisciplinary effort to conduct on-farm experiments on potential packages for sole plantings of sorghum, cotton, maize, and groundnuts. The Nigerian efforts, however, were based on a single research institute as opposed to the Senegal experience in which an integrated research and development approach was being piloted as a country development strategy. Still, both the Senegal and Nigerian activities reflected an interest in pursuing on-farm interdisciplinary research to identify constraints and to test improved technologies.

5) Mainly in light of the above, both Senegal and Nigeria had favourable institutional contexts for initiating national programmes for FSR relative to most other African countries. The dominant roles played by both countries in the strategies of their respective colonial governments led to substantial infrastructural, institutional, and human capital investments relative to other countries in West Africa. (Although still insufficient!) In both countries, there were well-established institutes or universities where FS activities could be located. In Senegal, all research was brought under ISRA's umbrella and in Nigeria the independent research institutes were federalized. Thus, in both countries there was a degree of national coordination of research but substantial decentralization along regional lines with respect to specific research decisions.

6) On a less optimistic side, in both countries a substantial gap existed between research and extension at the time FSR activities were initiated at the level of national policy. In Senegal, research was coordinated by ISRA but extension activities were the responsibility of independent, parastatal development agencies. In Nigeria, there were more than twenty research institutes located in the Ministry of Education, Science and Technology but extension was primarily located in the Ministry of Agriculture. It was assumed that recommendations could be generated independently and then passed on to the extension services.

Having summarized briefly some of our observations on similarities between Nigeria and Senegal, we do not wish to imply that there were not, and are not, significant differences. Indeed we will discuss some of the key differences below. Rather we want to make the point that there appears to have been a convergence going on in regard to the background to FSR activities relative to the gap which long existed between francophone and anglophone disciplinary research. The discussion on the four topics given for this paper should be viewed in this context, bearing in mind that FSR is seemingly moving towards a middle ground in West Africa which will exploit the strengths of both francophone and

anglophone research and development experiences and minimize the weaknesses of each approach. Nevertheless at the same time it is unreasonable to eventually expect that there will be a homogeneous approach. Country differences are likely to be important in determining the most appropriate model. Tourte and Billaz (1982) and Pickering (1985) have quite rightly emphasized the significance of the triangular linkage between agricultural research institutions, extension/development agencies, and farmers. What we are all struggling with is to find a way in which each of the links is strong and productive. So often one of the links is weak. Because of the tendency for a vertical chain of command and control in the research and development/extension institutions within national programmes, the link between them appears to be particularly vulnerable.

Institutionalization of Farming Systems Activities

In West Africa, research and extension organizations are usually placed under Ministries of Agriculture or parastatal organizations. Possibly the most unique situation in West Africa is that of Nigeria where some agricultural research institutes are located at universities and in some cases universities have retained independent research responsibilities along the lines of the US land grant model. In general terms, there is considerable bureaucracy in most of these organizations and as a result changing the status quo involves conflict. Such changes are inevitable in situations where FSR activities are being introduced because most countries have not been involved in this type of work for many years. It is not surprising that attempts to adopt and institutionalize FSR activities in agricultural research and development agencies have often faced the inertia, red tape, and vested interests typical of such bureaucracies.

The introduction of FSR activities in national programmes throughout Africa has ranged from the addition of a social scientist to existing multidisciplinary commodity research teams, to setting up of special teams which include the whole range of disciplines, to various positions in between. Obviously the introduction of innovational institutional components needs to be geared in the agricultural system within which change is being made.

A key institutional question which has repeatedly arisen is whether research or development/extension institutions are the appropriate location for FSR activities. This is a continuing source of debate but perhaps two points dominate discussion on the relative merits:

1) Farming systems activities have a local specific area orientation highly compatible with that of the extension/development agencies.

2) If FSR activities are located with extension/development agencies, and research and extension/development agencies remain essentially separate bureaucracies, there is a great danger that component or on-station research will remain isolated from its small farmer clientele. (In the northern

part of Nigeria, for example, on-farm research is undertaken by the Agricultural Development Projects (ADPs), somewhat in isolation from the Institute for Agricultural Research at Ahmadu Bello University. The only links that appear to exist between the two are based on personal relationships.)

FSR activities are increasingly seen as an effective device for linking research and extension, something which is lacking in most national agricultural programmes. The discussion on location is complicated by the different approaches to FSR as discussed earlier.

Experiences from nearly everywhere show it is easiest to establish linkages in the department or institute where an FSR programme is institutionally located and it is easier to establish linkages when research and/or extension officers are in close physical proximity. For example, in Botswana three projects have been located in the Department of Agricultural Research and have set up more or less close linkages with research station personnel. The team which had the closest linkages was the one that had both on- and off-station researchers as permanent team members. The team with perhaps the next closest linkages was the one that was sufficiently close to the main experiment station that some of the field monitoring of trials was carried out collaboratively. The team that was institutionally located in extension naturally had the closest linkages to development agencies in the country. Based on the experiences of these teams, FSR personnel in Botswana have agreed to recommend that teams should be composed of representatives of different departments rather than either being from a single department or being located in a newly created institutional slot. Perhaps such an approach is not feasible in countries with much larger bureaucracies and more personnel but the importance of institutional location is a key variable to consider when assessing country experiences with FSR coordination and linkages.

With the well-established commodity research institutions in Nigeria and Senegal, FSR has been institutionalized in both countries by adding special FSR programmes. In Senegal, FSR has been added as a separate department in the national agricultural research institution, ISRA. Closely aligned with the introduction of the FSR field team was creation of a Central Systems Analysis Group to coordinate FSR activities and a Macro-Economic Analysis Bureau to address policy and support system issues. The Central Systems Analysis Group should enable better coordinating of donor participation in FSR activities and might provide sufficient weight to FSR activities to help ensure coordination with commodity research and development agencies. One would anticipate closer linkages to commodity researchers since research is the institutional home of FSR activities.

In Nigeria, research institutes such as the IAR at Ahmadu Bello University have institutionalized FSR by creating a separate farming systems programme within the institute. There should be substantial opportunity for close collaboration with commodity researchers under this format but concern might be raised about the effectiveness of individual institutes to coordinate donor activities and there clearly might be problems in establishing linkages with extension and other development activities. This problem is in fact highlighted in Abalu's

(1986) paper, although in the south-eastern part of Nigeria, collaboration seems to be better (Unamma, Personal Communication).

In Mali, also, a separate division for FSR has been created in the national agricultural research institution, IER (Berte, Diarra, and Tangara, 1986). However, because in comparison with Nigeria and Senegal, Mali has fewer resources, questions can be raised as to whether Mali can, in the future, hope to meet the costs of such a programme - as currently articulated - from its own budget. Unlike ten years ago, when FSR started in Mali, alternative models for institutionalizing FSR within national settings have more recently been proposed by Collinson (Norman and Collinson, 1986).

Linkages Between Farming Systems Research and Component Research

Justification

Component research is mainly undertaken on experiment stations. As indicated earlier, there is considerable complementarity between FSR activities and experiment station-based research with reference to overall research system objectives. FSR can contribute in two ways:

1) By the adaptive testing, screening, and modification at the farm level of technologies developed on experiment stations.

2) By closely specifying requirements for improved technology development that can be fed to experiment station-based research programmes. Hopefully this will contribute to the cost efficient development of improved technologies.

Obviously, the second contribution has a longer term payoff than the first one. It is also more difficult to implement because it implies a more interventionist role on the part of farming systems teams. However, in the long run this is likely to be a very important role for FSR teams. To what extent this role can be exploited will depend very much on the personal relationships between the FSR teams and experiment station-based scientists, and the institutional linkages that exist.

It is now widely understood that specification of requirements for the development of improved technologies on experiment stations involves more than identifying research priorities. A related, and perhaps - in the short run - more realistic role than trying to promote certain research priorities, is to encourage experiment station-based researchers to consider the context of the farmers' environment in their experimental work. This will help ensure that even basic and applied commodity research undertaken on experiment stations is relevant. Some examples on how requirements for improved technology development might be specified by FSR teams are as follows:

1) It is very important for experiment station researchers to think through whether the special environmental situation of the experiment station is in fact providing a realistic

environment for development technology. Would the technology fail completely if it was then transferred to farmers' fields? For example, a great deal of herbicide work probably needs to be done on farmers' fields where the weed complex is likely to be very different from that on the experiment station. At a minimum, FSR teams could provide monitoring data on the technical environment found on farmers fields so experiment station researchers can assess environmental differences.

2) The results from experiment station research should be more relevant if researchers adjust the levels of their experimental variables to the levels farmers might actually be able to implement. If the level of inputs required is too high for the farmers to adopt then the research has relatively little relevance. This applies not only to external inputs like improved seed or fertilizer but also to endogenous inputs such as household labour availability.

3) A closely related consideration is what should even be the experimental and non-experimental variables in technology development done on the experiment station? It is not usually possible to assume that the "non-experimental variables" will be the same on-station and under farmers' conditions. For example, seed bed preparation is often much better done on experiment stations but this usually is considered a non-experimental variable in crop breeding programmes. Varietal testing under such conditions often gives very different results from what would occur if the seed bed preparation more nearly approximated that generally used by farmers.

4) Evaluation criteria on experiment stations are generally confined to yields per unit area but this is not always the relevant criterion to use from the viewpoint of the farmer. For example, many empirical studies in West Africa have shown that labour, particularly during certain peak periods, is often more limiting than land. In farming systems where both land and labour are available, the returns to additional cash inputs might be the most important consideration facing a farmer. In drought prone environments it may be most appropriate to consider the returns to the net soil-water balance over a season. Obviously on small experimental plots, it is often difficult to bring into play other evaluation criteria that are important to farmers. However, whenever possible, consideration of other criteria can be very important in ensuring that potentially relevant technologies are not rejected before they can ever be screened at the farm level.

