

Farming

Systems

Research

Along the

Senegal

River

Valley

Agricultural Research Alternatives

Mauritania Agricultural
Research Project II
College of Agriculture
The University of Arizona
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FARMING SYSTEMS RESEARCH ALONG THE SENEGAL RIVER VALLEY
AGRICULTURAL RESEARCH ALTERNATIVES

by

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EXECUTIVE SUMMARY

The AGRES II project is a University of Arizona project funded by USAID. The Mauritanian counterpart organization is the Centre de Recherche Agronomique et de Developpement Agricole (CNRADA) which is based in Kaedi. The project's approach to research and development is through applying the Farming Systems Research and Extension (FSR/E) methodology. Project goals include: 1) the enhancement of the research capabilities of CNRADA; 2) establishing stronger links between CNRADA and research, extension and educational institutions, and 3) institutionalizing the FSR/E methodology at CNRADA for developing and extending appropriate technologies to farmers.

A research strategy which identifies potential research activities to be implemented by CNRADA has been formulated. This information is based on the results of a FSR/E reconnaissance survey conducted in 34 villages on the Mauritanian bank of the Senegal River. A summary of the possible research alternatives is listed below.

Summary of Research Alternatives

A. Irrigated Agricultural Research

- Compare the performance of rice, maize and sorghum on different soil types.
- Alternative crops could be proposed which require less water than rice or maize.
- Investigate the practice of allowing secondary shoots of sorghum to act as a second season crop.
- Determine the effects of planting maize on ridges.
- Determine what is the optimum size of an irrigated holding.
- Compare the economic returns from small perimeters vs. large perimeters.
- Determine the net returns of alternative irrigated crops.
- Develop irrigation schedules based on crop water requirements.
- Conduct research on alternative leveling techniques (i.e., puddling, animal traction, two-wheeled tractors).
- Identify other appropriate labor saving technologies.

B. Grain Crop Research

- Investigate the potential of sesame as an oil seed crop.
- Investigate the potential of sunflowers as a suitable crop for the region.
- Conduct research on drought resistant, water efficient short cycle crops.
- Test sorghum varieties for high density planting in walo areas.
- Develop reliable indicators of soil moisture.
- Provide more support for seed multiplication programs.
- Collect local seed germ plasms to obtain desirable genetic qualities.
- Test hybrid seeds developed elsewhere (i.e., sorghum, maize)
- Conduct research on farmers' practices regarding competing cropping activities.
- Identify crop varieties that can be grown that reduce labor conflicts.
- Devise appropriate cropping calendar which take food shortages into account.
- Conduct research on transplanting crops in dieri and walo cultivation.
- Conduct research on the effects of bending sorghum stocks.
- Investigate the effects of mulching in dieri cultivation.

C. Vegetable Crop Research

- Identify or develop vegetable varieties that are adapted to different seasons and have different maturation periods.
- Conduct research on improving vegetable cultivation through better water management, cultural practices and input use.
- Identify vegetable varieties that have minimum water requirements.
- Identify or develop vegetable varieties that transport better.
- Conduct research on vegetable preservation and storage techniques.
- Explore alternative vegetable packing strategies.

D. Crop Protection

- Identify or develop bird resistant varieties of sorghum.
- Identify or develop sorghum varieties that are resistant to smuts, disease and insects.
- Identify or develop cowpea varieties that are resistant to aphids.
- Devise cropping strategies that minimize the damage caused by birds.
- Determine the most appropriate way to deal with nutgrass (herbicides, weeding, water management, ruminant grazing).
- Determine if nutgrass has any economic use.
- Conduct research on termites to determine appropriate control measures.
- Conduct research on cricket control measures.
- Experiment with chemical inputs to determine appropriate use (insecticides, herbicides).
- Initiate entomology studies on insect population dynamics.

E. Livestock Research

- Identify ways to incorporate forage crops more directly into cropping systems.
- Determine if crop residues can be improved nutritionally through genetic means or chemical additives.
- Conduct research on leguminous forage crops which would serve both as a food and a fodder.
- Identify forage crops with minimal water requirements for irrigated and walo cultivation.
- Determine the economic feasibility of promoting fodder crops as cash crops.
- Determine ways to improve animal productivity taking current animal potential and breeding conditions into account.
- Develop a viable plan for the progressive introduction of intensive livestock rearing.
- Identify ways to integrate livestock with crop production.
- Identify ways to better organize livestock marketing channels.

F. Soil Research

- Conduct a soil survey in the river valley to develop accurate soil maps.
- Develop a land use assessment methodology using climate, soil, aerial photography and landsat information.

G. Agroclimatic Research

- Conduct research on rainfall patterns to determine the optimum time for planting.
- Investigate the climatological, environmental and hydrological patterns in the river valley.

H. Pre-Extension and FSR Activities

- Conduct FSR/E reconnaissance surveys and thematic studies to understand present agricultural practices and constraints facing farmers.
- Initiate on-farm trials to test technologies and new cultivation techniques under actual farmers' conditions.
- Monitor and evaluate technologies which have been disseminated.
- Build stronger links between extension services and CNRADA (sharing information, conducting on-farm trials).
- Use teachers and students at the School of Agriculture, Kaedi to help set up on-farm trials and conduct surveys.
- Use Peace Corps Volunteers to conduct on-farm research.
- Introduce new technologies and practices as components rather than in packages.
- Identify all possible channels through which new technologies can be disseminated.

I. Other Research

- Conduct agro-forestry experiments to see if trees can more effectively be integrated into agricultural production (shelterbelts, alley cropping with nitrogen fixing trees).
- Investigate the possibility of using live fences to keep animals out of perimeters and fields.
- Determine if farmers are receptive to planting tree lots for fencing and firewood sources.
- Develop and test fuel efficient wood burning stoves.
- Investigate other possible energy sources such as peat, manure, solar energy and wind power.
- Set up an aquaculture research program to help develop fresh water fishing.
- Develop water harvesting and micro-catchment techniques for walo and djeri lands.
- Identify vegetation that can be planted in barren spaces.
- Conduct research in the Gorgol River Basin to determine the impact of the Foun Gleitat dam on farmers in the area.
- Conduct research on fonio.
- Develop the capability at CNRADA to obtain funding for research projects through submitting proposals to funding sources.

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I. INTRODUCTION

The AGRES II project is a University of Arizona project funded by USAID. The Mauritanian counterpart organization is the Centre de Recherche Agronomique et de Developpement Agricole (CNRADA) which is based in Kaedi. The project's approach to research and development is through applying the Farming System Research and Extension (FSR/E) methodology. This approach is multidisciplinary and considers the farm household as the main focus of all research and extension activities.

The overall objective of the AGRES II project is to improve the standard of living of farm households by increasing agricultural production, especially staple foods, and by arresting the deterioration of the environment in the river valley. To accomplish this objective, the project has three main goals to strive for during its life span (four and one-half years). These include: 1) to establish the research center in Kaedi as a credible and regionally recognized research institution (Institution Building); 2) to establish collaborative links between the various rural development, agricultural, educational and research institutions and organizations (Institutional Linkages); 3) to apply the FSR/E methodology and approach to research and extension by establishing on-farm trials and experiments and by extending the new appropriate technologies developed by CNRADA and on other research stations in the Sahel and West Africa (Establishing an FSR Capability).

In order to accomplish these goals, it will require a program emphasizing data gathering, training, and agricultural extension and dissemination. Field and village surveys, on-farm trials and experiments, and literary searches will need to be carried out in order to obtain an extensive data base and thorough understanding of the present agricultural systems and available research capabilities. Such information will enable researchers to determine the numerous social, cultural, economic and environmental constraints affecting agricultural production and marketing in the Senegal River Valley. A number of Mauritanian researchers, extension agents and educational people will have to be trained, locally, regionally and in the United States. Seminars, workshops and field trips will have to be organized and conducted in order to disseminate information and extend improved technologies that have been developed at research stations elsewhere in the Sahel and West Africa. Finally, a monitoring and feedback system must be established in order to quickly identify new constraints, to ensure the correct application of new technologies and the sustainability of the research and development goals and objectives.

