# The Creation and Establishment of Production Systemes Research in a National Agricultural Research Institute: The Senegal Experience

by

Jacques Faye, James Bingen and
Etienne Landais

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## SPECIAL NOTE FOR ISRA-MSU REPRINTS

In 1982 the faculty and staff of the Department of Agricultural Economics at Michigan State University (MSU) began the first phase of a planned 10- to 15-year project to collaborate with the Senegal Agricultural Research Institute (ISRA, Institut Sénégalais de Recherches Agricoles) in the reorganization and reorientation of its research programs. The Senegal Agricultural Research and Planning Project (Contract No. 685-0223-C-00-1064-00), has been financed by the U.S. Agency for International Development, Dakar, Senegal.*

As part of this project MSU managed the Master's degree programs for 21 ISRA scientists at 10 U.S. universities in 10 different fields, including agricultural economics, agricultural engineering, soil science, animal science, rural sociology, biometrics and computer science. Ten MSU researchers, on long-term assignment with ISRA's Department of Production Systems Research (PSR, Département de Recherches sur les Systèmes de Production et le Transfert de Technologies en Milieu Rural) or with the Macro-Economic Analysis Bureau (BAME, Bureau d'Analyses Macro-Economiques) have undertaken research in collaboration with ISRA scientists on the distribution of agricultural inputs, cereals marketing, food security, and farm-level production strategies. MSU faculty have also advised junior ISRA scientists on research in the areas of animal traction, livestock systems and farmer groups.

Additional MSU faculty members from the Department of Agricultural Economics, Sociology, Animal Science and the College of Veterinary Medicine have served as short-term consultants and scientific advisors to several ISRA research programs.

The project has organized several short-term, in-country training programs in farming systems research, farm-level agronomic research, and field-level livestock research. Special training and assistance has also been provided to expand the use of micro-computers in agricultural

research, to improve English language skills, and to establish a documentation and publications program for PSR Department and BAME researchers.

Research conducted under this collaborative project was originally published only in French. Consequently, the distribution of results has been limited principally to West Africa.

In order to make relevant information available to a broader international audience, MSU and ISRA agreed in 1986 to publish selected reports as joint ISRA-MSU International Development Paper Reprints. These reports provide data and insights on critical issues in agricultural development which are common throughout Africa and the Third World. Most of the reprints in this series have been professionally edited for clarity; maps, figures and tables have been redrawn according to a standard format. All reprints are available in both French and English. A list of available reprints is provided at the end of this report. Readers interested in topics covered in the reports are encouraged to submit comments directly to the respective authors, or to Drs. R. James Bingen or Eric W. Crawford, Co-Directors, Senegal Agricultural Research II Project, Department of Agricultural Economics, Michigan State University, East Lansing, MI 48824-1039.

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*In December 1987 MSU, ISRA and USAID/Dakar negotiated a 2 1/2 year contract (Contract No. 685-0957-C-00-8004-00) to extend MSU's program of research support and training in the social sciences, agronomy, forestry and research planning.

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

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Jacques Faye, James Bingen and Etienne Landais

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

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**Jacques Faye, James Bingen and Etienne Landais**

## INTRODUCTION

Production Systems Research (PSR or the systems approach to agricultural research) 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 PSR programs elsewhere in the region.

Some of the key features of the Senegal case are as follows. The decision to undertake PSR in Senegal arose largely from an evaluation of the results of research programs and experiences that were specific to the Senegal Agricultural Research Institute (ISRA). The PSR program, however, was established as part of a major institutional reorganization that created the Department of Production Systems Research and Rural Technology Transfer (PSR Department) and the Macro-Economic Analysis Bureau (BAME). Foreign aid projects and international agricultural research institutes continue to play an important role in helping ISRA to carry-out its PSR program throughout the country. Michigan State University (MSU), relying principally on PSR 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 Production Systems Department and BAME research programs. The Agrarian Systems Department of the International Center of Agronomic Research for Development (CIRAD)[1] has also helped in launching ISRA's PSR program.

This paper presents a brief history of agricultural research in Senegal, focusing on events that led to the creation of the Production Systems Department. The "Djibélor Experience" is subsequently described in detail to illustrate concretely how the PSR Department launched a program in

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[1]See the list of abbreviations.

one region of Senegal. In conclusion, some lessons for researchers and research administrators in West Africa and elsewhere are drawn.

## AGRICULTURAL RESEARCH IN SENEGAL - BRIEF HISTORICAL REVIEW

The Experiment Station at Bambey, established in 1921 to deal with groundnut research in Senegal, gradually expanded its research program during the colonial era to cover the Soudano-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.

