

Farming Systems



A Dry Season Reconnaissance Survey in Guidimaka, Gorgol, Brakna, and Trarza Regions

Mauritania Agricultural
Research Project II

College of Agriculture
The University of Arizona
Tucson, Arizona

April 1986

Supported by USAID/Nouakchott and USAID/Office of Nutrition,
Bureau of Science and Technology

FARMING SYSTEMS RESEARCH ALONG THE SENEGAL RIVER VALLEY

A DRY SEASON RECONNAISSANCE SURVEY IN
GUIDIMAKA, GORGËL BRAKNA AND TRARZA REGIONS

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Executive Summary

A dry season farming systems reconnaissance survey was conducted in Mauritania in the Guidimaka, Gorgol, Brakna and Trarza regions. Thirty-four villages were surveyed over a three week period in February 1986. A multi-disciplinary team of 11 to 16 members participated in the survey. Over 400 farmers were contacted, and indepth interviews guided by a topical outline were conducted with approximately 180 farm families. These interviews were conducted on farmers' fields. General inquiries were also directed to several hundred women in 27 villages regarding consumption patterns. The primary objective of this study was to provide information on the farming systems found in the Senegal River Valley to help CNRADA establish research priorities for the research station at Kaedi.

The major components of the farming systems found along the river include: 1) four cropping patterns (rainfed, recession, small perimeters and large perimeters); 2) livestock rearing (goats, sheep, cattle, donkeys and horses); 3) complimentary and competitive relationships between pastoral groups and sedentary farmers; 4) fishing; 5) charcoal production; 6) off-farm income generating activities (construction, herding, merchant, etc.) and 7) out-migration (both seasonal and permanent).

The farming systems vary by region as well as within regions. In the Delta region (St. Louis to Dagana) farmers rely heavily on irrigated agriculture, and very little on rainfed or recession cultivation. Rice and vegetables are the dominant crops grown in the perimeters. Corn is not widely grown due to the salt content of the soil. Sweet potato is the dominant crop grown in falo areas. Private perimeters are also common in this region. Some farmers operate large commercial vegetable gardens and are producing vegetables for large markets such as Rosso, Dagana and Nouakchott.

In the Lower Middle Valley (Dagana to Boghe), recession agriculture and irrigated agriculture are important, and rainfed agriculture receives little emphasis due to inadequate rainfall. Crops grown in the perimeters include rice, vegetables and corn. Recession crops grown include sorghum, cowpeas and watermelon. Except for the villages near large towns, villages in the region are more isolated, lack infrastructure and do not have easy access to markets. Farmers in several villages turn to charcoal production when crop yields are low (e.g. Darel Barka).

In the Central Middle Valley (Boghe to Matam), rainfed, recession, small perimeter and large perimeter cultivation can be found. Rainfed cultivation is highly variable. West of Bolo Dogo, no rainfed crops are grown. Between Bolo Dogo and Kaedi, farmers grow watermelon, cowpeas, and hibiscus. East of Kaedi, millet and sorghum are incorporated into the crop mix. Rainfed millet is more popular than sorghum in this area. Aside from sorghum, cowpeas and watermelon, corn and vegetables are grown in some recession fields located in the Dirol Plain. Floods recede in October and November, so planting begins earlier in this area than in the Lower Middle Valley.

In the Upper Middle Valley (Matam to Bakel), rainfed cultivation and irrigated agriculture are important while recession agriculture is less prevalent. A wide variety of crops are grown in dieri fields due to increased access to rainfall (e.g. peanuts). Sorghum is preferred over millet as the main rainfed grain crop. Women also play an important role in rainfed cultivation (Soninke). In the newly introduced

irrigated perimeters, corn is the dominant crop rather than rice. Sorghum, cassava, and other vegetables are also grown in irrigated parcels. In addition, out-migration of young men to France is a common pattern in this region.

Intra-regional differences in cropping patterns can be used to delineate four different types of farming systems. These include: 1) systems in which farmers do not have access to irrigated perimeters and rely totally on traditional rainfed and recession agriculture (e.g. Fondou, Ganki, Talhaya, etc.); 2) systems in which farmers rely almost exclusively on irrigated agriculture (e.g. Toufde Sive, Paliba, Darel Barka); 3) systems in which farmers combine traditional agriculture with small irrigated perimeter cultivation (e.g. Wompou, Sori Male, Dar es Salam, etc.); and 4) systems in which farmers cultivate plots in large perimeters as well as in small village perimeters and/or recession land (e.g. N'Gorel, Tienel). The third type of system is the most prevalent one found in the river basin (21 out of 34 villages).

The farming systems along the Senegal River are further differentiated on the basis of the alternative economic strategies farmers pursue to supplement their crop production. Farmers in some villages are oriented toward fishing (e.g. M'Bagne) while farmers in other villages are oriented toward animal husbandry (e.g. Bovel). Some villages have more income generating opportunities for farmers than others (e.g. Djovol) due to their size, institutional complexity or proximity to large urban centers. Out-migration may also be more common in some villages than in other villages (e.g. Toufde). In villages with limited economic alternatives, farmers may migrate or supplement their income with charcoal production (e.g. Darel Barka).

Constraints and Recommendations

The reconnaissance survey has identified a number of general and specific constraints which are pertinent to the farming systems found along the Senegal River Valley. The major constraints are summarized below along with possible strategies to deal with each type of constraint.

A. General Production Constraints

1. Environmental Degradation

- a. Integrate trees into agricultural production (shelterbelts, alley cropping).
- b. Adjust the market price of gum arabic so that farmers receive more income from gum sales.
- c. Encourage reforestation. Coordinate this effort with other forestry projects.
- d. Promote the establishment of additional watering points in pastoral zones in the north, coupled with proper range management practices.
- e. Integrate leguminous forage crops into cropping patterns.
- f. Re-establish vegetation over barren spaces by introducing fast growing woody and herbaceous plants (e.g. dune fixation).
- g. Develop a land use assessment strategy that determines appropriate use of land resources.
- h. Introduce efficient wood-burning stoves.

2. Access to Transport

- a. Continue to build roads and establish adequate maintenance programs.
- b. Improve planning efforts to insure that isolated villages gain access to food and agricultural inputs before the rainy season.
- c. Encourage barge transport for marketing agricultural products after the completion of the two dams (Manantali and Diama).

3. Inadequate Market Infrastructure

- a. Encourage improved transport facilities and services.
- b. Promote crops which generate income such as vegetables and sesame.
- c. Coordinate transport of agricultural products on a regional basis.
- d. Encourage the formation of regional cooperatives to share transport costs and improve the efficiency of transport.
- e. Encourage the formation of cooperative boutiques in villages as viable marketing mechanisms for buying and selling agricultural products, delivering inputs, and providing a source of credit and investment for farmers.

4. Access to Land

- a. Increase the size of irrigated holdings allocated to farm families.
- b. Increase the utilization of perimeters by promoting water efficient crops (e.g. sorghum) and better crop management.
- c. Introduce drought resistant, water efficient crop varieties for dieri, fonde and walo cultivation.
- d. Develop reliable indicators of soil moisture to determine optimum planting times and types of crops to plant on walo fields.

- e. Determine minimum seasonal crop water requirements through research.
 - f. Investigate the advantages and disadvantages of introducing crop intensification measures such as the use of animal traction or small tractors, the use of chemical inputs such as insecticides, fungicides or herbicides, and the use of bird resistant and disease resistant varieties.
 - g. Investigate the potential for water harvesting in a number of sites along the river (barrages/dikes).
- 5. Access to Appropriate Technology**
- a. Promote extension efforts.
 - b. Encourage the development of seed multiplication programs to produce sufficient quantities of improved seed.
 - c. Emphasize the diversification of cereal crops in seed programs.
 - d. Promote cooperative boutiques to improve farmer access to inputs.
 - e. Explore the possibility of using village merchants as intermediaries to introduce improved inputs.
- 6. Lack of Effective Extension**
- a. Build a stronger link between extension services and CNRADA through improved communication, training and coordinated research activities.
 - b. Improve the mobility of extension agents through the introduction of mopeds or motorcycles.
 - c. Utilize Peace Corps volunteers for disseminating information to farmers as well as setting up on-farm trials, monitoring experiments, collecting yield data and obtaining feedback from farmers.
 - d. Increase the support to educational institutions responsible for extension training.
- 7. Destruction of Crops by Animals**
- a. Investigate alternative fencing materials for protecting crops from animal intrusion.
 - b. Encourage the introduction of metal fencing as part of the construction of perimeters.
 - c. Consider introducing live fences or tree lots for supplying fencing material.
 - d. Consider introducing stricter penalties to be imposed on animal owners who do not supervise their animals adequately.
- 8. Emigration of Young Men**
- a. Encourage the equitable distribution of irrigated parcels so that young men gain access to land.
 - b. Encourage villages to establish community development funds so that remittances from migrants can be channeled into productive agricultural investments (e.g. pumps, spare parts, agricultural machinery, cooperative boutiques, credit source).
- 9. Potential Competition Among Agricultural Activities**
- a. Conduct research on farmers' practices regarding competing cropping activities.
 - b. Identify critical labor bottlenecks so that crop varieties can be

- introduced which reduce labor conflicts.
 - c. Develop appropriate cropping calendars for different regions along the river.
- 10. **Cultural Traditions Adversely Affecting the Cropping Calendar**
 - a. Investigate the possibility of working through village chiefs to introduce appropriate cropping calendars.
- B. **Specific Farming Systems Component Constraints**
 - 1. **Small Perimeter Constraints**
 - a. Size of Irrigated Holding
 - i. Increase the size of irrigated parcels allocated to each family.
 - ii. Conduct a study to determine the optimal size of an irrigated holding, taking yield and economic returns into account.
 - iii. Encourage better utilization of perimeters by promoting water efficient crops, crop intensification, and better crop management.
 - b. Problems Associated with Pumps
 - i. Improve farmer access to spare parts and diesel.
 - ii. Encourage more uniformity in the types of pumps installed.
 - iii. Conduct a survey to determine which pump parts break more frequently so that these parts can be supplied to cooperatives as reserve stocks.
 - iv. Improve access to diesel for villages isolated in the rainy season.
 - v. Provide better training to pump operators in the maintenance of pumps to reduce reliance on SONADER.
 - vi. Encourage villages to establish payment schemes for pump operators which provide incentives for good pump maintenance.
 - vii. Improve the water use efficiency of perimeters through better canal construction and maintenance, leveling of parcels, and irrigation schedules which take crop water requirements into account.
 - c. Inefficient water utilization
 - i. Improve the construction and maintenance of irrigation systems through better supervision and training.
 - ii. Conduct research on alternative leveling techniques such as puddling. Investigate the use of animal traction and two-wheeled tractors in levelling.
 - iii. Conduct research which focuses on developing irrigation schedules which are based on crop water requirements.
 - iv. Encourage the cultivation of water efficient crops (e.g. sorghum).
 - v. Conduct research on the advantages and disadvantages of using a sorghum ratoon crop as a second season crop in irrigated parcels.
 - d. Lack of effective extension
 - i. Provide pump operators with extension training at the same time they are trained to maintain pumps.

- e. Lack of appropriate equipment
 - i. Introduce labor saving technologies to groups of farmers in cooperatives as a way to deal with cost constraints.
 - ii. Conduct research on labor saving technologies to determine which are the most appropriate to promote, given farmers' current access to resources and training. (i.e., tractors, two wheeled cultivators, animal traction, etc.).
- f. Excessive indebtedness of farmers with small perimeters
 - i. Provide more adequate instruction to farmers regarding financial responsibilities associated with a loan.
 - ii. Train several cooperative members in fiscal management and simple accounting procedures.
 - iii. Establish payback schedules which are reasonable and manageable given farmers' resources.
 - iv. Establish a policy such that lending institutions share in the risk of crop loss, especially if they are responsible for poor input delivery, so that both the farmer and the institution are held accountable for their actions.
- g. Nutgrass
 - i. Conduct research on control measures to determine the most appropriate way to deal with nutgrass.
 - ii. Identify crop varieties that are resistant to nutgrass.

2. Walo Cultivation Constraints

- a. Reduction of inundated surface due to insufficient flooding
 - i. Conduct research on drought resistant, water efficient crops to be planted in walo areas.
 - ii. Develop water harvesting techniques in walo areas, especially where crops are inundated by runoff water from local water courses (e.g. Dirol Plain).
 - iii. Encourage the equitable distribution of irrigated land to farmers who do not have regular access to flooded walo (e.g. young, poor, women).
- b. Major pests and diseases
 - i. Encourage farmers to continue to use seed treatment dressing, treated seed, and insecticides to control pests and diseases.
 - ii. Encourage inputs to be made available through a number of channels such as government organizations and extension services, cooperative boutiques and village merchants.
 - iii. Instruct farmers as to the proper use of chemical substances.
 - iv. Identify sorghum varieties that are resistant to many pests and diseases (e.g. bird resistant, smut resistant).
 - v. Develop cropping strategies which minimize the damage caused by birds (e.g. combinations of high tannin and low tannin sorghums).
 - vi. Conduct research on the feasibility of adjusting the timing of crop planting to avoid peak periods of bird infestation.
 - vii. Conduct research on termites to determine the most effective way to control these insects (e.g. alternative land preparation techniques, soil treatment, destruction of crop residue, etc.).
 - viii. Initiate a national eradication program for grasshoppers.

- c. Access to Labor
 - i. Conduct research to identify the major labor bottlenecks so that adjustments can be made in the crop calendar.
- d. Water control measures for large perimeters impeding the exploitation of walo lands
 - i. Conduct a study along the Gorgol River to determine the negative impact of the dam at Foun Gleitat has had on farmers in the area.
 - ii. Compensate farmers who have been negatively impacted by water control measures by granting them irrigated parcels.
 - iii. Introduce water harvesting techniques to inundate crop land in affected areas.
- e. Other area of investigation
 - i. Conduct research on the positive and negative effects of bending over sorghum stocks before they are ripe.

3. Dieri cultivation constraints

- a. Environmental degradation
 - i. Promote agroforestry interventions such as shelterbelts and alley cropping.
 - ii. Identify drought resistant, water efficient short cycle varieties of millet, sorghum, cowpeas and watermelon.
 - iii. Introduce water harvesting techniques to utilize limited rainwater runoff.
 - iv. Conduct research on beneficial effects of micro-water catchment areas around plants.
 - v. Investigate the effects of mulching on the retention of soil moisture.
 - vi. Study the rainfall patterns of each region of the Senegal River Valley to determine optimum times for farmers to plant.
 - vii. Encourage farmers to produce more drought resistant legumes which can serve both as a food crop and a fodder crop.
- b. Other area of investigation
 - i. Conduct research on sesame to determine if it is a suitable crop to be introduced into the area.

4. Constraints for Vegetable Crops

- a. Access to water
 - i. Improve access to water for vegetable gardens by making available pumps, wells, and storage tanks.
 - ii. Conduct research on the feasibility of using animal traction, hand pumps or small diesel pumps to lift water into storage tanks.
 - iii. Promote better water management and more efficient irrigation techniques such as improvements in canal construction and maintenance, leveling parcels and appropriate irrigation schedules.
 - iv. Identify vegetable varieties with minimal water requirements.
- b. Access to appropriate vegetable seeds.
 - i. Identify or develop vegetable varieties which are adapted to different seasons and which have different maturation periods.

- ii. Consider bringing in more vegetable specialists to CNRADA to conduct research on vegetables.
- c. Access to transport
 - i. Continue to support transport infrastructural improvements.
 - ii. Encourage villages to regionally coordinate the transport of vegetables to larger markets through cooperatives.
- d. Packaging and conservation of vegetables
 - i. Instruct farmers how to pack, transport and conserve vegetables.
 - ii. Introduce appropriate storage and preservation techniques.
 - iii. Identify or develop vegetable varieties that transport better.
 - iv. Encourage small businesses to develop that deal with the transport, packaging and processing of vegetables.
- e. Access to extension
 - i. Improve extension services provided to vegetable growers in the areas of seed access, instruction on improved cultural practices, and information on packaging, transport and conservation.
 - ii. Continue to rely on Peace Corps Volunteers to provide extension advice.
- f. Competition with foreign vegetables
 - i. Explore the positive and negative effects of establishing a trade barrier on vegetable imports.
 - ii. Improve the infrastructure to facilitate vegetable marketing.

5. Livestock constraints

- a. Access to forage resources
 - i. Establish additional watering points in the northern pastoral zone to take pressure off of forage resources along the river. Appropriate range management practices would be introduced with wells.
 - ii. Encourage farmers to continue to use their crop residues as fodder supplements.
 - iii. Conduct research to determine if crop residues can be improved nutritionally through genetic means or chemical additives.
 - iv. Determine the feasibility of incorporating leguminous forage crops more directly into cropping systems.
- b. Access to Government services
 - i. Provide farmers and nomads more services and technical help.
- c. Other areas of investigation
 - i. Improve animal productivity taking current animal potential and breeding conditions into account.
 - ii. Develop a plan for the progressive introduction of intensive livestock rearing.
 - iii. Identify ways in which livestock can be better integrated with crop production (e.g. animal traction, manure, crop residue as fodder, etc.)

- iv. Identify ways in which marketing channels can be better organized to market animal products.
- v. Determine the feasibility of producing fodder crops as cash crops.

6. Consumption Constraints

- a. Seasonal food shortages
 - i. Improve the infrastructure so that villages are less isolated during the rainy season (i.e., all weather roads).
 - ii. Identify and introduce short maturing varieties of food crops to make food available during critical periods (i.e., rainy season).
 - iii. Collect germ plasms along the river of short cycle crop varieties.
 - iv. Develop cropping systems which combine crops in such a way that food gaps are eliminated (i.e., combining short and long cycle crops).
 - v. Search for other alternative food sources such as new crops, or wild plants.
 - vi. Conduct research on fonio to determine its potential as a food crop.
 - vii. Promote cooperative boutiques as food banks to store grain to be used during food deficit periods.
- b. Access to drinking water
 - i. Develop more wells and introduce simple filter systems to clean water from the river.
- c. Access to fresh water fish
 - i. Increase the quantity of fish available by stocking the river and marigots with fingerlings.
 - ii. Introduce fish nets which regulate the size of the fish caught. Establish laws to enforce the use of these nets.
 - iii. Introduce fish ponds to improve access and management.
 - iv. Introduce an aquaculture research program at CNRADA which focuses on improving fish production in the river basin (i.e., breeding program for fingerlings).
- d. Access to firewood for cooking
 - i. Promote agroforestry practices to improve access to firewood.
 - ii. Encourage farmers to plant stands of fast growing trees that can be systematically harvested for fuel use.
 - iii. Introduce fuel efficient wood burning stoves.
 - iv. Encourage farmers to use manure as a substitute for wood or charcoal.
 - v. Explore other alternative energy sources such as solar energy and wind power.

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I. INTRODUCTION

This research report presents the findings of a dry season farming systems reconnaissance survey that was conducted in Mauritania in the Guidimaka, Gorgol, Brakna and Trarza regions (See Map 1). Thirty-four villages were surveyed over a three week period in February 1986 (See Table 1). Over 400 farmers were contacted, and indepth interviews were conducted with approximately 180 farm families. In addition, general inquiries were directed to several hundred women in 27 villages regarding consumption patterns.* This study was carried out under the auspices of the Mauritania Agricultural Research Project II. This project is supported by USAID/Nouakchott and USAID/Office of Nutrition, Bureau of Science and Technology with cooperation from the Centre National de Recherche Agronomique et de Developpement Agricole (CNRADA). The University of Arizona, College of Agriculture and CNRADA have joint responsibility for directing the project. The primary objective of this study was to provide information on the farming systems found in the Senegal River Valley to help CNRADA establish research priorities for the research station at Kaedi. Dry season data were collected on cropping patterns (irrigated, recession, and rainfed), animal husbandry, off-farm economic activities, marketing and consumption. This study also focused on some of the key constraints facing farmers in these regions of the river basin. Although this information will be augmented and refined by upcoming surveys in the rainy season as well as by on-farm testing, it provides a basis for orienting research to the needs of farmers.

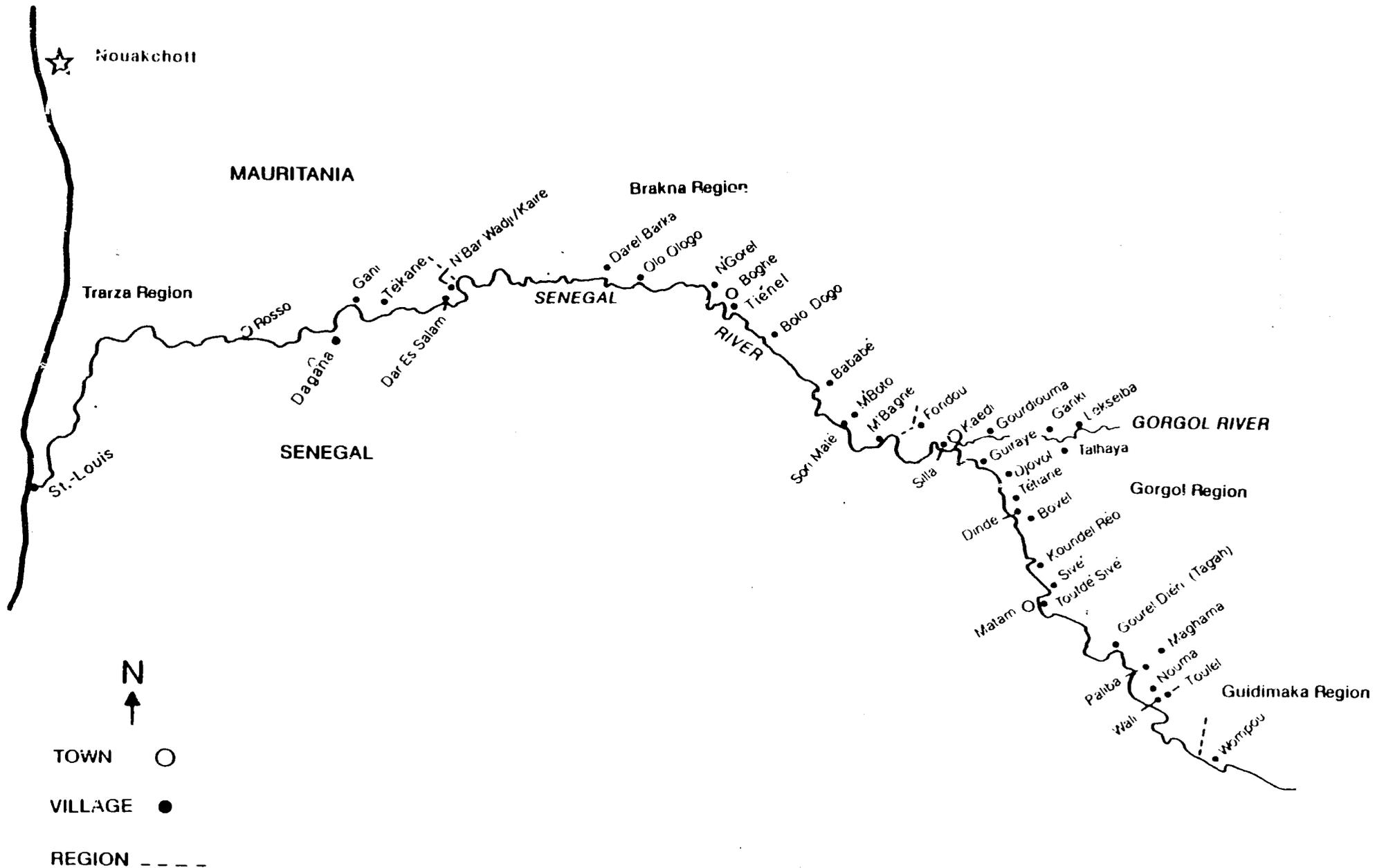
A. Methodology

To deal with the complexities of the farming systems found in the Senegal River Basin, a multi-disciplinary team was used (See Appendix A). The size of the team varied from 16 to 11 members, so not all of the researchers participated in the entire survey. The disciplinary backgrounds of the researchers included agronomy (4), extension (4), forestry (1), agricultural engineering (2), veterinary/animal science (1), anthropology (2), agriculture economics (1), health/nutrition (1), and geography (1). Five of these team members were expatriates (3 Americans, 1 British, 1 Dutch), and the rest were Mauritians. Two of the researchers were women.

Prior to conducting the survey, the research team reviewed secondary data sources obtained from USAID, CNRADA, other government agencies, and other projects. This information helped familiarize the team with the area and topics to be studied. In addition, background information was collected from knowledgeable personnel such as USAID officials, government officials, CNRADA researchers, project personnel, Peace Corp volunteers and other resource persons. Maps of the survey area and letters of transit were also obtained with the help of these officials.

*Women were interviewed in groups rather than individually, so it was difficult to determine the number of women contacted for the food consumption survey.