To guide project implementation, a research strategy which identifies potential research activities to be implemented by CNRADA has been formulated. This information is based on the results of a farming systems reconnaissance survey of the Mauritanian Bank of the Senegal River which covered 34 villages in four regions (Guidimaka, Gorgol, Brakna, and Trarza Regions) (see Report 1). The survey team involved 16 persons drawn from CNRADA, SONADER, Inspection Regional d'Agriculture, Direction d'Elevage, Direction de la Protection de la Nature, Office of the Governor of Gorgol, PMI, Cooperative Extension and Education, University of Leiden, Holland and the University of Arizona. This survey allowed the researchers to assess the current agricultural practices, constraints and needs of farmers so that research programs could be devised accordingly. This report draws upon this information and outlines a number of possible research alternatives which CNRADA can pursue. Before discussing these research alternatives, a brief description of CNRADA and the project personnel to be involved with the research is presented.

II. CNRADA

CNRADA (Centre National de Recherche Agronomique et de Developpement Agricole) is an autonomous research organization within the Ministry of Rural Development which is responsible for overseeing all agricultural research conducted in Mauritania. Established in 1974, its headquarters is located at Kaedi with substations in Selebaby, Kankossa, and Barkeol. CNRADA is managed by a director and a technical director. The technical director oversees the activities of eight divisions which focus on grain crops, irrigated rice, vegetables and fruits, soils, pre-extension, crop protection, agro-climatology, and forage¹ (see Chart 1). Although these various divisions constitute a wide based research program to cover important concerns of the National Program, they are thinly staffed and poorly supported by the National Budget. Because of financial and human resource constraints, research carried out by CNRADA is financed and generally administered by outside donors and expatriate assistance (Project Paper 1984:133). Donor support and technical assistance has come from FAC, GERDAT, FED, SAFGRAD, UNDP/FAO, and USAID.

Most of the research of CNRADA is focused at Kaedi which is the national research station for Mauritania. The new research station is located at Belinabe, 6 kilometers west of Kaedi. Previous research efforts included variety trials, production of selected seeds, improvement of farming practices, studies of factors affecting production (i.e., climate, soil, water requirements, fertilizers, etc.), vegetable trials, animal production studies, and testing of agricultural machinery (Project Paper 1984:23). Promising research results have been obtained from experiments on irrigated rice, irrigated vegetables and fruit trees. Rice research, primarily supported by UNDP/FAO has focused on varietal testing, fertilizer applications, spacing, planting dates and cold tolerance tests. Vegetable research has focused on species introduction, production scheduling and plant protection. A nursery for fruit trees was established at Rindiao in 1970 by IRAC. Experiments have also been conducted on rainfed millet (cultivars) obtained from CILSS). Work on sorghum, corn and cowpeas has only recently begun.

Although CNRADA has developed some technologies which are ready for on-farm testing, very little work has been done in this area. In the past, CNRADA initiated some limited on-farm testing in the Gorgol Region by hiring farmers to work on pilot perimeters near Kaedi (Project Paper 1984:24). Recently some limited on-farm testing has been conducted in the Guidimaka Region. Budgetary constraints have limited the expansion of these experiments to other regions.

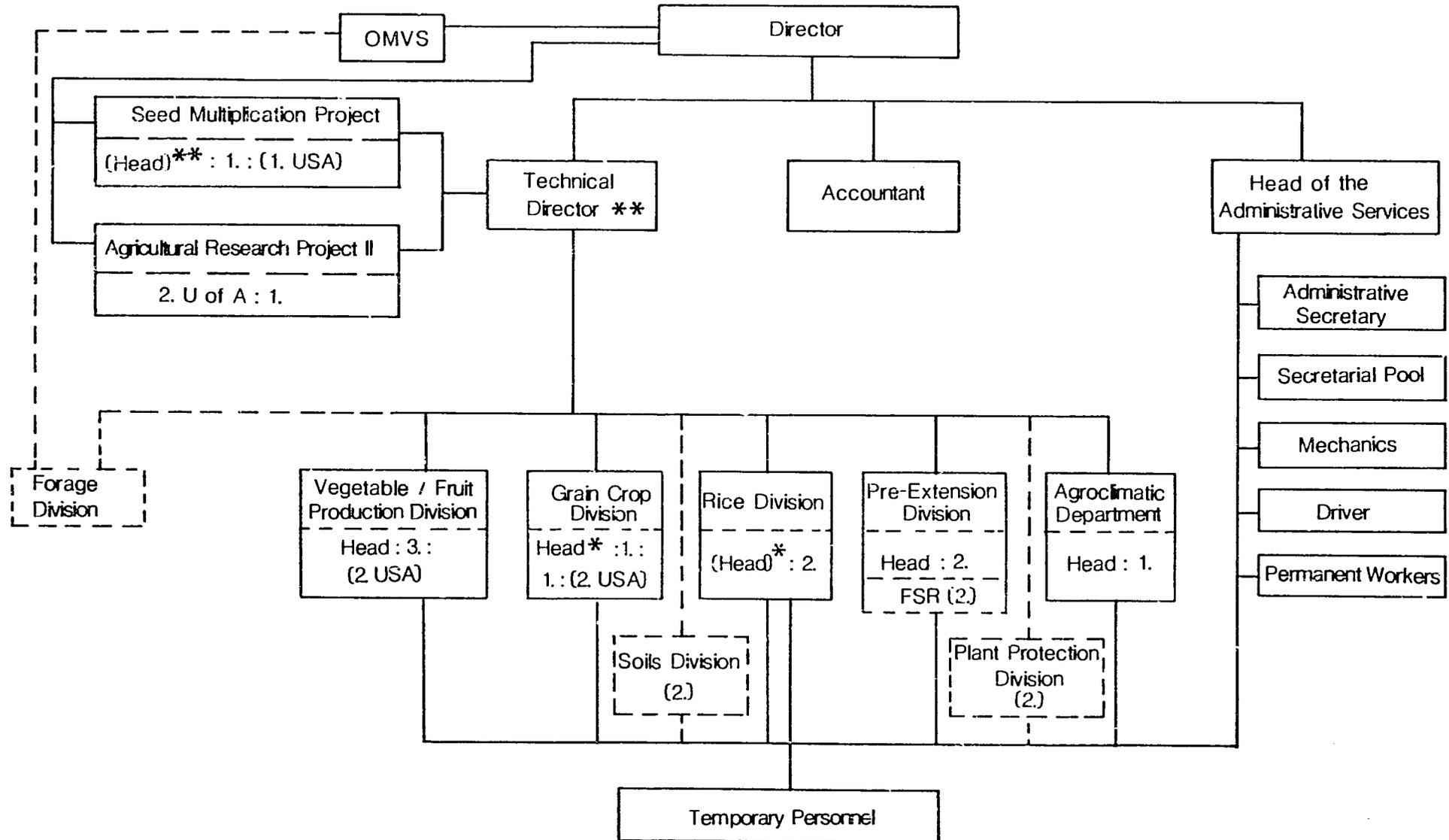
Another major constraint to on-farm testing and technology transfer has been the weak linkages between CNRADA and extension agencies. As stated earlier, one of the major goals of this project is to improve the linkages between research and extension as well as with educational institutions responsible for training these personnel (see Appendix A). How this will be accomplished is discussed below.

III. PROJECT STAFF

The project team is composed of two expatriates from the University of Arizona staff. These include a chief of party and an administrative manager.

¹ The forage division is an OMVS funded research activity.

CHART 1.
 ORGANIZATIONAL CHART OF THE NATIONAL AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
 AT KAEDI, GORGOL REGION



* } Head of Two Divisions
 ** }

CNRADA has seconded on a part-time basis a project coordinator who is also the technical director of CNRADA. Two other Mauritanian researchers are working with the project on a part-time basis. In addition, one Mauritanian has been assigned as an administrative technical assistant to help the administrative manager.

To effectively carry out the research activities envisioned for CNRADA, a number of staff members must be trained. CNRADA staff are being trained locally through workshops and "on-the-job" experience as well as by attending regional training workshops focusing on FSR/E methodologies (i.e., Gambia, Mali) (See Appendix B). In addition, five researchers from CNRADA have recently left for the United States to obtain B.S. degrees from the University of Arizona. Degrees are being sought in Agriculture Economics (minor in FSR), Agriculture (minor in soils and irrigation), Agronomy (minor in plant sciences and extension) and Soil Science. Two other B.S. level trained researchers will leave for the United States for Masters training in the next two years.

Although the long-term training is necessary, the loss of five researchers in 1986 and possibly two in 1987 greatly reduces CNRADA's staff of experienced researchers. This could put some strain on the remaining research staff, especially if replacements without field experience are hired. Thus, more staff with field experience (either Mauritanians or expatriates) will be required to implement many of the activities proposed for the research strategy.