To be truly effective, collaboration between FSR teams and component researchers must go beyond adaptive testing by FSR teams and the feeding-back of information to experiment station researchers. Experiment station-based research often involves, implicitly or explicitly, putting components together in packages. The major advantages of packages include the complementary or synergistic effects

between the various components. The disadvantages of packages are the complexities of putting them together and the likelihood of them being inappropriate to farmers in their entirety. Thus, when such packages are put together it is important that the components are assembled in such a way that they are based on an understanding of the main effects and first order interactions for each component with non-experimental variables being held at the farmer's level. Where packages contain components heavily dependent on interactions, which at the same time compete heavily with resource allocations in the system, an incremental approach is required to the recommendation and extension of the package (Collinson, 1972). Thus, it is important for experiment station-based researchers and FSR teams to work closely together to ascertain what step-wise approach could be used to the adoption of relatively complex technologies. While experiment station-based researchers are often in the best position to know the interactions between the various components, FSR teams can, through collaborative work, help design step-wise approaches for introducing technologies and also design fall-back strategies if farmers deviate from the proposed recommendation. Such collaborative work is very important in widening the possible applicability of packages to the needs of larger numbers of farmers.

Establishing links

Simplistically, three types of arrangements can be visualized with reference to the relationship between FSR work and component research. The three listed in order of ease of establishing links are as follows:

1) The addition of a social scientist - usually an agricultural economist but possibly also a sociologist - to experiment station-based commodity research teams, can help bring the farmers' perspective to their experimental planning and evaluation.

2) Establishment of regionally based FSR teams institutionally located in research organizations.

3) Establishment of regionally based FSR teams institutionally located in another department.

Scenario (2) has in fact been adopted in all three countries focused on in this paper, although the link with crop commodity research (component technology) research teams seem to be best developed in Nigeria.

Obviously, option (1) above is probably the least disruptive and lends itself to a "pre-determined focused" FSR programme. There are however a number of problems related to this type of FSR programme. (These are discussed in detail elsewhere, Norman and Collinson, 1986.) The other two approaches, (2) and (3) above, lend themselves more to FSR "in the small." However, having said this it is quite difficult, as mentioned earlier, for FSR teams institutionally located in a research institute, with a particular commodity mandate, to establish links with institutes with different mandates. A case in point is the FSR work in Nigeria at Ahmadu Bello University (Abalu, 1985). In Senegal, there also have been difficulties in negotiating protocols outlining

collaborative arrangements between the ISRA production systems teams and the regional development agencies.

In the first and second scenarios mentioned above, the personal relationships established between on-station and FSR researchers become critically important. Simmons (No Date) indicates that there are three common types of relationships between on-station scientists and off-station FSR researchers: mutually exclusive, leading - supporting, and uneasy. The mutually exclusive relationship unfortunately seems to be the most prevalent and generally evolves from being spatially separated, competing for the same very limited research resources, and a lack of mutual respect. With reference to the last point, off-station FSR researchers often think that experiment station research is out of touch with reality while experiment station researchers are often sceptical about the research and analytical techniques used by FSR researchers including losing control over the so-called ceteris paribus conditions in experimentation, and the resulting lack of precision in the results.

Perhaps the most constructive relationship but one that some off-station FSR researchers may have difficulty accepting is the leading - supporting type of relationship. As Simmons quite rightly points out, this may be the relationship that will pay off most in the long-run. In essence, on-station researchers are considered to be ultimately responsible for creating and sustaining a flow of consistently improved techniques and inputs. The FSR team by contrast supports the effort of the on-station scientists both by helping them to verify their on-station results on farmers' fields and by helping to more precisely define the research problems along lines which will increase the chances of actually developing technologies which will be of use to farmers. Having said this, however, it is important that off-station FSR research is not dominated by researcher managed and implemented (RM-RI) type work requested by the experiment station-based scientists. It is also important that the incentives to do on-farm research - and the role of farmers in setting priorities - is not reduced by limiting FSR teams to a supportive role involving only adaptive and verification trials.

When it can be managed, collaborative work between FSR and experiment station-based researchers together on farmers' farms (and on-station) is potentially the best way of establishing a good relationship. Participation in on-farm fieldwork helps broaden the perceptions of the experiment station-based researchers and where necessary, provides them with an environment which is closer to that of the farmers for testing their technologies. In Botswana, we are having some success in this type of collaborative work. Obviously, collaborative work is difficult in areas where the experiment station is a considerable distance from the farm experimental sites, such as tends to be the case in Mali. In Senegal, this should not be too much of a problem with the system regionally based experiment stations. It is perhaps more of a problem with reference to Nigeria although there should be substantial opportunity for collaborative research within the context of institutes such as IAR.

Other ways of encouraging the development of better linkages are for FSR teams to encourage commodity researchers to participate in

informal diagnostic surveys, to hold field workshops to which experiment station-based researchers are invited, and also to seek their advice on an informal basis to specific problems identified in the field.

With reference to the third scenario, the linkage between on-station based research and FSR teams is likely to be weakest in situations where such teams are institutionally located outside the research organization. However, in such cases the linkage with the extension/development agencies should be stronger. One danger faced in such a scenario is the possibility that FSR teams which are institutionally isolated from component researchers will begin to divert part of their effort to component research, as may in fact be the case of the ADPs in the northern states of Nigeria. Such a duplication of effort is obviously a waste of resources.

Linkages with Development Activities

Justification

As indicated earlier, improvement of the productivity and welfare of farmers is dependent not only on the development and dissemination of relevant improved technology but also the implementation of good policies and support systems.

Aside from the institutional location issue which has been discussed above, the types of linkages FSR establishes with development agencies and policy bodies depends on whether the FSR teams adopt a submissive or aggressive approach to infrastructural and support system improvement (Zandstra, 1978). In many FSR programmes, field teams have adopted a submissive approach, trying to identify technologies while accepting the institutional environment as a given. This, in many cases, has placed too great a burden on the development of relevant improved technology for improving the productivity of farmers. As indicated earlier, improving the productivity of farmers means the dissemination of both relevant improved technologies and policy/support systems. As FSR has shifted to national settings, however, FSR teams have become more aggressive in citing the results from on-farm testing of technologies to further the case for particular policy changes or modifications in support systems. For example, success with a fertilizer trial might lead to a call for increasing fertilizer distribution in an area.

Relatively few FSR programmes have taken a further step and have actually made assessment of policies and support systems priority areas of research. This may, however, be the wave of the future in FSR as more and more countries and donors shift towards broader views on achieving food security. Such a rebalancing is likely needed in FSR since past experiences would suggest that too much is currently being asked of technology improvement programmes. However, influencing changes in policies themselves is likely to be a lot more difficult than making suggestions on how to more efficiently implement given policies.

Establishing links

In general, as was indicated earlier, the easiest way to establish linkages with development agencies is to locate FSR teams in those agencies. This has been a very uncommon approach, except where there have been parastatals which are already responsible for both research and development activities for particular commodities - more frequently the case in francophone countries.

A second approach might be to have one or more of the individuals participating on an FSR team be seconded from a development agency or ministry. For example, an FSR economist might come from a planning unit and an extension agent might be assigned to an FSR team in order to assume responsibility for final stage testing and dissemination. In Botswana, we have been trying this approach with mixed results thus far. One of the major problems is that a scarcity of trained personnel discourages agencies from making secondments on a long term basis. Other problems encountered are the concern of the individuals involved that they will be overlooked when promotion decisions are made and a tendency for the influence of seconded individuals to decrease as soon as they are no longer directly affiliated with their development agency or ministry. On the other hand, such secondments can be quite effective when there is already a commitment to decentralize development programme (including extension) activities.

Two other approaches at establishing linkages might be envisaged, both of which have been tried in somewhat different formats in Senegal and Nigeria. The first is to establish a particular individual or agency to provide the interface between extension/development activities and research. The second is to establish a distinct sub-set of any FSR programme which is exclusively or nearly exclusively focused on issues of concern to development agencies rather than with technology improvement.

In Nigeria, FSR teams have generally been placed in research institutes. Following a modified land grant system, research results are passed to the Ministry of Agriculture in the form of extension recommendations. In the FSR programmes, researchers are linked to farmers and in the extension programmes, extension agents are linked to farmers, but the link between extension agents and researchers is weak. To help overcome some of the problems in linking research and extension, one of the twenty-two research institutes has been assigned specific responsibility for promoting research extension linkages. For the most part, though, linkages are in terms of information flows - generally from research to extension - rather than based on collaboration. With respect to linkages with policy, some of the research institutes have economic or social science departments which are involved in FSR and which try to address policy and support system issues.

In Senegal, parastatal development agencies have responsibility for extension activities. These agencies have specific geographic responsibilities which generally correspond to agro-ecological zones. As mentioned above, one of the main FSR institutional innovations in Senegal to promote closer linkages with development planning was to create a Macro-Economic Planning Bureau and a Central Systems Analysis

Group at the same time the production systems (FSR) teams were established. It is not clear though how much the agenda of the macro-economists and the economists on the field teams have been coordinated.

When ISRA was restructured to include FSR, it was initially hoped that a person could be seconded from ISRA to the development agency where each FSR team was operating. As described in the Senegal background paper (Faye, Bingen, and Landais, 1986), these efforts failed in the Casamance. Instead, an inter-agency protocol was negotiated which enables an input from the development agency into the research programme and commits them more to the work of the FSR team. Such accords might hold promise to improve linkages but also could on occasion divert the FSR team away from investigations that might have a longer-run pay-off, to investigations dealing with short run crises identified by the development agency. There does appear to be no easy solution to this problem. Probably, of the three countries, the FSR team in Mali Sud has the best linkage with a development agency - in this case, CMDT. It appears that so much credibility has been achieved by the FSR team that their major focus on technology development and testing is in danger of becoming blurred because of requests by CMDT to do other work.

Finally, we might note that the alternatives discussed deal with formal linkages. In practice, the most prevalent and effective linkages established to-date have been the informal linkages which fieldworkers, whether in FSR or extension, have the opportunity to establish when they all are working with farmers, their primary clients. One alternative approach to establishing linkages which has received little attention is to concentrate on establishing linkages at the village level by having representatives of FSR and development agencies participate in selected village (or regional) governing bodies. In this way, farmers or their direct representatives can serve the role of identifying which research and development activities should receive top priority.