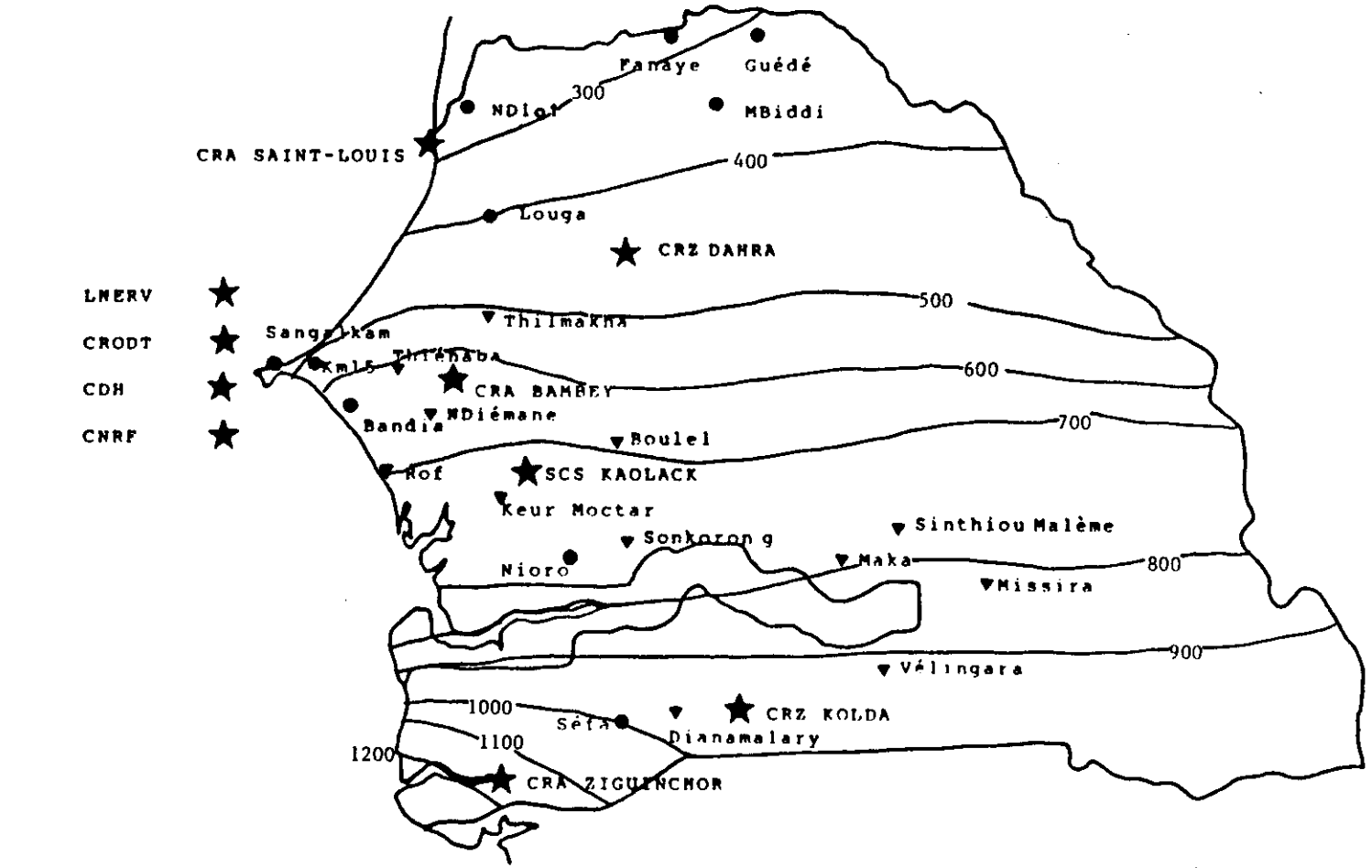
After independence in 1960, the Government of Senegal requested that France, through IRAT, The Tropical Agronomic Research Institute, and several other French research institutes (IRHO, IEMVT, CTFT and ORSTOM) manage the country's agricultural research programs. Additional research stations were built in each major agricultural region (at Séfa, Richard-Toll, Guédé, Djibélor) 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 today.

Several substations, or PAPEMs (Pre-Extension and Multilocal Experiment Stations), were also built during the 1960s in order to adapt research programs 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 farmers' conditions led to the proposal in the early 1960s to create ARDIs, Actions Régionales Pilotes de Développement Intégral, or action-research programs within each agro-ecological zone. Even though ARDIs were never begun, the idea served as the basis for creating the well-known Unités Expérimentales.

Figure 1

LOCATION OF ISRA RESEARCH FACILITIES (1985)




★ CENTRES

● STATIONS

▼ PAPEM

CRA = Crops Research Center

CRZ = Animal Production/Health Research Center

Isohytes (mm) 1950-1980

During its 12 years of existence from 1969 to 1980, the Unités program 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 production systems research 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 agroecological conditions. The program also contributed to the integration of socio-economic research into IRAT's and ISRA's research programs, and to defining CIRAD's agrarian systems research activities.