The FSR component to be introduced into CNRADA will be housed in the pre-extension division, and will maintain strong linkages with all of the other divisions. Given the multidisciplinary nature of this approach, the research activities will frequently involve researchers from the various divisions. The FSR staff will consist of two qualified persons of at least the B.S. level trained in agronomy/extension and agriculture economics/applied anthropology/sociology.

IV. RESEARCH ALTERNATIVES

The following research alternatives were derived from an FSR/E reconnaissance survey conducted in January and February, 1986. These alternatives are based on the current agricultural practices, constraints and needs of farmers located along the Mauritanian Bank of the Senegal River. Although the list is comprehensive, it is assumed that only a few of these alternatives will be implemented at any one time. No attempt was made to prioritize these research alternatives. This task has been left to CNRADA and the Ministry of Rural Development.

An attempt has been made to group these research alternatives under the various research divisions that may be responsible for implementation. For those alternatives which do not fit under existing divisions, these have been grouped under the category of "Other." Many of these research alternatives may be applicable to several divisions, and should not be viewed as mutually exclusive. The presentation of each research alternative will be followed by a statement regarding the current status of research in this area at CNRADA.

A. Irrigated Agricultural Research (Rizicole and Culture Vivriere Divisions)

- Research could focus on ways of improving the utilization of perimeters taking into account differences in access to soil, water, diesel and other inputs (p. 74).*
- a. Research could be conducted to compare the performance of rice, maize and sorghum on different soil types. The crops would be planted on both light and heavy soils.
- b. Alternative crops could be proposed which require less water than rice and corn. Sorghum is one possible alternative (p. 76).
- c. Research could investigate the practice of allowing secondary shoots of sorghum to act as a second season crop (p. 23). An economic analysis could be conducted to compare the net returns of this practice with replanting a second crop.

Current Status: CNRADA is presently working with varieties of sorghum that are well suited to irrigation (i.e., CE151, CE145). On-station research is focusing on comparison trials with rice, maize and sorghum being planted on different soil types (both light and heavy irrigated soils). In addition, on-farm variety and organic fertilizer trials are being conducted in 6 villages. Irrigated sorghum trials involving yield measurements are also being conducted in 5 perimeters. Sorghum trials testing varieties of fertilizer and intercropping with cowpeas are planned for the second campaign as well. CNRADA has also collected 29 local sorghum varieties which are presently being screened.

- Research could be conducted on the effects of planting maize on ridges (p. 21).

Current Status: Very little work has been done at CNRADA in this area.

- A socio-economic study could be conducted to determine what is the optimum size of an irrigated holding for a farm family, taking yield and economic returns into account. Other factors to take into account in this study would be environmental conditions, access to resources, family circumstances, and optimum size of perimeters for a given pump (p. 71).

Current Status: This research could begin with the indepth SONADER study that was carried out in 1980-1982 in the Gorgol perimeter (unpublished report 1982) (p. 14).

- A comparative economic study could be conducted focusing on small perimeters (types A and B) and large perimeters.

Current Status: This study would begin with the studies already conducted by SONADER.

*All page numbers cited refer to where this issue is discussed in Report No. 1.

- An economic analysis could be conducted to determine the net returns of alternative irrigated crops (p. 72).

Current Status: This study could begin by reviewing past studies by SONADER.

- Research could focus on developing irrigation schedules which are based on crop water requirements (p. 75).

- a. Determine what the minimum seasonal water requirements are for each crop (p. 75).
- b. Develop scheduling criteria for each type of crop taking season and soil conditions into account (p. 75).

Current Status: This work should build upon the work of SONADER and past research conducted by CNRADA. FAO has also done some work on this in the region.

- Research could be conducted on alternative leveling techniques (p. 75).
 - a. Experiments could be conducted on the advantage of puddling. This involves flooding a parcel before plowing and using the water as a transport vehicle for moving soil (especially the heavy soils found in the fonde areas).
 - b. Investigate the feasibility of using animal traction and two-wheeled tractors for leveling fields.

Current Status: CNRADA has been experimenting with small machinery, animal traction and puddling to level fields. Two-wheeled tractors are presently being used on the station for land preparation. Animal traction experiments were also conducted at Rindiao up to 1975. These experiments were funded by OMVS. CNRADA also practices puddling to level its irrigated fields for experiments. None of these technologies or practices have been extended to farmers. In addition to CNRADA, Partners for Productivity (PFP) is also experimenting with small machinery (i.e., rototillers). Collaborative efforts could be initiated with PFP in this area.

- Conduct research on other labor saving technologies to determine which are the most appropriate, given farmers' circumstances with regards to access to resources, inputs, spare parts and training (p. 83).

Current Status: Although CNRADA has not extended any labor saving technologies or practices to farmers, work is being conducted in this area at the research station (see above). CNRADA could collaborate with extension services and PFP to conduct research in this area.

Staff Requirements: If any of the economic analyses proposed are to be conducted, it may be necessary to bring in researchers trained in agricultural economics. An agriculture engineer might also be required if research into appropriate irrigation technology is to be conducted.

B. Grain Crop Research (Culture Vivriere Division)

- Researchers could investigate the potential of sesame as an oil seed crop for this region (p. 86-87).
 - a. Sesame seed could be obtained from the Sudan, Cameroon, and possibly international agricultural centers like ICRISAT and ICARDA. This sesame could be tested on station and in researcher managed trials on farmers' fields in the Guidimaka region (see Appendix C). An essential component in these trials will be the farmers' receptivity to the taste of sesame oil.
 - b. Low technology processing techniques for sesame should be tested to see if farmers are interested in adopting such technology. The current processing techniques used in the Sudan may be suitable for the region and are easily transferable.

Current Status: No research has been conducted on sesame by CNRADA in the past. Presently, CNRADA is conducting on-station research on sesame regarding fertilizer application and row spacing, timing of planting and land preparation, and intercropping (i.e., sesame, millet and cowpeas). On-farm trials are also being initiated this year in 6 to 8 villages. These trials are focusing on comparisons among sesame and two varieties of millet and intercropping of sesame, millet and cowpeas. In addition, one alley farming trial is planned in one village. Sesame will be planted in association with millet, Leuceana and Gliricidia (Acacia trees) (see Appendix C).

- Research could be conducted on sunflowers to determine if they are a suitable crop for the region.

Current Status: No research has been conducted on sunflowers by CNRADA in the past. Presently, CNRADA is conducting on-station research on sunflowers which focuses on spacing and fertilizer application under irrigated conditions. In addition, one on-farm trial is being initiated in a perimeter which deals with intercropping and fertilizer application.

- Research could focus on drought resistant, water efficient, short cycle crops for dieri, fonde and walo cultivation (p. 80).
 - a. On-station and on-farm trials could be conducted on short cycle varieties of millet, sorghum, maize and cowpeas which have been developed elsewhere (i.e., ICRISAT, SAFGRAD, CILSS, etc.).
 - b. Sorghum varieties could be tested for high density planting in walo areas.

Current Status: In recent years, CNRADA has been conducting varietal trials on millet, sorghum, maize and cowpeas. Varietal selection criteria include short season, yield and insect resistance. Millet varieties have been obtained from CILSS and SAFGRAD. Some promising millet varieties include HKP (CILSS), Souna (Bakel region), and Souna III (Senegal). Sorghum varieties have also been obtained from CILSS (CE151, CE145, and CE90). In addition, FAO collected millet and sorghum varieties in the area in 1984. Twenty-nine of the local sorghum varieties are presently being screened. One variety called Dabiri is photosynsitive and has good potential as a short cycle variety. Cowpea varieties have been obtained from IITA. Cowpeas are being selected

for short season and resistance to insect attack in storage. On-farm trials involving yield measurements will be conducted in 1986 in 10 villages for rainfed millet, rainfed and recession sorghum and rainfed and recession cowpeas.

- Research could be conducted on developing reliable indicators of soil moisture for walo fields (p. 80). This will enable farmers to determine optimum planting times and the types of crops to plant (i.e., sorghum, cowpeas, other crops).

Current Status: No work has been done in this area at CNRADA.

- Seed multiplication programs could receive more support in order to produce sufficient quantities of improved seeds to meet the needs of farmers (p. 65).
 - a. Develop seeds which are adapted to different climatic constraints and soil types.
 - b. Introduce new varieties as well as improve local varieties.
 - c. Local seed germ plasms could be collected and maintained in order to incorporate traits which are appreciated by local farmers (i.e., taste, bird resistance, long stocks, etc.).
 - d. Hybrid seeds developed in other regions of the Sahel (e.g. Sudan) could be tested to determine their appropriateness for Mauritania, especially for irrigated perimeters. If hybrids are introduced, care must be taken to insure that ample supplies of seeds are made available each year in a timely fashion, and that farmers are made aware that they cannot save the seed.
 - e. Diversification of cereal crops could be emphasized in seed programs. Farmers should be given alternatives so they can select the cereal crops and varieties that best fit their preferences and circumstances. The crops that receive first priority should be those which are the most widely grown and have the greatest potential for improvement.