Sequencing Farming Systems Activities

Earlier, the various conceptual stages of FSR were outlined and the point was made that in practice there are no clear boundaries between the various stages over time. It may not even be necessary to go through all stages. FSR team confidence in the transferability of strategies during the design stage can mean perhaps going straight to FM-FI work or even to the dissemination stage. Conversely, it sometimes is necessary to test a package in order to diagnose problems with its introduction into a particular farm system context. Thus, the process of FSR is dynamic and iterative with linkages in both directions between farmers, researchers, and funding agencies. The iterative characteristic can improve the efficiency of the research process by providing a means of identifying and fine-tuning improved technologies for a specific locale.

Much of what has been said about the stages of FSR pertains to IARC activities and FSR research in a project context. In both cases, there has tended to be a diagnostic phase which leads more or less quickly into design and testing. Testing has been focused on one or a few

leverage points often related to the mandate of the research institute or project.

The growing body of experience with national FSR programmes suggests that the sequencing is often different when trying to institutionalize FSR with a longer run perspective. The main difference relates to the diagnosis and design processes. FSR diagnosis is generally based on rapid rural appraisal surveys, often followed by some sort of verification survey. This was the procedure used in the Casamance in Senegal, for example. Although such a procedure generally lasts anywhere from a few months to a single season, the investment of professional time is often substantial. Normally, rapid rural appraisal surveys lead to diagnosis, definition of research domains, and design of potential interventions to be tested on-farm.

In a national programme context, it is not clear that large "up-front" diagnosis, even in the framework of rapid rural appraisal surveys, is always needed or is always the best approach. In countries such as Senegal and Nigeria where there is a backlog of both social science and technical research and there are well-established research and development institutions, there is a danger that substantial investments in diagnosis at the beginning of the programme will inhibit development of linkages and credibility. Instead, the FSR teams are more likely to set their own agendas. These agendas are not necessarily based on farmers' priorities either because, in many cases, the FSR teams have only a superficial understanding of farm communities and decision-making dynamics as a result of rapid appraisal surveys.

An alternative which we have observed in several countries and, in fact, we have been attempting in Botswana, is to carry out a very minimal diagnostic, rapid appraisal survey, possibly only lasting a week or two prior to the first season. Obviously in this case, design and the first year's testing programme must be based on a review of secondary sources and must build on components and packages currently being tested on-station. In this case, the bulk of diagnostic research takes place after experimentation has been initiated and, consequently, can be more highly focused on issues identified as affecting the acceptability of technologies.

Closely related to the idea of shifting the majority of diagnostic research farther back in the process is a growing realization that the FSR process may have to be repeated with respect to each survey or testing activity. In other words, for each new intervention one starts with informal diagnosis based on interactions with farmers, designs a survey instrument or trial, pre-screens the questionnaire or design with farmers, implements, makes assessments in conjunction with farmers, iterates to the next idea, etc. What we are describing here is nothing particularly new to those engaged in FSR programmes but it does shift the emphasis in sequencing from that of turn-around speed, which dominated early discussions of FSR, to procedures appropriate for on-going institutionalized problem-solving research programmes.

One other sequencing issue should be noted with reference to assessing country experiences in FSR. In most cases with which we are familiar, the FSR process has stopped at the testing stage. In

relatively few cases have FSR teams become actively involved in dissemination and in even fewer cases has the FSR process included post-dissemination monitoring, re-design, and re-testing of a recommendation. Until now, this has been excused on the basis that it often takes ten to fifteen years to have a major impact when promoting farming systems changes. While this is clearly true, it does raise the problem of when is testing and screening by researchers enough and when should extension and farmers' independent demonstrations and decisions take over. The appropriate amount of caution probably should be determined more by the potential harm to farmers (which often is not that great except when involving major system changes) than by the risks to the credibility of particular researchers, although this may be an issue over which technical scientists and social scientists will disagree. The issue of where extension should take over, and assume major responsibility, is one the FSR team in Mali Sud is currently struggling with.

Roles of Disciplines

It is now generally accepted that there are three or four key disciplines that should be included in FSR teams. These are an agronomist, an animal scientist where livestock is an important component in the farming system, an agricultural economist, and whenever possible, an anthropologist/sociologist. Having said that, it does not mean that there is not an important and significant role to be played by others. Particularly important and central to the FSR effort of course is the farmer. Extension personnel also have a very important role to play. It is important to note that all parties should be together right at the beginning of the research process - something that was not possible with reference to the FSR team in the Casamance in Senegal.

All disciplines have their role to play in all stages of FSR activities. The relative importance of different disciplines will change depending on the stage but it cannot be over-emphasized that all are important at all stages. Too often, social scientists have been left to do the descriptive/diagnostic work, the technical scientists to do the testing work, and extension personnel to do the dissemination. However, there is no doubt that the interaction between farmers, technical scientists, social scientists, and extension personnel at the descriptive/diagnostic stage can be very important in highlighting problems and needs of farmers. Similarly, involvement of all the disciplines in the design stage can be very important in deciding on testing strategies that might be relevant to the farming situation. The role of the social scientist in helping to analyze the economic feasibility and social acceptability of the proposed strategies during the testing stage, is crucially important.

While most people would agree that technical scientists must assume greater responsibility for diagnostic activities, we have observed less consensus on the extent to which social scientists should be involved in implementing trials. We believe it is fair to say that many agronomists and animal scientists would prefer that social scientists help with analysis of trial results but play a minimal role in designing and implementing trials. Such views are justified on the grounds that the

team can be most effective if each person sticks to his or her comparative advantage. Some arguments against this view are as follows:

1) Production is an integrated technical and social activity and so testing and screening of technologies must be a participant observation process involving social scientists rather than merely a statistical testing of treatments.

2) Social scientists participating in FSR should have sufficient technical training that they are fully capable of designing and implementing farm level trials - as FSR technical scientists can be expected to be aware of and sensitive to farmer circumstances and priorities.

3) Any tendencies on behalf of technical scientists to sacrifice farmer management in order to implement designs which increase the potential for formal analysis can be countered by a substantial role for social scientists who tend to be biased towards farmer management and assessment.

Debate over appropriate roles has no simple solutions and can, in the extreme, lead to the setting up of complementary, but hopefully not competitive, trial programmes with the technical scientists concentrating more on RM-RI and RM-FI work while the social scientists concentrate on FM-FI work.

Less intractable still are the "boundary" debates which go on endlessly among the social science disciplines involved in FSR. One clear lesson from our experiences earlier and now in Botswana is that neither economics nor anthropology nor rural sociology is sufficient to understand the dynamics of farming and prescribe solutions for farmers. Any social scientist operating in FSR must be prepared to draw on the insights and methodologies of several social science and technical disciplines if he or she is to be effective.

Possibly more important than the specific disciplinary roles of FSR team members is their role vis-à-vis farmers and extension agents. With reference to the FSR team-farmer relationship, Simmons (No Date) has defined three possible kinds: the investigator - subject relationship, the collaborator - participant relationship, and the teacher - learner relationship. Many of us have been guilty of treating the farmer as a research subject, and also have a tendency to act as a teacher as far as farmers are concerned. Obviously, the ideal approach is to act in a collaborative mode with the farmers who participate directly in the research process. The meaning of participation goes far beyond simply contributing labour and land. It is also crucially important that farmers provide verbal feedback as to the wisdom or foolishness of suggested on-farm trials (including trial designs). Of course, the ideal situation would be for farmers to suggest themselves what kind of technologies they need and the trials they would like to be involved with. However, this does assume that the farmers already have enough information on the types of technology that might be available. Chambers and Jiggins (1985) have criticized fairly harshly the tendency of FSR workers not to really treat farmers as true participants in the research process. We all recognize the problems of doing this (Matlon,

Cantrell, King, and Benoit-Cattin, 1984) but the criticism is nevertheless often valid.

One experiment that we are currently trying in Botswana, to encourage greater participation on the part of farmers, is to have farmer panel discussions. Groups of farmers get together monthly with the FSR researchers and village staff to provide a forum for trials management and discussion of ideas. There are usually three objectives to these meetings. First, farm activities and problems which have arisen during the month are reviewed by each farmer and problems are discussed by the group. Notes are kept on the issues raised to be fed into discussion about future trials. Second, developments relating to the trials being implemented by the farmers are discussed, focusing on both implementation problems and observations on intermediate outcomes. With reference to this objective, we sometimes go on field visits during the meetings. Third, farmers are encouraged to identify and discuss potential alternatives to existing practices - an on-going design process in which farmers play a leading role. In these meetings, there is a subtle change in the relationship between researchers and farmers. For one thing, the numbers of farmers outweigh the researchers which makes the farmer input potentially more dominant. If there is one major drawback to this experiment thus far, it is the problem that there is little tangible benefit relative to when FSR programmes subsidize or even implement trials for farmers.

The other critical relationship is between FSR researchers and extension agents. Unfortunately, in many cases, researchers are technically better qualified than individuals in the extension service and tend as a result to discount any contributions extension agents might make. Obviously, also, many extension workers consider work on farmers' fields by FSR researchers as being an invasion of their turf. Consequently, they appear sometimes to be somewhat sensitive about such work. It is essential to create good collaboration between research and extension. How this can be done will depend upon the local situation. If it is not done, however, the chances are greatly increased that potentially useful innovations will not spread beyond the actual villages where the FSR team is most active.

Problems of Donor Agency Support

In the last 10 years or so, the lack of improved technologies that have been adopted by farmers particularly in Africa has encouraged donor agencies to think of alternative ways of stimulating the development and dissemination of relative improved technologies. One of the major thrusts during the last decade has been a great deal of support for FSR type projects. Unfortunately, it appears that donor agencies moved too rapidly in supporting FSR type work before it had a time to mature. Expectations were too high and results were expected too quickly. Methodologies for resource efficient ways of implementing FSR are still evolving and successful institutionalization of the approach is only likely to be achieved if it is given a much longer time period to establish its credibility. Nevertheless, donors which used their funds to precipitate implementation of FSR are now turning to its evaluation.