ATLANTIC OCEAN



Map 1. Location of Villages Surveyed Along the Senegal River

VILLAGES SURVEYED

Date	Villages Surveyed	Region
Feb. 3	Guiraye	Gorgol
	Gourdiouma	Gorgol
	Silla	Gorgol
Feb. 4	Djovol	Gorgol
Feb. 5	Lekseiba	Gorgol
	Ganki	Gorgol
	Talhaya	Gorgol
Feb. 6	Wompou	Gudimaka
Feb. 7	Wali	Gorgol
	Touel	Gorgol
	Nouma	Gorgol
Feb. 8	Maghama	Gorgol
	Gourel Dieri	Gorgol
	Paliba	Gorgol
Feb. 9	Toufde Sive	Gorgol
	Sive	Gorgol
	Koundel Reo	Gorgol
Feb. 11	Tetiane	Gorgol
	Dindi	Gorgol
	Bovel	Gorgol
Feb. 12	M'Bagne	Brakna
	Fondou	Brakna
Feb. 13	Sori Male	Brakna
	M'Boto	Brakna
Feb. 15	Bababe	Brakna
	Bolo Dogo	Brakna
Feb. 16	N'Gorel	Brakna
	Tienel	Brakna
Feb. 17	Olo Ologo	Brakna
	Darel Barka	Brakna
Feb. 18	Dar Es Salam	Trarza
	N'Bar Wadji/Kaire	Trarza
Feb. 19	Tiekane	Trarza
	Gani	Trarza

The village selection process tried to take into account the variability that exists in farming systems along the river basin. Factors taken into consideration in village selection included location; size; access to roads; institutional complexity; access to small irrigated perimeters (both cooperative and private), walo lands, falo lands, dieri lands; proximity to the river, large perimeters, large towns, nomadic pasture lands; ethnic background; and general economic pursuits (i.e., fishing, animal husbandry, recession farming, etc.). To aid in this selection process, the river basin was surveyed from the air using a video camera. This video helped the research team visually pick out villages that had the desired characteristics. In addition, Mauritania researchers who were knowledgeable about the regions to be surveyed were consulted to help identify villages. Following this procedure, 40 villages were chosen to be surveyed. However, the number was later reduced to 34 due to logistical constraints.*

To help guide interviews, the team constructed a detailed topical outline prior to going to the field (See Appendix V). This topical list was open-ended so that farmers could express themselves freely on a variety of issues. The topics included in this outline were obtained from a number of sources. First, important variables identified in past studies were derived from secondary data sources and interviews conducted with knowledgeable personnel. Second, each of the researchers at CNRADA were consulted to identify the various kinds of information needed that would be directly relevant to ongoing research at the station. Third, the team members drew upon their own knowledge and past research experience in devising topics. The outline was formulated and reviewed by all the team members before going to the field. Once the team reached consensus on the items included in the list, the survey was initiated.**

Villages nearby Kaedi were surveyed first to test the topical outline. This allowed the team to refine the list and to determine the appropriate manner in which to ask some of the questions. Following this test, tables were constructed from the refined list which facilitated the transfer of data from field notes to a comparative format (See Appendix E). These tables allowed for continual comparisons among farmers which helped focus discussions among team members.

Before surveying villages in any particular region, an effort was made to contact the local officials to inform them of our activities and the purpose of our study. This was done to establish collaboration and to obtain their help. In addition,

*Due to scheduling problems, fewer researchers participated at the end of the survey than at the beginning. As a result, the number of villages surveyed each day had to be reduced.

**A similar type of topical outline was put together for the consumption component of the survey.

the information needs of these officials were elicited to ensure that the survey results might be useful to them.

As stated previously, the villages near Kaedi were surveyed first to test the outline and to familiarize the researchers with the approach prior to going to distant villages. Following this, the survey team travelled east to the Guidimaka region (Woumpou). Taking into account the fact that the floods recede earlier in this region than in the Central and Low Middle Valley, it was decided to proceed from east to west. Thus, the Brakna and Trarza regions were surveyed last.

Given the size of the survey team, it was decided to split the team up into three groups. Each group visited one village each day to conduct interviews with farm families. These villages tended to be located in the same area so that comparable data could be collected. Upon arrival in a particular village, the team members would first meet with the village leaders and other villagers present to explain to them the purpose of their visit and why so many questions would be asked. General inquiries were directed to the group assembled concerning village infrastructure, land tenure, demographic characteristics, general cropping patterns, village access to irrigation, use of wild foods and tree products, access to citrus trees, interaction with transhumants fishing, off-farm employment, sources of credit, general consumption patterns, food distribution programs, environmental issues, project interventions, major constraints and desired interventions.

After these initial inquiries, the researchers split up into smaller groups of two* to conduct interviews with farmers. If the team members did not know the local language,** a village translator was requested to accompany them. An attempt was made to conduct the interview with both the husband and wife of a household rather than with just the male farmer. This is because the women of farm households may also be responsible for a considerable amount of the labor performed in the family fields or have their own fields. Despite this attempt, it was not always possible to have the wife present during the interviews.

The interviews were conducted in the farmers' fields away from the village. This enabled the researchers to see the fields they were inquiring about and to obtain answers and opinions specific to the farm family being interviewed rather than the group consensus. It was felt that the presence of other farmers might bias a farm family's responses. The team also believed that conducting the interviews in the farmers' fields demonstrated to farmers that the researchers were seriously concerned about their problems, and this was likely to result in more truthful responses. Usually a pair of researchers could do one to two complete interviews in

*An attempt was made to match up one social scientist and one physical/biological scientist in each pair.

**In the area surveyed, 4 different languages were spoken. These include Soninke, Pulaar, Hassaniya, and Wolof.

a day. In some cases, it was only possible to do partial interviews, so the researchers interviewed more than two farmers in a day.

Team members did not work with the same research partner every day. The team members rotated on a daily basis giving each researcher an opportunity to work with and learn from the other team members. This greatly facilitated an exchange of ideas and helped establish better communication between team members.

After interviews with farm families were completed for a selected group of villages, the team members would assemble together to discuss the major findings of the survey. This procedure helped the researchers formulate hypotheses about the major attributes and constraints of the farming systems found in a given area, and provided a basis for comparison when survey work was conducted in other regions. At first it was our intention to assemble as a group at the end of every field day to review our findings. However, such a procedure was difficult to maintain due to scheduling problems and fatigue. Thus, review sessions were conducted every few days and during logical breaks in the survey schedule.

Once the survey was completed, the team members came together and discussed the overall findings. Hypotheses were generated regarding the major constraints which applied to the farming systems found along the river. These constraints were divided into general production constraints and specific farming systems component constraints. Once formulated, the team then proposed a series of recommendations and/or areas of investigation that addressed each of the identified constraints. This procedure was followed to allow each of the team members an opportunity to combine their various disciplinary expertise in formulating possible solutions. The team made no attempt to prioritize the constraints or recommendations because it was felt that such decisions should be made by the Government Ministries and CNRADA. After these tasks were completed, the results of the study were written up by several of the team members.

In addition to data being collected on general village characteristics, cropping patterns, animal husbandry, off-farm employment and marketing, the reconnaissance survey also focused on consumption patterns. It was felt that the linkages between production and consumption were very important to understand, given the marginal conditions farmers are faced with in this arid region.* Two female researchers collected consumption related data in 27 of the 34 villages surveyed. A topical outline derived from secondary data sources and past surveys was used to help guide interviews. This outline was refined in the early stages of the survey after it became apparent that it was too lengthy to complete in the time allotted. Interviews were usually conducted with a group of women from the village rather than with individual women. Thus, much of the consumption data is generalizable at the village level rather than at the household level. These interviews were conducted at the same time as the indepth farmer interviews. Each of the female researchers conducted the interviews alone rather than in pairs in order to expand the data coverage.

*Meeting family consumption needs is one of the primary goals of farmers in this region and must be taken into account in any proposed intervention.

These data were then transferred from field notes to tables to allow for village comparisons. As with the other types of farming systems information, the major attributes and constraints associated with consumption patterns were identified. Recommendations were also proposed to deal with the consumption constraints. This information is presented both as part of this report and in a separate document.

B. Content of the Report

The information provided in this report is divided into several sections. First, the types of farming systems found in the river basin are discussed in general. The next eight sections deal with the specific characteristics of the farming systems found in the area. These include sections on: irrigation systems (large and small perimeters, irrigation pumps, institutional relationships, major constraints, irrigated rice, irrigated maize, irrigated sorghum, and market gardens); recession agriculture (recession sorghum in walo land, fonde cultivation and falo cultivation); dieri cultivation; livestock practices; marketing patterns; off-farm sources of income (migration, local business employment, charcoal production, arts and crafts and fishing); sources of credit; and consumption. The tenth section focuses on the major farming systems constraints and recommendations proposed by the research team. This section divides the constraints into general production constraints and specific farming systems component constraints. Each constraint is addressed separately and recommendations are proposed for that constraint. Whenever appropriate, the present compensating strategies pursued by farmers to deal with each constraint are presented. The final section of the report contains the appendices. This section presents detailed information which does not appear in the main body of the report which should be useful to researchers and administrators. The types of information provided in the appendices include: the list of researchers involved in the survey; the data summaries of the farming systems survey; the timing of the cropping activities; lists of trees and their uses; livestock numbers; a list of animal diseases; the data summaries of the food consumption survey; food inventory, food price lists; recipes; list of wild foods; traditional remedies for ailments; list of sources consulted; lists of people and institutions contacted; organizational structures of collaborating government and research institutions; a chart on seed production activities; table of monthly soil temperatures; meteorological data; and the topics of inquiry used in the survey.

II. GENERAL FARMING SYSTEMS CHARACTERISTICS

A. Introduction

Although a considerable amount of variation exists in the economic activities of farmers living in the Senegal River Basin, a generalized farming system's model can be proposed which identifies the key agricultural components (See Figure 1). Each of these components will receive a different emphasis depending upon a farm family's geographical location, socio-cultural preferences, and economic opportunities. This section of the report identifies these major components and discusses how they are combined in various ways to form different farming systems along the river.

First, there are four cropping systems in the Senegal River Basin. These include traditional rainfed agriculture (dieri cultivation), traditional recession agriculture (walo, falo, fonde), small irrigated perimeters (both vegetable gardens and grain crops), and large irrigated perimeters. Second, livestock rearing is still an important activity carried out by all ethnic groups along the river, despite the fact that herds have been disseminated over the last 15 years due to the drought. Third, both complimentary and competitive relationships exist between pastoral groups and sedentary farmers. Fourth, fishing is an important source of food and revenue for many farm families. Fifth, charcoal production is a short-term economic alternative for farmers who need to supplement their food supplies and income. Sixth, many farmers pursue off-farm income generating activities to diversify their income sources (e.g. farm laborer, milk sales, herder, construction worker, merchant, mill operator, etc.). Seventh, young males will permanently migrate from the village and send remittances back to their families. Eighth, many farmers will seasonally migrate to urban areas, agricultural schemes, or Senegal to supplement their income.

Given the marginal environmental conditions of this region, farm families attempt to combine these various economic strategies in ways to reduce their risks so that the basic needs of the family can be met. Farmers may be pursuing a number of strategies simultaneously. For instance, a farmer may be involved with rainfed agriculture, recession agriculture and irrigated agriculture all at the same time. Although family labor resources may not be adequate to pursue all three of these crop enterprises effectively, farmers will adjust the allocation of their labor resources to each of these enterprises depending upon climatic conditions (i.e., rainfall, adequacy of the floods, etc.), and/or access to input (i.e., availability of diesel, spare parts, seed, etc.). Such flexible adjustments are an adaptive response to an uncertain environment. Similarly, farmers will pursue a wide diversity of other economic activities to supplement their income and reduce their vulnerability to crop failures. Understanding how these various activities are interrelated and how farmers use them in various combinations to adapt to local conditions is essential if improvements are to be made in the existing farming systems.

B. Inter-Regional Variability Among Farming Systems

The type of farming systems pursued by farmers is strongly influenced by their geographical location and cultural tradition. Not all agricultural components previously mentioned are viable in every region. For instance, in the Delta Region (St. Louis to Dagana), rainfed cultivation and recession agriculture are of limited

MAJOR COMPONENTS OF MAURITANIAN FARMING SYSTEMS

(Senegal River Basin)

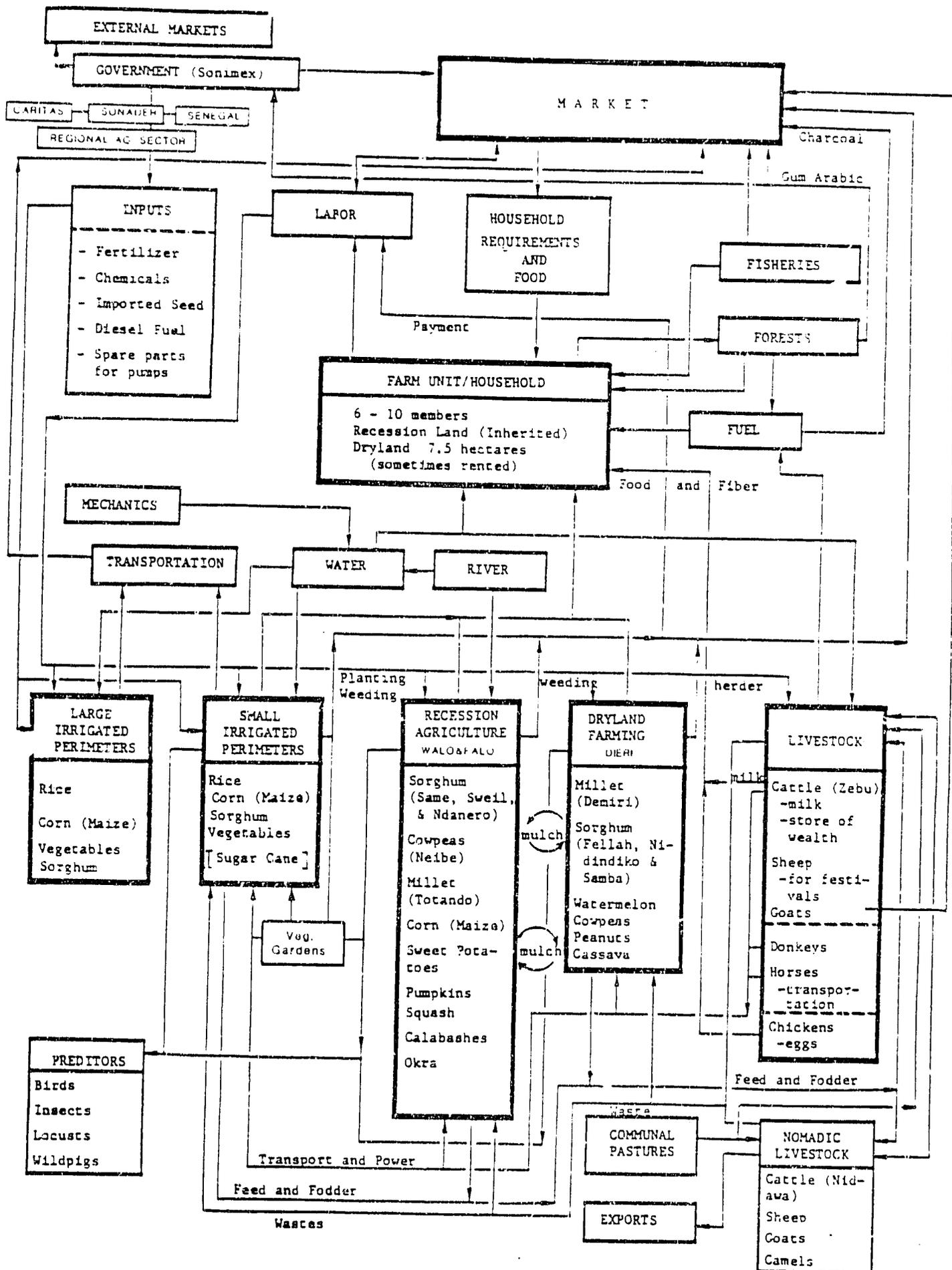


Figure 1.

potential. Farmers in this area rely heavily on irrigated agriculture to meet their needs. Rice and vegetables are the dominant crops in the perimeters. Because of the high salt content of the soil, very little corn is grown. Salty soils may also account for why the dominant crop in falo cultivation is sweet potatoes rather than corn.* To avoid salinity problems in vegetable gardens, farmers plant vegetables on the side of planting hills in their irrigated fields. Private irrigated perimeters are also common in this region. In fact, most of the large commercial vegetable gardens are found in the Trarza Region of the Delta. Vegetable marketing is encouraged by easy access to large markets such as Rosso, Dagana, and Nouakchott.

In the Lower Middle Valley (Dagana to Boghe), rainfed agriculture is of little importance due to inadequate rainfall, but recession agriculture becomes more prevalent. The soils in this area are good for recession cultivation because they are medium to fine textured alluvial deposits which are deep, moderately permeable, and have adequate water holding capacity. Marigots are also dispersed throughout the region, making recession cultivation more feasible. Floods recede in December, so planting begins later than in the upper portions of the river. Irrigated perimeters are also found in many of the villages in the area. A few private perimeters can be found, but most are located in the vicinity of Dagana. Aside from rice and vegetables, irrigated corn is also grown in the perimeter. Except for the villages near large towns like Boghe and Dagana, the villages in this region are more isolated, lack infrastructure, and do not have easy access to markets. This influences cropping strategies and alternative sources of income. Farmers in several villages turn to charcoal production when crop yields are inadequate.

In the Central Middle Valley (Boghe to Matam), all four cropping patterns can be found. As a result, there is a great deal of crop diversity. The potential for rainfed agriculture is somewhat variable; however, due to access to rainfall west of Bolo Dogo, very little rainfed cultivation can be found. Between Bolo Dogo and Kaedi, the crops grown on dieri fields are primarily watermelon, cowpeas and hibiscus. Millet and sorghum become part of the crop mix in villages east of Kaedi. Millet is more popular in the Central Middle Valley than in the Upper Valley.** Recession agriculture is also found throughout the area. The soils are similar to the Lower Middle Valley, and marigots are prevalent throughout the area. Aside from sorghum, cowpeas and watermelon, corn and vegetables are grown in some recession fields located in the Dirol Plain.*** Floods recede in October and November in this area, so planting begins earlier than in the Lower Middle Valley. In addition, both small perimeter and large perimeter irrigated agriculture are found in this region. Large perimeters are located near Boghe and Kaedi, while small perimeters are scattered throughout the area. There are very few private perimeters. Besides irrigated rice, corn and vegetables, irrigated sorghum can be found in villages in the eastern Brakna and Gorgol Regions.

*Taste preferences among the Wolof may also account for this pattern.

**Pulaar in this region prefer millet over sorghum.

***Corn and vegetables are planted in tributaries and stream beds.

In the Upper Middle Valley (Matam to Bakel), rainfed cultivation is important while recession agriculture is less prevalent. A wide variety of crops are grown in dieri fields due to increased access to rainfall (e.g. peanuts). Sorghum is preferred over millet as the main rainfed grain crop.* Women also play an important role in rainfed cultivation. This is a common cultural practice among the Soninke. Small irrigated perimeters have also been recently introduced into the area. In these perimeters, corn is the dominant crop grown rather than rice. Sorghum can also be found in the irrigated parcels, along with cassava and other vegetables. In addition, out-migration of young men to France is a common pattern in this region. The quality of house construction and village infrastructure demonstrate the importance of remittances to this area.

C. Intra-Regional Variation in Farming Systems

In addition to regional variability, the types of farming systems found within regions will differ depending upon access to resources and economic background. Intra-regional differences in cropping patterns can be used to delineate four different systems. For example, some villages in the area surveyed have no access to irrigated perimeters. Farmers in these villages rely totally on traditional rainfed and recession agriculture. Examples of such villages include Fondou, M'Boto, Gourdioma, Ganki, Lekseiba, Talhaya, Nouma and M'Bagne. All of these villages are located in the Central Middle Valley except Nouma, which is in the Upper Middle Valley.

Another type of farming system identified in the area is one where farmers rely almost exclusively on irrigated agriculture. Examples of this type of farming system can be found in Toufde Sive, Paliba, Darel Barka and in some of the villages located near the large perimeters outside of Boghe and Kaedi.

The most common type of farming system found throughout the surveyed area is one where farmers combine traditional agriculture with small irrigated perimeter cultivation. Twenty-one out of thirty-four villages follow this pattern. The types of traditional agriculture which are combined with irrigated agriculture will vary from village to village, depending upon access to rainfall and adequate floods.

A fourth type of farming system which is somewhat more complicated can be found in villages near large perimeters. In these villages, farmers may be cultivating plots in large perimeters as well as in small village perimeters and/or recession land. Examples of this type of system can be found in N'Gorel and Tienel near Boghe.

In addition to the variability that exists in cropping patterns, the farming systems found in the Senegal River Valley can be further differentiated on the basis of the alternative economic strategies which farmers pursue to supplement their crop production. For example, farmers in some villages are oriented toward fishing (e.g. M'Bagne), while farmers in other villages may be oriented toward animal

*Soninke taste preferences as well as soil conditions may account for this pattern. Villages located near the large perimeters outside of Boghe and Kaedi.

husbandry (e.g. Bovel). Likewise, some villages have more income generating opportunities for farmers than other villages (e.g. Djovol). This is strongly influenced by the size and institutional complexity of the village and its proximity to a large urban center. Out-migration may be a strategy followed more often in some villages than in others (e.g. Toulel). In villages with limited economic alternatives, farmers may have no recourse but to migrate or supplement their income with charcoal production (e.g. Darel Barka).

Taking all of these factors into consideration, it is apparent that the farming systems pursued by a given farm family will be some unique combination of the various farming systems components. Understanding each of these components and how they are interrelated is necessary if appropriate interventions are to be developed. The following sections of this report address each of these farming systems components in detail.

III. IRRIGATED SYSTEMS

The major goal of the Mauritanian food and agricultural policy is to reduce the country's dependence on imported food, especially grain. The principal means by which this goal is to be achieved is through the promotion of irrigated agriculture throughout the river valley. The irrigated perimeters, many of which have been recently constructed, have become an important and integral part of the overall farming system found within the river valley. The perimeters were for many of the riverine people their main hope for survival through the last drought cycle. Without them, most of the river valley rural population would not have planted any crops at all within the last several years.

The perimeters have allowed many farmers to plant and harvest some grain. The possibility of production in dry years has stimulated the demand for the construction of new small perimeters (M'Bagne and Tetiane) and the expansion of existing perimeters (Sori Male). Yet there are numerous perimeters that have been either taken out of production (Darel Barka, Paliba, and Olo Ologo) or are being under-utilized (Gani and Kaire) due to inappropriate cropping systems, poor water management practices, badly constructed perimeters, ill-prepared plots (not leveled), equipment failure, and/or the inexperience of the farmers. The perimeters involve intensive, as opposed to extensive, agriculture and the use of new technologies such as irrigation techniques. Farmers find the work harder and more demanding. They feel that the returns on investments and labor are inadequate. Most of the actual yields obtained to date in the perimeters, especially the small perimeters, are far below SONADER's projected irrigated crop yields (4 tons/ha for rice, 2 tons/ha for maize, 1.5 tons/ha for sorghum); crop costs are high, especially pump-running and maintenance costs; and cooperative indebtedness has increased considerably (see Appendix U). Thus many farmers, when asked, indicated that if a cycle of sufficient rains and adequate flooding were to return, they would go back to the traditional farming systems in the dieri and walo, which are extensive, less demanding, and give higher net yields per effort extended.

A. General Characteristics of Perimeters

An irrigated perimeter consists of a group of small plots (usually about 1/4 to 1/2 hectare) that are serviced by a system of irrigation canals and surrounded by an earthen dike to protect it from floods. Two types of perimeters exist; large perimeters and small perimeters.

A.1. Large Perimeters

Large perimeters are about one hundred hectares or more in size, with a system of large lined main canals and smaller lateral canals, service roads, and a high protective dike enclosing them. Examples are the Gorgol perimeter (600 ha) and the Boghe perimeter (403 ha). The large perimeters were developed with the help of international funds (e.g. World Bank, European Development Fund). Heavy machinery was required to level the land and construct the perimeter and canals. These perimeters are managed, supervised and maintained by SONADER. Farmers

in the large perimeters receive supervisory and technical help and also inputs and material assistance. The primary crop grown is rice; either once or twice a year. Recently, other crops such as sorghum and maize are being suggested for the dry season, as in Boghe. The most successful large perimeter within the area visited is the Gorgol perimeter, just west of Kaedi. Possible reasons for its success are: 1) the attention it receives from various research projects; 2) the extension and technical assistance it receives; and 3) size of the holdings which average about 0.75 ha.*

A.2. Small Perimeters

The small perimeters are about 20 hectares in size, with a system of small earthen canals and a low protective dike enclosing them. Examples are Toulel--16 and 36 hectares, Wali--23, 27 and 19 hectares, and Bababe--20 hectares. There are basically four types of small perimeters. There are: 1) Type A perimeters; 2) Type B perimeters; 3) private perimeters; and 4) garden perimeters. In the area covered by the survey, most of the perimeters varied between 4 to 30 hectares (there is one large private perimeter of about 250 hectares). The gardens are simple structures with a few watering canals fed by a one- or two-cylinder pump (e.g. Tienel cooperative garden), or a watering tank filled from the river by a pump (e.g. M'Bagne and Djovol cooperative gardens). The gardens are usually run by either a mixed or women's cooperative. Most of the perimeters have easy access to water** and are either on the fonde land*** next to the river or on walo lands that are close to the river or a marigot.

*An in-depth survey (of 400 farmers) was carried out between 1980-1982 in the Gorgol perimeter by SONADER (unpublished report, 1982). One conclusion was that the highest rice crop yields were obtained from farmers who had between 1 to 1.2 hectare plots or holdings. The smaller plots yielded less because the families divided their time between the perimeters and the dieri, while the larger plots obtained lower yields because they were less manageable.

**Some women's gardens are not located next to the river or do not have access to a pump (e.g. Silla). Water is carried by hand to such gardens by women.

***Most small perimeters are located on fonde land (alluvial levees) where the land use rights are less restrictive. Since production on fonde lands is dependent upon erratic rainfall, the land is considered less valuable than walo land. Rich flood recession lands are considered more valuable and are subjected to a complex set of land regulations. These land right regulations may act as a constraint to the development of small perimeters. SONADER has had problems in the past settling land disputes on walo land.

The most common small perimeters are the Type A and B perimeters, averaging about 25 hectares in size with an active cooperative membership of about 75 persons. The average size holding is between 0.25 to 0.5 hectares, where a holding can be one or more plots of various sizes. The Type A perimeters, which are surveyed and laid out by SONADER but farmer-built under the supervision of SONADER, are the most prevalent. These are the perimeters which SONADER prefers to develop. Examples of Type A perimeters are Djovol, Wali 1 and 2, and Koundel Reo. The Type B perimeters are those where the levelling and some of the construction work is done with machinery while the farmers do much of the less arduous work in constructing the smaller canals and plot divisions. The Type B perimeters, like Guiraye and Wali 3, appear better built. The cooperative members of the Type B perimeters had fewer complaints concerning the conditions and levelling of the perimeter. Most of the Type B perimeters visited had more uniform crops, and canal systems were in better condition.

The size of the plots vary from one perimeter to another even within the same village. A farmer may have several plots to make up a holding. The average size of a holding is around a third of a hectare, with a minimum of 0.1 hectare and a maximum of 1.5 hectares.