Current Status: A seed multiplication program supported by FAO has been ongoing at CNRADA for several years. Seed is being multiplied for rice, maize and sorghum.* In addition, FAO has collected local millet and sorghum varieties in 1984 for breeding purposes. As stated earlier, 29 of these varieties are being screened this year. CNRADA is also obtaining new millet, sorghum, and cowpea seed from elsewhere (i.e., CILSS, SAFGRAD, Senegal and IITA) as well as working with local varieties. Some work is being done on hybrid maize for use in irrigated perimeters as well. Although CNRADA is presently not working with hybrid sorghum, PFP is considering testing hybrid

*Although CNRADA is making an effort to make seed available, SONADER has complained that CNRADA is charging too much for the seed (J. Core personnel communication). However, farmers are paying three times the price CNRADA charges in the local market.

seed obtained from the Sudan. CNRADA could collaborate with PFP on this testing to see if such hybrids have potential for the area.

- Research could focus on farmers practices regarding competing cropping activities (p. 69).
 - a. Information could be collected on farmers' decisions regarding labor adjustments for different cropping patterns to deal with labor bottlenecks.
 - b. Identify crops and varieties that can be grown which would reduce labor conflicts.
 - c. Taking present practices and constraints into account, devise cropping calendars which are realistic plans for farmers to follow.
 - d. Adjust crop calendars to take seasonal food shortages into account (combine short cycle and long cycle varieties to fill food gaps).
 - e. Develop crop calendars which take into account the variability that exists in climate and access to land resources along the Senegal River.

Current Status: No work is being done in this area at CNRADA.

- Experiments could be conducted on transplanting millet to dieri soils to avoid dry top soil. Similarly, experiments could be conducted on transplanting sorghum to walo soils. Deep rooting millets and sorghum should be used to obtain the best results.

Current Status: No work has been conducted in this area at CNRADA. In Sudan, such millet transplanting was tested with some success. In Cameroon and Chad, high yields are obtained in recession sorghum cultivation by transplanting sorghum when walo soils are still moist.*

- Research could be conducted on the positive and negative effects of bending sorghum stocks before they reach maturity (p. 84).
- Research could be conducted on the effects of mulching on water retention and soil moisture in dieri cultivation (p. 86).

Current Status: No work is being conducted in this area at CNRADA.

Staff Requirements: To pursue many of the research alternatives outlined under grain crop research, an additional agronomist and possibly an agricultural economist will be needed. Both should be trained at the B.S. level.

*Land preparation before flooding also has a positive impact on yields.

C. Vegetable Crop Research (Maraichage, Fruitiere Division)

- Research could focus on identifying or developing vegetable varieties that are adapted to different seasons and which have different maturation periods. Such varieties would enable farmers to have access to vegetables for home consumption through most of the year, as well as help spread marketing out. Varieties may be obtained from Senegal, IITA, and the Asian Vegetable Research and Development Center in Taiwan (p. 89).

Current Status: Vegetable research has been carried out by CNRADA since 1976. The major goals of this research program are 1) to introduce vegetables and fruits into the country; 2) investigate cultural practices; 3) produce seed for distribution. Vegetable varieties are being obtained from IITA, Niger and the USA (Texas). Varietal trials and seed multiplication are being conducted for potatoes, lettuce, onions, tomatoes, carrots and cabbage. CNRADA is also testing different planting dates for onions. In addition to CNRADA, PFP is also testing new vegetable varieties obtained from Japan. PFP is trying to identify vegetable varieties which can grow during the three hottest months (April-June). CNRADA could collaborate with PFP on this research.

- Research could focus on improving vegetable cultivation through better water management, cultural practices and input use (p. 89).

Current Status: Although the vegetable research program at CNRADA views the investigation of local vegetable cultivation practices as important, very little work has been done in this area until recently. In April 1986, a three-week thematic survey focusing on vegetable production was conducted. This survey collected data from ten villages and three major markets. This information is intended to help guide future vegetable research conducted by CNRADA. Research on improved cultivation practices is also being initiated by PFP. Researchers are testing the advantages of planting vegetable crops in lower densities than is traditionally practiced by local farmers. CNRADA could collaborate with PFP on this research.

- Research should attempt to identify vegetable varieties that have minimum water requirements (p. 88). This could help cut down on the frequency of watering.

Current Status: No work is being done in this area at CNRADA.

- Research could focus on identifying or developing vegetable varieties that transport better.

Current Status: No work is presently being done in this area at CNRADA. Vegetable varieties that do transport better may already exist in Senegal. For example, certain types of tomatoes found in Senegal have harder skins and can be transported with minimum losses.

- Research could focus on vegetable preservation and storage techniques (p. 90). Forms of storage and preservation techniques which are appropriate to the resource base of farm families should be emphasized. Such practices could give farmers access to vegetables during other seasons and food deficit periods.

Current Status: No work is presently being done in this area at CNRADA. This research could begin with preservation and storage techniques already suggested in the USAID funded report entitled, "Vegetable Production Potential in Mauritania" (1982).

- Research could explore alternative vegetable packing strategies to identify a cost-effective way to transport vegetables with minimal damage (p. 90).

Current Status: No work is presently being done in this area at CNRADA. This is an area where extension could become involved.

Staff Requirements: To effectively deal with the research needs which will bring about improvements in vegetable production, more vegetable specialists should be brought in to CNRADA. One or two agronomists trained at the B.S. level will be needed. In addition, serious consideration could also be given to bringing in a food technologist to work on appropriate storage and preservation techniques. This person should also be trained at the B.S. level or higher.

D. Crop Protection (Defense Vegetaux Division)

- Research could focus on identifying or developing sorghum varieties which are resistant to pests and diseases (p. 82).
 - a. Bird resistant sorghum varieties could be identified or developed (i.e., long bristles, curved necked).
 - b. Sorghum varieties that are resistant to smuts, other diseases and insects could be identified or developed.

Current Status: Although CNRADA has not been focusing heavily on bird resistance and smut resistance in varietal selection, insect resistance is an important selection criteria. Further work could be initiated in this area.

- Research could identify or develop cowpea varieties that are resistant to aphids (p. 82).

Current Status: The work carried out by CNRADA on cowpeas has focused on selecting varieties that are resistant to storage insects. No work has been initiated on selecting varieties that are resistant to aphid damage. To begin this research, CNRADA could contact IITA to determine if any work has been done in this area.

- Research could focus on cropping strategies that minimize the damage caused by birds (p. 82).
 - a. Researchers could determine the beneficial effects of planting red and black sorghums on the outside of fields and white sorghum on the inside.
 - b. Research could focus on the feasibility of adjusting the timing of crop planting to avoid peak periods of bird infestation. Such adjustments are quite common in rainfed agriculture in other parts of the Sahel (i.e., Sudan).

- c. Experiments could be run on short cycle varieties of sorghum to see if they mature before peak periods of bird infestation.

Current Status: No research is currently being carried out by CNRADA in this area.

- Research should be conducted to determine the most appropriate way to deal with nutgrass (p. 79).
 - a. Control measures could be developed which include herbicides, appropriate weeding techniques, proper water management or ruminant grazing.
 - b. Research could attempt to determine if nutgrass has any economic use.

Current Status: No research is presently being conducted in this area by CNRADA.

- Research could be conducted on termites to determine the most effective way to control these pests. Some of the areas of investigation might include: 1) alternative land preparation techniques; 2) soil treatment; and 3) the destruction of crop residue. This research would be applicable to both walo and dieri cultivation.

Current Status: No research is presently being carried out in this area by CNRADA. Efforts in this area could begin through collaboration with the Integrated Pest Management Project (IPM).

- Research could focus on an effective way to control crickets. Crickets cause extensive damage to sorghum, especially when the crop is in the seedling stage (p. 80).

Current Status: No work is presently being carried out in this area by CNRADA. To initiate research in this area, CNRADA could collaborate with the IPM project.

- Researchers could conduct experiments with seed treatment dressings, insecticides, and other chemicals to determine the appropriate use of such chemicals and their economic viability for farmers.