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

In 1975, Senegal nationalized the agricultural research programs that had been managed separately for almost 15 years by French research institutes. As part of the newly created ISRA, research activities were reorganized into scientific research departments, of which one was a Department of Sociology and Rural Economy, the PSR Department's predecessor. ISRA's priorities were: to create five regional agricultural research centers[2] in response to the policy to decentralize government programs; to train Senegalese agricultural scientists; and, to expand socio-economic and off-station research programs.

In 1978, the Government prepared a Five-Year (1979-1984) Indicative Research Plan and called upon the World Bank to help define a program for improving the responsiveness of Senegalese agricultural research to the country's development problems. The Agricultural Research Project that was prepared began in 1982 and 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 programs and infrastructure construction, the project initiated a

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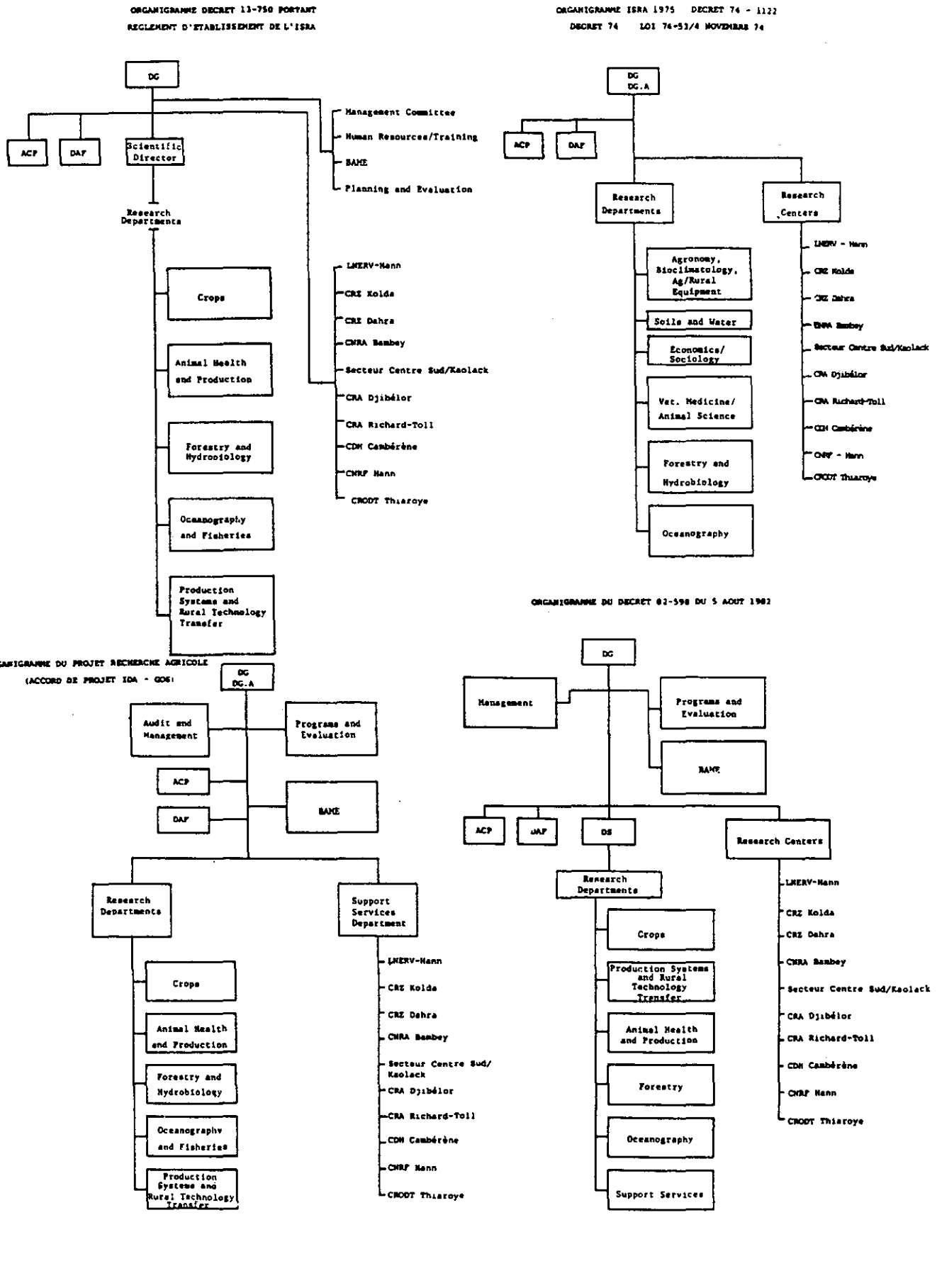
[2]Specialized centers for livestock, fisheries, forestry and horticultural research were also established.

Figure 2

# ISRA ORGANIZATION CHART



dramatic reorganization of ISRA's scientific and administrative structure. In fact, the speed of planned organizational change has pushed ISRA into the throes of an institutional crisis of such magnitude that the financial management system has broken down, the result of which is the resurfacing many old and unresolved problems that have existed since the days of French management.