Most farmers felt that the holdings were too small upon which to live. Because of this, farmers had to divide their available labor resources between the irrigated perimeters and the traditional croplands in order to survive. Farmers realize that sacrifices in production efficiency and output are being made by this division of labor between the traditional croplands and irrigated perimeters. In many cases where either traditional lands, perimeters, or both failed due to natural or management deficiencies, the farmers turned to charcoal production. A great majority of the cooperative farmers interviewed expressed a desire to have larger holdings, but only a few stated that the reason was to be able to concentrate their efforts on irrigated agricultural production. Nearly all the farmers considered the work in the perimeters very arduous, especially the manual preparation of the heavy clay soils (vertisols) of the fonde. This is understandable considering most of the farmers in the region covered are elderly, with many of the younger men having immigrated.

A.3. Irrigation Pumps and Maintenance

- 1) All the functioning perimeters have two cylinder pumps with a capacity to handle irrigation systems of about 20 to 25 hectares. Various makes of pumps from five countries can be found. The Lister HR2 from Britain is the most prevalent pump in the surveyed area (21 out of 43 perimeter pumps encountered). Most of the pumps are on a chassis situated at the river's edge. The rest are on floating platforms anchored in the river. With the low river level encountered during the hot, dry season, the pumps are lifting the water about 6-10 meters from the water source into a catchment basin at the top of the river bank (or fonde). From this point the water is gravity-fed to all the parcels in the perimeter through a system of earthen (unlined) canals. The canals vary greatly in capacity and condition from one perimeter to another, though the Type B perimeters have slightly deeper and better-constructed canals. In many of the perimeters there is a large water loss due to seepage, especially at the resealed outlets into the parcels, and due to the vegetative growth

in the canals. Because of the height of the lift and the increased water requirements due to the reduced canal efficiency, the pumps are overtaxed. This is especially the case in the older perimeters.

- 2) Pump breakdowns happen frequently in all perimeters save for one or two instances. The breakdowns are due not only to the over-taxing of the pumps but also to the inadequate maintenance of the pumps. Most of the pump operators are responsible for starting and shutting down the pumps, filling the pumps with fuel, and the regular changing of the engine oil. SONADER mechanics are responsible for changing the filters and all other maintenance and repairs to the pumps. All the pump operators encountered had some training of about three weeks or more in basic pump operations and rudimentary maintenance which was conducted by SONADER or CARITAS.

Pump operators do not have a great incentive in ensuring that the pumps are in good running condition. Cooperatives pay their pump operators in different ways. Some operators receive a flat monthly wage during the crop season, i.e., 6000 UM per month (paid in cash, product or food). Others receive a fixed quantity of a crop from each parcel (i.e., 3-1/2 kgs of grain per farmer); or a fixed payment per irrigated parcel (i.e., 20 UM per parcel per irrigation). In some cases an operator's parcels are planted, cultivated, and harvested by the farmers in order that the operator may devote his full time to his job. In a few instances pump operators were given incentives, whereby the payment depended upon the crop yields. In these cases pumps were better maintained and there was a noticeable difference in the times the pump was down.

- 3) Serious pump breakdowns have caused varying degrees of crop losses from decreases in crop yields to complete failures. Most prolonged pump down-times are due to either delays in the availability of the mechanics or, which is more often the case, the lack of available spare parts. Breakdowns due to this latter cause may last anywhere from one month to more than a year.
- 4) The lack of diesel fuel for the pumps has caused some pump down-times. The difficulty of supplying diesel on time to the perimeters increases as the village accessibility diminishes. Poor road access and slow communications are the main causes of the fuel delays.

A.4. Institutional Relationships with Perimeters

All the small perimeters, save for a few, are overseen or supervised by SONADER. A few (i.e., Paliba, Tagah/Gourel Dieri and Toufde Sive) are supervised by CARITAS, while others are privately owned. The relationship between the small perimeter cooperatives and the institutions involve a number of aspects. First, the institutions give the technical, engineering and some financial help towards the construction of the perimeters. They then finance the purchase of pumps and necessary equipment and train the pump operators. Thereafter, the institutions advance production inputs such as seed, fertilizer, insecticides and fungicides, diesel, oil, spare parts as well as finance pump repairs and sometimes land preparation. The SONADER loans are repayable in the following manner: 1) construction loans over ten years;

2) pump purchase loan over three years; and 3) crop loans at the end of the crop season. The cooperatives repay the loans advanced by the institutions either with the crop (rice, corn or sorghum) or in cash.

In the area surveyed, many of the cooperative farmers have expressed a negative view toward the institutions primarily because of the problems they have encountered. These problems include: 1) the fact that the parcels are not level; 2) crop losses due to prolonged pump breakdowns; 3) damage and devastation caused by intruding animals, especially camels; and 4) the indebtedness incurred due to crop losses or failures. In each case the institutions are blamed even though both may be at fault. The farmers are ill-informed with regards to irrigated crop and financial expectations. In some cases farmers have admitted that they are ill-prepared with regards to perimeter cultivation, and sometimes resources have been mismanaged. Farmers also have a tendency to rely on the institutions to help them out in times of crisis instead of resolving the problem themselves. At the same time, the technical help and back-up supplied by the institutions, especially with respect to the pumps, have been inadequate.

A.5. Major Constraints

Four major constraints stand out as inhibiting the successful production of crops in irrigated perimeters.

- 1) The most vulnerable point of an irrigated crop system such as that of a small perimeter is the pump. Pump failures reduce or eliminate the access to water for irrigation which in turn leads to lower crop yields or even total crop failures. A number of observed factors have led to lower pump efficiency or failures:
 - a) overtaxing of the pumps,
 - b) inefficient canal systems, thus requiring increased pump use,
 - c) inadequate or inappropriate irrigation techniques requiring higher water usage,
 - d) inappropriate cropping systems for specific soil types,
 - e) insufficient and untimely diesel pump maintenance,
 - f) scarcity of spare parts for the diesel pumps,
 - g) inadequate training of pump operators,
 - h) the lack of incentives for pump operators to ensure the timely availability of irrigation water for the crop perimeters.

- 2) A second constraint is the lack of knowledge that the farmers have of irrigated cultivation practices, techniques, possibilities, and limitations. Certain factors that have led to this are:
 - a) the diverse backgrounds of the villagers which include fishermen and herdsmen, that apparently had not been taken into account when establishing perimeters,
 - b) the lack of adequate and/or sufficient technical help to the farmers,
 - c) the role of the cadres as enforcers rather than as extensionists providing technical help and information to the farmers.

- 3) Thirdly, the intrusion of animals into the perimeters has caused extensive damage to the crops and in some cases, such as Fimbo Paliba, the total loss of a crop. This problem has arisen as a consequence of:
 - a) a lack of adequate fences around the perimeters to keep out goats, sheep, donkeys and camels,
 - b) the accessibility of sufficient fences and/or the inability to obtain appropriate fencing material. In most of the surveyed area along the river valley, the situation is further aggravated by the fact that the farmers have little to no recourse within the judiciary system to exact retribution or payment of damages, especially if the damage occurs during the day. Yet if the animals, especially camels, are at any time inadvertently harmed in the perimeter or in their removal from the perimeter, the farmers have to pay damages to the owners of the animals.

- 4) The fourth major constraint is the mounting debt that some of the cooperatives have accumulated because of their inability to repay long term and short term crop loans. This inability to repay is due to crop losses and failures. The cooperative indebtedness has brought about:
 - a) closures of perimeters due to lack of operating funds or pump inputs,
 - b) inability of cooperative farmers to plant irrigated crops due to the lack of funds to repair motor pumps.

B. Irrigated Rice

B.1. General Characteristics

Most of the farmers with plots in small perimeters grow paddy rice, though it is more prevalent down-river (west of Kaedi) where the older perimeters are found, than up-river (east of Kaedi). Farmers in some downstream perimeters cultivate rice twice a year. The heavy fonde lands are more suited for rice production, with yields of between 3 to 5 tons per hectare from average crops. Some rice is grown in the lighter walo lands with resultant lower yields, e.g. parts of the Sori Male perimeter which yielded about 0.65 tons per hectare as compared to 3.7 tons per hectare from the heavier soil. Most of the rice is grown during the wet and flood seasons from June to December. The seedbeds are prepared in June, and transplanting occurs in July and August. Harvesting occurs from October through December. If a second rice crop is planted, transplanting occurs in December and it is harvested in April. This second rice crop yields less than the first crop because it is affected by the cooler temperatures and shorter days during December, January and February.

B.2. Varieties Grown

The varieties of paddy rice grown in the small perimeters were Inkompao (IKP), Chinchungway, Tishun Native No. 1 (TNI), Diaya, Gaire (from Senegal), TNA (from Senegal), IR28, IR18, 1521208. The first three varieties are supplied by SONADER. Many of the rice farmers saved their own seeds from the previous year's crop.

B.3. Land Preparation

In the majority of the cases the farmers started to prepare the land in May. They applied an irrigation to soften the soil. Otherwise the soil is very hard and extremely difficult to manually prepare for planting. This task is normally done by the men or hired laborers. The preparation of the parcels takes up to two months to complete. The major problem in preparing the land for transplanting the rice is the levelling of the parcel by hand. In reality, this task was rarely accomplished. A few farmers were able to obtain tractors or hand cultivators to prepare their lands.

B.4. Inputs Used

Fertilizer was applied in most of the perimeters. Urea was applied in the plots, sometimes in conjunction with a phosphate fertilizer. The rates vary from 25 kgs to 280 kgs of phosphate, which was applied either before transplanting or up to 10 days after transplanting. The rates of urea were between 25 and 300 kgs per hectare, normally in split applications at pre-transplant, between 8-30 days after transplant, and at heading time. Some insecticides were applied, but not often. In one case, dust was applied around the perimeters to stop the penetration of insects into the rice crop.

B.5. Water Application

Farmers try to maintain a permanent flood in the parcels where the paddy rice is grown, but this is not always possible because of uneven land, lighter (more porous) soils, or pump breakdowns. Water is applied about every 8 to 20 days, the more frequent application being necessary on the lighter, sandier soils.

B.6. Cultivation Practices

Rice transplanting was done by the farmer and his family. In cases where the farmer had larger holdings hired labor was used. In a very few instances, such as the case of some farmers in Tiekane, the rice was broadcast directly. Even though the farmers preferred this practice, it is being discouraged by SONADER. The plots were weeded from one to three times by hand. In most cases the male farmer performed the chore, and the family helped in the harvesting and threshing of the rice. The threshing was nearly always done in the field. The unhulled rice was stored in sacks, while the straw was gathered and taken home for the animals. Occasionally the straw was burnt in the field.

B.7. Major Pests

The major insect pests that were encountered included the stem borer, grasshoppers, crickets and termites. Birds and animals were a big problem. The estimated crop loss due to them was between 5 to 20% in most perimeters. Camels destroyed all of the crop in one perimeter.

C. Irrigated Maize (corn)

C.1. General Characteristics

The majority of the maize under irrigation is grown during the cold dry season between November and April. In the region surveyed, most of the irrigated maize is grown between Wompou and Darel Barka. In the western part of the Brakna region and in the Trarza region very little maize was grown under irrigation in the perimeters visited. The cultivation of irrigated maize is more prevalent up river. Three perimeters grow maize twice a year (Wompou, Toulel and N'Gorel) while some others did so in the past. Some farmers in three other perimeters planted maize twice a year. Yields were not obtainable because the crops are harvested and stored on the cob. Some maize is harvested green for home consumption or marketed. Three to four cobs sell for 20 UM. A few perimeters such as those of Wali and Bababe had excellent, well tended crops.

C.2. Varieties Grown

In most cases, farmers did not know the name of the variety of maize that they planted. Most farmers assumed that they had a local variety; others knew that they had introduced varieties. The maize seed in most cases was either saved from the previous year's crop, bought in the local market, or obtained in Senegal.

An early maturing variety of maize was found in Toufde Sive. This maize matured in seventy to eighty days. Farmers said that they obtained the seed in Senegal. A similar short-maturing variety was also found in Fondou (on falo land).

C.3. Land Preparation

The majority of the land is prepared manually; mostly by the men in the Gorgol and Brakna region and by both men and women in the Guidimaka region. Only in a few instances were tractors used such as in Silla and Toulel. For the wet season crop, the land is pre-irrigated before land preparation is carried out (e.g. Wompou).

C.4. Inputs Used

Farmers in nearly all of the eastern perimeters used fertilizer on their maize crops. The types, quantities applied and times of application varied. Urea was frequently applied, usually in split applications at planting time and at knee high or tasseling time. The amount of urea used per hectare varied from 60 to 200 kgs. In a number of perimeters in the Gorgol region, phosphate fertilizer was added by farmers either before planting or at planting time. At Bababe, manure (about 400kg/hectare) and small quantities of urea (about 20kg/hectare) were distributed over the land before planting. Some of the villages used insecticides to control insects (e.g. Bolo Dogo, Koundel Reo).

C.5. Major Pests

On most of the irrigated perimeters where corn was grown, the major pests were stem borers, termites, crickets and grasshoppers. Aphids and green

flies were also cited as corn pests. In addition, monkeys and birds were identified as corn pests in the village of Toulel.

C.6. Water Application

Farmers irrigated their corn crops three to seven times during the course of the growing season. An attempt was made to water the crop every 15-20 days. The water application frequency did not seem to be adjusted to differences in soil conditions.

C.7. Cultivation Practices

The maize crop grown during the rainy season is planted in June or July. Maize grown during the cool dry season is planted between November and February. It is usually planted using the traditional method of dibbling a hole in the flat land, dropping in some maize seed with cowpeas or another crop, and then covering up the seed with some sand.

Other crops found planted in association with maize included hibiscus, sweet potatoes, squash, watermelon, okra, cabbage, calebash, sorrel, lettuce, tomatoes and cassava. Planting is usually done by the whole family. In some villages such as Wali and Bababe, farmers planted their maize on hills. Yields were good following such a practice.

The maize is usually weeded by hand one to four times depending on the availability of labor and the density of the weeds. Weeding is usually done by the male farmers or with their families. Occasionally, hired labor may be used at a wage rate of 100 UM per day plus meals (e.g. Toulel).

Maize planted during the wet season is harvested during the months of October and November, while maize planted during the cool, dry season is harvested in April and May. The crop is mostly harvested when it is mature, although cobs are also taken green to either sell or for consumption. Harvesting is usually done by the farmer's family. The maize is either stored on the cob in bins or stacked in a room.

The timing of maize harvesting in some Soninke villages in the Guidimaka region is determined by the village chief. Unfortunately, not all of the corn matures at the same time because of differences in leveling, soil type, timing of planting, etc. Once the chief has made the pronouncement, the pump is turned off. Those whose corn has not reached maturity lose their crop. Sanctions against harvesting prior to the chief's pronouncement are quite severe. The rite is a traditional dieri rite which has been imposed upon the perimeter.

D. Irrigated Sorghum

D.1. General Characteristics

Irrigated sorghum is grown in perimeters found mostly in eastern Brakna, Gorgol and Guidimaka regions. Some farmers planted irrigated sorghum for the first time on their parcel during the 1985 cropping season. Several farmers in the Guiraye and Djovol perimeters plant sorghum twice a year.

Two reasons are cited by farmers for why they are growing irrigated sorghum. First, growing sorghum helps cut down on the risk of crop loss due to pump failures and fuel shortages. Sorghum's minimal water requirements make this crop less vulnerable. Second, the yields provided by other crops such as rice are insufficient to cover input and water costs.

D.2. Varieties Grown

The most common variety of sorghum grown in the perimeters is fellah. In Toulel a variety called Nabaane was planted while in Keundel Reo a same variety was grown. All of the sorghum seed was either saved from the previous season or bought in the local market.

D.3. Land Preparation

In most cases, the land was tilled manually by the farmers themselves. Sive was the only village visited where a tractor was used to prepare the land before the rains.

D.4. Inputs Used

Farmers in six perimeters (43% of the perimeters visited that grew sorghum) applied fertilizer. Urea was the most common substance used. In Guiraye, phosphate was added. In Bovel, a complete fertilizer (10-20-20) was applied. In every case, farmers were unable to specify the amount of fertilizer used. Only three farmers in Sive used an insecticide to control the cricket and grasshopper infestation. Government agricultural extension agents helped with the spraying and good results were obtained.

D.5. Water Application

Normally two to three irrigations are sufficient to raise a sorghum crop. Dindi and Sive irrigated their crops every 15 days. Flood or basin irrigation was practiced in every case.

D.6. Cultivation Practices

The main season for sorghum cultivation is the rainy season from July to November. Sorghum is also cultivated during the dry season in some villages from December/January to April. The sorghum crop is planted on a flat parcel using the traditional method of breaking the soil surface with a hoe, dibbling a hole with a pole, dropping in the sorghum seed with possibly other seeds such as cowpeas, and covering the seeds with sand. Other crops planted in association with sorghum include hibiscus, okra, calabesh, cucumbers, sweet potatoes, watermelon and squash. In nearly every case, the farm family does the planting.

The sorghum is usually weeded between one and three times. This operation is mostly done by the men of the household. Harvesting is a family activity. The sorghum heads or panicles are cut, dried and then taken to the compound for storage. Sorghum is stored on the panicle in most cases. Occasionally the sorghum is threshed soon after harvest.

A cultivation practice observed in the village of Djovoi is worth noting. Some farmers would harvest their sorghum planted during the rainy season and allow the secondary shoots to act as a dry season crop. Farmers said that this practice helped cut down on the labor inputs required for the second planting. They indicated that they used to follow a similar practice in walo cultivation. Farmers stressed that not all sorghum varieties would produce good secondary shoots. Fellah varieties were good for such purposes while some other varieties were unsuitable. Researchers should seriously consider conducting an economic analysis to determine if this practice brings higher net returns to farmers than replanting a second sorghum crop.

D.7. Major Pests

The major pests reported by farmers which attack irrigated sorghum are grasshoppers, birds, crickets, stemborers, aphids and wild pigs. Domestic animals also do considerable damage (especially camels).

E. Market Gardens (Vegetables)

E.1. General Characteristics

Vegetable gardens exist in a variety of forms in the villages surveyed. First, there are vegetable plots located along the river in the falo areas (see below). Both men and women cultivate these plots. Second, there are cooperative gardens. These may vary in size from 150 square meters to several hectares (e.g. the garden in Dar es Salam is 20 hectares). Most of the cooperative gardens are for the women in the village, although some are mixed like those found in Koundel Reo and Toufde Sive. Toulel had a separate garden for men and one for women. Some villages have three or more cooperative gardens (e.g. Djovoi). Such gardens tend to be in close proximity to the village. Third, several villages have individual vegetable gardens. These may vary from small individual plots located near the household compound (e.g. Talhaya) for home consumption to large private commercial vegetable gardens (e.g. Gani). Most of the large commercial gardens are located in the Traza region. In some villages, all of these types of vegetable gardens can be found together.

E.2. Water Source and Application

All of the gardens had access to water either from the river, marigot or a well. Villages close to the river or a marigot, such as Guiraye, Wali, Toulel, Silla or Tetiane, watered their vegetables by pump irrigation or hand carried water. In villages where river water is pumped to the gardens, a cooperative owned water pump (e.g. Guiraye) or a pump used in the small perimeter (e.g. Sori Male) are used for this purpose. This water is usually applied using the basin irrigation technique. In villages located some distance from the river (e.g. Ganki, Fondou, M'Boto and Lekseiba), well water is used for the gardens. The well water is all hand drawn and applied to each vegetable plot either with watering cans or any available container. Some villages have, or are in the process of building, holding tanks for the gardens (e.g. M'Bagne and Djovoi).

E.3. Vegetables and Other Crops Grown

A variety of crops are grown in the gardens. These include cabbages, lettuce, tomatoes, eggplants, onions, peppers, carrots, potatoes, sweet potatoes, cassava, peanuts, parsley, mint, beans, turnips, cucumbers, beets, hibiscus, okra and maize. In some cases, fruit trees and bananas are grown as well. The crops grown in the gardens are usually cultivated during the cool dry season.* Very little is grown during the hot dry season, or the rainy season due to the proliferation of fungus diseases. Because most of the vegetables are grown during the cool, dry season, they tend to be harvested at about the same time. This seasonal surplus of vegetables results in lower market prices, reducing the economic returns to farmers.

E.4. Cultivation Practices

Most of the vegetables are grown in basins. This is especially true on sandy soils and where watering cans are not available. A few villages made raised beds and/or hills to plant crops such as potatoes and cabbage. In Gani in the Trarza region, commercial vegetable producers were planting tomatoes on the sides of hills. This was done to avoid excess salt buildups in the soil on the top of the hills. The gardens appeared to be well tended and clean, but in many cases villagers were not receiving enough technical advice or help. In the villages where SONADER cadres or Peace Corps volunteers were present, the market gardens were doing well (e.g. Wali).

Vegetable yields were hard to determine, but some gardens of approximately one hectare grossed about 10,000 UM per year for the portion of the crop sold. The majority of the income came from onion sales. The major constraint to marketing the more perishable vegetables is the lack of adequate transport.

E.5. Inputs Used

The major inputs used were organic fertilizer, humus and some urea. Some insecticides such as orthene or sevin are used if available to control worms and crickets. If pumps are being used to water the garden, the major input costs are diesel and pump maintenance.

E.6. Women's Cooperative Gardens

As stated earlier, most of the cooperative vegetable gardens are managed by women. The size of a cooperative will vary considerably, but the average is between 1 and 5 hectares. Anywhere from 19 to 700 women may be members of a cooperative. Labor arrangements within these cooperatives will also vary. In some villages such as Koundel Reo, Silla, Bababe, Fondou,

*Some villages also grow some vegetables during the rainy season. These include Gani, Tiekane, N'Gorel, Toulel, Djovol, and Talhaya.

Tienel and Olo Ologo, the women have individual plots which they manage and reap the benefits for themselves. In Toulel, Tetiane and Darel Barka, the gardens are managed cooperatively with the members sharing in the labor tasks and the output. A mixture of these two types of labor arrangements are found in Dar es Salam, M'Boto, Sori Male, M'Bagne, Wali, N'Gorel and Talhaya. In such villages, women perform cooperative tasks on given parcels as well as manage their own parcels. The produce obtained from individual parcels is often for home consumption, although some may be sold to purchase other commodities such as tea, sugar or bread. The vegetables produced on the cooperative parcels may be distributed among the women or sold. If the produce is sold, the money may be used by the cooperative to purchase needed inputs such as seed, tools, diesel or be used to buy capital intensive items such as a mill (e.g. M'Boto and Dar es Salam). In the village of N'Gorel, the production from the communal parcels is divided three ways. One-third is sold to purchase seed and tools; one-third is shared among the members for consumption; and one-third is stored (i.e., onions) to be sold later when food supplies are limited.

The majority of the women's cooperative gardens obtain water through the use of a motor pump. However, water is still being transported by hand from the river or marigot to the garden in many villages (e.g. N'Bar Wadji, M'Bagne, Silla, etc.). In villages far from the river, well water is used to water the gardens (e.g. M'Boto, Fondou, Tetiane, Lekseiba, etc.). Water access is considered a critical constraint for many of the gardens in the villages surveyed.

Other constraints cited by the women included: 1) the lack of inputs such as diesel, seed, fertilizer, spare parts for the motor pump, tools and watering cans; 2) the lack of markets for vegetable products; 3) the lack of adequate transport to distant markets; and 4) crop losses due to pests such as camels, goats, wild pigs and grasshoppers.

IV. RECESSION AGRICULTURE (Decrue)

A. General Characteristics

Recession farming is a common practice followed by farmers in the Middle Valley region of the Senegal River basin.* This cultivation practice involves planting crops in flood plains after seasonal floods have inundated the area and have receded. The amount of land available for recession agriculture can vary considerably from one year to the next. For instance, the area under recession cultivation can fluctuate between 15,000 and 140,000 hectares (ORGATEC 1978:13). The amount available for cultivation is determined by the magnitude and duration of the annual flood. Thus, a farmer's access to recession land may vary each year making it difficult to achieve consistent levels of production.**

Access to recession land is restricted because of its high production potential. Recession land is usually subdivided into many small plots, and a single farm family may be cultivating several different plots at any one time. In most cases, the land is collectively owned by a lineage and distributed to lineage members. Given the tenure arrangements found in the survey area, older male farmers (40-60 years old) are more likely to have access to the prime recession land, which is consistently flooded, than younger male and female farmers.

Farmers who do not own land can gain access through a number of ways. First, the farmer may enter into a sharecropping arrangement with the owner (called rempecien or assakal in Pulaar).*** In this arrangement, the farmer pays the landlord a part of the harvest (varies from one-tenth to one-third). Second, farmers can gain access by paying a fixed rental charge to the landlord (loubal). Third, farmers can pay a rental charge in advance in cash or in kind to gain access to land (ndioldi). Although this arrangement is similar to loubal, it can be denounced at any time. Fourth, in some rare cases, land can be purchased by the heir from the lineage (thiotigou). The price may vary according to the nature of the soil. Fifth, a farmer may gain access to land by promising so many labor days to the landlord (ndofal). Sixth, farmers may promise to work on the landlord's land on Thursday to gain access to land (horekossam). Seventh, an arrangement is established between the landlord and the farmer such that any time the farmer kills an animal, the landlord receives the breast (diyai). Eighth, a farmer gains access to a portion of a field if he cultivates all of the rest of the field for the landlord (sambaremorou). Farmers who are sharecroppers or rent land are not likely to have access to recession land during poor flood years.

*Recession farming is especially prevalent in the Lower and Central Middle Valley between Dagana and Matam and less prevalent in the Delta and Upper Valley regions (ORGATEC 1978:63).

**Some villages have not had a walo crop since the mid seventies (e.g. Tetiane, Koundel Reo, Wompou, Darel Barka and Guiraye). This is primarily due to the persistent drought conditions which have plagued the area

***All arrangements described are in Pulaar.

There are three different land types associated with recession agriculture. Falo lands are located along the river bank (see below). Approximately 7 percent of all recession land is falo (ORGATEC 1978:63). Fonde lands are part of the alluvial levee along the river which is rarely flooded. This land is not always cultivated and may be left in bush or be the area where a village is located. Fonde land is also the area where small perimeters tend to be built. Approximately 16 percent of all recession land is in this type of land (ORGATEC 1978:63). Walo land is the regularly flooded low areas or flood plains of the river basin. The lowland soils are locally called "Hollalde" in Pulaar, and they consist of silty clay deposits. This land is flooded annually when the river overflows its banks and fills tributaries and marigots adjacent to the river. Approximately 76 percent of all recession land cultivated is walo land (ORGATEC 1978:63). Sorghum is the most important crop grown in walo areas (see below).