There is a great danger that evaluation will be done from an academic conceptual perspective and without due regard to the slow process of developing national and indeed international capacity.

The problem with most donor agency operations is that the very power and influence they carry can result in misallocation of resources within national settings. Having now or in the recent past put a lot of money into FSR, the trend among some of the donor agencies appears now to be moving back to the greater emphasis on commodity research. While some rebalancing in favour of commodity research may in fact be needed, it might be asked whether donor support for FSR has now resulted in national programmes that cannot be sustained once donor support is withdrawn?

What is important is to try and get donor agencies to fulfill the expressed needs of the national institutions. However, donor agencies are faced with the problem of getting quick short-term results from their aid programmes. This can cause problems in research and institutionalization projects where the gestation period is often rather long. In addition, many FSR programmes have been put into countries in Africa where there has not been a lot of technology already available on the shelf for plugging into the local environment. Thus, much of the work of FSR teams in such situations is feeding back priorities to researchers on the experiment stations. Although this is a valuable contribution, it goes against the need for quick returns from investment by the donor agencies.

It could also be argued that currently donor agencies on occasion are initiating projects when there is not sufficient national or technical assistance to reasonably ensure success. This has often been the case with FSR type projects. In addition to the difficulty of recruiting suitable staff to implement such projects, many of the personnel eventually are not in the field for more than two years. This is very unsatisfactory in an FSR project where even people experienced in FSR work take more than two years in a new area before they can truly be effective.

There seems to be no doubt that stronger control on the part of national agencies is important in order to ensure that the return from donor assistance to FSR work is maximized. At the very least, it appears there should be coordination at the centre which can nationally monitor and therefore influence FSR teams in the regions that may be financed by different donors. However, this is of course easier said than done.

Both Senegal and Nigeria appear to be in a relatively stronger position vis-à-vis donors than is the case with other African countries such as Mali. Neither country has a severe problem with research being dominated by a preponderance of expatriate staff, as is common in Africa. Both are trying to institutionalize FSR on a permanent basis, with a mind to recurrent cost problems, rather than hoping for an endless stream of donor projects. Senegal has perhaps developed a model worthy of close study with the World Bank-led donor consortium behind the reorganization of ISRA. Eventually both the Central Systems Analysis Group and the Macro-Economic Analysis Bureau should be in a position to specify donor roles and coordinate donor funding in the FSR area.

Concluding Comments

Hopefully, we have been able to provide some useful background for discussion on FSR country experiences with reference to institutionalization, coordination, and linkages.

Before closing, we would like to highlight three issues which were not included in our assigned topic but which are in our assessment equally important considerations affecting country experiences with FSR.

The first issue is the need for donors and national programme administrators to shift their emphasis from specific research results to institution building. This point is being made more and more frequently but is not yet being reflected in the types of donor-sponsored FSR projects being funded. We would suggest for consideration the simple rule that all donor-funded FSR programmes should have as their primary objective institution building. As a corollary, we would propose that no country should accept an FSR project unless there is a substantial training component and there is a firm obligation that one output of the project will be a plan for transforming the project into an institutionalized programme. Also, part of the institutionalization issue is the problem of what type of training should people be getting to be effective in FSR. Expensive, long-term, overseas training in particular disciplines does not appear to be a cost-effective way of staffing localized FSR teams. Perhaps the donor agencies need to work with some of the leading African universities to see whether it would be feasible to set up short and intermediate training courses in on-farm research to take over some of the responsibility now assumed by donor-funded projects. The change to an institution building focus on the part of the donor agencies means that different criteria could be used in their evaluation of FSR projects. FSR intrinsically is part of the whole agricultural research process and as such is not really amenable to the usual benefit/cost ratio evaluative criteria that are usually employed.

Second, we are concerned about the long run potential of FSR programmes to have a significant impact with reference to the deteriorating agrarian situation found in many African countries. FSR is, by most definitions, micro-level research but it perhaps should not be so micro in its orientation. Institutional change and opportunities for improvements in rural economies are tightly tied to policy-making and political processes. It is sometimes surprising that, except in few cases as in the Senegal project, political scientists, land use planners, and others with substantially different perspectives than the usual FSR complement have not been incorporated into the FSR process. The problem of impact is compounded not only by the range of perspectives on current FSR teams but by the common isolation of FSR teams from key decision-makers.

Third, we have found that in most FSR projects there continues to be a top-down orientation in the designation of priorities and potential interventions, notwithstanding the time and effort which has been put into diagnosis. In part, this stems from the pre-determined mandates of most programmes on particular commodities, livestock, or practices (e.g., introduction of fertilizers and hybrids). It would indeed be

surprising if, in even a majority of the farming systems where FSR projects are actively concentrating on changes in husbandry practices, farmers would specify the same areas of intervention as their priority problem area. Instead, it is usually an "outside" analysis of the researchers which leads to the specification of experiments. So we would like to end by adding our voices to those that are calling for increased attention to the nature and extent of farmer participation (Chambers and Childyal, 1985; Chambers and Jiggins, 1985; Matlon, Cantrell, King, and Benoit-Cattin, 1984). While FSR activities to date have greatly influenced the manner in which technologies are being tested, better taking into account the potential levels of farmers' inputs and micro-environments, we still have a long way to go with reference to finding ways to make sure farmers have more effective control over the research and development agenda.

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FARMING SYSTEMS RESEARCH IN SOME OTHER WEST AFRICAN COUNTRIES

By

Susan V. Poats

The summaries presented below are based on short capsule reports presented by FSR researchers from most of the other West African countries participating at the workshop. Each of the summaries presented is based on a more complete written report which was made available either before the presentation or shortly thereafter. This report attempts, therefore, to only cover the highlights of each report.

Each report followed a similar format:

1) Historical development of agricultural research and FSR in the country (focusing attention on institutions).

2) Current setting for FSR.

3) Linkages between FSR and component research.

4) Linkages between research and development activities.

5) Donor financing for FSR.

6) Problems or lessons learned.

Reports from countries where FSR is less developed followed a more abbreviated form. In each case, the name or names of the authors or presenters are indicated alongside the country.

1. Ivory Coast: M. Diomande and S. Doumbia

This country presentation was based on two reports. The first was from On-Farm Research in Ivory Coast (OFRIC), a loosely organized project affiliated to several institutions conducting interdisciplinary on-farm research, and supported by Ford Foundation and IITA. The second report called attention to a single institution, Institut des Savanes (IDESSA), located in the central portion of the country in Bouake, where a "filiere" or programme between several disciplines within the

institute has been created in order to facilitate on-farm or FSR activities. The OFRIC report gives a rather unique institutional model of cooperation which points out the difficulties of working across several institutions at once. An additional OFRIC problem lies in the fact that not only are the team members institutionally separate, but the site where they have initiated on-farm research is 350 km to the north of the capital city, where most team members reside. This means that the team rarely visits the field site and has difficulty developing close relationships with village level extension agents or farmers. Monitoring of field activities is also hampered by distance and logistics.

The IDESSA report provides another perspective on the FSR institutional setting: that of a single institution which tries to formulate an interdisciplinary activity among separate disciplines. In this case, FSR is only part of a larger re-direction of IDESSA away from its prior mandate on cash crops towards a focus on food crops. Thus, some of the difficulties of FSR may actually be part of a larger internal conflict within the institution. IDESSA only works in the central and northern areas of the country, so it may have a specified regional focus in its FSR activities. In many respects, IDESSA filiere and OFRIC are quite similar. Both are new initiatives, still searching for their "own" methodological pathways. They are experimental, entering into FSR with little prior experience within the country and little prior contact with neighbouring countries having longer FSR histories. Both programmes are also confronted with the problem of developing FSR in a country where cash crops for export have been predominant, where the country itself is considered "more developed" than its neighbours, and where population pressure on the land resources is less than in most other nearby countries. All of these factors serve to shape the way in which FSR can be implemented.

2. Sierra Leone: M. Dahniya

With a fairly long trajectory of agricultural research during colonial and post-independence times, Sierra Leone now benefits from two FSR activities, which have certain developmental linkages. The first set of activities comprises the Adaptive Crops Research and Extension (ACRE) project which started in 1980. The project is financed largely from donor sources (USAID) and supplemented by government funds. This project demonstrates strong linkages with extension; in fact, the major focus of the project is extension to a target group of 20,000 small holder agriculturalists. This project has a base at Njala University for on-station research and in the development area through the Integrated Agricultural Development Projects (IADPs). The second FSR initiative, started in 1985, comes from a newer thrust directly operated by Njala University in areas near the university and is funded by IDRC. Both FSR activities draw personnel from Njala University faculty and students.

The report is unusual in that it demonstrates the heavy involvement of the university in FSR, a situation which is found also in Nigeria and is being initiated in Cameroon. Because the Sierra Leone FSR experience is "deep" enough to have already successfully transferred on-farm

research results to farmers, the report provided some very important "lessons learned." In particular, the report indicated the great importance of consumption and nutrition considerations in the design and testing of agricultural technologies. Second, the Sierra Leone experience argues for the improvement of diagnostic techniques, i.e., less reliance on long, detailed socio-economic surveys which take too long to analyze, and the need to use quicker, more informal diagnostic surveys. The report also demonstrated the importance of trial result evaluation which considers not only returns to yield, but returns to labour, which may in fact be the most limiting. The Sierra Leone experience demonstrates the need for FSR to conceptualize problems within the farmer framework, such as not working with chemical inputs if farmers do not have access to these. The report also demonstrates the utility and benefits of farmer evaluation of on-farm research, even in terms of field trial design (need for larger plots) and also shows the problems of managing FSR, especially the logistics of providing mobility.