The project called for the creation during the first year, 1982-1983, of five production systems teams at each regional research center. The PSR Department was also requested that a management structure be established for the subject-matter, or support-research, programs in agroclimatology, weed control, farm equipment, post-harvest technology, soil fertility and agricultural hydrology. In reality the PSR Department was able to begin only three production systems programs (Djibélor, Kaolack and St-Louis) over a three year period, plus a multidisciplinary, sylvopastoral research program at the Dahra Center for Animal Production Research. Each team is composed of an agronomist, an animal scientist, an economist and a sociologist.[3] A multidisciplinary, Dakar-based Central Systems Analysis Group of senior researchers provides scientific support for these teams.

The Macro-Economic Analysis Bureau has gradually established its programs since 1982 to oversee agricultural policy research on the economics of agricultural production, cereals marketing, agricultural price policy, consumption, international agricultural markets and food security. These programs, based in Dakar, Djibélor, Kaolack and St. Louis, are closely coordinated with the activities of each regional PSR 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.

In addition, the PSR Department/BAME manages the long- and short-term training for its scientific staff, oversees the introduction and use of microcomputers, and assists in the diffusion of the results of agricultural

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[3]Other disciplines have been added to these "core teams" in response to specific agricultural problems in the varying regions.

research and in establishing research-extension relationships with rural development agencies. In other words, the PSR/BAME is more than a unit tied to a foreign aid project, as its programs 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 utilizing more efficiently the institute's scientific and support personnel. In addition, the current research "Departments" will become "Directions" with both scientific and managerial responsibility for research programs. The regional research centers will be managed directly by a specific research directorate rather than operating as line units reporting directly to the ISRA General Manager and the PSR Department will integrate the PSR and BAME programs and change its name to the Directorate for Agrarian Systems and Agricultural Economics Research. Subject-matter research programs will be regrouped within a separate research directorate.

## THE DJIBELOR (LOWER CASAMANCE) EXPERIENCE

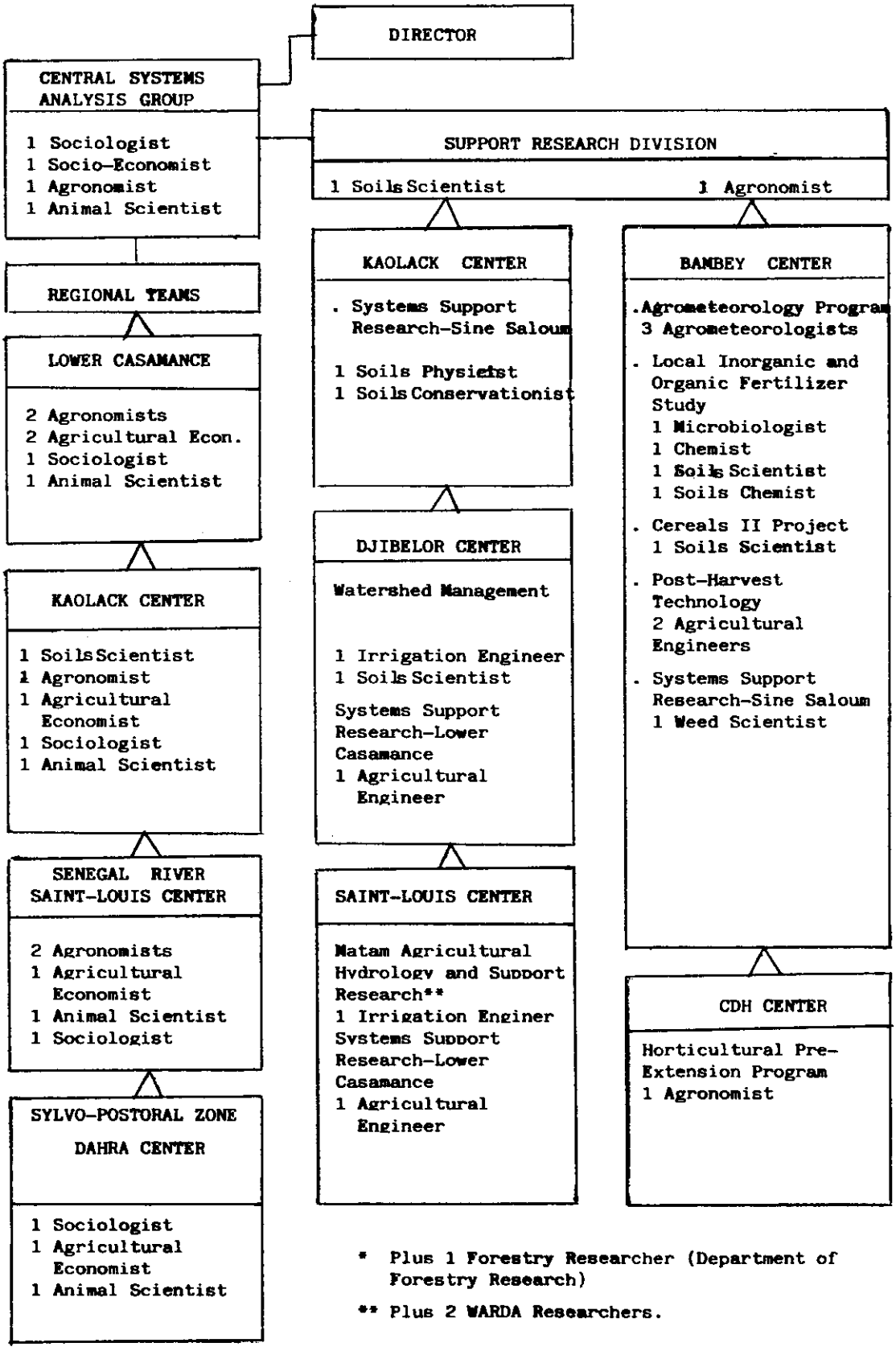
The Lower Casamance area is comprised of the land surrounding the Delta of the Casamance River and its tributaries. Rice production dominates the low-lying inundated zones that are affected by the infiltration of saltwater; rainfed crops are produced on upland fields.