It is important to emphasize that Mauritanian farmers may have access to recession land on both sides of the Senegal River. In nearly half the villages surveyed, farmers owned recession land in Senegal. This is an important factor to take into consideration when assessing the status of recession agriculture in Mauritania.*

B. Recession Sorghum in Walo Lands

B.1. General Characteristics

As stated earlier, a farm family may be cultivating several small plots of recession sorghum on walo lands during a cropping season. The suitability of a walo field for sorghum cultivation will depend upon how long the field has been inundated by flood water. A common rule of thumb is that a walo field must be submerged for at least 30 days. However, farmers indicated that the adequate length of submersion will vary depending upon the type of soil in the field. The minimum number of days cited was 15 (i.e., Fondou, Bolo Dago, Tienel), and the maximum was 4 months (Guiraye). The average was around 50 days.

The floods begin in July and peak in August and September. The flood waters begin to recede in late October or November in the Upper and Central Middle Valley and December in the Lower Middle Valley.

B.2. Varieties Grown

The local varieties of sorghum grown in the walo are fairly homogeneous and well adapted to the ecological conditions of the river valley.** They rely

*This reconnaissance survey did not thoroughly investigate the agricultural land belonging to Mauritanian farmers in Senegal due to logistical constraints. Such information should be collected in future surveys to provide a complete picture of the agricultural situation in the river valley. The Senegal River Valley is one ecological zone and should be treated as such when it is surveyed.

**The local varieties belong to the sub-series Dura in Snowden's classification system. The most common sorghum grown is the sorghum cernum var. agricolarum.

totally on the soil moisture available from receding floods and can withstand low temperatures and the dry winds characteristic of the dry season. Local varieties vary in the grain color, the presence or absence of a brown layer and the shape of the panicle (straight or curved). The most common varieties grown are the same varieties (nbeleri (black), nboderi (red), ndaneri (white)). These varieties have a brown layer surrounding the seed. The second most common variety is sewil. This variety has small grain, is white to ivory in color, and does not have a brownish layer. This type of sorghum is preferred by farmers for its taste. However, sewil is also vulnerable to birds, especially the Golden Sparrow (oasser luturus). For this reason same is more widely grown. A third variety frequently grown in walo lands is fellah. This variety is considered better tasting than same but not as good as sewil. A fourth variety that is commonly found is pourdi (danedio and jonngai). This variety has large seeds, is white to gray in color, and has a brownish layer around the seed. A fifth variety found in the area is called samba suki. This variety has large grain, and is yellowish to redish in color. Two other varieties found which are less common are mariam faty and sawaski. Two millet varieties also grown in walo areas are called thiotandi and jortani.

The growing cycle of these sorghums range from 100 days (sewil) to 140 days (same). The actual maturation period will be affected by planting dates. Most farmers plant several varieties in the same field as a way to reduce risk. Farmers seldom plant sewil in a separate stand to avoid bird attacks. One farmer planted same varieties around his sewil crop as a way to deal with the bird problem.

B.3. Land Preparation

The major operation that occurs before planting is weeding. Farmers may begin removing brush from their walo fields prior to the flood season, but most of the weeding is done as the floods recede. Weeds may be cut while water still covers the field (ORGATEC 1978:66). These weeds are assembled and burned prior to planting. Weeding before planting is a major task in walo cultivation and has a limiting effect on the size of the cultivation unit. The quantity and nature of weed growth is related to the number of years in a row the land has been inundated (ORGATEC 1978:66). Areas that are inundated every year may have more severe weed problems. Thus, low walo lands may be more difficult to cultivate than high walo land. Some farmers may use animal traction (i.e., Toulel) or tractors (i.e., Lekseiba) to deal with the weeding problem. Other farmers may hire labor to help with the weeding (i.e., Tiekone).

B.4. Inputs Used

Farmers in nearly half of the villages surveyed were using seed treatment fungicides. The normal application was one matchbox of fungicide for every 4 kgs of seed. Some farmers also used insecticides (i.e., fenitrothron) to protect their fields (i.e., N'Gorel and Fondou). One farmer used 50 kgs around his field to protect it from crickets (i.e., Dar es Salam). Another farmer washed his sorghum seeds in animal urine to protect them from smut (i.e., Olo Ologo). No farmers in any of the villages surveyed used fertilizer on their walo fields.

B.5. Cultivation Practices

Sorghum planting often begins 15 to 20 days after the floods have receded when the soil is still moist (ORGATEC 1978:66). The earliest time cited for walo planting was September (i.e., Ganki), while the latest time mentioned was December (i.e., M'Boto). Planting operations usually begin earlier upstream than they do downstream. Four people may be involved with the planting, usually from the same family. One person uses a long hole (jindangu) and digs a series of holes approximately 1 meter apart.* Each hole is about 10 to 15 centimeters wide and 2 to 3 centimeters deep (ORGATEC 1978:66). Another person follows with a sharp stick (luugal) and makes a depression in the first hole about 4 to 5 centimeters deep. A third person comes along and places 3 to 5 sorghum seeds with cowpeas and/or another crop in the depression. A fourth person follows and covers up these seeds with sand (ORGATEC 1978:66). The density of planting ranges from approximately 1500 to 3800 planting hills per hectare.**

Cowpeas are the most common crop planted in association with sorghum. In addition to planting it in the same hole as the sorghum, some farmers will plant cowpeas immediately after the floods have receded before the sorghum is planted. This is done in order to have an early food source before the main harvest. In addition to cowpeas, watermelon and squash are commonly planted with sorghum. Corn may also be grown in the same walo fields with sorghum, especially in the Dirol Plain region (i.e., M'Boto, Fondou, Tietane). Other crops less frequently found planted with sorghum include sweet potatoes, tomatoes, hibiscus and cabbage (i.e., Talhaya, Fondou).

The sorghum is usually weeded one to three times depending upon the density of the weeds and the availability of labor. Some farmers did not find it necessary to weed their walo fields after planting. If weeding is required, the male farmers and/or the families perform the operation. Occasionally hired labor may be used.

The walo fields sometimes have a fence constructed of tree branches and bushes surrounding the cultivated area. This is done to protect the fields from intruding animals, although such fences are not very effective against camels. Farmers with fields that border the edge of the cultivated area are more likely to build fences. Thus, not all farmers with walo land build fences.*** Sometimes the fences are constructed in a cooperative effort with each farmer in an adjacent field constructing a portion of the fence. Men are usually involved with fence construction although families may also participate. To complete a fence, it takes anywhere from 4 to 30 days.

*The spacing between holes will vary in different parts of the river basin.

**These planting densities were determined by measurements taken in the aerial photographs.

***Only farmers from nine villages visited said that they constructed fences around their walo fields.

Guarding fields from birds and other predators takes up a considerable amount of the farm family's time. Women and children play a major role in this task. Predators can destroy up to 75 percent of the crop, so many farm families will live in shelters near their fields to watch their crops. This is especially true during the critical stages of sorghum development when bird damage is most likely (i.e., Talhaya). To discourage birds from attacking the sorghum, farm families will throw rocks, crack whips, yell, build "scarecrows," drape cloth over ripe heads, construct elaborate noise makers from string and pans, and bend over sorghum stalks so that ripe heads are not easily detected. Aside from birds, farm families guard their fields from other predators such as domestic livestock, wild pigs and rodents.

The timing of the harvest for recession sorghum will vary according to when planting activities were initiated and when the harmattan winds begin.* It can begin as early as the end of February or as late as May (e.g. Djovol). The most frequently mentioned time period was the end of February/beginning of March. The harvesting is done manually with a sickle or a knife by the farmer and his family. The heads are cut and transported to the village. They are stored on the panicle in the house or in a separate granary and threshed as the need arises. Grain yields for recession cultivation tend to be low and variable, in the range of 250 to 300 kgs/hectare. However, the accuracy of farmers' estimates of yield are questionable because yields are measured by the number of carts, horse or donkey charges or by the basket. In addition, the common practice of women collecting seed heads before the main harvest to meet food needs could account for a substantial portion of the sorghum grown. Thus, yields are underestimated.

Farmers will consume most of the sorghum they produce in their walo fields. All or a portion of the stalk will also be cut and transported back to the village to be used as fodder for domestic animals or sold. The stalks that are left in the field are grazed communally by village livestock and nomadic herds.

B.6. Pests and Diseases

The major pests which attack recession sorghum include grasshoppers, crickets, birds, domestic livestock, rodents, wild pigs, aphids, termites and stem borers. The most serious pests are grasshoppers, crickets and birds. Grasshoppers and crickets attack the young seedlings, forcing farmers to replant several times. Wild pigs also attack the seedlings. Birds do serious damage when the sorghum is in the milky stage of development up to maturation. Aphids attack both sorghum and cowpeas and are responsible for the cowpea disease locally called "miellat." This malady is detected by the sugary sap that is exuded on the cowpea plant by the aphids. The most common diseases identified in the survey were smuts. These include covered smut, long smut and head smut.

*The hot, dry harmattan winds can cause significant crop damage if they occur at the time the seed heads are in flower. Crop yields may be reduced 40 to 50 percent or the entire crop lost as a result of these winds (ORGATEC 1978:51).

B.7. The Impact of Large Perimeter Water Control Measures on Recession Sorghum

The walo lands along the Gorgel River have been adversely affected by two water control measures that were built for the Kaedi large perimeter. In the past, the area received flood waters from rainfall runoff in the upper valley of the Gorgel River and the Senegal River. The dam built at Fom Gleitat on the Black Gorgol and the regulating dam in Kaedi have reduced flooding along the Gorgol Basin. As a result, large tracts of walo land have been taken out of production (i.e., Lekseiba, Talhaya, Ganki). Farmers believe that there could be better coordination between the Fom Gleitat dam and the regulatory dam at Kaedi so that they can maintain access to their walo land.

A similar situation exists near Boghe. A considerable amount of walo land has been taken out of production due to the dike built for the large perimeter (e.g. N'Gorel).

C. Fonde Cultivation

C.1. General Characteristics

As stated earlier, fonde lands are clayey soils that form part of the alluvial levee along the river where villages and small perimeters tend to be located. Because these areas are rarely flooded, crop planting may coincide with the beginning of the rains rather than when the river recedes. However, in those low areas where fonde land is flooded either by the river or rainfall runoff, cropping activities resemble those in walo areas. The size of fonde fields range from one to three hectares.

C.2. Crops Grown

The major crops grown on fonde land are fellah, cowpeas and watermelon. Other types of sorghum found include same, sewil, gnindco and rahaya. Corn and a variety of millet called thiotandi are also planted. Other crops less frequently grown on fonde fields include okra, hibiscus, budi (local squash), calabash, zucchini, sweet potatoes, squash and tomatoes. Many of these crops are grown in the low areas of fonde soil where water accumulates (i.e., Fondou).

C.3. Inputs Used

The only input used by farmers who cultivate fonde land was seed treatment fungicides. No farmers surveyed used fertilizer or insecticides on their fonde fields.

C.4. Cultivation Practices

Farmers will plant their high fonde land at the beginning of the rainy season (July-August) and their low fonde fields when the floods recede (December). The cropping activities followed are similar to those described for walo cultivation. If the fonde fields are planted during the rainy season, they are harvested three months later. Fields which are planted after the floods recede are harvested in March or April.

C.5. Major Pests

The major pests which attack fonde fields are grasshoppers, crickets, birds, spanish flies, termites, aphids and stem borers. Grasshoppers and crickets totally wiped out one farmer's fonde crops in Tienel. Domestic livestock also do considerable damage to fonde fields.

D. Falo Cultivation

D.1. General Characteristics

Recession agriculture is also pursued by farmers on lands located along the river bank referred to as falo land. Falo soils will vary according to location on the bank. Sandy loams are commonly found on the higher areas of the bank while loamy sands are found close to the river. These soils may be submerged for one to four months and crops are planted in succession down the river bank as the water recedes.

In comparison to walo cultivated areas, falo plots are quite small. In most cases, the area grown is less than a hectare*. Despite the limited size of falo holdings, these lands are considered very valuable by farmers in their region. This is especially true given the fact that recent drought conditions have resulted in poor floods, limiting production in walo areas. Unfortunately falo production is not enough to meet most farm family needs.

The falo land belonging to farmers is usually subdivided into several small plots dispersed along the river. It is not uncommon for a particular farmer to have plots in Senegal as well as Mauritania (e.g. Gani, Dindi, Tienel, Olo Ologo, Sori Male). Similarly Senegalese farmers may have large tracts of falo land in Mauritania (e.g. Gourel Dieri).

D.2. Crops Grown

A wide diversity of crops are cultivated on falo lands. These different crops are dispersed on the river bank in such a way as to take advantage of differences in soil and water conditions. The very top part of the bank is planted in sorghum (same, sewil, fellah). Further down the bank, corn is usually planted. It is estimated that 75 percent of all falo land is planted in

*Only a few farmers had falo lands greater than a hectare.

corn (ORGATEC 1978:63). Below this will be planted sweet potatoes, tomatoes, pumpkin, squash, calabash, okra, cucumbers, egg plant, lettuce, zucchini, hibiscus, sorrel, yams, onions and possibly millet (thiotandi). Cowpeas and various types of watermelon are usually dispersed throughout the plot.

In most villages surveyed in the Guidimaka, Gogol and Brakna regions, corn was the dominant crop in the falo fields. However, in the Trarza region, sweet potatoes appear to displace corn as the main crop (e.g. Gani). This might be explained by differences in food preference or by the poor performance of corn on the salty soils found in the area.

D.3. Inputs Used

Seed treatment fungicides were used by some farmers on their falo crops (e.g. Fondou, M'Boto). No farmers reported the use of fertilizers or insecticides in their falo fields.

D.4. Cultivation Practices

Extensive weeding and cleaning of brush may be required in falo cultivation. Some farmers may find it necessary to remove small tufts of weeds from their plots with machetes prior to planting. Planting starts soon after the water recedes and the soil has partially dried. The planting period occurs between October and December, and is usually staggered. The planting dates will vary in different parts of the river basin due to differences in flood recession. The most frequently mentioned falo planting period was November. Due to the nature of falo soils, farmers rarely use the jincangu (long hoe) in seed hole preparation. The luugal (long stick) is used to make depressions in the loose and moist soil for planting sorghum, corn, cowpeas and other crops. After the seeds are dropped in the hole, they are covered up with fine sand. Sweet potatoes and yams are planted differently. Cuttings of these crops are placed in seed holes prepared with a traditional hoe (dialo) or some other appropriate tool. These cuttings are also covered by sand. Some farmers will also transplant vegetables such as onions from a nursery to their falo plots (e.g. Silla).

Weeding can begin prior to the end of planting since planting is staggered. Using a dialo, the weeding tends to proceed from the highest portions of the falo plot downwards, due to the sequence of planting. In general, only one or two weedings are performed.

Most farmers with falo fields will construct fences along the borders of their fields to keep livestock out. These fences are constructed immediately after the water recedes and may be built in a progressive manner. Men are usually responsible for the fence construction. The recent drought conditions have limited the availability of fencing material. Thus, some farmers will use the same fence material for several years (e.g. Silla).

Because falo planting is staggered, crops are harvested over a longer period of time. Harvesting may begin in January and extend until April. Harvesting is usually done by hand with family labor. However, one farmer indicated that there is a lot of social pressure on farmers to ask other villagers to help in the harvest of corn despite the fact that family labor could handle

the work (e.g. Silla). Those who help are each given some of the produce, so the traditional practice operates as a form of redistribution. Corn is often harvested green and then roasted. In one village (e.g. Silla), farmers would cut the top part of the corn plant off down to the stem where the cobb is growing right before harvest. Farmers claim that this practice produces larger ears of corn. Sweet potatoes and yams are harvested by digging the tubers out of the ground with a dialo.

Farmers consume much of the produce grown on their falo plots, although many farmers also sell a portion of their crops. For instance, in N'Gorel and Sive, farmers indicated that they sell 80 percent of their falo crops. Corn is often sold fresh by the ear for 5 to 10 um per ear, while sweet potatoes are sold around February for 30 um per kg (e.g. Gani). Other vegetables such as hibiscus, squash, zucchini and calebesh are also sold on the market. The corn and sorghum stalks are normally cut and used as fodder for livestock.

D.5. Major Pests

The major insects which were identified by farmers as attacking falo crops included stem borers, grasshoppers, crickets, lady bugs, aphids and termites. Other pests which did considerable damage included birds, domestic animals and monkeys (e.g. Ganki). Pelicans, in particular, were cited as a serious pest in some villages (e.g. Ganki).

V. DIERI CULTIVATION

A. General Characteristics

Traditional rainfed agriculture is practiced throughout the Senegal River Valley, but is most prevalent in the Central Valley and Upper Valley areas where rainfall is higher. It is especially prevalent in the Guidimaka region where Sonnike farmers live. The amount of rainfed land available along the Mauritanian side of the Senegal River varies from 30,000 to 40,000 hectares (Humpal 1982:2). Cultivation is extensive, primarily because land availability is not a constraint. The size of a household's holdings will vary from 1 to 7 hectares.*

The land upon which dryland farming is practiced is referred to as dieri. Dieri soils are brown, sandy textured soils located on dunes which have low water holding capacity. The organic matter content in these soils is low and they are rarely flooded. Following a bush-fallow rotation system, dieri land is cultivated for 4 to 6 years, then allowed to revert back to bush for 2 to 5 years. The appearance of striga or tribulus are the plant indicators used by farmers to determine that fertility levels of the dieri soils are low, and that the fields should be returned to fallow. On the average, dieri fields may be located one to five kilometers away from the village.

Access to adequate rainfall is the limiting factor in dieri cultivation. The recent droughts have forced many farmers to abandon fields (e.g. Darel Barka, Tekane) or to systematically cut back on the size of the field they cultivate.** In the western parts of the surveyed area, very little dieri land is cultivated. Past and present cultivation practices under drought conditions have exposed large areas to wind and water erosion. This degradation process has been accelerated by a number of other factors such as: 1) the exploitation of previously abandoned dieri land by landless people migrating from the north; 2) overgrazing of vegetation by transhumant herd and village livestock; and 3) removal of trees and bushes for firewood, charcoal and fencing material. As a consequence, much of the productive dieri lands are being threatened by sand encroachment.

*It is difficult to get accurate land area estimates because farmers measure the size of their fields by the amount of seed they sow. ORGATEC (1978) estimates that a household of eight persons could reasonably cultivate 5 to 10 hectares (ORGATEC 1978:51)

**Some farmers are only planting in the low depressions (bas/fonde) in their dieri fields where enough water accumulates to produce a crop.

B. Crops Grown

The major crops grown on dieri fields were millet, sorghum, cowpeas, and watermelon. Several millet varieties were mentioned, including souna, n'demiri, sanio and boyoli. The most common sorghum variety grown was fellah. Other types of sorghum planted included gnindico, nabaane, niobougu, diappal, balari and diyamiti. Millet is more popular in the Central Middle Valley than in the Upper Valley. Sorghum is more prevalent in the Guidemaka region. Taste preferences, access to rainfall and access to soil may account for these differences.

In addition to these major crops, peanuts may also be planted in dieri fields. This is especially true in the Guidemaka region (e.g. Toulel and Wompou). Other crops grown include hibiscus, squash, okra and various types of melons.

As stated previously, drought conditions are influencing cropping patterns on dieri lands. East of Koundel Reo where adequate amounts of rainfall are available, a wide variety of crops are grown. Between Bolo Dogo and Kaedi, farmers are opting to grow primarily watermelons, cowpeas and hibiscus on their dieri fields due to limited rainfall. West of Bolo Dogo, no dieri lands have been cultivated for many years.

C. Land Preparation

Farmers who cultivate crops on dieri lands usually begin clearing in the hot dry season (March to June). This activity involves removing weeds and crop debris and topping trees. Family labor is often used for this task. Sometimes farmers will graze their animals on their fields or allow transhumans to do so to take advantage of manuring prior to planting. Once farmers have removed the debris from their fields, it is burned. A few farmers also use animal traction to prepare their fields for planting (e.g. Toulel).

D. Inputs Used

Some farmers used seed treatment dressings on their seeds prior to planting to protect them from fungus and other pests. No farmers mentioned using fertilizer or insecticides on their dieri crops. This may be due to the uncertainties of the rainfall.

E. Cultivation Practices

Farmers plant their dieri fields at the start of the rainy season, anytime between June and August. July was the most frequently mentioned month for planting. Farmers will plant their dieri crops either before the rains (e.g. Talhaya) or immediately after the first rains. This is done to take advantage of all available moisture.* Two people are usually involved with the planting operation.

*Unfortunately if the crops are planted too early, they may not germinate, so replanting may be necessary.

One person with a long handled hoe (jindangu) digs a series of holes about one meter apart. Each hole is approximately two to three centimeters deep (ORGATEC 1978:52). A second person follows placing 10 to 15 seeds of millet or sorghum mixed with watermelon, cowpeas and/or another crop in each hole and covers it with their foot. Millets tend to be planted on the lighter soils while sorghums are planted on the heavier soils or in the low depressions. For example, in Toulel, fellah and nabaane were planted in the bas fonde areas of the dieri fields. If peanuts are grown, they are planted in clusters dispersed throughout the fields on the same types of heavy soils as the sorghums are planted.

Farmers will construct fences around their dieri fields to protect them from animals. The construction of these fences may begin before planting.

Weeding is the major task in dieri cultivation and is usually done in August through September (ORGATEC 1978:52). A farmer may weed his/her field two to five times in the course of a cropping season, depending upon access to labor and the severity of the weeds. In the past, this operation was primarily done by men, but women and children are performing this task more frequently due to male out-migration. Hired labor may also be used (both from the village and outside). ORGATEC (1978) estimates that it takes approximately 25 to 30 mandays to weed one hectare (ORGATEC 1978:52). Manday estimates for the second weeding are 18 to 19 per hectare (ORGATEC 1978:52).*

Dieri crops are harvested between the end of September (e.g. Djovol) and the middle of November. The most frequently mentioned time period was November. The entire farm family may participate in the operation, with men cutting the heads of the millet and sorghum and women gathering the heads. The gathering operation may be delayed until recession planting is completed. The heads are then brought back to the village and stored on the panicle in a room in the house or in a separate storage structure. Sometimes the heads are threshed immediately and the grain is stored in sacks (e.g. Wompou). Most of the crops are consumed by the farm family. The stocks are usually left in the field for animals to graze.

Dieri grain yields are low and have fallen significantly in recent years because of the drought. The rough yield estimates for sorghum and millet obtained in this survey ranged between 200 and 400 kilograms per hectare. These figures are comparable to ORGATECs (1978) yield estimates for the Middle Valley which ranged between 240 and 460 kilograms per hectare (ORGATEC 1978:56).

F. Pests and Diseases

The major pests which attack dieri crops are grasshoppers, birds, stemborers, and domestic animals. In dry years (i.e., 1982), losses attributed to grasshoppers have been as high as 50 percent (Humpal 1982:14). Other pests cited by farmers included crickets, termites, aphids, and spanish flies. Some farmers identified smuts as a problem in their dieri fields (e.g. Silla).

*Total labor inputs for dieri cultivation are estimated to be about 70.5 mandays per hectare (Boutillier et al 1962).

VI. MARKETING OF CROPS

Aside from growing crops for subsistence, farmers in the villages surveyed are also marketing some of their crops. However, marketing activities are limited in many isolated villages due to the lack of transport. The major marketing channels available to farmers include government organizations such as the Commissariat a la Securite Alimentaire (CSA), Societe Nationale d'Import-Export (SONIMEX), SONADER, as well as CARITAS, local boutiques, and other farmers. CSA is a parastatal which buys all domestic grain as well as distributes food donations. SONIMEX is a government run trade monopoly which deals with numerous products including milled rice. SONADER and CARITAS are development organizations which provide inputs to farmers and are reimbursed in grain. In addition to these channels, farmers in some villages have formed cooperative boutiques to purchase agricultural products from farmers to facilitate marketing of such products (i.e., Bolol Dogo, N'Gorel). These boutiques also purchase grain from other market centers to sell to farmers at stable prices. Given these various marketing channels, the following discussion focuses on some marketing patterns of specific crops found along the Senegal River Valley.

A. Rice Marketing

The rice produced by farmers is mostly used for home consumption and to pay back loans to SONADER or CARITAS (i.e., Paliba, Sori Male, Bababe, Tienel, Dar es Salam, N'Bar Wadji, Tiekane). Farmers usually do not produce enough to market rice in large quantities. Some farmers will sell rice to CSA in the larger towns (i.e., Gani, Gourel Dieri). The money obtained from such sales is used to buy other commodities such as tea and sugar. In addition, farmers will trade rice for other products such as tomatoes (i.e., Silla), dairy products and meat (i.e., Gourel Dieri, Bolol Dogo, Dar es Salam), sorghum, salt, fish and wild food (i.e., Tiekane).

B. Maize Marketing

Similar to rice, much of the irrigated maize that is grown is for home consumption, especially in the Sininke region of the river valley (i.e. Wompou). Some maize is sold, especially in the larger villages where there is a local market (i.e., Wali, Bababe). The fresh heads are usually roasted and sold on the cob for 5 to 10 UM per head (i.e., Guiraye, Dindi, Toufde Sive, N'Gorel). The maize produced on falo or recession lands may also be sold on the cob (i.e., Guiraye, Gourel Dieri, M'Botu). The money obtained from such sales may be used to help pay crop debts.

C. Sorghum Marketing

Very little sorghum grown on irrigated perimeters or on recession land is sold. Most of it is used for home consumption. Some farmers may sell sorghum to pay back debts (i.e., Djoval) or to buy other commodities (i.e., Bovel, Sive). Sorghum may also be exchanged for dairy products (i.e., Wali, Wompou). In Bolo Dogo, farmers market their sorghum through a cooperative boutique to purchase rice which sells at a lower price.