3. Burkina Faso: S. Sawadogo

This report concerns a country with a long and diversified history of colonial and post-independence research, and several FSR initiatives with different donors which has resulted in several rather different "styles" of FSR. These styles can be seen in the ICRISAT OFR work, the French activities in Yatenga, and the USAID-sponsored Farming Systems Unit within the SAFGRAD programme. In some ways, the institutional and donor situation is similar to that of Senegal, however, the solution which is being attempted is quite different. In 1985, a coordinating entity, Institut Burkinabe de Recherches Agronomiques et Zootechniques (IBRAZ) for all research, was established. Within IBRAZ is a "horizontal" FSR program, which has the mandate to coordinate and direct the FSR activities in the country. This type of institutional arrangement is found elsewhere (Bangladesh for example). It attempts to create linkages "above" separate research projects and development programmes while coordinating, to some extent, donor activity. One important objective of IBRAZ is to promote closer harmony between donor efforts and national objectives and priorities.

4. Benin: F.D. Adjahossou

This report, presented within the context of the historical development of FSR in Benin, emphasized the importance of certain "critical events," such as seminars or workshops where outside resource persons interacted with national researchers on issues concerning FSR. Such "critical events" seem to play important roles in introducing FSR into national settings. These workshops or colloquia are often conflict-ridden and cause arguments. Sometimes they are destructive, but more often, like in the Benin case, they are constructive and serve to lay out the initial pathways for FSR development. These events also often shape the type of FSR "perspective" which will be adopted, at least for the time being, in a country. In Benin, the critical event

was a seminar with French experts in 1980, which set the tone for FSR. Important also in this seminar was the presence of experts from Senegal, Togo, and Ivory Coast. In many ways, this example shows the importance of exchange and networking in the development of an FSR perspective.

5. Togo: A. Kwami and Nguyen Vu

This report emphasized the need to draw the best methods and experiences from wherever one can (francophone or anglophone) and combine them into the "best" framework for the national strategy. In Togo, one can trace several "flows" of FSR information and many simultaneous initiatives within multiple projects located up and down the country, funded by outside donors. Although there is a common "FSR" perspective within the Direction de Recherche Agronomique (DRA), and many projects also demonstrate a similar "FSR philosophy," it does not appear that the DRA has achieved a coordinating role for FSR in Togo. It would appear that the DRA would benefit by initiating an internal networking in FSR in order to pull together the valuable experiences from all of these various efforts and attempt to find a common perspective which may serve to unify national FSR initiatives, eliminate unnecessary overlap, and encourage greater application of the perspective. This appears to be the objective of the report's concluding comments concerning the need to create an interdisciplinary team within DRA in the near future.

6. Cameroon: P. Fotzo

This report focused on the design of an FSR effort within a university setting. The university project in question has two important objectives. The first is defined as "research-development," which proposes to engage academically oriented faculty in practical research on farms. The point is to provide faculty with the skills needed to work and teach within this framework. The second objective is to provide a "hands on" training medium for young researchers and extension leaders as part of their basic training. The project might be viewed as merely a "laboratory experiment," however, it was pointed out that the long-term goal extends beyond an experiment and aims to rejoin research and teaching/training within the university while at the same time, re-establish the role of extension in teaching and learning. An equally important part of the long-term goal is to conduct viable research which will have realistic and practical applications for farmers within the target area. Teaching by doing and learning by doing are logical outcomes of this project.

It appeared from the oral presentation and the paper itself that an additional potential benefit for FSR from this project will be methodological development. In the process of teaching methods, there is a need to refine, clarify, and reduce inconsistencies. Students are often as exigent and critical as farmers of the methodological inconsistencies proposed by research.

7. Mauritania: H. N'Gaide

This project was only a couple of months old and the report concentrated on initial plans, objectives, and activities. It is far too early to judge what might be the outcome, but the presentation did provide a "window" on how new FSR initiatives are being conceptualized today. It will be enlightening to see to what extent this project will gain from the experience of others. Will progress in project design and implementation be made, or will the same mistakes be necessarily repeated in order to re-enact the development process?

The project is different in one important way from earlier USAID-funded FSR projects in that rather than imposing a large expatriate team, only two expatriates will join the Mauritanian group. The selection of administrative expatriate project personnel appears to reflect a recognition of the necessity of dealing full time with the donor bureaucracy when engaged in a project. Thus, the technical advisor is free to concentrate on technical advice. The project objectives are being defined, specified, and re-defined through a diagnostic process, the first results of which were presented in the report. Finally, the preliminary alternatives for consideration as possible technical solutions are being drawn from farmer-informed alternatives.

8. Niger: M. Kadi

It appears that in many ways Niger shares a similar agricultural research and development history with the other Francophone West African countries. What seems different is the way in which methods and perspectives from both francophone and anglophone traditions appear to have been recast into a Nigerian FSR perspective. It seems that Niger is forging a national strategy upon which to organize the research - development linkage in the name of FSR. The presentation focused on a methodological description, which detailed how different methods and perspectives have been combined. Some of the results from the on-farm research were also reported. Unlike some of the other countries, FSR in Niger appears to be "results-driven." That is, the results of on-farm experimentation are beginning to pay off in terms of what is to be transferred to farmers via extension, and to whom it is to be extended. Finally, the report explicitly details two types of experiments: those which test researcher suggestions and those which test farmer suggestions. The fact that both are conducted is a measure of the success of the FSR effort in Niger.

9. Ghana: L. Diehl, E. Ampong, and A.S. Ibrahim

This report was not presented during the meeting but was sent after the meeting to the editor. The historical background of agricultural research in Ghana is similar to that of Nigeria during colonial and post-independence times. There are presently two major projects in

Ghana where FSR is practiced. The first is the Ghana/CIDA Grains Development Project, a bilateral aid venture between the governments of Ghana and Canada started in 1979. The other is the Nyankpala Agricultural Experiment Station which is a bilateral project between the governments of Ghana and West Germany. This project was started in 1980. Both projects follow simple FSR procedures and appear to be achieving some success. The grains development project has succeeded in encouraging the government of Ghana to fulfill its critical role of ensuring that inputs, especially agro-chemicals and associated applications equipment, are the right type and are in the correct place at the appropriate time. However, the biggest success of both projects is their apparent overall influence on Ghanian agricultural policy. There now appears to be a general concern in the country on how to link agricultural research and extension most effectively. Besides, a reorganization of agricultural development effort is being discussed and would probably be effected soon.

10. Other Countries

The final two country reports, Guinea Bissau and Guinea (Conakry), were made orally. However, similar to the Mauritania case, it would appear that both are experimenting with different avenues to introduce the FSR perspective. In the case of Guinea Bissau, the research and development activities are at the point of exploring possible ways to begin work within a systems perspective. With support from CIRAD (France), planning has begun for initial work on a limited basis with external funds. A novel twist evident in Guinea Bissau is the consideration that FSR may be able to play a role in the reduction of rural to urban migration by encouraging students in urban educational institutions to return to the rural areas to study and work. In the case of Guinea (Conakry), FSR is in its infancy, as the approach was only recently introduced. The primary objective of the Guinea (Conakry) representation to the network is to gain information to enable further consideration of FSR within the national programmes.

SUMMARY OF WORK GROUP DISCUSSIONS ON WORKSHOP SUB-THEMES

LINKAGES BETWEEN FSR AND COMPONENT RESEARCH

Rapporteur: S. Sawadago

This work group adopted a three-point work plan as follows:

1) Description of the different types of linkages.

2) Analysis of the advantages and disadvantages of each type.

3) Suggestions for the improvement of linkages between FSR and component research.

Description of the different types of linkages

Seven types of linkages depending on where FSR is located were identified.

Type 1: The entire institution is geared towards component research. There is a central FSR "cell" which influences the overall research structure of the institute. Gambia is in the process of setting up a research structure of this type, largely because of lack of adequate number of researchers.

Type 2: FSR occupies the same position as the departments or programmes of the institute. Example, Nigeria, Senegal, and Burkina Faso.

Type 3: A group of researchers from component research programmes of the institution join up with a nucleus of systems researchers to conceptualize, implement, and evaluate the FSR programme. Example, Benin.

Type 4: A group of component researchers from different stations and research institutions are called upon to carry out a national FSR project. When their mandate is up, they return to their original stations or institutions and the project is continued by another group. Example, Ivory Coast.

Type 5: FSR is carried out by a university, using the services of teachers and students. This situation is found in Benin and Cameroon.

Type 6: Systems researchers belonging to different disciplines are made available to component research programmes to help orient and enlighten the component programmes on the development of technological innovations adapted to the needs of peasant farmers.

Type 7: FSR is located within on-going agricultural development structures. Example, Sotoco in Togo and Agricultural Development Projects in Nigeria.

Analysis of the advantages and disadvantages of the different types of linkages

The table below reflects the conclusions of the work group on the impact of the different types of FSR linkages with component research discussed above on the conduct of component research itself, the linkage with development activity, the consumption of financial resources, and the use of human resources.

Focusing on the probable impact of the different types of linkages on the conduct of component research, the group arrived at the conclusion that Type 1 is the best form of linkage between FSR and component research. However, in reality, Type 2 and Type 7 predominate in West Africa, along with a few peculiar cases of Type 3 in Benin and the projected Type 1 case in Gambia. It was, therefore, proposed that the group examine the two predominant types (2 and 7) in more detail with a view to seeing how they could be improved upon.

An assessment of the different types of linkages on selected aspects of research

Type of localization	Link with thematic research	Link with development	Consumption of financial resources	Consumption of human resources
1	+++	0/+	+	+
2	+(0)	0/-	+	+/0
3	+	+	+	+
4	+	+	+	+
5	+	0	+	+
6	++	+	+	+
7	-	++	+	+/0

Key:

+ = positive impact
0 = neutral impact
- = negative impact

Several observations emerged from this examination as follows:

1) FSR is seen by component researchers as a destabilizing threat to their own supremacy but as a benefit of the socio-economic sciences, and this explains the frequent unwillingness of component researchers to adopt FSR methods.

2) In general, FSR has not yet sufficiently demonstrated its usefulness to merit its acceptance by component researchers.