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

The establishment of the program can be divided into two phases, a pre-diagnostic phase, followed by a phase of diagnostic research, experimentation and technology transfer. Researchers began the first phase 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, PIDAC (Integrated Development Project for the Casamance) was chosen by the PSR Team for its research

Figure 3

PSR DEPARTMENT ORGANIZATION CHART (1985)

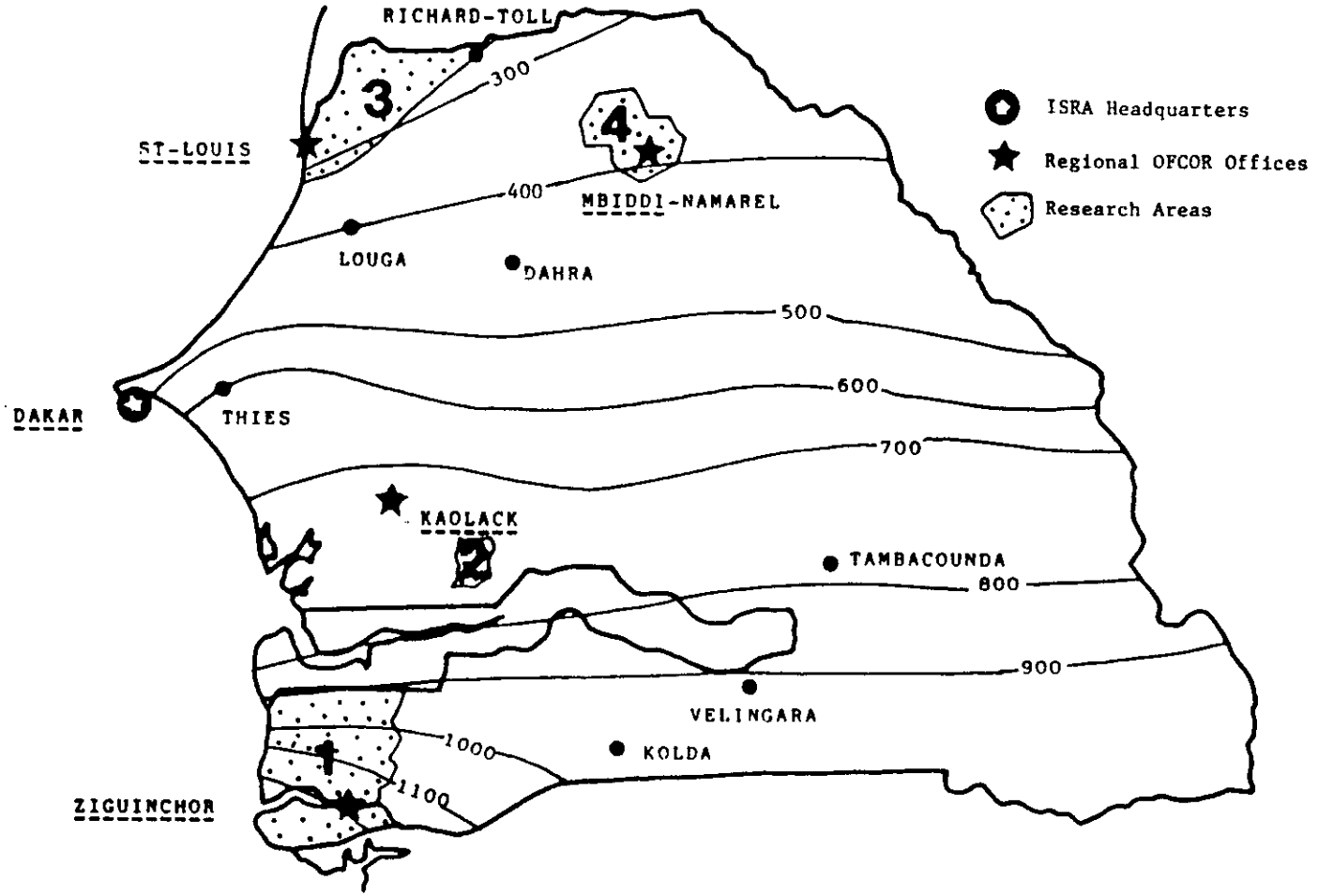



* Plus 1 Forestry Researcher (Department of Forestry Research)