Current Status: No research is presently being conducted in this area by CNRADA. As stated earlier, CNRADA could establish collaborative links with the IPM Project to conduct this research.

- Entomology studies could be initiated on the insect population dynamics in the different agricultural systems.

Current Status: No research is presently being carried out by CNRADA in this area. As mentioned before, CNRADA could work with the IPM Project in this area.

Staff Requirements: If CNRADA is to establish an effective plant protection section, it will need to bring in additional staff trained in entomology and possibly plant pathology. At least one entomologist trained at the B.S. level will be required as well as one plant pathologist trained at the B.S. level. If such staff cannot be brought in, CNRADA might consider integrating an IPM researcher into their research program.

E. Livestock Research (Forage Division)

- Research could focus on ways to improve access to forage by incorporating forage crops more directly into the cropping systems followed by farmers. (p. 93).
 - a. Research could be conducted to determine if crop residues can be improved nutritionally through genetic means or by chemical additives. For instance, rice stocks can be treated with NH_3 to improve the nutritional value of the residue.
 - b. Research could focus on leguminous forage crops which could serve both as a food and a fodder. A 45-day cowpea variety (CB-5) recently introduced into Senegal might be worth testing for this purpose.
 - c. Leguminous forage crops with minimal water requirements could be identified which could serve as an irrigated rotation crop to be planted in the second season and third season of a perimeter.
 - d. Researchers could identify or develop a forage crop to be planted in walo areas that are not inundated long enough for sorghum production.
 - e. Research could focus on the economic feasibility of promoting fodder crops as cash crops, especially during the dry season.

Current Status: CNRADA currently has a division supported by OMVS which focuses on forage resources. However, the division is not presently focusing on any of the research alternatives outlined above. PFP also intends to work on forage in its project. CNRADA could coordinate its efforts with PFP in this area as well as with the Livestock Direction of the Ministry of Rural Development.

- Research could focus on ways to improve livestock production (p. 94).
 - a. Develop ways in which animal productivity could be improved taking current animal potential and breeding conditions into account.
 - b. Develop a viable plan for the progressive introduction of intensive livestock rearing practices which minimally disrupt existing farming systems.
 - c. Identify ways in which livestock can be better integrated with crop production (i.e., animal traction, manure, crop residue as fodder, etc.)
 - d. Identify ways in which marketing channels can be better organized to market animal products.

Current Status: As stated earlier, CNRADA conducted research on animal traction at Rindiao up to 1975. This research was funded by OMVS. In addition, CNRADA obtains manure from the Agriculture School to apply to its experimental fields. Considerably more could be done in livestock related research. This research could be conducted in collaboration with the Direction of Livestock.

Staff Requirements: CNRADA might consider bringing in additional researchers to address the research alternatives proposed for livestock research. At least one animal scientist with B.S. training should be brought in to conduct some of this research. This person could work closely with the other crop divisions, especially with regards to forage crops. In addition, CNRADA might negotiate with the Direction of Livestock to have a livestock specialist assigned to the CNRADA research facilities.

F. Soil Research (Pedologie Division)

- A soil survey could be conducted in the river valley so that accurate soil maps could be drawn up for the region. This survey would identify the various soil types, their local names, and the significance of the name to the local culture. This survey would also attempt to specify what crops are normally grown on particular types of soil.

Current Status: No research is presently being carried out in this area by CNRADA. This work would build upon the past surveys conducted in the area such as: 1) the 1973 FAO sponsored soil and land classification study done by La Societe d' Etude et de Developpement Agricole (SEDAGRI); 2) the aerial survey that was made by Groupement Monantali in 1970-71 of the entire Senegal River Basin (1977); 3) the soil suitability study that assessed the potential for irrigation all along the river done by Groupement Manantali (1977); and 4) the land use survey conducted in April 1980 in the Etude Socio-Economique du Bassin du Fleuve Senegal."

- Research could focus on developing a land use assessment methodology for determining appropriate use of land resources. Using climatic, soil, aerial photography and landsat information, researchers could specify which area should be used for agriculture, animal husbandry and forests.

Current Status: The AGRES II project intends to use aerial photography and landsat information to monitor agricultural activities and other land use patterns along the river. This information could be combined with the climatic data and the soil survey information to specify appropriate use of land resources along the river. The secondary information outlined above would also be useful for this research.

Staff Requirements: To effectively carry out the soil research, CNRADA will need to bring in staff trained in this area. Presently, CNRADA has no soil scientist to do this work. The AGRES II project is presently training one soil scientist for this purpose. In addition, the project intends to bring in one soil scientist on a short-term basis to initiate this survey work.

G. Agroclimatic Research (Agroclimat Division)

- Research could focus on rainfall patterns to determine the optimum period for planting.

Current Status: Climatic data are already being collected by CNRADA on a regular basis at some of the research stations. The rainfall statistics could be analyzed to determine if there are any recurring patterns.

- A broad study could be conducted which analyzed the climatological, environmental and hydrological patterns in the river valley. This study would attempt to identify significant patterns and any changes which may have impacted the ecology and farming systems in the Senegal River Valley.

Current Status: No work is presently being carried out in this area. This work could begin with the environmental assessments done in the past by ORGATEC (1978) and RAMS (1980).

Staff Requirements: Additional staff would be required if CNRADA were to conduct the broad ecological study. The rainfall analysis could probably be accomplished with existing staff and one additional person.

H. Pre-Extension and FSR Activities (Pre-vulgarisation Division)

- A farming systems research methodology will be used to ensure that the technology generated by CNRADA is applicable to the needs of farmers.
 - a. Reconnaissance surveys and thematic studies will be conducted to obtain a thorough understanding of the present agricultural systems and constraints facing farmers. (See Appendix D for some possible thematic research alternatives).
 - b. On-farm trials will be initiated to test technologies and new cultivation techniques under actual farmers' conditions and to obtain farmer feedback regarding such technologies.
 - c. Technologies which are disseminated will be monitored and evaluated to identify new constraints, to ensure the correct application of new technologies and practices and to determine the short- and long- term impact of such technologies.

Current Status: The AGRES II project is intended to strengthen CNRADA's capabilities in conducting farming systems research. The dry season reconnaissance survey conducted in January and February 1986 helped generate the research alternatives presently discussed in this report. A rainfed survey is scheduled for September and future thematic studies will be conducted as the need arises. On-farm research is being initiated in 10 villages this rainy season. On-farm trials are also planned for recession and second season irrigation in 10 villages as well.

- Steps could be taken to build a stronger link between the extension services and CNRADA (p. 67).

- a. Extension agents could be brought in periodically to be informed by CNRADA researchers about the findings of ongoing research. Extension agents could be kept up-to-date on the latest trials, improved seeds and improved techniques.
- b. Extension agents could participate in FSR training seminars to learn about new data collection techniques and ways to approach their work.
- c. Extension agents could provide feedback to CNRADA regarding farmers' problems and needs.
- d. CNRADA could also elicit the aid of extension agents in conducting on-farm trials and monitoring experiments.

Current Status: In the past, few linkages existed between CNRADA and extension agencies. Presently, efforts are being made to collaborate directly with the extension agents in the region, especially in conducting on-farm trials. Representatives from the extension services were also involved in the FSR reconnaissance survey.

- In addition to the extension services, CNRADA could use teachers and students at the School of Agriculture in Kaedi to help set up on-farm trials and conduct surveys.

Current Status: In the past, the collaboration between CNRADA and the School of Agriculture has been minimal. Recently, preliminary discussions have been initiated about the possibility of collaboration. CNRADA intends to include at least one staff member from the school in the rainfed FSR reconnaissance survey to be conducted in September 1986.

- Peace Corp Volunteers (PCVs) could work with CNRADA in conducting on-farm research (p. 67).
 - a. PCVs could help monitor experiments and collect yield data for the on-farm trials.
 - b. PCVs could provide feedback to CNRADA researchers from farmers with regards to the trials.
 - c. Health PCVs could be used to collect consumption data such as food preferences, seasonality of foods consumed and quantities of food consumed.

Current Status: Although minimal collaboration has existed between CNRADA and Peace Corp Volunteers in the past, steps are being taken to improve the link. PCVs are currently being asked to help monitor on-farm trials in a number of villages along the river. Steps are being taken to train these PCVs in on-farm research techniques through workshops put on by CNRADA.

- Improved cultivation techniques, inputs and crop varieties to be disseminated to farmers could be introduced as separate components rather than in packages. In this way farmers can adopt the components they can afford.