D. Vegetable Marketing

In most of the villages surveyed, vegetables are grown for consumption and for sale. In villages that are more isolated, vegetables are primarily grown for home use. In larger villages (i.e., Djoval, Wali, Bababe, Tiekane) or in villages near large

marketing centers (i.e., N'Gorel, Tienel, Gani, Toufde Sive), vegetables are being sold. The major constraint to vegetable marketing is that most farmers grow their vegetables during the cool dry season so that excessive supplies flood the market at the same time. This seasonal surplus drives the prices down, reducing the economic returns to farmers. Many farmers also lack transport to major markets to avoid these market bottlenecks as well as appropriate storage and preservation techniques. The money which is obtained from vegetable sales may be used to purchase other food commodities such as tea, sugar and bread. This money might also be used to purchase inputs such as seed, tools and diesel or be used to buy capital intensive items such as a mill (i.e., M'Boto and Dar es Salam).

VII. LIVESTOCK

A. General Characteristics

Livestock raising and herding are still very important aspects of the farming systems in the villages surveyed even though the herds have been decimated over the last 15 years due to a succession of droughts (See Table 2). A few villages such as M'Bagne and Bababe have comparatively large herds of goats and sheep numbering over 2000. None of the villages visited claimed to have over 300 head of cattle. In the western region, the worst years for livestock losses were 1968, 1972-73, 1982-83 and 1985. In the eastern region the worst years were 1972-73, 1974-75, 1977, 1982-83 and 1985. The greatest losses were sustained in 1972-73 and 10 years later in 1982-83. Because of these prolonged drought conditions, cattle exports have been reduced dramatically. Once ranked the second highest foreign income earner for Mauritania, cattle exports have virtually dropped to zero according to official records.*

With the onset of the drought, the nomadic herds have penetrated farther south seeking pastures and water. The persistent drought conditions have dried up watering points on the northern boundary of the Sahel region forcing nomadic herds to remain longer in the southern region along the river. The competition for pasture and water has become intense between the nomadic herds and the herds of the river basin farmers. This is especially true for camels. In recent years, unattended herds of camels have caused extensive crop damage all along the river valley. In some villages, camel herds have rendered the main water sources unsuitable for human consumption.

The competition for grazing resources coupled with the persistent drought conditions have led to a significant reduction of natural pastures all along the Senegal River. Thus, herders have had to cut down the limbs of trees to provide fodder for their livestock. This practice, in connection with the browsing habits of camels and goats, has left large numbers of trees and bushes throughout the basin denuded of vegetation.

Because of this fodder shortage, many farmers no longer leave crop residues on their fields for nomadic herds to graze. Farmers are collecting the straw and stocks for their own animals, especially for milking animals and sheep being fattened for special occasions. In addition, the practice of selling animal fodder has become common in many areas. It is sold by farmers in the major towns such as Kaedi and Boghe. Crop residues, tree foilage or natural vegetation from marshy areas sell for a high price in times of scarcity from April through June. The price of fodder is 10 times more expensive during this period than it is immediately after harvest. For instance, a large bundle of sorghum stocks sells for 15 to 20 UM after

*It is possible that substantial numbers of cattle are still being exported on the hoof to Senegal which are not being officially recorded.

LIVESTOCK NUMBERS
1970, 1980 and 1986
(at Village Level and Farmer Level)

	Goats			Sheep			Cattle			Donkeys			Horses		
	70	80	86	70	80	86	70	80	86	70	80	86	70	80	86
Guiraye															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	0-9	--	--	--	--	--	0	--	--	--	--	--	0
Gourdiouma															
Village	--	--	200	--	--	100	--	--	60	--	--	25	--	--	--
Farmer	--	--	5	--	--	3	--	--	1	--	--	2	--	--	0
Silla															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Djovol															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	5-15	--	--	--	--	--	0-3	--	--	0-2	--	--	0-1
Ganki															
Village	--	--	30	--	--	20	--	--	24	--	--	10	--	--	1
Farmer	--	--	0-1	--	--	0	--	--	0	--	--	--	--	--	--
Lekseiba															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Talhaya															
Village	--	--	31	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	5	--	--	--	--	--	--	--	--	--	--	--	--
Wompou															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	2-15	--	--	1-10	--	--	2-10	--	--	1-4	--	--	0-1

LIVESTOCK NUMBERS
1970, 1980 and 1986
(at Village Level and Farmer Level)

	Goats			Sheep			Cattle			Donkeys			Horses		
	70	80	86	70	80	86	70	80	86	70	80	86	70	80	86
Toulel															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--
Nouma															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	5	--	--	3	--	--	2	--	--	1	--	--	1
Wali															
Village	2000	--	300	--	--	--	2000	--	100	--	--	--	--	--	1
Farmer	--	--	0	--	--	0-2	--	--	0-3	--	--	0	--	--	0-1
Koundel Red															
Village	--	--	4	--	--	2	--	--	0	--	--	0	--	--	0
Farmer	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetiane															
Village	--	--	400	--	--	300	3300	--	260	--	--	--	--	--	--
Farmer	--	--	5-6	--	--	--	--	--	--	--	--	--	--	--	--
Dindi															
Village	--	--	100	--	--	20	--	--	50	--	--	5	--	--	1
Farmer	--	--	20	--	--	10	--	--	5	--	--	2-5	--	--	1
Bovel															
Village	--	600	200	--	--	--	--	500	60	--	15	15	--	1	1
Farmer	--	--	40	--	--	--	--	--	6	--	--	1	--	--	0

LIVESTOCK NUMBERS
1970, 1980 and 1986
(at Village Level and Farmer Level)

	Goats			Sheep			Cattle			Donkeys			Horses		
	70	80	86	70	80	86	70	80	86	70	80	86	70	80	86
Maghama															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	20	--	--	7	--	--	37	--	--	3	--	--	2
Gourel Dieri															
Village	--	--	200	--	--	--	--	--	200	--	--	40	--	--	10
Farmer	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Paliba															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	4-26	--	--	0-20	--	--	0-9	--	1	1	--	1	1
Toufde Sive															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	5-6	--	--	--	--	--	--	--	--	1	--	--	--
Sive															
Village	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Farmer	--	--	5-10	--	--	0-4	--	--	8-10	--	--	3	--	--	1
M'Bagne															
Village	--	--	2000	--	--	2000	15,000	--	50	--	--	15	--	--	12
Farmer	--	--	0	--	--	0-2	--	--	0	--	--	0	--	--	0
Fondou															
Village	--	--	20	--	--	--	--	--	0	--	--	1	--	--	1
Farmer	--	--	0	--	--	1	--	--	0	--	--	0	--	--	1

LIVESTOCK NUMBERS
1970, 1980 and 1986
(at Village Level and Farmer Level)

	Goats			Sheep			Cattle			Donkeys			Horses		
	70	80	86	70	80	86	70	80	86	70	80	86	70	80	86
Sori Male															
Village	—	—	—	—	—	—	—	400	10	—	—	50	—	—	5
Farmer	—	—	1	—	—	12	—	—	1	—	—	0	—	—	0
M'Boto															
Village	—	—	1000	—	—	1000	—	—	40	—	—	30	—	—	3
Farmer	—	—	10	—	—	2	—	—	—	—	—	1	—	—	1
Bababe															
Village	—	—	700	—	—	800	15000	—	200	—	—	200	—	—	35
Farmer	—	—	0-3	—	—	0-3	—	—	0	—	—	0-1	—	—	0
Bolo Dogo															
Village	—	—	80	—	—	40	200	—	0	—	—	—	—	—	—
Farmer	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
N'Gorel															
Village	—	—	60	—	—	50	—	—	0	—	—	3	—	—	2
Farmer	—	—	0	—	—	0	—	—	—	—	—	0	—	—	0
Tienel															
Village	—	—	100	—	—	600	—	—	20	—	—	10	—	—	16
Farmer	200	—	0	—	—	3	15	—	0	—	—	0	—	—	1
Olo Ologo															
Village	—	—	60	—	—	20	—	—	32	—	—	30	—	—	4
Farmer	—	—	0	—	—	11	—	—	9	—	—	1	—	—	0

LIVESTOCK NUMBERS
1970, 1980 and 1986
(at Village Level and Farmer Level)

	Goats			Sheep			Cattle			Donkeys			Horses		
	70	80	86	70	80	86	70	80	86	70	80	86	70	80	86
Darel Barka															
Village	—	—	100	—	—	50	—	—	20	—	—	10	—	—	6
Farmer	—	—	7	—	—	—	—	—	—	—	—	1	—	—	—
Dar es Salam															
Village	—	—	100	—	—	—	—	—	50	—	—	4	—	—	20
Farmer	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
N'Bar Wadji/Kaire															
Village	100/Fam	—	100	—	—	—	10-100/Fam	—	2	—	—	10	—	—	7
Farmer	—	—	0	—	—	0	—	—	0	—	—	0	—	—	0
Tekane															
Village	—	—	200	—	—	300	20-100/Fam	—	100	—	—	20	—	—	50
Farmer	—	—	0-4	—	—	0-6	—	—	0-5	—	—	0	—	—	0-2
Gani															
Village	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Farmer	—	—	1	—	—	2	—	—	0	—	—	0	—	—	2

Years of Heavy Animal Losses

1968	first great loss (west)
1972-1973	lost most of the animals (east and west)
1974-1975	(east)
1977	(east)
1982-1983	again lost many animals, especially in Mali and Senegal (east and west)
1985	(east and west)

harvest. Such a bundle sells for 150 to 200 UM during times of scarcity (April through June).

The village livestock are normally herded daily from compounds or stockades to grazing areas where grass, green shrubs and trees are still available. A herdsman is usually hired to look after a number of animals. Normally cattle, sheep and goats are herded together.* The herdsman is either given livestock as a form of payment or paid a specified amount by each family.** The practice varies from one village to another. Because livestock numbers have been significantly reduced, animals are less likely to be sent to distant pastures in Mali or Senegal.***

B. Goats

Goats are the most numerous animals found in the villages. Because of their wide adaptability, they are able to sustain themselves even during drought periods. This adaptability, however, can lead to environmental degradation. Goats can strip bushes and the lower branches of trees of their foliage as well as graze grasses to the roots in overgrazed pastures. Such eating patterns can make it difficult for vegetation to regenerate.

Goats are the major source of red meat for farm families and also provide milk and milk products. For those farmers that have a number of goats, they are a capital reserve for hard times and a source of income for purchasing other household supplies. In some cases, goats have been sold to pay debts incurred in the production of irrigated crops.

Although goats are susceptible to a number of diseases (See Appendix L), the most common ones found in the area surveyed included: 1) mange or scabbies (saanitere****); 2) food poisoning (filto); 3) foot dropsy (ndiyam); 4) foot rot (fecco); and respiratory ailments (joffe).

C. Sheep

Sheep are less numerous than goats. They are less adaptable to the harsh environment and large numbers have been lost due to the drought during the last 15 years. Similar to goats, sheep also graze the grass to the roots and feed off bushes and lower tree limbs. Because sheep are not as agile as goats in climbing, herdsman will cut down tree limbs to feed sheep. Some farmers who have small flocks of

*This is primarily because of the limited number of cattle present.

**Normal payment will range between 10 to 30 UM per month for each animal.

***An exception to this is the village of Darel Barka where animals are still grazed in Senegal during the hot dry season.

****The local names are given in Pulaar.

sheep will collect fodder for them, especially when pasture resources are scarce (e.g. April through June). Sheep are normally kept for special occasions and as a source of wealth. They are marketed only when the need arises or slaughtered at specific times such as during festivals. Sheep suffer from the same basic diseases as goats.

D. Cattle

Cattle numbers have declined significantly since the onset of the drought in the early seventies. Large herds died out because of reduced pasture resources and limited water supplies. Presently very few farmers own more than a couple of head of cattle each.

The most commonly mentioned cattle diseases in the area surveyed included: 1) botchellism (nedo or latche); 2) contagious bovine pleuropneumonia (dioffe or yeedo); 3) rinderpest (bade); 4) trypanosomiasis (daasu); 5) foot and mouth disease (safo); 6) symptomatic anthrax (kourel) and 7) mange (tiro).

E. Donkeys

Donkeys are a common beast of burden in the area although not every farmer owns one. They are used for hauling and transport. Similar to other livestock, donkeys are often left to graze open pasture. When left unattended, donkeys can do considerable damage to crops. In addition to open grazing, donkeys are also fed crop residues to supplement their diets. The most common ailments mentioned for donkeys were respiratory problems (juko).

F. Horses

Horses are less common than donkeys and may be considered a luxury. Similar to donkeys, horses are used for hauling and transport, and are fed crop residues and gathered fodder. Respiratory ailments are also a common problem for horses as well as gastro-intestinal problems.

G. Interaction between Sedentary Farmers and Nomadic Herders

Farmers in many of the villages surveyed still maintain complimentary relationships with nomadic herders who migrate through the area (i.e., M'Bagne, Talhaya, Gourel Dieri, Bolo Dogo, etc.). Nomads will exchange animals (Gourdiouma), milk (M'Boto, Toufde Sive), meat (Nouma), and wild fruits (Fondou) for grain and fish (Koundel Reo, Fimbo Paliba). Nomadic herds are also allowed to graze crop residues in several villages (i.e., Nouma, Silla, Toufde Sive). In return, manure is deposited on farmers' fields (i.e., Tetiane, Sive).

Despite these complimentary relationships, competition and conflict over limited pasture and water resources has increased between nomads and farmers in recent years. As stated earlier, persistent drought conditions have dried up northern watering points, forcing nomadic herds to remain longer in the southern region along the river. As a result, natural pastures along the Senegal River have been over-exploited and trees and bushes throughout the basin have become denuded of

vegetation. Nomadic herds have also caused extensive crop damage in the area. In almost every village surveyed (30 out of 34), crop damage due to unattended nomadic herds was cited as a serious problem. Camels were consistently mentioned as the primary problem. In addition, competition for limited water resources was also cited as a problem in some villages (i.e., M'Boto, Bababe, Ganki, Tetiane). Limited well water which is being used for watering gardens and home consumption is being used by nomads to water their animals. This competition and conflict over water and pasture resources is likely to continue unless steps can be taken to ease the pressure on these resources (see Section XIII for possible solutions).

VIII. OTHER SOURCES OF INCOME

In addition to cropping and livestock activities, farmers in the Senegal River Valley rely on a number of other sources of income to meet their family food needs. This diversity of income sources is an adaptive response to fluctuating climatic conditions characteristic of this region of the Sahel. The following discussion focuses on some of these alternative income sources.

A. Fishing

In the past, many villages along the river pursued fishing as their primary economic activity. Unfortunately, prolonged drought conditions have had a negative impact on the viability of fishing. Farmers in several villages surveyed indicated that yields have significantly declined in recent years (e.g. Sori Male, M'Bagne, Tienel). Villages that once were thriving fishing villages have had to rely heavily on irrigated agriculture to meet subsistence needs. Still, fishing is considered an important income earning activity in 12 of the villages (one-third) surveyed. These are Djovol, Guiraye, Sori Male, Dar es Salam, Gani, Paliba, Gourel Dieri, M'Bagne, Koundel Reo, Bolo Dogo, N'Gorel and Tienel. Fish are sold locally in these villages, or if enough fish are caught, they are sold to other villages. Women are often responsible for selling the fish (e.g. Bolo Dogo).

In addition to these commercially oriented fishing villages, a number of farmers in other villages will fish to supplement home consumption needs. These villages include Wompou, Toulel, Wali, Ganki, Talhaya, MBoto and Bababe.

Farmers vary in their opinions regarding the optimal time for fishing. In N'Gorel and Bolo Dogo, farmers stated that between October and November is the best time to fish, just after the rainy season has ended. Whereas in Koundel Reo, farmers indicated that the best fishing period is between January and June. The worst time to fish is during the dry season when the marigots and river become shallow or completely dried out.

B. Wood and Charcoal Sales

Many farmers rely on wood and charcoal sales to supplement their income or to meet their immediate food needs. In almost one-third of the villages surveyed (10), some farmers were pursuing this source of revenue. These villages include Olo Ologo, Darel Barka, Dar es Salam, Gourel Dieri, Toufde Sive, Dindi, Gourdiouma, Fondou, Talhaya, and Sori Male.

Although this economic strategy helps farmers meet their family needs in the short run, it is having a long term negative impact on the environment. These deforestation practices are accelerating the process of environmental degradation, leading to sand encroachment on prime agricultural lands. To understand why farmers are pursuing such a strategy, it is important to look for the underlying causes.

It is important to note that in the majority of the villages (7 out of 10) where wood cutting and charcoal production are found, agricultural production has not

been adequate or viable. For example, in Olo Ologo and Darel Barka, pump failures have prevented farmers from producing crops on their irrigated parcels. Recession agriculture and rainfed agriculture have been of limited potential in these villages as well. In Gourel Dieri and Toufde Sive, farmers have not been able to produce an irrigated crop because the operating funds and inputs have been cut off by CARITAS, due to excessive debts incurred over the years. As a result, some farmers in Gourel Dieri are being forced to exchange wood for food. In Gourdiouma, farmers do not have access to a perimeter and their dieri crops did not produce due to inadequate rains. In Sori Male, farmers have not produced a dieri crop in five years; large tracts of recession land were not planted this year due to poor floods, and fishing yields have dropped significantly. In Talhaya, village access to flooded recession lands has been reduced due to the dam at Fom Gleita. Thus, farmers have turned to wood cutting. A wagon load of wood sells for 200 um.

The strong association between wood cutting, charcoal production and poor agricultural performance demonstrates the linkages that exist in the farming system. Improvements in agricultural production could help alleviate the necessity of pursuing such short term strategies with long-term detrimental consequences. The prevalence of wood cutting and charcoal production could be an indicator of the economic status of a community. Such an indicator could help identify villages for targeting interventions.

C. Other Sources of Income at the Village Level

In addition to cropping, animal husbandry, fishing, and charcoal production, farmers are diversifying their income through a variety of other activities. The number of income generating opportunities available will depend upon the size and institutional complexity of the village, and proximity to a large urban center.

One source of income which some farmers are pursuing to supplement their income is to work as farm laborers on other people's farms (e.g. Tiekane, Guiraye, Ganki, Talhaya). The daily rate will vary from one village to another. In Toulel, a farmer paid 100 um per day to his hired laborer plus provided breakfast and lunch. Work usually stops when lunch is served. Another source of income is the sale of milk (e.g. Olo Ologo, Nouma, M'Boto). Farmers with goats and cattle may sell milk to other farmers. The women of the household are often in charge of this activity, and may generate 30 to 80 um per day (e.g. M'Boto). A third source of income is construction work in the dry season. Farmers may specialize in mud house construction (e.g. Wompou, Djovci) or work as brick layers (e.g. Talhaya, Gourel Dieri, Toufde Sive). A fourth source of income is livestock herding. Farmers may herd animals for other villages or have their sons perform this task. In Talhaya, a farmer's sons brought in 600 um per month through herding activities. A fifth source of income for farmers living in villages close to larger towns is urban employment. Farmers may work as guards (e.g. N'Gorel) or agricultural laborers (e.g. Silla) for the government or for wages for some urban based businesses (e.g. Tienel). Other village based income generating activities identified in the survey included mill operator (e.g. Maghama), driver (e.g. Gourdiouma), Koranic teacher (e.g. Wompou, N'Gorel), blacksmith, tailor and merchant (e.g. Djovol). In addition to these income sources, some older farmers also receive pensions from past employment (e.g. Fondou, Sori Male, M'Boto, Toulel, etc.).

Aside from these income earning activities, farm families might also produce arts and crafts for sale. For example, Moorish women may produce mats and

cushions for sale (e.g. N'Bar Wadji) while Pulaar women may sell woven or dyed cloth, pottery or leather goods. These objects are sold in the village or in outside markets such as Nouakchott.

It is important to take these other income sources into account when introducing new technologies into a village. Such activities may place limits on the labor a farmer has available to put into additional agricultural activities. The opportunity costs among alternative activities should be considered in any proposed interventions.

D. Migration

Although the Senegal River Valley has had a long history of out-migration, this pattern has been accelerated by recent drought conditions. Limited economic opportunities have forced many of the young men between the ages of 18 and 40 to permanently migrate for work in cities (e.g. Nouakchott, Boghe, Kaedi, Rosso, Nouadhibou), other African countries (e.g. Senegal, Zambia, Liberia, Gabon), or Europe (e.g. France, Germany).^{*} Nearly two-thirds of the villages surveyed indicated that out-migration was a common phenomenon. However, the magnitude of this migration is highly variable from one village to another. In some villages, 50 to 80 percent of the young males had migrated (e.g. N'Bar Wadji, M'Boto, Tekane, Tetiane, Ganki). In other villages, 30 percent or less had migrated (e.g. Dar es Salam, Olo Ologo, Bababe, Dindi).

Seasonal migration is also quite common in several of the villages surveyed. To supplement their farm income, farmers will migrate for work to larger cities (e.g. Darel Barka), agricultural schemes (e.g. Talhaya), or Senegal (e.g. Guiraye). Some of the villages surveyed where seasonal migration was common include Bovel, Guiraye, Gourdiouina, Djovol, Fondou, Koundel Reo, Darel Barka and Talhaya.

Out-migration can have both negative and positive effects on the village. One negative consequence is that migration depletes villages of labor resources and educational skills which could be channelled into agricultural production. This places limits on the agricultural activities of some farm families. To compensate for this situation, women have become increasingly involved in the production of subsistence and commercial crops.^{**} Farm families are also relying on hired laborers to replace males who migrate. Seasonal migrant workers from outside the region may be used for this purpose.

^{*}It has been estimated that as much as 25 percent of the river population is absent in Mauritania and Senegal (Project Paper 1984:118).

^{**}The increasing role of women in agricultural production in the area must be taken into consideration by both researchers and extension.

Aside from easing the pressure on limited family food supplies, a positive impact which out-migration can have is the increased cash flow into villages from remittances.* This money is often used for purchasing consumer items, food, livestock, hiring labor and building mosques. Farmers in nearly half (14) of the villages surveyed stressed the importance of remittances as a supplement to family income and source of funds to purchase food during deficit periods.** Emigrants from one village have even banded together and pooled their money into a community development fund for their villages (e.g. M'Boto). This money is being used to build wells, dispensaries, schools and mosques.

Despite the positive effects of remittances, not all of this money is being channelled into productive endeavors. A considerable amount of money goes towards building mosques, and very little is invested in agricultural production. If remittance money could be channelled more effectively into agricultural investment, the long term gains could be significant. A community development fund similar to the one started by M'Boto could provide emigrants the means to channel these remittances. The creation of such a community fund could be encouraged in other villages.

Given the current economic situation and persistent drought conditions which characterize the surveyed area, it is unlikely that out-migration will stop in the near future. Until better opportunities for employment, education and agricultural production are provided to young men at the village level, out-migration will continue.

*Not all villages where out-migration is persistent receive large remittances. For instance, in Tetiane where 70 percent of the young men migrate out, farm families receive very little money. This is primarily due to the fact that the migrants have no education and are only able to obtain low paying jobs.

**Although purchased foods may help fill food deficits, the substitution of purchased food for subsistence food could have adverse nutritional impacts on the household.

IX. CREDIT

Access to credit is a significant problem facing most farmers in the villages surveyed. Credit is required for purchasing agricultural inputs (seed, fertilizer, insecticides, labor, etc.), paying for transport of crops to the market, and buying food while waiting for the harvest. The credit sources available to farmers are limited to government agencies and development organizations like SONADER and CARITAS, merchants (both local and urban), friends and relatives, and cooperatives.

A. Loans Provided by SONADER or CARITAS

Farmers in the majority of the villages surveyed (19) have received loans from SONADER or CARITAS to construct and operate their irrigated perimeters. Loans are provided to farmer cooperatives for the construction of the perimeter (10 year payback period), the purchase of the pump and necessary equipment (3 year payback period), and production inputs which include seed, fertilizer, fungicides and insecticides, diesel oil, spare parts, pump repair and land preparation (1 year payback period).* The farmers repay the loans either with the crop (rice, corn or sorghum) or in cash.

Although these loans have helped many farmers improve their agriculture production, not all farmer cooperatives have been able to meet the loan repayment schedules. As stated earlier, the inability to repay is primarily due to crop losses resulting from pump breakdowns, animal intrusion, insect and bird damage, and inappropriate irrigation techniques. Poorly constructed perimeters, inexperience with irrigated agriculture, lack of extension, poor fiscal management, and inadequate field size have also contributed to farmers' inability to pay. In some villages, the accumulated debt burdens have become excessive, and organizations like CARITAS have stopped providing operating funds and inputs to these village perimeters (e.g. Gourel Dieri, Toufde Sive, Paliba). This has resulted in the closure of these perimeters, creating food shortages for farm families. To compensate for crop shortages, farmers have been forced to turn to charcoal production, leading to further environmental degradation.

B. Merchants

Merchants are another credit source in many of the villages surveyed. Farmers in twelve villages indicated that food or money will be borrowed from merchants during food deficit periods. Rarely is a large sum of money borrowed to purchase agricultural inputs. If food is borrowed, merchants usually do not charge interest (e.g. Darel Barka, Toulel). However, farmers in one village indicated that the price of the borrowed food may be higher than normal so that merchants can gain some return from the loan (e.g. Toufde Sive).

*In Tekane, the production inputs borrowed from SONADER each cropping season amount to 690,000 um.

Aside from borrowing food and money from local merchants, farmers may travel to other villages and towns to obtain loans. For instance, farmers in Talhaya took out loans with merchants in Lekseiba and Kaedi. Similarly, farmers in Gani were borrowing from merchants in Nouakchott. In addition, farmers may travel to Senegal to obtain loans (e.g. Koundel Reo).

C. Friends and Relatives

Farmers will also turn to friends and relatives when they are in need of food or cash (e.g. Sive, Guiraye, Djovol). Interest is rarely charged on such loans.

D. Cooperative Boutiques

Farmers in two separate villages have formed cooperative boutiques to facilitate marketing and to maintain stable grain prices (e.g. Bolo Dogo and N'Gorel). These boutiques purchase agricultural products such as sorghum from farmers in February and March and sell rice and sorghum to farmers in September or October when food supplies are low and food prices are usually high. The boutique in N'Gorel will also lend money, sugar and rice to farm families in need.*

Given the function these boutiques serve, such institutions should be promoted in other villages. Aside from serving as food banks, these boutiques could operate as viable marketing mechanisms. In addition to buying and selling food crops, inputs could be made available to farmers in a timely fashion. Cooperative boutiques could also serve as a source of credit and investment for farmers.

*The boutique in Bolo Dogo does not lend money.