3) FSR, on the contrary, has often adopted an over-critical language with regard to component research, e.g., non-adoption of innovations by peasants, failure to take real peasant conditions into consideration, etc.

4) FSR programmes are too frequently directed by socio-economists, while research institutions, on the other hand, are directed by component scientists (e.g., breeders, agronomists, etc.). This does not facilitate inter-professional understanding.

5) Sponsors often prefer to finance specialized FSR structures like Types 2 and 7 that involve concrete departments and programmes and this usually creates link-up problems right from the start.

6) Component researchers often understand the FSR procedures but find it difficult to become part of it without raising doubts about the scientific reputation and recognition which they have already carved out for themselves within their own discipline.

Suggestions for the improvement of linkages between FSR and component research

By way of introduction, the group emphasized the initial point that FSR is neither a science in the proper sense of the word nor is it supposed to be the panacea for any group or any professional discipline (especially the socio-economic sciences). The aim of FSR practitioners therefore, should be to encourage researchers in all disciplines to adopt a systems approach, preferably Type 1, a methodology more in line with the basic principles of FSR. To accomplish this, and improve upon the present Type 2 set-up which predominates in national institutions in West Africa, the group suggested a need for the following:

1) The formation of multidisciplinary work groups drawing upon researchers in component research departments and programmes to assist the FSR department in carrying out FSR programmes.

2) The reduction of the scale of existing departments operating FSR programmes so as to force them to fall back on researchers from existing thematic departments to assist in carrying out their projects.

3) A deliberate effort by FSR practitioners to demystify FSR by steady and continuous training involving component researchers, e.g., the Senegalese effort.

4) Concerted efforts by FSR teams to produce useful and convincing results in order to prove the usefulness of FSR to component research.

5) The teaching of the FSR approach at training centres and universities in order to encourage young researchers and development staff to become sensitized to the approach right from the beginning of their career.

6) The need for sponsors of research to be flexible enough to finance FSR structures other than those that fall under Type 2.

LINKAGES BETWEEN RESEARCH AND DEVELOPMENT

Rapporteur: M. Diomande

Introduction

The need to set in motion various mechanisms for the transfer of technology for the benefit of development structures as well as for achieving increases in production is obviously becoming more and more imperative. The numerous constraints inhibiting production require urgent solutions which will take into account the aspirations of the producers themselves. The question is therefore to find effective ways and means of attaining these objectives in the short, medium, and long term. In this light, the setting up of a programme centred around FSR is vital, and could serve as a stepping-stone towards an active and mutually advantageous collaboration between research and development.

General procedure

Given the nature of the existing technical and socio-economic situations in West Africa and in light of information accumulated by research, several linkage alternatives suggest themselves. Generally speaking, the partnership of researchers, developers, and farmers, drawn together in a cell will form the FSR team which, in turn, will serve as a driving-belt, with a certain number of tasks assigned to each of the partners as follows:

Roles of FSR:

1) Identification and analysis of constraints, needs, and problems.

2) Setting up of technical field tests.

3) Correction of inadequacies or imperfections discovered during tests.

4) Formulation of the technological components from experimentation.

Roles of component research:

1) Setting up of technical tests of a thematic nature.

2) Formulation of technological components.

Roles of development:

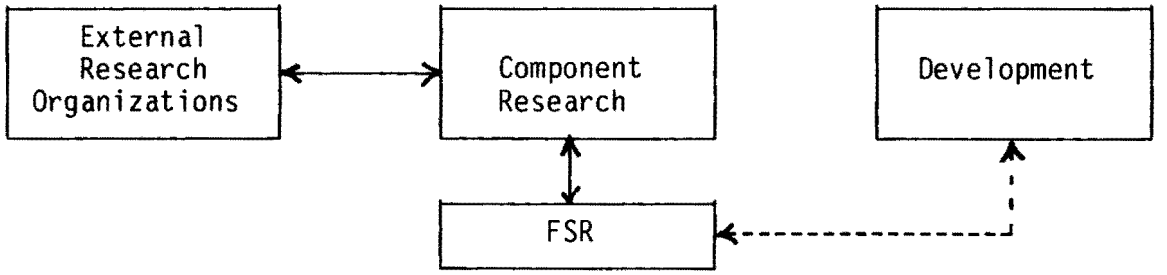
1) Application of the results of research.

2) Extension of successful techniques.

Variants of the procedure

First variant

In the first variant of the above procedures, FSR is integrated into the component research structure. In this case, the flow of information and of techniques between FSR and component research is copious while the flow between FSR and development is weak, even though it does exist. An illustration of this variant of the procedures is as follows:



The advantages of this variant include:

1) Input and feedback between FSR and component research are obvious.

2) Resource allocations to component research could be increased.

3) Regular presence of component researchers in the field is guaranteed.

The disadvantages of the variant are as follows:

1) The effect of the procedure on development programmes is minimized.

2) The influence on resource allocations to development is insignificant.

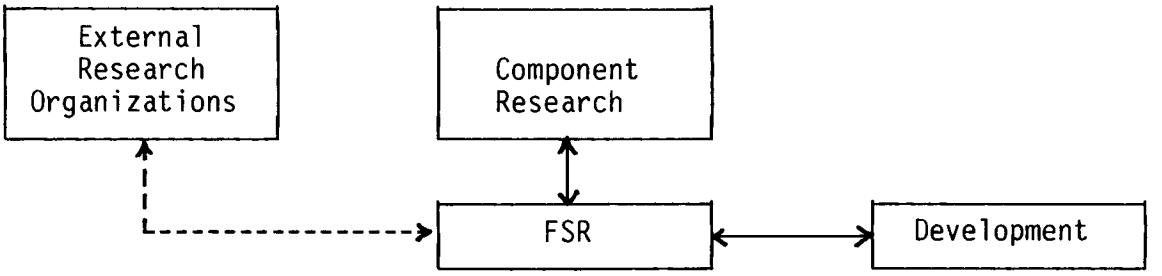
3) Component research could run into financial difficulties, given that development programmes tend to appeal more to donors.

This variant is of interest in situations where available technology is minimal because the integration of the various partners

could provide a new lease of life to component research. The farmers' adoption of research results would, however, only occur in the long run because the FSR has little hold over development.

Second variant

In this variant, FSR is integrated into the development structure while the flow of exchanges between FSR and component research becomes reduced. The structure of this variant is as follows:



Its advantages include the following:

1) FSR has a greater influence over development programmes.

2) FSR has an increased influence over the allocation of development resources.

3) The FSR team can obtain funds more easily.

The disadvantages of the variant are as follows:

1) Reduced feedback to component research.

2) Reduced influence on resource allocations to component research.

3) Difficulty in getting component researchers to the field.

4) Conflict between the long-term objectives of research and the short-term objectives of development.

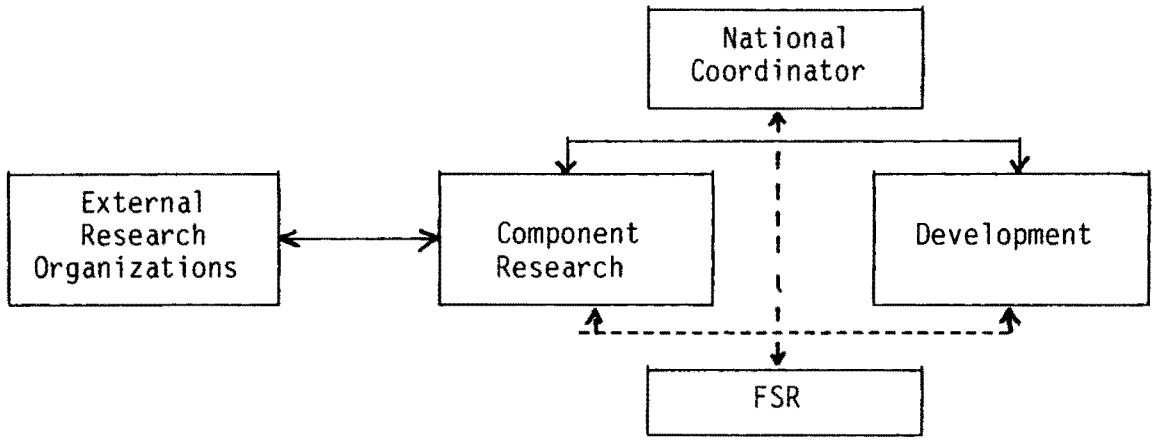
5) Risk that development workers will begin to carry out component research.

6) Lack of adequate funds for basic research.

This variant is useful when appropriate technological experience is available. The adoption of research results by the farmer in this case can be immediate.

Third variant

The third variant is as depicted below:



In this variant, the FSR team belongs to both the research and the development structures but is not totally integrated into either. As a result, the technological flow is more spread out. In this type of situation, a national coordinator, independent of both bodies, could "pilot" FSR.

Its advantages include the following:

1) It requires few human resources.

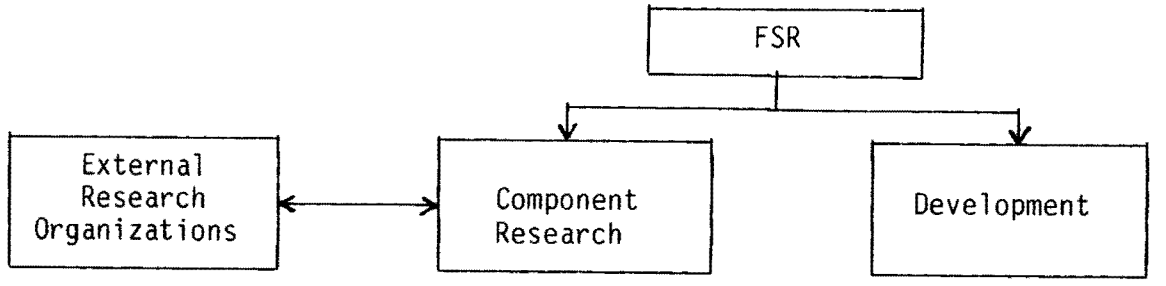
2) Collaboration between researchers and developers could be strengthened.