Current Status: In the past, CNRADA has attempted to disseminate new technology in packages rather than as separate components. For instance, improved varieties of rice, sorghum and corn were introduced with fertilizers, insecticides and land preparation techniques. CNRADA researchers now realize that the average farmer will not adopt packages and they are attempting to introduce separate components.

Efforts could be made to identify all the possible channels through which new varieties, inputs and improved cultivation practices can be disseminated. For example, new technologies and practices can be disseminated through extension services, organizations like SONADER and CARITAS, village merchants and farmer networks.

Current Status: No work is presently being done in this area at CNRADA.

Staff Requirements: In order to effectively carry out many of the FSR activities envisioned for CNRADA, two more staff members will have to be incorporated into the Pre-Extension Division. One researcher should have at least B.S. training in agronomy/extension and the other should have B.S. training in agriculture economics/applied anthropology/sociology.

I. Other Research

- Agro-forestry experiments could be conducted to see if trees can be more effectively integrated into agricultural production (p. 57).
 - a. Researchers could identify appropriate trees for shelterbelts to be planted around farmers' fields to help cut down on wind erosion, sand encroachment and evapotranspiration. Such trees could help retain soil moisture and could serve as a source of fuel, building material and a source of fodder. Trees that might be used for this purpose could be Prosopis spp., a number of Acacias or Australian pine.
 - b. Nitrogen-fixing trees could be identified that can be intercropped with other crops in fields (i.e., alley cropping or strip cropping). Acacia senegal is one possibility. Researchers could determine the proper spacing patterns that should be between trees to allow for intercropping of other crops.
 - c. Researchers could identify or develop bird resistant varieties of millet and sorghum that can be planted in association with trees. Alternatively, researchers could introduce a drought tolerant cash crop like sesame that birds will not attack.
 - d. Researchers could investigate the possibility of using live fences to keep animals out of perimeters and fields. Australian pines may be useful for this purpose.
 - e. Village trials could be conducted to determine if farmers are receptive to planting tree lots that could be systematically harvested for fencing material and firewood. Proper management will ensure continuous access and natural vegetation will not have to be used.

- f. Researchers could investigate alternative ways to ease the pressure on forest resources. For example, fuel efficient wood burning stoves could be developed and tested to determine the most appropriate type for a given region. In addition, other alternative energy sources might be explored such as peat, manure, solar energy and wind power.

Current Status: CNRADA has already been conducting research on *Prosopis* spp. and Neem trees to see if they can be used as live fences. This research has been conducted on station (Rindiao) in collaboration with a Direction Protection de la Nature project called Projet Poles Verts. Projet Poles Verts (green areas) is attempting to re-establish gonkier forests along the Senegal River. This project is also promoting the planting of fruit trees and the intercropping of gum trees with other crops. CNRADA has established a tree nursery for the Poles Verts project from which the trees are transplanted to farmers' fields. Another project which CNRADA could collaborate with is the Projet Regeneration du Gummier. This project focuses on regenerating gum forests in Trarza, Brakna, Gorgol and Assaba regions. They are promoting 6 types of reforestation to protect crops. CNRADA could also collaborate with the Peace Corps regarding the development of fuel-efficient wood-burning stoves. The Peace Corps has been promoting such stoves for several years. In addition, a recent study just completed by USGS indicates that there are considerable quantities of peat available in the river basin. Peat could be substituted for wood as a cooking fuel.

Staff Requirements: CNRADA might consider bringing in a researcher to focus on agro-forestry experiments. This researcher should be trained to at least the B.S. level in forestry. This person could work closely with the other crop divisions. In addition, CNRADA might negotiate with the Direction Protection de la Nature to have a forestry specialist assigned to the CNRADA research facilities.

- An aquaculture research program could be set up at CNRADA to help develop fresh water fishing along the river (p. 97). Fish ponds could be established at the station for setting up of breeding programs to provide farmers with fingerlings for stocking marigots and ponds.

Current Status: No work is presently being conducted in this area by CNRADA. To initiate work in this area, collaborative links could be established with the Direction Protection de la Nature, Direction de la Peche Antisanale and Peace Corps. The Peace Corps has had extensive experience in setting up fish ponds throughout West Africa. In addition, CNRADA could contact the Central Agricultural Research Institute (CARI) in Liberia for advice in setting up such a research program. GTZ has also had some experience in this area in Liberia and could provide some useful advice.

Staff Requirements: To initiate work in this area, CNRADA will need to bring in a researcher trained in aquaculture. This person should have at least a B.S. degree. CNRADA could also ask the Peace Corps or the Direction Protection de la Nature if they are interested in assigning one of their staff to work at the CNRADA research facilities to set up such a program.

— Research could focus on developing water harvesting and micro-catchment techniques for walo and dieri lands to improve utilization of rainwater runoff (p. 80).

- a. In walo and dieri areas that are being inundated by runoff water from local water courses rather than the river, a number of small barrages and dikes could be constructed to increase water retention.
- b. Research might investigate the beneficial effects of water catchment areas around plants to take advantage of limited rainfall. Small depressions or furrows might be created around each plant to collect water.

Current Status: No research is presently being carried out in this area. However, CNRADA has been working with land preparation techniques as a way to retain soil moisture. To initiate research in this area, CNRADA could establish collaborative links with Genie Rural.

Staff Requirements: If research on water harvesting and micro-catchment techniques are to be conducted by CNRADA, a researcher trained at the B.S. level in agricultural engineering should be brought in. CNRADA might also consider requesting Genie Rural to assign one of its staff members to CNRADA to work on this research.

— Researchers could identify vegetation that can be planted in barren spaces which have resulted from overgrazing and sand encroachment.

- a. Fast growing woody and herbacious plants could be introduced into barren areas (i.e., capparidaces and mesquite).
- b. Experiments could be conducted on various types of vegetation which could provide vegetative cover for sand dunes.

Current Status: No work is presently being conducted in this area by CNRADA. To initiate this work, collaborative links could be established with Direction Protection de la Nature.

Staff Requirements: CNRADA could consider negotiating with the Direction Protection de la Nature to assign a specialist in land reclamation to the CNRADA research facilities.

— Socio-economic research could be conducted in the Gorgol River Basin to determine the positive and negative impact of the Foun Gleitat dam on farmers in the area (p. 83).

Current Status: No work is presently being conducted in this area by CNRADA. This study could be conducted by a team of representatives from CNRADA, SONADER and the Inspection Regional d'Agriculture.

Staff Requirements: To conduct this study, CNRADA will need to bring in a researcher trained at the B.S. level in agriculture economics/applied anthropology. This researcher could be the FSR social scientist working in the Pre-Extension Division.

- Research could be conducted on fonio to develop a food crop which supplements the other domestic grains.

Current Status: No research is presently being conducted by CNRADA in this area. If research is to be initiated on fonio, links might be established with agricultural research organizations in Mali where fonio is cultivated by some farmers.

Staff Requirements: No additional staff would be required in the grain crop research program to conduct research on fonio.

- CNRADA could actively try to obtain funding for research projects by submitting proposals to funding sources. This activity could help CNRADA overcome its financial constraint.

Current Status: CNRADA presently does not have this capability.

Staff Requirements: CNRADA could recruit an experienced proposal writer to help them secure research funds. This capability will enable CNRADA to carry out sustainable research programs which are not always dependent on a single source for funding. The role of this staff person would be critical to the future efforts of CNRADA.

V. POSSIBLE EVALUATION CRITERIA

To effectively evaluate the efforts of the AGRES II project, a mix of quantitative and qualitative criteria could be used. The following evaluation criteria are suggested as possible alternatives.*

General Criteria

- Project Impact on Farmers. Farmers targeted by the project could be asked about their perceptions of the project by evaluators.
- Project Impact on Intermediate Clients. Local researchers and extension personnel could be asked what their perception of the project has been.
- Institutionalization of the FSR/E Approach. How successful has the project been in institutionalizing the FSR/E approach in-country?
- Dialogue between Research and Extension. How much has the project contributed toward increasing meaningful communication between CNRADA researchers and extension personnel?

*These criteria were derived from the Informal Evaluation Criteria Meeting, West African Farming Systems Research Network Workshop, Dakar, March 1986. (Dan Galt, unpublished report, 1986). The actual numbers associated with the specific criteria will be determined through negotiation with CNRADA, USAID and the Ministry of Rural Development.