** Plus 2 WARDA Researchers.

Figure 4

PRODUCTION SYSTEMS DEPARTMENT RESEARCH SITES (1985)




1. Lower Casamance
2. Kaymor Rural Community
3. Senegal River Valley - Delta
4. PSD - Watering/Feeding Points

Isohytes (mm) 1950-1980

area, thus PIDAC became the Team's choice as an intermediary for research and technology transfer.

Exploratory surveys in 35 of the 330 Lower Casamance villages, chosen with assistance from PIDAC field agents, followed bibliographic work and 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 for soil fertility and commodity specialists.

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.

Using the results from this first phase, the Team selected three criteria for defining five agricultural zones or situations within the Lower Casamance: (1) the division of labor;[4] (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 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 and 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.

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

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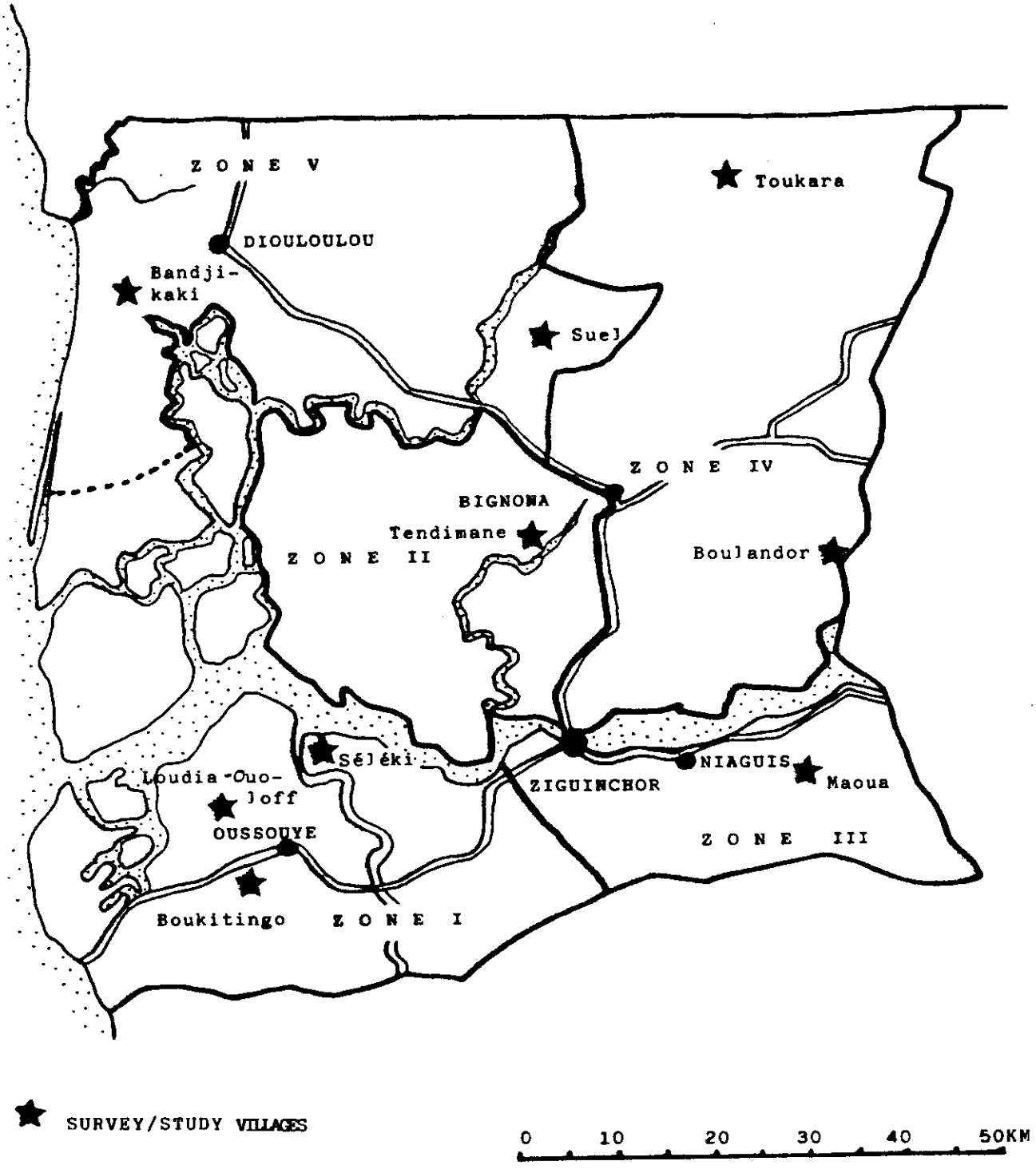
[4]Among the Diola in the South and West, both men and women work in the rice fields but specialize by task; among the Diola influenced by the Mandingue culture, men cultivate only rainfed crops and women cultivate only irrigated rice.