Its primary disadvantage is that the FSR procedure has little impact on research or development activities, at least in the short term.

This arrangement is appropriate in countries where the research set-up is still rudimentary. On the other hand, it does require a national coordinator independent of both research and development structures.

The ideal arrangement

The ideal situation depicted below involves a full-scale integration of FSR into both research and development structures so that all the principal partners can have significant and mutually beneficial effect.



Its advantage is that the flow of exchange is continuous between all partners, but especially between research and development; farmers, extension workers, and researchers are also integrated into the set-up at the appropriate levels. The utilization of resources is also optimal.

The adoption of this or any of the other variants of the procedure will depend on the particular conditions obtaining in each situation, taking into account the human, material, and technical resources which are available and which can be quickly mobilized.

SEQUENCING OF FIELD ACTIVITIES AND THE ROLE OF DIFFERENT DISCIPLINES

Rapporteur: P. Fotzo

In discussing the correct sequencing of field activities and the role of the different disciplines in FSR, this group focused on the real experiences of group members in Senegal, Mali, Burkina Faso, Ivory Coast, and Cameroon.

Stages of Field Activities

The following stages were identified as being important in the transfer of component technology to users by means of FSR:

1) Choice of zone.
2) Bibliographical research.
3) Selection of reference sites or regions.
4) Description and diagnosis.
5) Experimentation.
6) Pre-extension.
7) Extension.

Of the seven stages, FSR is directly responsible for only the first five.

Choice of zone

The choice of zone is dictated by the objectives which are set out for the team. Where it is a question of providing scientific support for a regional development project, the zone is obviously the region where the project is being carried out (e.g., the choice of the cotton zone by the CMDT in Mali). In such cases, the choice is based on a certain homogeneity springing from a regional development situation, and has nothing to do with the team's wishes. Where the zone is to serve as a training ground, the team is normally allowed to play a role in its choice and this choice is determined as much by considerations such as distance from the institution (the IDESSA case) and running costs as by agro-ecological and socio-economic factors.

Bibliographical research

Once the zone has been selected, it is vital to make a full assessment of the situation based on relevant bibliography. The take-off of any FSR project must include this bibliographical stage.

Selection of sites

After choosing the zone and compiling a comprehensive bibliography, the team is in a good position to identify representative sites for a diagnostic survey. It has been customary, before this stage, to make pre-diagnostic investigations, but this is becoming less and less the case. Reference sites or areas are also chosen in line with priorities laid down at the outset.

Description and diagnosis

Backed up by preliminary surveys, this stage makes it possible to establish structural or functional typologies which will in turn help in the selection of the villages to be studied. This typology can be dynamic, as in Senegal, where the toposequence and the different types of village soil can determine which are the strategic choices (rizi-culture in the low-lying areas, other alternatives on slopes and summits).

Historical and sociological considerations (generic division of labour) can affect these choices. When all these factors are taken into account, it is often necessary to readjust choices.

The case of the CMDT team in Mali is an example of functional typology where the villages were catalogued according to their level of tillage: entirely or almost entirely manual; intermediate level with animal traction; and advanced with intermediate or light motorization.

Generalization potentials should be taken into account in the choice of the size of sample, both at site level and at the level of the peasant farms.

This stage enables drawing up of a graded inventory of limitations and assets.

Surveys should preferably be carried out during the rainy season, so that farms may be observed in action. However, external factors may oblige the team to carry out the surveys during the dry season.

The length of time this stage takes varies considerably according to the number of villages involved.

Experimentation

This crucial phase in the systems research procedure uses as its guideline the graded inventory of limitations and assets referred to above.

It should bring about a mobilization of what needs to be done and should, at least, partly answer most of the questions originally tabled.

This stage should also be considered as a diagnostic tool to improve the team's knowledge of the area. This in turn can entail an on-going adjustment of methodology.

Pre-extension

Depending on the organization of the institutional framework, FSR can participate in pre-extension work prior to the extension stage proper, which is totally in the hands of the institutions or organizations in question.

This pre-extension participation by FSR can be seen as a form of on-the-job training for institution and company organizers and administrators.

Role of the Various Disciplines

Rather than drawing up lists of appropriate disciplines for each stage, the group concentrated on general principles. These principles included the following:

1) Systems research is a procedure and not a discipline.

2) All disciplines can be useful to systems research, depending on the nature of the limitations and assets.

3) Multidisciplinarity should draw upon confirmed mono-disciplinary competence, to avoid producing Jacks-of-all-trades.

4) The bibliography is compiled on a monodisciplinary basis and the results are collated at a coordination meeting.

5) The disciplinary composition of the basic FSR team, which optimally should include just three members, should be based on the nature of the environment, the society, and the method of cultivation. This means that the team must include an agronomist, a social scientist (economist, sociologist, or anthropologist), and a specialist in the dominant form of activity of the area under examination (zoologist, sylviculturist, etc.).

6) The senior researcher(s) should direct, orient, and inspire the team, while avoiding a dictatorial approach.

7) The disciplinary composition for the experimental phase should be based on the graded inventory of limitations and assets drawn up by the original core team.

8) Component researchers who are not part of the team can be called in at any stage to give more profound insights into an

aspect of a problem (especially during the experimental stage).

Training

While recognizing that FSR is far from being a discipline, the work group believes that the educational structures (especially professional schools and universities) should place increasing emphasis on it, in order to familiarize students with real situations. In this regard, training sessions could be organized for selected final year students.

Training workshops also constitute a valuable tool for in-service training which should be encouraged among professionals.

COORDINATION OF DONOR ASSISTANCE FOR NATIONAL FSR ACTIVITIES

Rapporteur: D. Adjahossou

Following general discussions, the group arrived at a set of conditions most suitable for ensuring effective coordination of donors' aid to national FSR activities.

These included the following:

1) The existence of a well-defined national agricultural policy and a national research strategy, so that the donors' contributions can be slotted into a precise framework.

2) The development of a minimal level of agronomic research in the country.

3) The establishment of regular dialogue between the donors and the various countries.

Several cases of coordination were examined as follows:

1) Coordination between one donor and one country

In this case, the following points should be considered:

a) Technical Assistance

The following aspects come under this heading:

i) level
ii) cost
iii) efficiency
iv) priority
v) training of counterparts

b) Duplication of Demands

This duplication is often a result of the scattering of FSR programmes in several ministries, and of the lack of an agricultural development strategy in the country. Several solutions were suggested to this type of duplication:

i) Defining a national Research and Development strategy.

ii) The bringing together of all FSR programmes under a single ministry.

iii) The setting up of a national FSR coordination committee.

iv) Institutionalizing FSR in order to bring the wishes of the donors and those of the country into line with one another.

(2) Coordination between several donors and one country

This type of coordination should take the form of exchanges of information by means of:

a) Regular meetings between donors and nationals.
b) Distribution of results and reports to all donors.

The coordination could be consolidated by joint planning:

a) Between nationals.
b) Between donors and nationals.

(3) Coordination between several donors and countries

Several alternative forms of coordination of donors' activities in countries were put forward:

a) At country level, e.g., SACCAR, CILSSNSAH, SAFGRAD, etc.
b) At donor level, e.g., CDA, IARC, CGIAR, etc.
c) Others, e.g., Networks, Individual and External Sub-groups, etc.

SUMMARY OF THE REFLECTIONS ON THE KEY THEMES AND CONCLUSIONS OF THE WORKSHOP

Rapporteur: Deborah Merrill-Sands

In this concluding session of the substantive part of the workshop, four panelists presented brief statements highlighting what they considered to be the key themes and conclusions of the workshop. The meeting was subsequently opened for group discussion of the panelists' commentaries and the groups' perceptions of the principal areas of consensus and/or disagreement which had emerged from the presentations and discussions of the workshop. A broad range of topics was reviewed. The summary is limited, therefore, to the major themes which ran through both the panelists' presentations and the ensuing informal group discussion.

(1) There was a strong consensus among participants in the workshop that enormous progress has been made over the past 15 years in integrating the farming systems approach to research within national agricultural research systems (NARS) in West Africa. The viability of the approach is no longer under debate; all 13 countries reporting had one or more FSR programmes at various levels of maturity. Today, the emphasis is on developing the most effective and efficient means for implementing farming systems research (FSR) and for institutionalizing the approach within NARS on a long-term, sustained, basis.

(2) With NARS accumulating experience with FSR, problems of implementation are emerging. These relate to the organization of FSR within research institutes; manpower recruitment and development; financial resource acquisition and management; experimental design; supervision and logistics of conducting multi-locational research; and, perhaps most importantly, information management and communication across disciplines, between farmers and researchers, between on-station and on-farm research, and between research and extension.

Many of the implementation problems NARS are now experiencing derive from the fact that in the development of the FSR approach, little attention has been given to the appropriate institutional means for integrating FSR into national agricultural research and extension systems. In the haste to disseminate FSR and achieve short-term impact, the tendency among donor agencies was to create large, heavily funded, FSR projects of finite duration which were appended to, rather than integrated within, NARS. The projects relied largely on expatriates for

required manpower and on substantial funding from external sources for capital and operating expenses.

As a consequence, projects have too often evolved into isolated research endeavours with little or no effective contribution to the long-term objectives of institution building and strengthening of national research capacities. Once donor support is removed, the FSR approach is difficult to sustain within NARS because no institutional foundation has been laid and the projects, as organized, are incompatible with the local institutional context and resource base. A related problem experienced in some countries is that while resources were funneled into FSR, the complementary build-up of component research received less attention. In the long-term, this is detrimental to FSR which cannot function independently of component research. There was general agreement in the workshop that strong and effective research programmes leading to agricultural development require a judicious balance in resource allocation between farming systems and component research programmes.