X. FOOD CONSUMPTION

The FSR reconnaissance survey included a food consumption component because it was felt that the linkages between production and consumption were important to understand. Meeting family consumption needs is one of the primary goals of farmers in this region and must be taken into account in any proposed intervention. The following section summarizes some of the food consumption patterns which were found in the villages surveyed (See Appendix E). This information is presented in greater detail in Report No. 3 entitled "Food Consumption Survey in Guidimaka, Gorgel, Brakna and Trarza Regions."

A. Food Preferences

The survey results concerning the preferred grain staples indicate that on the whole, millet, sorghum and rice are equally preferred. Women appear to prefer rice over sorghum and millet because it takes less time and is easier to prepare (i.e., Gourel Dieri, Tiekane). Inquiries regarding meat preferences indicate that meat and fish are equally desirable. The major food items women would buy if they had more money include meat, fresh fish, millet, rice and sorghum.

B. Seasonality of Foods Consumed

In all of the villages surveyed, there is a marked difference in seasonal access to food. The rainy season is the most frequently mentioned time of food deficits. A second hungry season occurs in several villages in the month of February (i.e., Darel Barka, Olo Ologo, N'Bar Wadji, N'Gorel, Gourel Dieri Sive, Tekane). During the dry season, fish, meat and vegetables are in short supply. Villages which are isolated during the rainy season also have trouble gaining access to salt water fish, which is a major protein source. The major sources of funds to purchase food during food deficit periods are remittances, credit from merchants, seasonal migration, charcoal production, selling animals, selling cloth, credit from friends and relatives, selling grains, selling fish and selling personal jewelry.

C. Food Habits

A commonly mentioned eating pattern found in the majority of the villages surveyed was the tendency for men to be served first and to eat separately. Children are often served second while women and small girls eat last. Food sharing is not common but was mentioned in six villages (i.e., Wompou, Toulel, M'Boto, N'Bar Wadji, Gani and Tetiane). Barter is very common, especially transactions which involve dairy products for grain. Few food taboos exist except for pork and eggs. As for specialty foods, pregnant women and lactating women are not usually provided such food stuffs. However, a number of specialty foods are prescribed for women who have just given birth such as millet porridges and meat dishes.

D. Food Purchases

The most commonly mentioned foods being purchased daily include fish, vegetables (especially tomatoes and onions), rice, sugar, oil, coffee, tea, milk, maggie cubes, bread and sorghum. Major items purchased periodically include sugar, oil, coffee, tea and soap.

E. Gathered Foods

Wild fruit such as jujube and balanitessie are frequently consumed during the rainy season during the time when food is in short supply. Sixteen villages indicated that they consume such fruit although supplies have dwindled considerably due to the drought. Women and children are usually responsible for gathering the wild fruit. In the dry season, Paguiri (fonio) is a wild grain gathered in the dry season to supplement grain supplies (i.e., Talhaya, Dar es Salam, Darel Barka).

F. Food Storage and Preservation

In the majority of the cases, millet and sorghum are stored on the panicle while rice is stored in sacks. Recent drought conditions have seriously limited the amount of surplus grain put in storage. In many cases, the grain supplies in storage only last 1 to 2 months after harvest (i.e., Lekseiba, Tetiane, Fondou, M'Boto, Sori Male, Bababe). Storage losses are caused by termites, crickets, and rats (i.e., Fondou, Tetiane, Tekane). Some farmers also practice some vegetable conservation techniques to preserve their vegetables. The crops mentioned which farmers will preserve through drying or storage in the sand include onions, sweet potatoes, hibiscus, okra, carrots and cowpeas.

G. Free Food Distribution

In the area surveyed, villages claimed that free food was not regularly received. Respondents in 10 villages said that they had only received free food once in the last year (i.e., Tetiane, Fondou, Lekseiba, Wompou, Toulel, Olo Ologo, Gani, M'Baigne and Tienel). One village had never received free food (i.e., Koundel Reo). The rest of the villages indicated that food was distributed two to three times a year. Because food was delivered so infrequently in most of the villages, it did not act as a disincentive to agricultural production. In fact, several villages were experiencing severe food shortages and could benefit greatly if food were distributed to them as soon as possible (i.e., Darel Barka, Olo Ologo).

H. Infant Feeding Practices and Health

In the majority of the villages surveyed, children were breast fed for 1 to 2 years. Few villages have special weaning foods, and weaning begins anywhere from 6 months to a year. Diarrhea is quite common among children in many of the villages. It frequently occurs when the river begins to rise (July-August). Diarrhea is the most common killer of infants. The most common treatments for diarrhea mentioned include rice water, baobab fruit, lemonade, curdled milk, and charcoal (See Appendix J). Other diseases mentioned which have caused infant deaths include measles, hepatitis, chicken pox, malaria, whooping cough, and eye illnesses. Hunger was also mentioned as the cause of an infant's death.

XI. CONSTRAINTS, AREAS OF INVESTIGATION AND RECOMMENDATION

The major constraints and proposed areas of investigation pertinent to the farming systems found along the Senegal River Valley are summarized below. To facilitate the analysis, these constraints are divided into general production constraints and specific farming systems component constraints. General production constraints include environmental degradation, access to transport, inadequate market infrastructure, access to land, access to appropriate technology, lack of effective extension, destruction of crops by animals, emigration of young men, potential competition among agricultural activities, and cultural traditions negatively affecting the cropping calendar. Specific farming systems component constraints include those that apply to small perimeters, walo cultivation, dieri cultivation, vegetable gardening, livestock rearing, and consumption. Each constraint will be addressed individually and preliminary recommendations and/or areas of investigation will be proposed. Whenever appropriate, the compensating strategies which farmers pursue to deal with each constraint will be presented.

A. General Production Constraints

General production constraints include those which pertain to all crops.

1. Environmental Degradation

The degradation of the environment is occurring at an alarming rate in all of the regions surveyed. Three factors are contributing to this phenomenon. First, the drought conditions which have persisted over the last two decades have limited the available resources in the region. Second, such conditions have placed limits on agricultural production, forcing farmers to resort to alternative strategies to meet their immediate food needs such as wood cutting and charcoal production. Such deforestation has accelerated the process of environmental degradation. Third, drought conditions have placed limits on pasture and water resources, forcing transhumant herds southward to graze areas along the river adjacent to villages for extended periods of time. These animals, coupled with the livestock owned by the villagers, are overgrazing the communal pasture land in the region, exposing vast areas to wind erosion. These animals also pose serious threats to crop production, forcing farmers to cut down trees for building fences to protect their fields. The crop losses incurred because of these animals again force farmers to exploit alternative means to meet their food needs (i.e. charcoal manufacture). The combination of these processes is leading to: 1) sand encroachment into productive agricultural lands (i.e., some walo areas and some perimeters); 2) soil erosion due to excessive water runoff; 3) ecological damage such that favorable conditions for fish and other wildlife are being eliminated. Thus, the feedback effect of these various processes forms a vicious cycle which accelerates the deterioration of the environment (See Appendix D).

Compensating Strategies:

1. Some farmers will resort to short-term solutions such as wood cutting and charcoal production to compensate for poor agricultural production

due to extended drought conditions. Unfortunately this short-term strategy exacerbates the degradation of the environment.

2. A group of farmers may band together to request a small perimeter from SONADER or some other organization to help meet their food needs in a more reliable fashion. Ideally, reliance on irrigation is less risky than on rainfed or recession agriculture (see small perimeter constraints).
3. Some farmers may resort to seasonal or even permanent migration to urban areas because of the limited production possibilities imposed by adverse environmental conditions.

Recommendations

Any crop production improvements will have minimal long-term impact unless immediate steps are taken to curtail environmental degradation. Taking this into consideration, a number of possible measures can be initiated to improve existing conditions.

1. Researchers should investigate the possibility of integrating trees more effectively into agricultural production. For instance, agro-forestry experiments could help identify appropriate trees for shelterbelts. Shelterbelts planted around farmers' fields help cut down on wind erosion, sand encroachment and evapotranspiration, as well as help retain soil moisture. In addition, such trees could serve as a source of firewood, a source of building material and a source of fodder. Trees that might be used for this purpose include Prosopis spp. or a number of Acacias (e.g. Acacia senegal). Efforts should be made to identify other appropriate trees for such uses.

In addition to shelterbelts, agro-forestry experiments could identify nitrogen fixing trees that could be intercropped with other crops in fields. Such trees help exhausted soils recover or maintain fertility levels. Acacia senegal is one possibility. Aside from serving the functions outlined above, Acacia senegal also provides gum which can generate income for farmers while their fields remain in fallow. Researchers could determine what the proper spacing pattern should be between trees to allow for intercropping of other crops.

Despite the advantages of planting trees in association with other crops, farmers may be reluctant to implement such suggestions because they fear that the trees would serve as nesting sites for birds. Birds are a serious pest in the area, especially for millet and sorghum. Steps might be taken to help relieve these fears by promoting bird resistant varieties of millet and sorghum with the introduction of shelterbelts and tree intercropping. These varieties have long bristles protruding from the heads. Some of these varieties already exist in some farmers' fields. Another alternative is to introduce a drought tolerant cash crop that birds won't attack. Sesame is an oil seed crop grown in other parts of the Sahel which might serve this purpose (see section on dieri constraints).

2. The Mauritanian Government through SONIMEX might consider adjusting the market price of gum arabic to the extent that farmers could earn

more income from the sale of gum. This price adjustment could stimulate a great deal of interest on the part of farmers to plant *Acacia senegal* and to refrain from cutting down trees for charcoal production. Such a market intervention might provide the necessary economic incentive for replenishing and maintaining gum reserves.

3. Agro-forestry experiments should be coordinated with existing forestry projects being implemented by Direction Protection de la Nature. Examples of such projects include *Projet Poles Verts* and *Projet Regeneration du Gommier*.^{*} In addition to promoting the planting of trees in agricultural areas (both dieri and walo areas), reforestation, the protection of existing forests and the organized exploitation of forests should be encouraged. The linkages between such resources and agricultural production should be emphasized. For example, forest reserves can be used to protect walo areas from sand encroachment.
4. Overgrazing of communal pasture lands might be lessened by promoting two types of interventions. First, additional water points might be established in pastoral zones to the north where grazing resources might exist with limited water supplies. This could lessen the pressure on pastoral resources along the river. Second, leguminous forage crops might be integrated into cropping strategies as rotation crops. Such crops could be grown on dieri lands, in walo areas not inundated long enough for sorghum production, and in perimeters as a second or third season crop. These forage crops should have minimal water requirements.
5. Attempts should be made to re-establish vegetation over barren spaces which have resulted from overgrazing. Fast-growing woody and herbaceous plants could be introduced into areas (e.g. capparidaceae and mesquite).
6. Efforts should be made to promote sand dune fixation to prevent sand from invading agricultural areas. Reforestation and the protection of vegetable cover on dunes should be encouraged.

* *Projet Poles Verts* (green areas) is attempting to re-establish *gonekier* forests along the Senegal River. This project also is promoting the planting of fruit trees and the intercropping of gum with other crops. *Projet Regeneration du Gommier* focuses on regenerating gum forests in Trarza, Brakna, Gorgol, and Assaba. They are promoting six types of reforestation to protect crops.

7. A land use assessment strategy could be devised and implemented which makes use of climatic and soil data to determine the appropriate use of land resources. Such an assessment strategy could then determine which areas should be used for agriculture, livestock grazing, and forest reserves. In this way favorable ecosystems for agriculture could be identified. This land use assessment could make use of landsat data, aerial photography, and some reconnaissance surveys to help in delineating areas.
8. Efficient wood-burning stoves should be introduced on a wider scale along the river to help cut down on the use of firewood. Alternative designs should be tested to determine the most appropriate type for a given region. Present efforts initiated by Peace Corps in villages like Dar es Salaam (Trarza) should be monitored to determine the receptivity of villages to such interventions.

2. Access to Transport

Inadequate access to transport adversely affects agricultural production in the area surveyed along the Senegal River Valley. Except for river transport, many villages are essentially isolated during the rainy season because of poor road conditions. This factor negatively affects access to food as well as access to inputs. Spare parts for pumps, diesel fuel, insecticides, and fertilizers may be difficult to obtain in a timely fashion under such conditions. Similarly, inconsistent and/or inadequate transport adversely affects the marketing of agricultural products. This is especially true for vegetables.

Compensating Strategy:

1. Farmers rely on river transport to obtain food and other inputs when they are cut off by road. Unfortunately, river transport can be quite slow and costly.

Recommendations

1. Efforts should continue on the part of the Government and other donor agencies (e.g. USAID) to improve the road conditions in the country. In conjunction with this, maintenance programs should be established to help keep the roads which already exist in working order.
2. For those villages which do not have good access to roads, especially during the rainy season, efforts could be made through appropriate planning to insure that such villages gain access to required inputs before they become isolated. This is especially true for villages with perimeters. Similarly, villages which could experience severe food shortages and will be isolated in the rainy season can be identified.

Appropriate measures can then be taken prior to the rainy season. Such planning could prevent unnecessary hardships and could improve agricultural production in many areas along the river.

3. As the river level stabilizes at higher levels due to the completion of the two dams, river transport may become a more viable option for marketing agricultural products. Barge transport might be used to move vegetables and grains to larger markets along the river (e.g. Kaedi, Boghe, Rosso). Similarly, inputs can be transported into such villages by barge.

3. Inadequate Market Infrastructure

The market infrastructure in the survey area is not well developed, primarily because of transport problems. Marketing channels for agricultural products are limited, often being restricted to local buyers (i.e. other farmers and local boutiques). In addition, input markets are inadequate because of the shortage of cash available in many villages to pay for such inputs. Many villages rely on input loans from SONADER, CARITAS or other organizations which often result in high debt burdens. Farmers may also rely on these organizations to market their produce. The lack of a viable cash crop makes it difficult to purchase inputs or to pay back debts.

Compensating Strategies

1. Farmers will travel to nearby market towns, urban centers or Senegal to obtain inputs such as seed, seed treatment dressings, insecticides and fertilizers.
2. Farmers in some villages have banded together to form cooperative boutiques to purchase agricultural products from farmers to facilitate marketing of such products. Similarly, such boutiques also purchase grains from other market centers to sell to farmers at stable prices.
3. In addition to selling grain, some farmers are selling vegetables to obtain cash. These sales usually occur locally, but vegetables and grains may also be transported to other towns and urban centers for sale. Unfortunately, transportation costs are quite high to distant urban markets.

Recommendations

1. The market infrastructure will improve as access to transport improves. Thus, any improvements along these lines should be encouraged.
2. Crops which generate income should be encouraged. Considering the fact that many farmers are now selling vegetables for cash, efforts should be made to promote this activity. Vegetable production can be made more viable

through a number of interventions. First, research can identify vegetable varieties that are adapted to different seasons and which have different maturation periods. This could help spread the marketing out throughout the year. Second, effective extension could be provided to farmers regarding cultivation practices, water requirements and conservation measures, input use and packaging for transport. Given the shortage of extension personnel available, other human resources could be called upon to provide this help such as the Peace Corps. Third, transport could be regionally coordinated. Several villages with vegetable cooperatives might organize themselves into regional cooperatives or unions to help share the transport costs and improve the efficiency and reliability of transport. Problems of transport are lessened with the appropriate economy of scale. Peace Corps, SONADER, or some other organizations might help organize these activities.

In addition to vegetable crops, other cash crops might be introduced such as sesame. Sesame is an oil seed crop grown in other parts of the Sahel (e.g. Sudan) which does well on sandy soils with minimum amounts of rainfall (i.e., 250-300 mm). Aside from the oil being used for home consumption, local markets for sesame could develop. Researchers (i.e., CNRADA) should initiate sesame trials to determine its potential in this region. In conjunction with the possible introduction of sesame, inexpensive processing techniques using local materials will also have to be introduced. Such techniques already exist in the Sudan and could easily be transferred to this region.

If vegetable crops and other cash crops like sesame can be promoted, it is likely that input markets will develop as more cash is made available.

3. Cooperative boutiques should be encouraged in other villages as viable marketing mechanisms. In addition to buying and selling grain, such cooperatives could help organize the sale of vegetables.* Likewise, these boutiques could obtain needed inputs in a timely fashion for sale to farmers. Such cooperatives could also serve as a source of credit and investment for farmers. Thus, cooperative boutiques could serve a number of functions for rural communities (see consumption constraints). For this reason, serious consideration should be given to introducing such boutiques in association with small perimeters.

*Flexibility should be exercised in the establishment of such cooperative boutiques to take into account cultural differences among villages. In some villages separate boutiques may need to be established for men and women.

4. Access to Land

Although land resources appear to be plentiful in Mauritania, access to land which is consistently productive is limited in many of the villages surveyed. A number of farmers do not have access to walo lands which are adequately inundated, and insufficient rainfall has adversely affected dieri cultivation. Similarly, the size of the irrigated holdings available to each farm family may be too small to meet the family's consumption needs.

Compensating Strategies

1. Some farmers will borrow and rent walo land from other farmers. If they rent land, they may pay 10% of their production to the owner. Such rental agreements are common, especially on Mauritanian land owned by Senegalese farmers.
2. Some farmers will plant low areas in the dieri (bas fonde) where water accumulates.
3. Many farmers will plant two or three successive crops on their irrigated holdings. This strategy depends upon access to water (i.e., the level of the river), access to diesel, pump maintenance, and the receptivity of SONADER or CARITAS to such successive cropping (if they financed the perimeter).
4. To maximize the use of individual fields, many farmers are intercropping a number of crops in their walo, fonde, falo, and dieri fields. Similarly, farmers may plant a number of crops in and around the edge of their irrigated parcels.
5. To compensate for inadequate yields, farmers will pursue a number of activities to obtain income for purchasing food. Some of these strategies include the sale of vegetables, the sale of fodder, charcoal and wood sales, animal husbandry, working as farm laborers, fishing, and working for wage employment for a local business or the government.
6. Some farm families rely on remittances to help supplement the agricultural production. In fact in some Soninke villages, remittances account for a sizeable proportion of the income received.
7. Some farmers may opt to migrate on a seasonal or permanent basis because of limited land access. They may migrate to urban areas and large irrigated schemes (e.g. Gorgol or Boghe) for wage employment. Alternatively, some may migrate to other countries in Africa or France for wages.

Recommendations

1. The size of irrigated holdings for each family should be increased so that production from such parcels can meet a larger portion of the family's food needs. When new perimeters are built, the parcel allocated to each family might be 1 hectare rather than 0.25 or 0.5 hectares. For perimeters that are already constructed, parcels can be added by extending the perimeters without admitting new farmers. When such extensions are made, care must be taken not to exceed the capacity of the pump.
2. In addition to increasing the size of holdings, efforts can be made to increase the utilization of perimeters. Presently, many of the small perimeters are used only in the rainy season. Although economic reasons are cited for why crops are not planted in the dry season, alternative crops which require less water and less diesel than rice and corn can be grown.* Sorghum requires little water and would be an excellent dry season perimeter crop. Many farmers have expressed an interest in growing sorghum in their perimeters because of diesel shortages, and some villages are already doing so (e.g. Djovol). Given the differences that exist across villages in access to water, diesel and other inputs, decisions regarding the kinds of crops grown in different perimeters should take these factors into consideration. An economic analysis might be conducted to determine the economic returns of alternative irrigated crops, especially for the dry season.
3. Another way to increase production in perimeters is through crop intensification. Better crop management through appropriate cultivation techniques, use of inputs and improved seeds could significantly improve production for a given parcel. This alternative will require more extension and timely access to inputs, both of which are limited at present. Also the cost of such inputs are a constraint for many farmers. Thus, improved techniques and inputs should be developed and introduced as separate components rather than in packages. In this way farmers can adopt component technology which they can afford. Given the cost of chemical fertilizer, the use of organic fertilizers might be recommended. Some farmers in villages along the river are already using goat manure on their parcels (e.g. Toulel).

*Some farmers are presently using too much water on their fields. Too much water may cause nitrogen loss. Excess water use may result in a 60% loss of efficiency in fertilizer (J. Core Personal Communication).

4. Crop intensification measures might be introduced for dieri, fonde and walo cultivation. To deal with the problem of limited water supply, drought resistant, water efficient varieties could be introduced. Short cycle varieties have already been developed elsewhere which could be tested in on-farm trials. Such crops could be adapted to high density planting in walo areas. Also for walo fields, reliable indicators of soil moisture could be developed to determine optimum planting times and types of crops to plant (e.g., sorghum or forage). In addition, minimum seasonal crop water requirements could be determined through research. Other crop intensification measures might include the use of animal traction or small tractors for land preparation in walo areas, the use of seed treatment dressings and insecticides in all cropping activities to cut down on crop loss due to pests and diseases, and bird resistant and disease resistant varieties.
5. Water harvesting potential should be investigated at a number of sites along the river in both dieri and walo areas. In many places, walo crops are actually inundated by runoff water from local water courses rather than the river (e.g. Tetiane and numerous locations on the Dirol Plain). In such places, a series of small barrages/dikes or other water harvesting techniques could be used to greatly increase the areas grown as well as the reliability of cropping.

5. Access to Appropriate Technology

Many farmers have difficulty gaining access to appropriate technologies which would allow for production increases. This is due to: 1) a lack of awareness of inputs and techniques which are available; 2) lack of cash to purchase inputs; and 3) an underdeveloped input market in most of the area surveyed. Thus, farmers have difficulty acquiring appropriate seed (i.e., short cycle varieties, high yielding varieties, treated seed), fertilizer, insecticides and appropriate tools and equipment (including animal traction equipment). Many farmers must rely on SONADER, CARITAS and other organizations to provide such inputs.

Compensating Strategies

1. As stated earlier, farmers will travel to larger towns or Senegal to obtain inputs such as seed, seed treatment dressings, insecticides or fertilizers.
2. Some farmers are renting the use of a tractor from other farmers or using a cooperative tractor to do land preparation.
3. A few farmers are using animal traction to prepare their land for dieri cultivation (e.g. Toulel).

4. Some farmers are using goat manure as fertilizer for their irrigated parcels to compensate for high costs or limited supplies of chemical fertilizers.

Recommendations

1. Greater support should be given to extension to help promote farmer awareness of improved techniques and the use of inputs (see below). Such extension efforts should take into consideration the limited resources available to farmers when promoting new techniques.
2. Seed multiplication programs should receive more support in order to meet the needs of farmers. Attempts should be made to produce sufficient quantities of improved seed and make this seed available. Seeds which are adapted to different climatic constraints and soil types should be distributed to farmers. Aside from introducing new varieties, efforts might focus on improving local varieties. To facilitate this effort, local seed germ plasm should be collected and maintained in order to incorporate traits which are appreciated by local farmers (e.g. taste, bird resistance, etc.).

In addition, hybrid seeds developed in other regions of the Sahel (e.g. Sudan) might be tested to determine their appropriateness for this region. Such hybrids might be well suited for irrigated perimeters. If hybrids are promoted, 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. Such measures may be difficult to implement given the current infrastructure. Until such infrastructure is established, research might concentrate on other improved seed varieties rather than hybrids.

Diversification of cereal crops should also be emphasized in seed programs. Farmers should be given a number of alternatives so that they can select the cereal crops and varieties that best fit their preferences and circumstances. However, because of limited resources, there are limits to how extensive this seed program can be. For this reason a compromise should be reached so that research does not spread itself too thin. The crops which receive first priority should be those which are the most widely grown and have the greatest potential for improvement. (This effort should be coordinated with FAO.)

3. Input markets should improve as cash becomes more available through the sale of vegetables and other possible cash crops. The interrelationship between these factors must be recognized.

4. As stated earlier, access to inputs might be improved through the promotion of cooperative boutiques. Such boutiques could acquire inputs in a timely fashion for sale to farmers. Another alternative is to use village merchants as intermediaries to introduce improved inputs.* Village merchants may already perform this role in many villages. Such merchants could promote the distribution of improved seed varieties** (early maturing, bird resistant, disease resistant, treated seeds, etc.) as well as other inputs.

6. Lack of Effective Extension

Except for some perimeters, effective extension is lacking in most of the areas surveyed. This is primarily due to: 1) the insufficient number of extension agents; 2) the limited mobility of agents due to lack of transport; 3) the inadequate training of the existing agents; and 4) the approach used by agents in working with farmers. This constraint adversely affects the potential adoption of improved techniques and the appropriate use of inputs by farmers.

Compensating Strategies

1. Some farmers will travel to large towns and urban centers to seek out advice from extension personnel (i.e. Kaedi, Boghe, Rosso, Tekane, etc.).
2. Some farmers will rely on advice given by cadres working on SONADER or CARITAS financed perimeters.
3. Some farmers will go to Senegal to seek out advice from extension agents and farmers working there.

* Promoting the distribution of improved inputs through village merchants is not advisable in villages where merchants have established exploitive relationships with farmers. This may be the case if the merchant is from a different ethnic group. The feasibility of this approach must be assessed on a village by village basis.

** Care must be taken to impress upon merchants the importance of not mixing seed varieties.

Recommendations

1. The first step to improving extension in the survey area could be to build a stronger link between the extension services and CNRADA. Such a linkage could promote additional training for the agents and exchange of information between organizations. In addition to the debriefing they receive from their own departments, agents could be brought in periodically to be informed by CNRADA researchers about the findings of on-going research. In this way, extension personnel could be kept up-to-date on the latest trials, improved seeds and improved techniques. In addition, extension agents could participate in FSR training seminars to learn new data collection techniques and ways to approach their work. Emphasis could be placed on the importance of understanding the farmers' perspective, access to resources and constraints so that appropriate research can be conducted. With such training, extension agents could provide feedback to CNRADA regarding farmer problems and needs. CNRADA could also elicit the aid of extension agents in conducting on-farm trials and monitoring experiments. This mutual collaboration could benefit both organizations and would improve their effectiveness.
2. The mobility of extension agents might be improved through the introduction of cost effective means of transport such as mopeds or motorcycles. SONADER agents in Tiekane are already using such means of transport.
3. Because of the shortage of agents in the field, other human resources could be called upon to help with extension efforts. Peace Corps volunteers (PCVs) could help provide information to farmers as well as help CNRADA set up on-farm trials. With proper training and guidance from CNRADA and the extension organizations, the PCVs could monitor experiments, collect yield data and obtain feedback from farmers regarding the trials. In addition, health PCVs might collect consumption data such as food preferences, seasonality of foods consumed and quantities of food consumed. This data could be used by CNRADA in designing useful technologies. Extension personnel could help coordinate these efforts on a regional basis.
4. Improvements in extension training might be promoted by increasing the support to educational institutions responsible for such training. Successful agricultural programs will not come about unless research, extension, and education are strongly linked.