- Dialogue between FSR/E Practitioners and National Policy Makers. Has the project established a mechanism for transferring field data to policy decision makers?
- FSR/E Team-Researcher Linkages. Are the FSR/E research results having an impact on commodity research conducted at the station?
- Research Priorities. How has the project assisted CNRADA in setting up research priorities? Are these priorities oriented toward the constraints facing farmers?
- Absorptive Capacity of the Host Country Research-Extension Structure. Has the AGRES II project considered the capacity of CNRADA and extension/development organizations to absorb trained individuals back into the system?

Specific Criteria

- Self-Evaluation. AGRES II should have a built-in capacity for self-evaluation. Systematic record keeping should be used throughout the life of the project to document: 1) false starts and inappropriate experiments; and 2) team building processes.
- Dissemination of Technical Innovations. By year y, x technical innovations will be used by extension in area z.
- On-farm Trials Conducted. Since the beginning of the project, the proportion of trials conducted by researchers on-farm has increased from x% to y%.
 - a) the proportion of researcher implemented, researcher managed on-farm trials has decreased from a% to b%;
 - b) the proportion of researcher implemented, farmer managed trials has changed from c% to d%;
 - c) the proportion of farmer-implemented, farmer-managed trials has increased from e% to f%.
- Students Trained. X number of students have been trained in the appropriate disciplines a, b, c....over y years using project funds since the project began.
- Completion of FSR Stages. By year y, x diagnostic surveys will have been completed.* By year (y+1), z on-farm trials will have been conducted and u thematic surveys will have been initiated or completed. By year (y+n), two to three technologies appropriate for extension will be available to be disseminated to a broader region.

*The project should take into account that diagnostic surveys, thematic surveys and researcher managed on-farm trials may be conducted throughout the project.

VI. IMPLEMENTATION PLAN 1986 - 1987

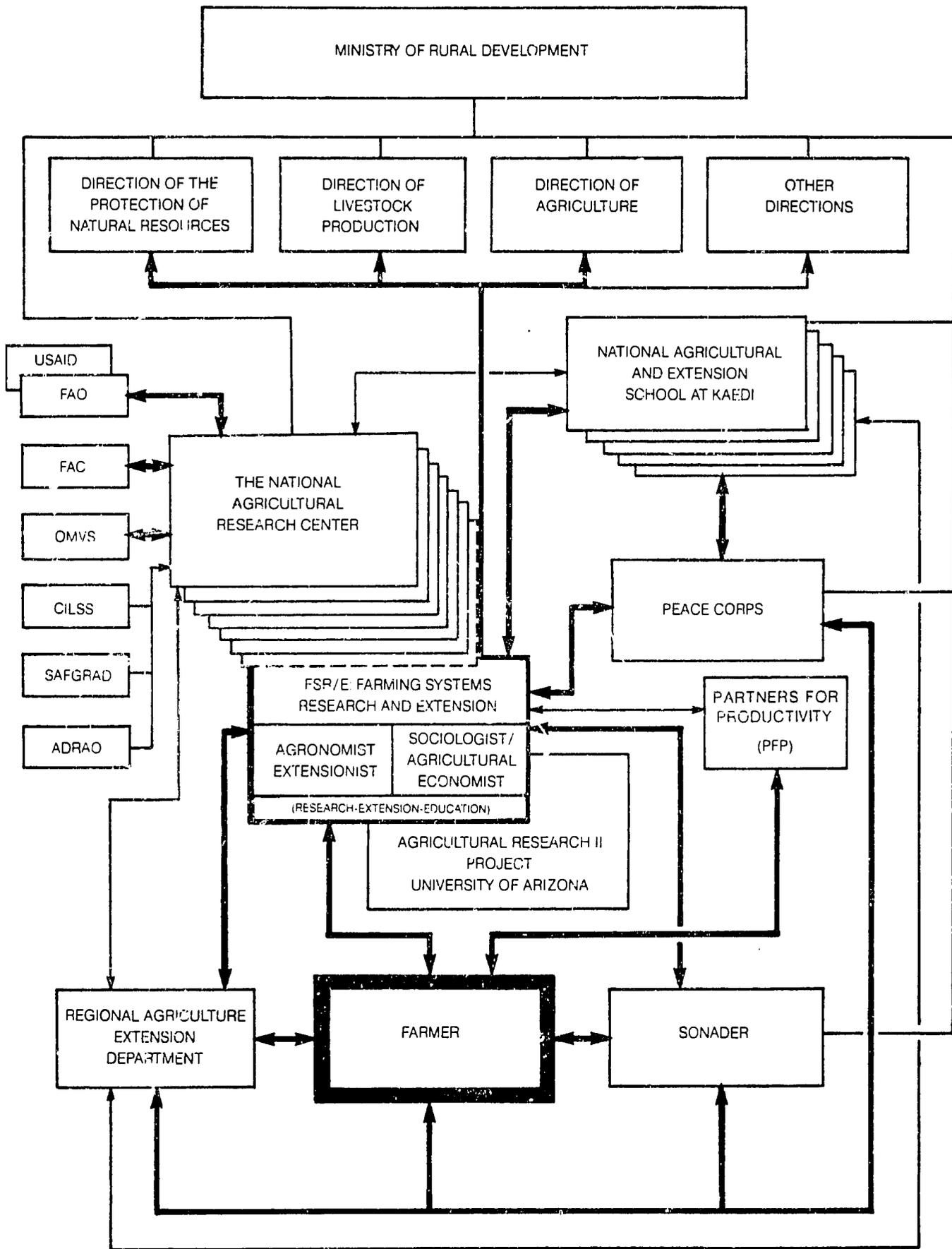
1. Initiate soil survey of the River Valley - August 7, 1986.
2. Aerial reconnaissance of rainfed agriculture in the Senegal River Valley - August 23-30, 1986.
3. Preparation for "Introduction to FSR/E workshop - August 26-30, 1986.
4. "Introduction to FSR/E" workshop in French. Open to all institutions and organizations in Mauritania (maximum 25 persons) - August 31 - September 4, 1986 (one week).
5. Reconnaissance survey of rainfed agriculture in the river valley. Six- to eight-person team - September 7-18, 1986.
6. Prepare draft of rainfed agriculture general report and consumption report - September 20 - November 7, 1986.
7. Plan and design on-farm trials for the second season (recession agriculture and irrigated perimeters) in collaboration with CNRADA, Inspection Regional d'Agriculture, School of Agriculture, SONADER and PCV - September 1986.
8. Soil survey report completed and submitted - October 31, 1986.
9. Implementation of on-farm trials and experiments - October - November 1986.
10. Analysis of data from the first season of on-farm trials - October - December 1986.
11. Rainfed agriculture draft report arrives at University of Arizona and translation begins - November 17 - December 15, 1986.
12. Final production of rainfed agriculture draft at University of Arizona - December 5-15, 1986.
13. Rainfed agriculture report sent to Nauakchott.
14. "Techniques for Design and Analysis of On-Farm Experimentation," four-week FSR workshop - February/March 1987.
 - a) Week 1: Trainers' Workshop
 - b) Week 2: Survey Techniques
 - c) Week 3: Design of On-Farm Experiments
 - d) Week 4: Analysis (Data Collection and Statistics)
15. Analysis of data from the second season of on-farm trials - March/April 1987.
16. Completion of all thematic survey reports conducted during the year - April 1987.
17. Completion of Final Report of year's activities of on-farm trials - April 1987.