(3) The workshop participants agreed that NARS which have formulated a comprehensive plan for national agricultural research and development could avoid many of the problems incurred from externally imposed models for implementing FSR which are incompatible with existing institutional structures and resource endowments. With a national plan, NARS would be in a position to work with donors to pursue a rational strategy for the development of a national FSR capacity. NARS would be able to generate proposals for projects which contribute to their needs and long-term objectives, rather than receiving projects formulated by donors which reflect donors' priorities and funding strategies.

(4) It was emphasized in the discussions that institutional factors must be taken into consideration when introducing FSR within NARS. The implementation of FSR implies more than the introduction of a new methodology; it implies forging a new conceptual approach to research. This explicitly requires developing organizational structures and management processes which will permit FSR to attain its objectives and perform its designated functions within the national technology generation and dissemination system.

The effective implementation of FSR requires that several new channels for the flow of information and knowledge be established. This necessitates organizational arrangements which are typically not well developed in NARS. The systems perspective requires that linkages must be established across traditional disciplinary or commodity programmes. Linkages between FSR and component research must also be developed. FSR complements component research and one of its primary functions is to generate information on farmers' production problems and management conditions which can be used to enhance the relevancy of priority-setting and programming in component research. Additionally, FSR, with its specific orientation towards agricultural development and its emphasis on on-farm research, provides a crucial link between research, extension, development agents, and farmers, the ultimate clients of research. It was emphasized in the workshop that FSR needs to be fully integrated into the agricultural research and development process, if it is to be effective in performing these various linkage functions.

Participants were concerned that the two most common models for organizing FSR in NARS in West Africa (establishing a separate FSR department and organizing FSR within a development project) do not facilitate strong linkages between FSR and component research. This is particularly worrisome in the West African context, where there is little appropriate component technology "on the shelf" ready for adaptive research. The group concluded that greater attention must be given to developing institutional means to improve this linkage.

(5) The reviews of member countries' experiences with implementing FSR clearly revealed that there is no single optimal model for organizing and implementing FSR. There is substantial diversity among NARS. They vary in terms of institutional structure, organization of research, human and financial resource capacities, and research needs. All of these factors will influence the most appropriate means for integrating FSR to perform its functions efficiently and effectively.

It was concluded, therefore, that the optimal arrangement for integrating FSR can only be determined with respect to the existing institutional structure and resource situation of a specific NARS. It was stressed that any plan for developing an FSR approach to research within a NARS must derive from a sound analysis and clear understanding of the existing research and technology dissemination system.

It was also noted, however, that lessons and general guidelines for institutionalizing FSR could be abstracted from analyzing NARS' experiences with integrating FSR. Through such a comparative analysis, it could be observed how diverse NARS have responded and adjusted to the introduction of FSR, and key problem areas in implementation could be identified.

(6) There was general consensus in the group that integrating FSR into a national research system is an evolutionary process. If FSR is to have sustained impact over the long term, it requires that mutually supportive and productive relationships be developed, both with scientists working in disciplinary and commodity research programmes, as well as with extensionists, development agents, and policy-makers. The formation of such relationships can clearly be facilitated by specific organizational arrangements and management processes, but it also requires that FSR practitioners cultivate an understanding among these groups of the potential contribution FSR can make to enhancing the relevancy of research to agricultural development.

The experiences of the countries in the network indicate that this can best be accomplished through assimilation rather than confrontation. Productive linkages with component research have been developed in several NARS through sustained efforts to involve component researchers in FSR research activities such as diagnostic surveys, programming of on-farm experiments, and evaluation of on-farm trials; through FSR programmes organizing in-house training workshops; and through stressing FSR on timely dissemination of research results and findings. Other countries reported using similar mechanisms to develop collaborative relationships with extension and development agencies.

It was concluded that over the long term, this objective could be most effectively reached by placing greater emphasis on training young scientists in universities in the FSR approach to research, as described in the paper presented by the representative from Cameroon. The ultimate goal for the integration of FSR within NARS is to have the farming systems approach to research, with its specific orientation towards development, pervade the entire research system and be implicit in what is considered to be good science.

(7) The issue of the cost of FSR programmes relative to other types of research was repeatedly raised in the workshop discussions. No consensus was reached in the group about whether or not FSR was more expensive than other forms of research. However, it was recognized that FSR is perceived as being expensive. This is an emerging concern among some donors which could potentially jeopardize continued support of FSR. Because little information is available on the relative cost of implementing FSR within NARS, it was agreed that this should be a priority area for future research.

It was noted that FSR is particularly vulnerable to budgetary constrictions because it has a higher proportion of recurrent costs due to its heavy reliance on on-farm work. Participants agreed that the costs of FSR programmes should be carefully monitored and that the approach should be implemented in a way that can be sustained under the resource conditions of NARS. Several means for reducing costs were proposed. These included sharing some of the costs of FSR with development agencies, looking for solutions which are better rather than best, and relying more heavily on local, rather than expatriate, personnel. The latter implies that more effort and resources should be allocated to advanced training of national researchers in FSR.

(8) The group recognized that now that FSR is reaching a stage of greater maturity in NARS, there is a need to begin to analyze the experiences of NARS with integrating FSR, and to evaluate its impact. Although the group was confident that FSR has proven to be a productive and effective approach to research aimed at agricultural development, it was agreed that a systematic assessment of results would assist FSR practitioners to improve the implementation of FSR and would also help them to promote a deeper understanding of the contribution FSR can make to development.

Such an assessment is problematic. FSR is only one of several inputs contributing to the process of agricultural development and is dependent for its success, therefore, on the effective functioning of other components. Furthermore, often the most important results of FSR, such as generating feedback on farmers' production conditions and priority problems to enhance the relevancy and efficacy of research, development planning, and agricultural policies, are neither readily apparent or tangible. This makes it very difficult to isolate the specific impact of FSR for evaluation.

Several participants argued, for example, that the long-term contribution of FSR is in rationalizing the priorities for research. FSR initiates the process for solving farmers' problems in the future. Although there may not be immediate solutions at hand, component

research is much more likely to produce technological breakthroughs now that it has benefited from the information supplied by FSR. Research has, indeed, become more relevant to development and to solving farmers' needs and problems through the contribution of FSR. The feedback is working.

The question remains, however, how such long-term impact can be incorporated within an assessment of FSR. No firm conclusions were reached in the group discussion. It was underscored, however, that a comprehensive assessment of FSR would have to encompass its multiple functions and evaluate its impact both in terms of concrete results in technology generation and diffusion, and in terms of its more intangible and long-term impact on enhancing the relevancy of the development process.

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ABBREVIATIONS AND ACRONYMS

ABU	Ahmadu Bello University (Nigeria)
ACRE	Adaptive Crops Research and Extension (Sierra Leone)
ADP	Agricultural Development Project (Nigeria)
ARCN	Agricultural Research Council of Nigeria (Nigeria)
ARDI	Actions régionales pilotes de développement intégré (Sénégal)
BAME	Bureau d'analyses macro-économiques (Sénégal)
CESA	Comité d'étude et de suivi de la stratégie alimentaire (Mali)
CIDA	Canadian International Development Agency (International)
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (International)
CMDT	Compagnie malienne de développement des textiles (Mali)
CNRA	Comité national de la recherche agronomique (Mali)
CSAG	Central Systems Analysis Group (Sénégal)
CST	Comité scientifique et technique (Mali)
CTFT	Centre technique forestier tropical (International)
DDI	Division de la documentation et de l'implémentation (Mali)
DET	Division des études techniques (Mali)
DPE	Division de la planification et de l'évaluation (Mali)
DRA	Direction de recherche agronomique (Togo)
DRA	Division de la recherche agronomique (Mali)
DRFH	Division de la recherche forestière et hydrobiologique (Mali)

DRSPR	Division de recherche sur les systèmes de production rurale (Mali)
DRZ	Division de la recherche zootechnique (Mali)
FAO	Food and Agriculture Organization of the United Nations (International)
FACU	Federal Agricultural Coordinating Unit (Nigeria)
FMST	Federal Ministry of Science and Technology (Nigeria)
FSR	Farming Systems Research (International)
IADP	Integrated Agricultural Development Project (Sierra Leone)
IAR	Institute for Agricultural Research (Nigeria)
IAR&T	Institute of Agricultural Research and Training (Nigeria)
IBRAZ	Institut burkinabe de recherches agronomique et zootechnique (Burkina Faso)
IBRD	International Bank for Reconstruction and Development (World Bank) (Nigeria)
IDESSA	Institut des savanes (Côte d'Ivoire)
IEMVT	Institut d'élevage et de médecine vétérinaire des pays tropicaux (International)
IER	Institut d'économie rurale (Mali)
IITA	International Institute of Tropical Agriculture (International)
INRFH	Institut national de la recherche zootechnique, forestière et hydrobiologique (Mali)
IRAT	Institut de recherches agronomiques tropicales et des cultures vivrières (International)
IRHO	Institut de recherches pour les huiles et oléagineux (International)
ISRA	Institut sénégalais de recherches agricoles (Sénégal)
MSU	Michigan State University (International)
NARS	National Agricultural Research Systems (International)
NCRI	National Cereals Research Institute (Nigeria)
NCRP	Nationally Coordinated Research Project (Nigeria)

NCST	National Council for Science and Technology (Nigeria)
NRCRI	National Root Crops Research Institute (Nigeria)
NSTDA	National Science and Technology Development Agency (Nigeria)
OHV	Opération haute vallée du Niger (Mali)
OFRIC	On-Farm Research in Ivory Coast (Côte d'Ivoire)
ORSTOM	Office de la recherche scientifique et technique d'outre-mer (International)
PAPEM	Point d'appui de prévulgarisation et d'expérimentation multilocale (Sénégal)
PAR	Points d'appui à la recherche (Mali)
PEP	Points d'expérimentation permanents (Mali)
PIDAC	Projet intégré pour le développement agricole de la Casamance (Sénégal)
PIRT	Projet inventaire des ressources terrestres (Mali)
RERU	Rural Economy Research Unit (Nigeria)
RRC	Research Review Committee (Nigeria)
SOMIVAC	Société pour la mise en valeur de la Casamance (Sénégal)
USAID	United States Aid for International Development (International)