Figure 5

LOWER CASAMANCE AGRICULTURAL ZONES

(ISRA, "Production Systems" Team,Djibélor, 1985)



Formal surveys verify, refine and quantify information obtained during the exploratory surveys. They are done 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, labor 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 clearer picture of the resources available within households, the agricultural labor calendar and constraints in each zone, the cropping calendar, the farmers' agricultural practices, and the amount of production and the distribution of various crops.

In 1984, an economic survey and input-output study was added for a sub-sample of 30 representative households. Four sociological research studies also began in early 1984: (1) the social organization and topology 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 was 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 were run from 1982 through 1984 to examine the following: 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 manioc; 3) the recuperation of abandoned land through trials on saline soils; and 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 test and propose new cultivation practices in comparison with actual practices. These trials examined: 1) the technical effectiveness of proposed practices in terms of production, labor 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, different from standard on-station trials only in their underlying logic and objectives, were prepared to address the question of technical effectiveness. Off-station trials, managed directly by farmers with the aid of a field assistant, were exploratory and had few, if any, repetitions. The fertilizer and varietal trials, for example, used two repetitions, but were conducted on fairly large plots (500-1,000 $M^2$).[5]

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 program. In part the revisions reflect the broadening of the research perspective as new researchers from different disciplines have joined the team, in addition to the fact that each year's research results also led to changes. And after almost four years of research the Team appears to be entering yet another phase of research.

Following discussions with the CSAG in late 1984 that centered on the Team's research methodology, an internal program review of the Team's objectives and program 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 program 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 perspective from the level of the household to the level of producers' groups, the village land area (terroir), the

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[5]Only the rainfed and irrigated rice trials were run on small plots of 30 square meters.

watershed management area, the level of and the overall agrarian system of the sub-region.

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 toward irrigated rice. As a result, the Team's overall research program 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 PRODUCTION SYSTEMS, COMMODITY AND SUBJECT MATTER RESEARCH PROGRAMS

Prior to the creation of the Djibélor Production Systems Program, commodity researchers at the Djibélor 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 program 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 Djibélor were associated with the PSR Team's exploratory surveys. The commodity researchers did not, however, modify their programs in response to problems identified during the exploratory diagnosis. They viewed the systems program more as a competitor or threat than a contribution to their research.

Similarly, the PSR Department as a whole met staunch resistance from "non-systems" researchers. Considerable hostility emerged from the animal production and health department, which harbored the unfounded fear of losing control over its off-station research programs and management of the two livestock research centers at Kolda and Dahra. In fact, the climate of opposition and hostility reached such a level that in July 1982 the PSR Department was summoned before a general meeting of ISRA scientists and administrators to present and justify its research approach, its program of work and the calendar for establishing the Team programs. 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 programs 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 toward the Agricultural Research Project. The PSR 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 PSR Department concerning the relationship between commodity and systems programs has been very clear. Instead of capturing other programs, the Department has invited commodity researchers in rice, maize, millet, sorghum, sweet potatoes, cowpeas and manioc to assist in the PSR trials without sacrificing their own off-station commodity work. Researchers have been invited to accompany the systems team during its field work and to discuss their experiences together. They have also been encouraged to factor many of the identified constraints or priorities into their on-station work.

Even within the PSR Department/BAME, subject-matter or disciplinary research is encouraged. The agricultural machinery specialist at Djibélor, for example, has completed a census of equipment and a study of the role of local blacksmiths. He also collaborates both 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 the 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 Djibélor research programs.

In addition to linking the Departmental research programs with those of other departments, the PSR Department has organized several training workshops between 1984 and 1986 to bring together researchers from different departments and agents from several regional development agencies.[6]

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. PSR 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 programs. 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 program. Such a role for PSR, however, continues to be resisted by the entrenched interests surrounding on-station and laboratory research.

## RESEARCH-EXTENSION

The need for a close relationship between agricultural research and extension programs has been debated in Senegal for over 25 years. At

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[6]These included: Production Systems Research Orientation (October 1984); Micro-Computers in Agricultural Research (MSTAT-January 1985); Agronomic Research under Farmers' Conditions (May 1985); and The Methodology of Livestock Research in Sub-Saharan Africa (February 1986).

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 programs. 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 accused of being narrow-minded and productionist in orientation at the expense of addressing farmer problems and interests.

Most recommendations for closing the R-E gap 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 assure 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 programs.