7. Destruction of Crops by Animals

Crop damage caused by animals is a serious problem throughout the area surveyed. Of the types of animals responsible, camels were cited specifically as the most serious pest. Farmers expressed a great deal of frustration with the situation because: 1) legal means were essentially ineffective in stopping this destruction; and 2) acquiring the necessary wood for fencing material subjected farmers to penalties from forestry agents.

Compensating Strategy

1. Farmers in some villages got together and constructed large wooden fences around their perimeters to keep camels and donkeys out (e.g. Wompou).

Recommendations

1. Appropriate fencing material should be made available to farmers to protect their crops from animal intrusion. Thorn bushes are not that effective against camels, so alternative materials should be introduced. Metal fencing can be effective and might be made available to cooperatives as part of the construction of perimeters. However, individual farmers may find the cost of such fencing material higher than they can afford. An alternative would be to plant rapid growing live fences around fields (e.g. Prosopis) or to plant stands of fast growing trees to be used primarily for fencing. Systematic harvesting of such tree lots could ensure adequate supplies of fencing material so that natural vegetation would not have to be used.
2. As stated earlier, another way of dealing with this problem would be to establish water points in pastoral zones to the north where grazing resources might exist with limited water supplies. This could lessen the pressure on grazing resources along the river. In addition, more forage crops could be grown by farmers on dieri, waio and irrigated parcels to lessen the pressure on communal grazing resources. Thus, nomadic herds would have more access to natural pasture and be less compelled to eat farmers' crops.
3. Stricter penalties should be imposed on animal owners who are not supervising their animals adequately. The fines for retrieving animals which have trespassed should be high enough to act as a disincentive for negligent herd management. Brands might be required so that owner identification is made easier.

8. Emigration of Young Men

In many of the villages, a sizable proportion of the young men have migrated to urban areas, other African countries or to France seeking employment. This is especially true for Soninke villages. This out-migration depletes villages of labor resources and educational skills which could be channelled into agricultural production. Aside from migrating for jobs and education, some emigrants may be forced to leave their villages to ease the pressure on limited family food supplies. Although emigrants may be sending back remittance money to help support their families and community projects, this remittance money is not always channelled into productive endeavors (e.g. mosques). Thus, the absence of this human capital adversely affects production.

Compensating Strategies

1. Some emigrants are banding together and pooling their money into a community development fund for their village. This money is then used to build wells, dispensaries, and schools as well as mosques (e.g. M'Boto).
2. Some families depend upon remittances for securing food supplies during food deficit periods, especially when crop yields are low.

Recommendations

1. Out-migration will continue until better opportunities for employment, education, and agricultural production are provided at the village level. For this reason, production improvements could provide the needed incentives for young men to remain in their village. However, access to land may still pose a constraint for these individuals. Efforts should be made to insure that irrigated parcels are equitably distributed to these individuals to induce them to stay.
2. Efforts could be used to channel remittances more effectively into productive agricultural investment. The setting up of community development funds could be encouraged in other villages. Such funds could be used to provide the starting capital for setting up cooperative boutiques as well as for the purchase of pumps and their parts, agricultural machinery and other inputs. These funds might also be used as a credit source for farmers.

9. Potential Competition Among Agricultural Activities

One important constraint which many farmers face involves the potential competition that exists among different cropping activities. Cropping activities on the irrigated perimeters may coincide with cropping activities on dieri lands. Similarly, labor bottlenecks may arise between irrigated cropping activities and walo cultivation, especially if a second season crop is grown in the

perimeter. Dieri harvesting might also compete with walo planting. Differences do exist between regions and villages as to which cropping activities are in competition because of differences in access to land resources and climate (e.g. Soninke villages have limited access to walo).

Compensating Strategy

1. Farmers will attempt to adjust their cropping activities to minimize labor conflicts. For example, if rice is being planted in the perimeter, little competition arises between the planting of rice beds and dieri planting. However, if corn or sorghum is grown on the perimeter, it appears that these crops are planted first before dieri lands. (This may be due to the risk factor.) If farmers have inundated walo lands as well as irrigated parcels, they appear to plant their walo fields prior to planting a second season crop on the perimeter. Walo planting appears to occur after the harvesting of the first irrigated crop and before dieri lands are harvested. The delay in planting of a second season irrigated crop due to walo planting can be substantial. If farmers don't have inundated walo fields, they may not hesitate to plant their second crop on the perimeter. Harvesting of the walo does not seem to compete with the harvesting of the second irrigated crop because of the different planting times.

Recommendation

1. More research is needed on farmers' practices regarding competing cropping activities. Researchers should attempt to collect information on farmers' decisions regarding labor adjustments for different cropping patterns. In this way, the most critical labor bottlenecks can be identified. This information will help researchers identify crop varieties which can be grown which might reduce labor conflicts due to adjustments in the cropping calendar. Taking a farmer's present practices and constraints into account, cropping calendars can be devised which are realistic plans that farmers can follow. Such cropping calendars can also take seasonal food shortages into account. Different crop varieties and calendars should be developed for different regions along the Senegal River because of the variability that exists in climate and access to land resources.

10. Cultural Traditions Adversely Affecting the Cropping Calendar

In some villages in the Soninke region of the Guidimaka, farmers growing corn on their perimeters were obligated to harvest their crops when the village chief declared it was time to do so. Unfortunately, not all of the corn matured on the perimeter at the same time because of differences in leveling, soil type, timing of planting, etc. Some farmers had corn which had matured much

earlier, while other farmers' corn was not ready to harvest. Once the chief made the pronouncement, the pump was turned off. Those whose corn did not reach maturity lost their crop. Sanctions against harvesting prior to the chief's pronouncement were severe enough to prevent farmers from doing so. This rite is a traditional dieri rite which has been transferred to the perimeter.

Recommendation

1. Extension personnel should impress upon village chiefs that not all parcels will mature at the same time due to differences in leveling and soil types. To prevent unnecessary losses, the chief must be convinced that it is in the best interest of the village to allow farmers to harvest their crops at different times. Such a rite can be put to good use in determining planting dates, however. Working closely with the chief, the extension agent could specify when farmers should plant to obtain optimal results. Thus, working through traditional lines of authority could help implement appropriate cropping calendars. Such fine-tuning of a cultural tradition could work to the benefit of farmers.

B. Specific Farming Systems Component Constraints

1. Small Perimeter Constraints

a. Size of the irrigated holdings

The size of the irrigated holdings allocated to most farm families is too small to meet the consumption needs of the family (e.g. .25 to .5 ha).

Compensating Strategies

1. As stated earlier, many farmers will cultivate two or three successive crops on their irrigated holdings. The viability of the strategy depends upon access to water, diesel, pump maintenance and the receptivity of SONADER or CARITAS to such successive cropping.
2. Farmers will plant a number of crops in and around the edge of their irrigated parcels to maximize the use of these parcels. For instance, farmers in Wompou plant cassava around the edges of their corn perimeters.

Recommendations

1. As previously stated, the size of irrigated parcels allocated to each family should be increased so that production from such parcels can meet a larger portion of the family food needs. For instance, when constructing new perimeters, the size of parcels allocated to each family might be larger, that is, 1 hectare rather than .25 or .5 hectares. When perimeters are extended, this land should be allocated to families possessing holdings already rather than to new families. If such extensions are made, care must be taken not to

exceed the capacity of the pump. A study might be conducted to determine what is the optimal size for an irrigated holding taking yield and economic returns into account. The size of the recommended holding should take into consideration the environmental conditions, access to resources and family circumstances.

2. As mentioned earlier, better utilization of irrigated parcels should be encouraged. Currently, many small perimeters are only used in the rainy season. Alternative crops which require less water than rice and corn should be grown in the dry season. Sorghum is an excellent dry season crop which could be promoted. Farmers have expressed an interest in growing sorghum on their parcels because of diesel shortages. In fact, some villages are already growing it (e.g. Djovol). Given the variability that exists across villages in access to water, diesel and other inputs, decisions regarding the kinds of crops grown in different perimeters should take these factors into account. Economic analyses could help determine the economic returns of alternative irrigated crops, especially for the dry season.
3. As stated earlier, increased production in irrigated holdings might be promoted through crop intensification. Better crop management through appropriate cultivation techniques, use of inputs and improved seed could improve production significantly. Such efforts will require more extension and timely access to inputs, both of which are limited at present. In addition, many farmers cannot afford such inputs. For this reason improved techniques and inputs should be developed and introduced as separate components rather than in packages. In this way farmers can adopt the components which they can afford. Furthermore, given the cost of chemical fertilizers, the use of organic fertilizers might be encouraged. Some farmers are already applying goat manure to their parcels in some villages (e.g. Toulel, Bababe).

b. Problems associated with pumps

The motor pump of the small perimeter is the most vulnerable component of the system. Pump breakdowns are persistent problems for perimeters all along the river. Aside from over-utilization, the occurrence of breakdowns is partially due to improper maintenance. Breakdowns become significant when spare parts are difficult to obtain. This problem is exacerbated by the lack of uniformity in the type of pumps used along the river. Such breakdowns may result in crop losses or crop failure, creating food deficits for farm families. Farmers may be forced to resort to charcoal production to compensate for these crop losses, which leads to further environmental degradation (e.g. Darel Barka, Olo Ologo). Thus, access to spare parts and proper maintenance are paramount to effective utilization of perimeters.

In addition to pump breakdowns, access to diesel also poses significant problems for small perimeters. Limited supplies of diesel can have the same effect as pump breakdowns, in that crops

may not receive enough water. Significant crop losses may result from such shortages.

Compensating Strategies

1. Almost all villages with perimeters have a local villager who serves as the pumpist in charge of running and maintaining the pump. Most of these pumpists are trained by SONADER so that they can do the basic maintenance themselves (i.e. oil changes). Each village has devised its own payment system for the pumpists' services. Some of these payment schemes are ingenious in their attempts to provide incentives for pumpists to operate the pump effectively. For example, one village (Tiekane) determines the payment to the pumpist on the basis of the third highest parcel yield.
2. Some farmers will travel to other towns to purchase diesel and spare parts for their pump if SONADER delays in coming. However, not all farmers have the means to do this and may lose their crop.
3. Some farmers will plant crops in their parcels which are less vulnerable to pump failure or diesel shortages, such as sorghum. Rice and corn are more vulnerable to such breakdowns and shortages due to their water requirements.
4. Some villages will opt not to plant a second-season crop to avoid additional diesel costs or excessive wear on the pump (e.g. N'Bar Wadji/Kaire).

Recommendations

1. If irrigated agriculture is to be successfully promoted in Mauritania, spare parts and diesel should be made readily available to cooperatives to avoid pump shutdowns. To facilitate access to spare parts, efforts should be made to encourage more uniformity in the types of water pumps installed.* In this way, spare parts can be ordered in large numbers. In addition, surveys can be conducted to determine which pump parts break the most frequently. Once identified, additional stocks of these parts can then be distributed to cooperatives and held in reserve for ready access. Similarly, reserve stocks of diesel and motor oil should be made available to cooperatives, especially those which are isolated in the rainy season.

*SONADER already appears to be doing this east of Kaedi. Most of the pumps in perimeters in this region were Listers.

2. Better training should be provided to the pump operators in the maintenance of pumps so that reliance on SONADER for maintenance is reduced. This additional training could be provided at regional training centers already established by SONADER (e.g. Kaedi, Boghe, Rosso, etc.). The success of such training will be highly dependent upon the selection of the pump operator. Thus, villages should be made more aware of how critical this selection is. Presently, substantial differences exist among villages regarding the quality of the pump operator. For instance, the operator at Kaire is recognized by SONADER agents to be quite good. This perimeter has experienced very few extended breakdowns because of the pump operator's efforts.
3. Following the example set by Tiekane, villages should establish payment schemes for the pump operators which provide incentives for good pump maintenance. Flat rates should be discouraged. By having the payment based upon the crop performance of certain farmers with parcels in the perimeter, the pump operator receives a higher return if the performance is better. Such a system might also insure that trained pump operators remain in the village rather than seek employment elsewhere. Losing well-trained pump operators has been a serious problem for many villages in the past. This proposed payment scheme appears to be the best available with regards to incentives for the operator.
4. To reduce the use of diesel, steps could be taken to improve the efficiency of perimeters in terms of water utilization. Improvements could be made in canal construction and maintenance, leveling of parcels, and irrigation schedules which take crop water requirements into account (See below).

c. Inefficient water utilization

Water is not being efficiently used in many of the perimeters. This is due to a lack of understanding of the interrelationships that exist between pump capacity, land area, cropping patterns and individual crops. First, water loss is significant because of poor construction and maintenance of canals. This could be due to the fact that the construction and maintenance of perimeters is often poorly supervised. This is especially true for Type A perimeters. Second, perimeters are often not leveled properly. Proper leveling is difficult with hand tools. Third, irrigation schedules are not often based on crop water requirements. Thus, water distribution is not efficient. Fourth, some perimeters have been expanded beyond the capacity of the pump to effectively water rice or corn crops. As a result, farmers obtain lower yields for these crops.

Compensating Strategies

1. As stated earlier, farmers will plant crops such as sorghum which do not have high water requirements as a way to compensate for water shortages due to pump breakdowns, or shortages of diesel. Sorghum is also grown in perimeters that have been expanded beyond the capacity of the pump to effectively water rice or corn crops. In addition, some farmers will allow sorghum to produce from secondary shoots to provide them a second-season crop (e.g. Djobol).
2. Farmers will plant a number of crops in the parcel or along the edge of the parcel to take advantage of the water provided to their parcel.

Recommendations

1. Water losses in the canal system can be reduced by better construction and maintenance of irrigated systems. This entails better supervision in the construction of perimeters so that dikes and canals are properly built and parcels are leveled (especially in Type A perimeters). Maintenance programs should also be set up so that dikes and canals do not deteriorate. Training programs could be established so that farmers can maintain their perimeters themselves. This training could be provided by SONADER, CARITAS or extension services.
2. Research could be conducted on alternative leveling techniques. For instance, puddling is one alternative worth investigating. By flooding the parcels before plowing and moving the soil, the water could be used as a transport vehicle for the heavy soils found in the fonde areas. This could make it more feasible to level the fields by hand, with animal traction* or with small two-wheeled tractors. Level fields would significantly increase irrigation efficiency.
3. Research could focus on developing irrigation schedules which are based upon crop water requirements. Building upon the work of SONADER and other past research conducted by CNRADA, scheduling criteria could be developed for each type of crop, taking season and soil conditions into account. Such information could then be provided to extension personnel, SONADER cadres, pump operators and farmers so that more efficient water scheduling can be implemented.

*If animal traction is to be used, fodder supplies need to be made available, possibly through the production of such crops on parcels. In addition, adequate training needs to be provided to farmers to effectively implement such technology.

4. As mentioned earlier, better water utilization could be promoted through the planting of water-efficient crops like sorghum. Sorghum requires little water as compared to corn and rice and might be an excellent second-season crop for perimeters. In addition, the practice implemented by some farmers involving the growth of secondary shoots of sorghum to act as a second-season crop should be investigated. An economic analysis might be conducted to determine if this practice brings higher net returns to the farmer than replanting a second crop of sorghum.

d. Lack of effective extension

As stated earlier, the lack of effective extension is a serious constraint for many perimeters (see item 6 under General Production Constraints). Many farmers have limited experience with irrigation techniques and, therefore, need more guidance from extension personnel regarding appropriate irrigated cropping techniques, water use, use of inputs and maintenance of perimeters. Aside from the lack of sheer numbers, agents have difficulty providing adequate extension due to their limited mobility, lack of training, and sometimes improper approach to farmers' problems. Unfortunately, some SONADER cadres who could be providing extension advice are obligated to spend much of their time recording farmer water usage for accounting purposes. This lack of extension may adversely affect adoption rates of improved technologies and the appropriate use of inputs.

Compensating Strategies

1. As mentioned before, some farmers will travel to large towns, urban centers or to Senegal to seek out advice from extension personnel or other farmers.
2. Some farmers obtain information from cadres working on SONADER- or CARITAS-financed perimeters.

Recommendations

1. As stated earlier, extension might be improved by: 1) building a stronger link between the extension service and CNRADA; 2) providing mopeds or motorcycles to enhance mobility; 3) relying on other human resources such as Peace Corps Volunteers to help with extension efforts; and 4) increasing the support to educational institutions responsible for training (see Recommendations under Item 6 of General Production Constraints).
2. Another way to deal with the shortage of extension personnel for small perimeters is to give pump operators extension training at the same time they are trained to maintain pumps. In this way, the pump operator serves two important

functions. If the pump operator is paid on the basis of the performance of the perimeter, there is an incentive for him to maintain the pump and provide good extension advice. If the perimeter is too large for one individual to maintain the pump and provide advice, another person might be trained to fill the extension role. This person's payment might also be based on the performance of the perimeter.

e. Lack of appropriate equipment

Farmers in many of the perimeters surveyed have limited access to labor-saving technologies such as small tractors, two-wheeled cultivators or animal traction. Most of the cropping activities are done by hand.

Compensating Strategy

1. As mentioned previously, some farmers are renting tractors for land preparation from other farmers or using a cooperative tractor for such purposes.

Recommendation

1. Although farmers should have greater access to labor-saving technologies, such technologies are usually too expensive for most farmers to afford. For this reason, such technologies should be introduced to groups of farmers in cooperatives as well as to individual farmers who can afford it. Cooperatives could purchase the equipment and share it among the members. Many cooperatives already follow such a strategy.
2. Research should be conducted on the various types of labor-saving technologies which are available for small perimeters to determine which are the most appropriate to promote given farmers' current access to resources, inputs, spare parts and training. For instance, if small tractors are to be used, the size of the parcels should be at least 5 hectares to make such a capital investment economically viable. Presently, many parcels are too small for effective tractor use. For smaller parcels, two-wheeled cultivators similar to those used in S.E. Asia might be introduced. In addition, animal traction might be more applicable to smaller parcels. If animal traction is to be introduced, such technology requires adequate fodder supplied as well as effective training for the operators.

f. Excessive indebtedness of farmers with small perimeters

Many small perimeter cooperatives are experiencing difficulty in paying back long-term and short-term loans to organizations like SONADER and CARITAS. The inability to repay is due to crop losses and crop failures. Crop losses are due to pump breakdowns, animal intrusion, pest damage (insects and birds) and inappropriate irrigation techniques.

Farmers also lack an adequate understanding of financial expectations. It is not clear that they fully comprehend the terms of the loans being processed. Farmers have become totally dependent on organizations like SONADER and CARITAS for supplying inputs and coming to their aid in times of crisis rather than becoming self-sufficient in these matters. They do not understand the limits of these organizations. At the same time, technical help and back-up supplied by these institutions have not always been delivered in a timely fashion, resulting in crop losses or failure. Such losses are incurred solely by the farmers and are not shared by these organizations. As a consequence, farmers find themselves accumulating debt burdens which are difficult to repay. When these debts become excessive, these organizations stop providing operating funds and inputs to the perimeters, forcing closure of the perimeters. In several of the villages where inputs have been cut off, farmers have been forced to turn to charcoal production to compensate for crop shortages (Gourel Dieri, Tagah, Toufde Sive, and Paliba). This practice leads to further environmental degradation.

Recommendations:

1. Farmers should receive more adequate instruction regarding these financial responsibilities whenever a loan is granted. This may require training several of the cooperative members in fiscal management and simple accounting procedures. In addition, payback schedules should be reasonable and manageable given the farmers' resources. This may require spreading payments out over longer periods. A moratorium may be required for existing loans until a reasonable payback schedule can be devised.
2. Farmers can help reduce their debts by instituting a series of measures that cut down on the cost of inputs. These include: 1) switching to crops that cost less to produce (i.e., sorghum); 2) improving their water management practices (i.e., better canal construction and maintenance, leveling of parcels, appropriate irrigation schedules, etc); 3) improving pump management and maintenance, and 4) following cropping patterns which are well suited to their perimeter.
3. Farmers should not be held solely responsible for crop losses which are caused by factors outside of their control. The risk of such losses should be shared with the lending institution. How this risk is absorbed will be determined by the circumstances of the loss. For instance, if crops are destroyed by animals or pests, then both parties might share in the loss. However, if the motor pump breaks down and SONADAR or CARITAS is slow to repair it, then the losses incurred by the perimeter should be absorbed by the responsible institution. Following such a procedure, both the farmer and the institution are held accountable for their actions.

g. Nutgrass (Cyperacea)

Nutgrass was found in several of the perimeters surveyed. The spread of this weed could reduce irrigated crop yields significantly.

Compensating Strategies

1. Most farmers will weed their plots by hand periodically to prevent excess buildup of such weeds.
2. The nuts of this plant have some economic value and may be collected for consumption or sale.

Recommendations

1. Research should be conducted to determine the most appropriate way to deal with nutgrass. Control measures may include herbicides, appropriate weeding techniques, proper water management or ruminant grazing. Attempts might also be made to identify crop varieties which are resistant to nutgrass. An alternative to these control measures would be to determine if nutgrass has any other economic use.

2. Walo Cultivation Constraints

a. Reduction of inundated surface due to insufficient flooding

Access to walo land which has been adequately inundated is a constraint, especially during years of poor flooding. Given the tenure arrangements found in the survey area, older male farmers (40-60 years old) are more likely to have access to inundated land during poor flood years than younger male farmers. Thus younger farmers may be forced to migrate.*

In addition, farmers who are primarily sharecroppers (poor male farmers and women) are not likely to have access to inundated walo land during poor flood years. Small perimeters are more critical in areas where yearly access of inundated walo land fluctuates considerably than in areas which are more consistently flooded.

*This migration may have negative implications for the transfer of traditional agriculture knowledge.

Compensating Strategies

1. The compensating strategies followed by farmers to deal with limited access to inundated walo land are similar to those identified under "Access to Land" in the General Production Constraints (page 62).

Recommendations:

1. As stated earlier, research should focus on drought resistant, water efficient crops to be planted in walo areas which can produce on minimal amounts of soil moisture. These crops could be adapted to high density planting to deal with problems of access to inundated walo land. As part of this research, the minimal seasonal crop water requirements of each of these crops should be determined. In conjunction with this, reliable indicators of soil moisture could be developed to determine optimum planting times and types of crops to plant.
2. As mentioned previously, water harvesting techniques should be developed in a number of walo areas along the river. This is especially true in places where walo crops are actually being inundated by runoff water from local water courses rather than the river (Tetiene and many villages in the Dirol Plain). The construction of a number of small barrages and dikes could increase the area grown and the reliability of cropping.
3. In villages where access to inundated walo land fluctuates considerably, efforts should be made to insure that irrigated parcels are equitably distributed to those farmers who do not have regular access to flooded walo. This group of farmers includes the younger men, the poor men, and the women of the villages. Aside from improving the production potential of these farmers, the equitable distribution of these lands may help lessen the outmigration of younger men that is occurring in these villages.

b. Major pests and diseases

Walo crops, especially sorghum, are attacked by a number of pests and diseases in the villages surveyed. These include granivorous birds, animals (camels, donkeys, sheep, goats and wild pigs), insects (grasshoppers, crickets, locust, termites, aphids, and cut worm), weeds and smut (covered smut, long smut, and head smut). Birds and grasshoppers do the greatest damage to sorghum. Grasshoppers attack the sorghum at all stages while birds attack when the sorghum is in the milky stage of development. Crickets are also a serious problem after the sorghum seed has germinated and is in the seedling stage. Many farmers were forced to replant their sorghum several times because of cricket damage. Aphids

attack both sorghum and cowpeas and exude a sap in the cowpea plant that resembles honey (miellat). Crop damage due to animals has also become a significant problem due to the limited availability of alternative forage resources. Various kinds of smut were also present in almost every field visited.

Compensating Strategies

1. Most farm families spend a considerable amount of time scaring birds from their fields. Women and children play a major role in this task. Some farm families will even live in their fields during the critical stages of sorghum development to minimize bird damage (e.g. Talhaya).
2. Many farmers will cover their ripe sorghum heads with cloth to prevent birds from eating them. In addition to draping cloth in the field, they will erect noise makers from string and pans as well as construct "scarecrows."
3. Many farmers will bend the sorghum stock over before it is completely ripe so that it is not easily detected by birds (e.g. N'Gorel). Farmers indicated that this practice also helps prevent lodging by the wind.
4. One farmer said that he deals with the bird problem by planting red and black sorghum varieties on the outside of his field and white sorghum on the inside. The birds dislike the red and black sorghum.
5. Some farmers will build fences around their fields to keep animals out of the fields. This is especially true for farmers who have fields that border the edge of the walo areas. Most of these fences are constructed of small tree branches and are not very effective in keeping camels out.
6. Many farmers use seed treatment dressing to protect their seeds from insects and disease (e.g. Fondou and M'Boto). These dressings are obtained from larger towns like Kaedi, Boghe or Rosso or from Senegal.
7. Some farmers will deposit insecticides around their fields to protect them from crickets and other insect pests (e.g. Dar es Salam).

Recommendations:

1. Farmers should be encouraged to continue to use seed treatment dressing, treated seed, insecticides and other chemicals which help control pests and diseases. Such inputs should be made readily available through a number of channels.*

*We do not recommend that the Mauritania Government subsidize these chemical inputs. We believe that this would be too costly a program for the government to maintain.

Aside from extension offices and organizations like SONADER and CARITAS, farmers might also obtain such inputs through cooperative boutiques and village merchants. Improved varieties and other inputs might also be promoted through such channels. If widespread use of such chemicals are to be encouraged, it is essential that farmers are instructed in the proper use of such substances. These instructions could be provided by extension agents, SONADER cadres, CARITAS personnel as well as other organizations like Peace Corps.