18. Presentation of results of project activities to:

- a) Ministry of Rural Development
- b) Governors of Gorgol, Brakna, Guidamaka
- c) USAID/Nouakchott
- d) USAID/Dakar
- e) GAE Project, the Gambia

APPENDICES

APPENDIX A



INSTITUTIONAL LINKAGES AT KAEDI , GORGOL

APPENDIX B

PROJECTED WORKSHOPS

Out of Country

1986	AUGUST	Methods of FSR/E for Practitioners (Diagnosis; on-farm research; implementation); 3 weeks - Gainesville, Florida, USA - Cost \$1850.00/person plus transport and lodging, etc. 1 person to attend
1986	OCTOBER	Farming System Research/Extension Annual Symposium; 3 to 4 days - Manhattan, Kansas
1986	NOVEMBER	Techniques for Design and Analysis of On-farm Experimentation; (French) 3 weeks - Mali (?) - approximate cost 1000.00-2000.00/person plus transport and lodging, etc. 1 person to attend
1987	TO BE DECIDED	
1987	JUNE/AUGUST	Vegetable Crop Production and Marketing (USDA TC 130-11); (USDA TC 130-11); Cost approximate \$9000.00/person
1987	JULY	Water Management and Runoff Farming Methods for Small Scale Agriculture (USDA TC 120-25); Cost approximate \$5000.00/person

APPENDIX B

PROJECTED WORKSHOPS

In Mauritania

1986	JUNE	Design of On-farm Experiments and Trials; French and English - 2 days each
1986	AUGUST/ SEPTEMBER	Introduction to FSR/E Workshop I; French - 6 days: for Mauritians English - 2 to 4 days: for PCV's
	TO BE DECIDED	
1987	FEBRUARY/ MARCH	Techniques for Design and Analysis of On-farm Experimentation; French - 4 weeks: for West African Region Week 1 - Trainers workshop Week 2 - Survey Techniques Week 3 - Design of On-farm Experiments Week 4 - Analysis (Data Collection and Statistics)
1987	TO BE DECIDED	Techniques for Design and Analysis of On-farm Experimentation: English - 2 to 3 weeks: for PCV's
1987	APRIL/MAY	Presentation of Results and Conclusion of Station and On-farm Experiments and Trials and of Surveys - seminar; French - 1 to 2 days
	TO BE CONSIDERED	Workshop on Extension
	TO BE CONSIDERED	Workshop on Management of Research and Extension
	TO BE CONSIDERED	Lectures and seminars on specific agricultural themes given by short term consultants

APPENDIX C

MATRIX OF EXPERIMENTS AND TRIALS

CROP	PLACE	ON-STATION	ON-FARM
<u>First Campaign:</u>			
SESAME:	Kaedi	(1) Fertilizer and row spacing (4 x 4) 4 replications	(1) Comparison trials: sesame and two varieties of millet or sorghum (3) 3 villages
	Kaedi	(2) Time of planting and land preparation (4 x 2) 3 replications	(2) Intercropping: sesame, millet, and cowpeas
	Selibaby	(3) Time of planting trials (2 or 3) 4 replications	(3) 1 village
	Selibaby	(4) Intercropping trials (sesame, millet, and cowpeas) (6) 3 replications	(4) 4 villages
SORGHUM:	Kaedi	(5) Comparison trials on different soils: rice, maize and sorghum-light and heavy irrigated soils	
SUN- FLOWERS:	Kaedi	(5) Spacing and fertilizer (3 x 5) 4 replications	(4) Intercropping and fertilizer (3 x 2) 1 perimeter
ROCK PHOSPHATE			2 perimeters
<u>Second Campaign:</u>			
SORGHUM			(5) Varieties and inter-cropping with cowpeas (2 x 2) 5 villages (6) Varieties (with cowpeas) and fertilizer (N and P) levels (2 x 4 x 2) 5 villages

APPENDIX C

MATRIX OF EXPERIMENTS AND TRIALS

CROP	ON-STATION	ON-FARM
<u>Both Campaigns:</u>		
MILLET - rainfed		Yield measurements 10 villages
SORGHUM		
rainfed		10 villages
recession		10 villages
irrigated (1)		5 perimeters
irrigated (2)		5 perimeters
MAIZE		
irrigated (1)		Yield measurements 5 perimeters
irrigated (2)		5 perimeters
COWPEAS		
rainfed		Yield measurements 10 villages
recession		10 villages
RICE		
1st campaign		Yield measurements 5 perimeters
2nd campaign		5 perimeters
VEGETABLES	Yield measurements	Yield measurements and pricing 10 gardens
ALLEY FARMING		Sesame, millet, with Leuceana and Gliricidia (Acacia trees) 1 village (site) only (Possibly)

APPENDIX C

ON-FARM TRIALS - VILLAGES

In Guidimaba Region

(1) Kinikoumou	5 farmers
(2) Daugrimou	6 farmers
(3) Hassy Chagard	5 farmers
(4) Guemou	5 farmers
(5) Guaraye	5 farmers

In Gorgol Region

(1) M'But	5 farmers
(2) Waly	(2 perimeters)
(3) Ganki	—
(4) Roufi Audi	1 farmer

In Erakna Region

(1) Farala	4 farmers
(2) Garala	—

APPENDIX D

POSSIBLE THEMATIC STUDIES

Ecological Research

- Study of the salt and acidity changes over the years (10-15) throughout the Senegal River Valley (Mauritanian bank).
- Study of the change in soil texture, pH, salinity and other soil characteristics over a specific period of time (3-6 years) from the closing of the Diama Barrage.
- A study of the drought in Mauritania focusing on: 1) causes (man or climate); 2) adaptive strategies of farmers and herders, and 3) future desert encroachment.
- Produce an inventory, describing the uses of the following:
 - a) types of trees and bushes
 - b) grasses and wild plants
 - c) domesticated plants, grasses and trees
 - d) animals, both wild and domesticated
 - e) fishes
 - f) soils and minerals.

Irrigation Research

- Study of 10-15 small perimeters along the Senegal River Valley, covering soil types, cropping patterns, farmers' social and cultural practices, historical background, production and marketing practices. This study would cover a 5 to 10 year time span.

Livestock Research

- A study of livestock patterns, focusing on the changes that have occurred between the past and present situation. This study would cover the cultural, social and economic practices of both nomadic and sedentary herders. It would also study the past and present interactions between these groups. Recommendations would be generated regarding interventions, further studies and policy implications.
- A comparative study of extensive vs. intensive livestock production, taking cultural, social and economic factors into account.
- A study that focuses on animal traction as a way to extend or intensify agricultural production. This study would investigate the use of animal traction in land preparation and cultivation (i.e., tilling, weeding) as well as in other activities (lifting water).

Marketing Research

- An indepth study of the rural economy in the river valley covering production, marketing, credit and savings, cash flows, material product flows, labor patterns and movements, labor uses, risk aversion and risk taken. Also

considered in this study would be pricing, cropping patterns, imports, constraints, macro-micro interaction, policy and farmer response to macro incentives.

- A study of the pricing policy and market structure of grains, livestock and meat, and other products since independence.
- Effects of Food Aid on the production and marketing of grains.
- Study of the transition from traditional subsistence agriculture to a market oriented economy. This study would focus on the effects of such a transition on the different ethnic, social and economic groups.

Socio-Economic Research

- Specific studies of individual villages along the Senegal River, covering all aspects of village life (i.e., cultural, social and economic activities). At least one village would be studied in each region to allow for comparison.
- A study of women in agriculture, and their role in agricultural production and development. This study would be conducted on a regional basis, taking tribal, religious and social constraints into account. This study would attempt to assess what effect the introduction of new and improved technology has on women's status and rights.
- A detailed study of rural labor patterns by cropping and animal systems, including domestic and off-farm work.
- A study of the effects of past development efforts on agricultural production and the rural economy. This study would involve a literature review focusing on the history, results, conclusions and recommendations of previous research conducted in the Senegal River Valley.
- A study of farmers' and herders' objectives, goals and values.

Comparative Studies

- A survey of the Senegal River Basin (South Bank) in order to obtain an idea of the influence Senegal has on Mauritanian farmers, as well as how the various Senegalese activities impact the farming systems on the Mauritanian bank of the river. This study would also investigate the activities of Senegalese farmers in Mauritania, as well as trade barriers, custom checks and other important border questions.
- A study which compared the Mauritanian farming systems with Senegalese farming systems in the Senegal River Basin. Similarly, a study could be conducted which compared the Mauritanian farming systems with Gambian farming systems in the Gambian River Basin.

Linguistic Research

- Study the agricultural terms used in the river valley region by Wolof, Poular, Soninke and Hassania. Specify the significance of these terms to agricultural

production and marketing.

- List the French agricultural terms and equivalents in English in order to bring the dictionary up-to-date.
- Construct a table of weights and measures which compare metric and U.S. measures to local weights and measures.

Storage Research

- Studies of post harvest losses as they relate to the types of storage facilities and/or environmental factors in the Senegal River Basin (3-4 years).

Extension Research

- A study of farmers' acceptance of new technology (e.g. who, why, when). This study would attempt to determine what types of technology will be more readily accepted, what are the farmers' criteria, and what risks will the farmer take. Important areas of investigation include;
 - A) How do farmers accept or adopt new technology? From whom will they accept the technology? Which dissemination method is more effective?
 - a) on-station visits
 - b) on-farm visits
 - c) seminars/workshops
 - 1) on station
 - 2) in village
 - d) through extension or cadres
 - B) What is the most effective media to disseminate information to farmers, extension agents, researchers and government officials?
 - a) pamphlets
 - b) radio
 - c) film (audio-visual)
 - d) seminars or workshops
 - e) agents (extension or researchers)