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 SOMIVAC (The Casamance Development Agency) 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 PSR 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, socioeconomic (production systems) studies and surveys, and agricultural inputs and agricultural policy. The principal, jointly-designed programs 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 1985-1986 include a follow-up study of the use of groundnut seeders for rice, joint R-E visits to rice seed multiplication farms and an analysis of PIDAC's special credit program among selected producers' groups (Groupement de Producteurs).

Training has also been an important component of the ISRA-SOMIVAC relationship since 1984, and SOMIVAC/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 toward the problems of salt-water intrusion control and mangrove swamp watershed management, the Liaison Unit organized a June 1985 round table 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 Djibélor PSR Team represents an important step toward closing the R-E gap in Casamance. The PIDAC (The Casamance Integrated Development Project Authority) extension program now includes thèmes or recommendations for intensified cropping that were proposed by the PSR 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 R-E 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 programs. The ultimate test of successful R-E 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 programs 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 PSR Department to deal with than the logistic and management problems associated with establishing a systems research program.

Overall, the PSR Department's programs have had adequate annual financing but researchers have not obtained sufficient funds when required. ISRA's inability to assure 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 PSR Department and BAME. Some research programs have, in fact, as many as five or six different sources of financing. An extremely complex budgeting system has

developed to manage these multiple sources of financial support. The Senegal public accounting procedures require separate accounts by program, by source of financing and by unit of disbursement. Added to this, each donor agency requires 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 continue 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, but this support is channeled 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 program 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 programs largely in the hands of expatriate scientists.

In 1980, ISRA initiated a massive recruitment and training campaign, whereby twenty of the PSR 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 MSc. degrees. Consequently, most of the PSR 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 program direction and activities[7].

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.[8]

## 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 PSR 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-PSR researchers rejected the legitimacy of the Department's role in programming and evaluation, believing it represented a threat to their autonomy, and some even felt that the Department wanted to control all of ISRA's agricultural research programs.

The creation of a new PSR Department also accentuated ISRA's budgetary stress. The projects that financed the creation of the PSR Department/BAME

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[7]Improved training that would permit technician-level staff to assume more sophisticated research responsibilities should also be considered.

[8]Budgetary and personnel constraints of the type discussed here are among the reasons why the PSR Department limited the number of PSR Teams during the 1982-1986 period.

channeled additional resources into ISRA, but experience has revealed that the Institute must more than ever before be rigorously selective in defining its research priorities and concentrate its resources on a few select programs. The financial management crisis and the animosities generated by the creation of the PSR Department, however, often detract from dealing with the critical administrative and policy issues.

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

Some PSR Department researchers still doubt the need for a separate production systems research department, arguing that PSR 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 programs should be oriented toward 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 PSR 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 and 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 administrators, 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 PSR 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 PSR 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 production systems approach or department into a research structure, but how to get the research institution as a whole to evolve toward an approach that is sensitive to farmers' problems. The Lower Casamance experience illustrates a step in this direction through its effort to link research programs 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 programs 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 PSR experience has not generated any innovations in PSR methodology. This experience adds little to the currently available literature on production systems research. The ISRA case, however, does permit reflection on the adequacy of PSR, as commonly conceived, to deal with the complex problems of agricultural development in Senegal and throughout Sub-Saharan Africa.

PSR 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, 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 programs in favor of "local self-reliance" suggests that PSR programs should give more attention to the role of local organizations in agricultural development.

In other words, most PSR programs give minimal attention to agricultural policy questions. Perhaps this reflects the fact that PSR methods and concepts were developed by the International Research Institutes to respond primarily to specific, crop-related problems. The PSR Department and BAME, in becoming a single unit for agrarian systems and agricultural economics research, is taking the first step toward linking micro and micro perspectives in agricultural research. Each PSR program is also taking steps to incorporate a broader perspective in its research activities. That is, despite the complex, frustrating and unresolved institutional problems discussed in this paper, ISRA is striving to pioneer in agricultural research.

## LIST OF ABBREVIATIONS

French Research Institutes (Selected)

| | | |
|---|---|---|
| CIFT | - | Centre Technique Forestier Tropical/Tropical Forestry Center. |
| CIRAD | - | (Formerly GERDAT): Centre de Coopération Internationale en Recherche Agronomique pour le Développement/International Center of Agronomic Research for Development. |
| IEMVT | - | Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux/Research Institute for Tropical Livestock and Veterinary Medicine. |
| IRAT | - | Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières/Tropical Agronomic Research Institute. |
| IRHO | - | Institut de Recherches pour les Huiles et Oléagineux/Institute for Oilseeds Research. |
| ORSTOM | - | Office de la Recherche Scientifique et Technique d'Outre Mer/Office for Overseas Technical and Scientific Research. |

Senegal Regional Development Agencies (Selected)

| | | |
|---|---|---|
| PIDAC | - | Projet Intégré pour le Développement Agricole de la Casamance/Integrated Development Project for the Casamance. |
| SOMIVAC | - | Société pour la Mise en Valeur de la Casamance/Casamance Regional Development Agency. |

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