2. Research should focus on identifying sorghum varieties that are resistant to many of the pests and diseases. For instance, bird resistant varieties which have long bristles protruding from the heads could be identified and developed. Some of these varieties already can be found in some farmers' fields. Similarly, high tanin sorghum varieties might be introduced that birds do not like. The problems associated with such sorghums is that farmers don't like the taste either.* Processing techniques might also have to be introduced to help remove the bitterness of the tanins. In addition to bird resistant sorghum, varieties might be identified or developed which are resistant to smuts, other diseases and insects. Similar kinds of research could be done on cowpeas to identify resistant varieties.
3. Taking the lead from farmers, cropping strategies should be developed which help minimize the damage caused by birds. Further research is needed to determine the beneficial effects of planting red and black sorghums on the outside of fields and white sorghum on the inside. In addition, 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 (e.g. Sudan). Alternatively, short cycle varieties of sorghum could be introduced that mature before peak periods of bird infestation.
4. Entomologists could conduct research on termites to determine the most effective way to control these insects. 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 also be directly applicable to dieri cultivation.)
5. Due to the severity of the grasshopper problem in Mauritania, a national eradication program may be necessary to effectively control this pest. This effort could be coordinated on a regional basis.

*High quantities of tanin may pose health related problems.

c. Access to Labor

Access to labor, especially for land clearing and planting can pose a constraint for farmers cultivating walo lands. This constraint becomes more significant when walo cropping activities coincide with cropping activities on irrigated perimeters and dieri land. Such labor bottlenecks may cause substantial delays in walo planting. This problem is exacerbated by cricket infestations which may force farmers to replant the walo crops several times.

Compensating Strategy

1. As mentioned earlier, farmers will adjust their cropping activities to minimize labor conflicts. For instance, farmers will wait to plant their walo fields until they have their irrigated crops.

Recommendations

1. As stated previously, research should attempt to identify the most critical labor bottleneck in walo cultivation so that crop varieties and labor saving technologies can be introduced which effectively deal with these constraints. Crop varieties which have different growing seasons than the traditional varieties might be introduced to adjust the cropping calendar so that labor shortages do not pose a serious problem. Labor saving technologies such as animal traction, small tractors or two-wheeled cultivators may help reduce the labor inputs associated with land clearing. In addition, cricket damage can be reduced through the promotion of chemical inputs and resistant varieties so that replanting is minimized.

d. Water control measures for large perimeters impeding the exploitation of walo lands.

Although the large perimeters at Kaedi and Boghe have significantly increased the amount of irrigated crop land available in Mauritania, the water control measures built for these perimeters have adversely affected farmers' access to walo lands nearby. For instance, the dam built at Fom Gleitat has reduced flooding along the Gorgol River taking large tracts of potential walo land out of production (e.g., Lekseiba, Talhaya, Ganki). Farmers in this area are negatively impacted by such a development because they were highly dependent upon these walo lands. Similarly, there are walo lands near Boghe that are not flooded because of the dike built for the large perimeter (e.g., N'Gorel).

Recommendations

1. A study should be conducted along the Gorgol River to determine the negative impact that the dam at Fom Gleitat has had on the farmers in the area. This study might be conducted by a team of representatives from SONADER, CNRADA and the extension service.

2. Farmers who have been adversely affected by water control measures should be allocated irrigated parcels in the perimeters or compensated in some other way. Alternatively, water harvesting techniques can be introduced to inundate crop land. A series of low barrages or dikes with gates could be built along the Gorgol River to help stop water when it is released from the dam. Some of the water can then be used to flood cropping areas. Such water harvesting techniques might also be used on small tributaries that flow into the Gorgol. These interventions will help farmers recover much of the walo land that they lost.

e. Other areas of investigation

Many farmers along the Senegal River (especially the Pulaar) will bend their sorghum stalks over before the crop is fully mature. Two reasons are cited for why this is done. First, the bent over stalk is less susceptible to bird attacks because the head is not upright in the field. Second, this practice prevents the plant from lodging in strong winds. One drawback of this practice is that the seed head takes longer to mature.

Recommendation

Research might be conducted on the positive and negative effects of bending over the sorghum stalk before it is ripe. A comparison might be made between taller sorghum varieties which are bent over and shorter varieties. It is possible that opting to grow taller varieties and bending them over provides more fodder than can be obtained from shorter varieties. Farmers may prefer taller varieties for this reason.

3. Dieri Cultivation Constraints

a. Environmental degradation due to droughts and overexploitation of land resources

As stated earlier, a number of interrelated factors account for the environmental degradation which is occurring in dieri lands (see Environmental Degradation under General Production Constraints). The droughts and the irregular rains have significantly limited the production of rainfed crops as well as the growth of other vegetation. The clearance of land for cultivation under drought conditions exposes large areas to wind and water erosion. This degradation process has been accelerated by a number of other factors which include: 1) the exploitation of dieri land by landless people migrating from the north; 2) overgrazing of vegetation by transhumant herds and village livestock; and 3) removal of trees and bushes for firewood, charcoal and fencing material. As a result, much of the productive dieri agriculture lands are being threatened by sand encroachment.

Compensating Strategies

1. As previously mentioned, farmers will rely on irrigated parcels or recession agriculture (if available) to compensate for poor production on dieri lands. They may plant two or three successive crops on their irrigated land to meet their consumption needs.
2. Many farmers will continue to cultivate crops in dieri lands but may restrict the cultivation to the low areas in the fields where water accumulates (bas fonde).
3. As mentioned earlier, farmers will pursue a number of strategies to obtain income to supplement their agriculture production. These include the sale of vegetables, fodder, charcoal and wood; wage labor on other farmers' fields; animal husbandry; fishing; remittances from relatives, and seasonal or permanent migration for wage employment.

Recommendations

1. As stated earlier, one way to deal with environmental degradation in the dieri lands is to promote the integration of trees more effectively in agricultural production. Agro-forestry experiments should be initiated which determine the feasibility of promoting shelterbelts and the intercropping of nitrogen fixing trees with crops. Such practices could help cut down on wind and water erosion, sand encroachment, and evapotranspiration as well as help exhausted soils recover or maintain their fertility levels. When the dieri lands are returned to fallow, the trees act as a reserve for firewood, a source of building material and a source of fodder.*

To incorporate trees effectively in dieri lands, food and cash crops have to be identified or developed which will not be adversely affected by bird infestation. Bird resistant varieties of millet and sorghum or oilseed crops like sesame (see below) which are not attacked by birds will have to be introduced in conjunction with trees.

*In addition to the integration of trees in dieri cultivation areas, existing forest reserves should be protected and improved and new forest reserves should be promoted. These forest reserves should be exploited in a sustainable way. Such efforts should be coordinated with the ongoing projects being implemented by the Direction Protection de la Nature.

2. Given the drought conditions and irregularity of rainfall, efforts should be made to identify drought resistant, water efficient, short cycle varieties of millet, sorghum, cowpeas and watermelon. This research should begin with the varieties which farmers are already using in conjunction with varieties previously developed elsewhere in the Sahel. These varieties can then be tested in on-farm trials.
3. In addition to drought resistant varieties and agro-forestry interventions, research should focus on other possible measures which could enhance dieri production under existing environmental conditions. First, as with walo cultivation, water harvesting techniques might be introduced to better utilize limited rain water runoff. Small barrages or dikes can be constructed along certain water courses in dieri areas. Second, research might investigate the beneficial effects of water catchment areas around plants to take advantage of limited rainfall. Small depressions might be created around each plant to collect water. Third, research could be conducted on the effects of mulching as a way to help retain soil moisture.
4. Rainfall patterns for each region of the Senegal River Valley could be carefully studied to determine if there are optimum times for farmers to plant. Timing is very critical under limited rainfall conditions and such information could be very valuable.
5. As stated earlier, overgrazing of vegetation in dieri lands might be lessened by improving water resources in pasture zones to the north as well as by encouraging farmers to produce more leguminous forage crops. Drought resistant legumes which can serve both as a family food resource and as a fodder crop would be ideal. One possibility would be a 45-day cowpea variety recently introduced in Senegal. Such legumes could be adapted to be grown on dieri lands as well as on walo and irrigated parcels.
6. As mentioned previously, periodic land use assessments may be necessary to determine favorable ecosystems for dieri cultivation. Such assessments would make use of landsat data, aerial photography and reconnaissance surveys. The information would also help identify areas appropriate for livestock and forest reserves.

b. Other area of investigation

As stated earlier, one rainfed cash crop that might be successfully introduced along the Senegal River in the higher rainfall areas is sesame.* Sesame is a drought tolerant oilseed crop grown in other

*Sesame might also be a suitable crop to introduce in other rainfed zones of Mauritania which are not located near the river.

regions of the Sahel which does well on sandy soils and minimum amounts of rainfall (e.g. 250-300 mm). Considering the fact that Mauritania is presently importing most of its oil, such a crop could help meet domestic consumption needs. However, the ultimate value of this crop will be determined by how well it fits in with the taste preferences of the local population. Sesame is not attacked by birds, so it is a suitable crop for agro-forestry interventions. Aside from the oil possibly being used for home consumption, local markets could develop it to generate much needed cash for farmers. Initially, inexpensive processing techniques using local materials could be introduced at the village level. If sesame production catches on, larger processing plants might be developed in urban areas to handle future production increases.* In addition to the value of the oil, a growing export market already exists in Europe for sesame cake as a cattle feed supplement. Thus, the potential gains associated with sesame are considerable and make it worthwhile to test in the river basin.

Recommendation:

1. Sesame should be tested by CNRADA to determine its potential in this region. Seed varieties could be obtained from the Sudan, Cameroon and possibly international agricultural research centers like ICRISAT and ICARDA.

These varieties should be tested on-station as well as in on-farm trials in the Guidimaka region. An essential component in these trials will be the farmers' receptivity to the taste of sesame oil. In addition, low technology processing techniques will also have to be tested to see if farmers are interested in adopting such technology. The current processing techniques used in the Sudan may be suitable for this region and are easily transferable.**

4. Constraints for Vegetable Gardens

a. Access to water

Access to water is a serious constraint for many of the vegetable gardens found along the river basin. This is especially true for women's cooperative gardens. Water is often in short supply, and many farmers lack the appropriate means to obtain sufficient

*Such plants would be similar to those found in El Obied, Sudan.

**This village level technology consists of a hollowed-out log within which is inserted another log that acts as the grinding tool. This grinding log is then hooked up to a camel which walks in a circle around the processing equipment. A horse could easily replace a camel in Mauritania as the beast of burden.

water. For instance, pumps may not be available if the garden is adjacent to the river. If the gardens are located a considerable distance from the river, wells may not be available. Thus, water may have to be transported by hand over great distances. Limited access to water seriously inhibits the expansion of vegetable gardens, thereby limiting the potential for commercialization.

Compensating Strategies

1. In some villages where a separate water pump is not available exclusively for the vegetable gardens, farmers will use their small perimeter pump for this purpose (e.g. Sori Male). Unfortunately, this practice can over-tax the pump leading to more breakdowns.
2. A few villages are building water holding tanks for their gardens. Other villages are building wells within or adjacent to their gardens.
3. In several villages with limited access to water, women are carrying water in organized work parties (e.g. Silla). In such cases, water transport takes up a considerable amount of the women's time.

Recommendations:

1. Efforts should be made to improve water access for vegetable gardens by making pumps available for gardens close to the river and improving access to wells for gardens away from the river. Storage tanks might also be appropriate, especially for some gardens where access to water is more limited. Research might be conducted on the feasibility of using animal traction, hand pumps or small diesel pumps to lift water into storage tanks. All of these measures require capital outlays or credit for equipment which may be in short supply. Thus, any intervention prescribed should take into consideration the resources available to farmers and their ability to pay for equipment received.
2. To conserve water, efforts could be made to promote better water management and more efficient irrigation techniques. As stated earlier, improvements in canal construction and maintenance, leveling of parcels and appropriate irrigation schedules will result in more efficient water use.
3. Research could identify or develop vegetable varieties which have minimal water requirements. This will help cut down on the frequency of watering.

b. Access to appropriate vegetable seed

Farmers in the villages surveyed tended to plant vegetable varieties that only grow well during the cool, dry season. Because most of the farmers are planting their vegetables at the same time, the vegetables are harvested during the same period as well. This tendency adversely affects the marketing of vegetables since excessive supplies drive the prices down. Thus, the income which farmers receive for their marketed vegetables is significantly less than it would be if the market were not saturated.

Recommendations

1. As stated earlier, research should identify or develop vegetable varieties which 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. By avoiding market bottlenecks, farmers could receive higher returns for their products. Such varieties might be obtained from Senegal, IITA or the Asian Vegetable Research and Development Center in Taiwan.
2. To effectively deal with the research needs which will bring about improvements in vegetable production, the Government may want to bring in more vegetable specialists to CNRADA. Considering the fact that vegetables are one of the best cash crops available to farmers, improvements in vegetable production are likely to bring about improvements in the rural economy. Thus, investment in this type of research could have a high payoff for the Government.

c. Access to transport

Many families lack effective transport to larger markets, thereby limiting their ability to sell their products where the demand is greater. Transport is difficult due to the isolation of villages and poor conditions of the roads. When transport is available, the costs of hauling vegetables to large markets may be relatively high.

Compensating Strategies

1. Some farmers will join together and rent a horse-drawn cart or taxi-bus to haul their vegetables to market.
2. In one area near the Dirol Plain, several village vegetable cooperatives are trying to organize themselves so that they can share in the cost of transport. Cost sharing lessens the burden on any one cooperative. A Peace Corps volunteer is helping the villages coordinate this effort.

Recommendations

1. As stated previously, vegetable marketing will improve as access to transport improves. The Government, USAID and

other donor groups should continue to support infrastructural improvements along these lines.

2. As mentioned earlier, transport of vegetables to larger markets should be regionally coordinated. Taking the lead from farmers, several villages with vegetable gardens in the same area could join together to share the transport costs. This would provide the appropriate economy of scale to lessen the problems of transport, making it more efficient and reliable. Vegetable marketing within villages might be organized through cooperative boutiques (see Inadequate Market Infrastructure under General Production Constraints). These boutiques could bring together the village vegetables so that the marketing is coordinated with other collaborating villages. These regional marketing efforts might be organized by the extension service, SONADER, Peace Corps or some other organizations.

d. Packaging and conservation of vegetables

The vegetable products which are transported to larger markets are often of inferior quality due to poor packaging and conservation measures. For this reason foreign vegetables coming from Senegal may be preferred over Mauritanian vegetables in the larger markets (see below). In addition, due to the lack of appropriate conservation measures, vegetables are not readily available for consumption on a year-round basis.

Recommendations

1. Efforts should be made to teach farmers how to pack, transport and preserve or conserve vegetables. Aside from improving the marketability of vegetables, such practices could give farmers access to vegetables during other seasons and food deficit periods. Forms of storage and preservation techniques which are appropriate to the resource base of farm families should be emphasized.
2. Research could focus on identifying or developing vegetable varieties that transport better. For example, certain types of tomatoes have harder skins and can be transported with minimum losses. Such varieties may already exist in Senegal.
3. Small businesses could be encouraged that deal with the transport, packaging and processing of vegetables. For instance, small cottage industries could be started which specialize in producing vegetable concentrates, canning supplies or drying of vegetables. Other businesses might specialize in packing materials such as crates for vegetable transport. Some business could just specialize in transport. All of these enterprises could help stimulate employment in the rural economy. The viability of such businesses will

depend upon the growth of vegetable production along the river. This will vary from one region to another.*

e. Access to extension

Effective extension is lacking for many of the vegetable gardens. The reasons for this have already been cited (e.g. insufficient number of agents, limited mobility, lack of training, improper approach, etc.). As a result, farmers may not be adopting improved techniques or using inputs properly.

Compensating Strategies

1. The compensating strategies followed by farmers to deal with this constraint are similar to those outlined under Item 6, "Lack of Effective Extension" in the General Production Constraints.

Recommendation

To improve vegetable production, effective extension will be a necessary ingredient. Some of the services which extension agents could provide include: 1) the dissemination of new vegetable varieties; 2) instruction on improved cultural practices (i.e., input use, irrigation schedules adjusted to crop water requirements, etc.), and 3) providing information on packaging, transport and conservation of vegetables (including forms of storage and methods of preservation). Unfortunately, there are limited numbers of extension personnel available to provide these services and even these agents have limited mobility due to lack of transport. Therefore, it may be necessary to rely on other organizations like the Peace Corps to provide these services.

f. Competition with foreign vegetable products

Foreign vegetables are coming in from Senegal and competing with Mauritanian vegetables in the larger markets (e.g. Nouakchott, Kaedi, Boghe, etc.). Senegalese vegetables seem to have a slight competitive advantage over Mauritanian vegetables because of their higher quality. This competition adversely affects the potential income earnings of Mauritanian farmers.

*For instance, the growth of private gardens in the Rosso region of the river basin makes this area a likely place to promote such business ventures.

Recommendations

1. One way to deal with the problem of vegetables being imported from outside is to establish trade barriers. Unfortunately, this is a complicated solution since many of the Mauritanian farmers have land on both sides of the Senegal River. In addition, should Mauritania substantially increase its output of vegetables, such trade barriers could restrict potential expansion into outside markets.
2. An alternative to the trade barrier option is open competition. To do this effectively, the Government should attempt to improve the infrastructure within Mauritania to facilitate vegetable marketing. This would include: 1) providing better support for research on vegetable varieties and improved cultivation practices; 2) improving access to water in the gardens; 3) supporting interventions which improve transport; 4) promoting extension activities which transfer improved technologies and information on packaging, transport and conservation; and 5) supporting small businesses which specialize in services associated with vegetable marketing.
5. Livestock Constraints
 - a. Access to forage resources

Due to recent drought conditions, natural forage resources are in limited supply, especially during the hot, dry season. This forage deficit is exacerbated by the competition for communal pasture between nomadic herds and the herds of the river basin farmers. The drought has dried up watering points to the north, forcing nomadic herds to remain longer in the southern region along the river. Since the livestock of both groups primarily depend upon extensive grazing, competition for pasture resources has become intense. As a result, there has been a significant reduction of natural pasture along the river.

Compensating Strategies

1. Livestock herders are cutting down the limbs of trees to provide fodder to their animals. Unfortunately, this practice can lead to further environmental degradation.

2. To compensate for fodder shortages, many farmers no longer leave crop residues in their fields for nomadic herds to graze. They are collecting the stocks and straw for their animals to supplement their feeding.
3. Many farmers are gathering crop residues from their fields and selling it in times of scarcity (April through June) to other farmers and nomads in need of fodder for their animals. This fodder can sell for a considerable profit during these periods.
4. Some farmers and nomads will herd their animals to Senegal or Mali to take advantage of distant pasture land.

Recommendations

1. To decrease the pressure on communal pasture resources along the Senegal River, additional watering points can be established in pastoral zones to the north. Such an intervention could expand all grazing area available to nomadic groups, reducing the competition with sedentary herds for limited forage. Care must be taken to insure that the construction of these wells will not promote further environmental deterioration by encouraging nomadic groups to expand their herds. Additional watering points must be introduced with appropriate range management practices.
 2. Farmers should be encouraged to continue to utilize their crop residues as fodder supplements. This is the first step in promoting intensive livestock practices. Research might 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.
 3. Research might focus on the feasibility of incorporating forage crops more directly into the cropping systems followed by farmers. As stated previously, leguminous forage crops which are drought resistant and can also serve as a food crop would be ideal. A 45-day cowpea variety recently introduced in Senegal might be worth testing for this purpose. Adapting these crops to be grown under different water requirements, suitable varieties could be introduced for dieri, walo and irrigated cultivation.
- b. Access to government services
- In the area surveyed, livestock owners receive limited technical advice and services from the Government. For instance, livestock owners receive little extension input and animal health services are lacking.

Recommendation

Farmers and nomadic groups should receive more services and technical help from the Government. If livestock rearing is to become more productive, better managed and sustainable, this input is essential. This is especially true if livestock systems are to be developed which do not lead to further degradation of the environment

c. Other areas of investigation

Recommendations

Five other research topics which focus on livestock could be investigated. These include:

1. Developing ways in which animal productivity could be improved taking current animal potential and breeding conditions into account.
2. Developing a viable plan for the progressive introduction of intensive livestock rearing practices which minimally disrupt existing farming systems.
3. Identifying ways in which livestock can be better integrated with crop production (i.e., animal traction, manure, crop residue as fodder, etc.).
4. Identifying ways in which marketing channels can be better organized to market animal products.
5. Determining the feasibility of producing fodder crops as cash crops.

6. Consumption Constraints

a. Seasonal food shortages

Many villages experience seasonal food shortages, especially during times of drought. The most critical food deficit period occurs during the rainy season (July through September). This is the same period when labor requirements are at a peak. Some villages also experience a second "hungry season" just prior to the harvest of the walo crops (February). The severity of food deficits is compounded by the fact that many villages are seasonally and regionally isolated. Several villages are cut off during the rainy season or they may be great distances from the nearest markets. The lack of reliable transport also poses problems. In addition, many of these villages lack community food reserves or sources of credit to overcome food shortages.

Compensating Strategies

1. Some farmers will plant short maturing varieties of crops to provide a source of food while waiting for the main harvest. For instance, farmers in Fondou are growing a short maturing corn variety that matures in 60 days. They consume this while they are waiting to harvest their sorghum.
2. Some farmers will plant cowpeas before they plant their sorghum in the walo fields to gain access to the crop prior to the sorghum harvest (e.g. Ganki).
3. Some villages have started cooperative boutiques as a way to provide inexpensive access to food and credit during food deficit periods (e.g. Bolo Dogo and N'Gorel). In addition to purchasing agricultural products from farmers to facilitate marketing, these boutiques also purchase grain from other market centers and sell it to farmers at stable prices.
4. Some farm families will supplement their diet with wild foods that are gathered locally. Wild fonio is one type of grain which is gathered for this purpose.
5. Many farmers will sell animals or their material possessions to purchase food. Women in one village acknowledged that they sold their jewelry and cloth to buy food (e.g. Fondou).
6. Some farmers' families will deal with food deficits by cutting down on the number of meals they consume in a day.
7. Some farmers will plant two or three successive crops in their irrigated holdings to increase their access to food supplies.
8. Most farmers will intercrop a number of crops in their walo, falo, dieri and irrigated fields to diversify their production of food crops. This strategy may insure that some food crop output will be retrieved from a given cultivated area.
9. As stated earlier, farmers will pursue a number of activities to obtain income for purchasing food. These include the sale of fodder, charcoal and wood; animal husbandry; working as wage laborers, and fishing. In addition, farmers may migrate on a seasonal basis for wage employment or rely on remittances from relatives who have migrated to help supplement their food production.
10. Many farm families rely on food distribution programs sponsored by the Government or other donors to supplement their food supplies. Unfortunately, these supplies do not appear to be enough to meet their food needs during deficit periods.

Recommendations

1. To make villages less isolated during the rainy season, the infrastructure will have to be improved. All-weather roads would help overcome this problem. The Government should continue its efforts along these lines.
 2. To effectively deal with seasonal food shortages, short-maturing varieties of food crops should be identified and extended to farmers. Such food crops would make food available during critical periods, especially during the rainy season. Examples would be short maturing varieties of millet, sorghum, corn, and cowpeas. For instance, the corn variety grown by farmers in Fondou should be made available to other villages. This research might begin by collecting germ plasms along the river of short cycle crop varieties.
 3. Researchers should develop cropping systems which combine crops in such a way that food gaps are eliminated. This will require combining both long and short cycle crops in the cropping cycle.
 4. Other alternative food sources might be sought, such as the introduction of new crops, or increasing the utilization of food producing wild plants, bushes and trees. For instance, research on fonio might be pursued to develop a food crop which supplements the other domestic grains.
 5. Taking the lead from farmers, seasonal food shortages could be overcome by promoting cooperative boutiques in other villages. These boutiques could act as food banks to store grain and other foods to be used during food deficit periods.
- b. Access to drinking water.

Many villages do not have access to good drinking water. This is especially true for villages located close to the Senegal River. Mud and salt accumulate in the water obtained from wells in such villages.

- Recommendation

Drinking water can be improved in some villages farther away from the river by digging more wells. Well diggers should be trained not to dig wells near toilets or corals. In the villages close to the river where salt and mud are accumulating in the well water, filter systems may have to be introduced.*

c. Access to fresh water fish

In the villages surveyed, many farm families indicated that they were experiencing difficulty in obtaining adequate quantities of fresh water fish.

*Water purification techniques must be initiated which are cheap and easy to manage.

The fish that were being caught were extremely small. As a result, farm families are forced to rely on dried salt water fish.

Recommendation

1. To improve village access to fresh water fish, a number of steps can be taken. First, the marigots and river need to be stocked to increase the quantity of fish available. Second, fishing equipment such as nets can be introduced which allow farmers to catch only the large fish due to the size of the mesh. Third, laws must be established to regulate the exploitation of fish by requiring net sizes to meet certain specifications. Fourth, fish ponds can be introduced to improve access and management. In conjunction with this, temporary lakes such as marigots might be stocked and managed like a fish pond.
2. Aquaculture research programs might be set up at CNRADA to help develop fresh water fishing along the river. Fish ponds could be established at the station to set up breeding programs for fish fingerlings. Farmers could then be provided with fingerlings for stocking marigots and ponds.

d. Access to firewood for cooking

Many villages along the river have limited access to firewood due to inappropriate exploitation patterns. Farm families (especially the women) are spending a considerable amount of time searching for wood supplies. This reliance on the natural vegetation for fuel is promoting further environmental degradation.

Compensating Strategies

1. Some farmers will purchase firewood and charcoal from other farmers to cut down on the time spent on gathering wood.
2. Some farm families are using manure as a fuel source to substitute for charcoal and wood, (e.g. Talhaya).

Recommendations

1. Access to firewood can be improved in two ways. First, villages can plant stands of fast growing trees that can be systematically harvested for fuel use. Proper management will ensure continuous access and natural vegetation will not have to be used. Second, agro-forestry practices would also improve access to firewood. By planting trees in conjunction with crops, trees could be harvested for fuel use.
2. Farm families should be encouraged to use fuel efficient wood burning stoves. This would help cut down on the use of firewood. As stated previously, alternative designs could be tested to determine the most appropriate type for a given region.
3. Farmers should be encouraged to continue to use manure as a substitute for wood or charcoal. In addition, other alternative energy sources might be explored such as solar energy and wind power.

APPENDIX A

FARMING SYSTEMS RESEARCH RECONNAISSANCE TEAM

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APPENDICES

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APPENDIX B

SUMMARY OF RESULTS FOR FARMING SYSTEMS RECONNAISSANCE SURVEY

Variables	WOMPOU	TOULEL	NOUMA	WALI	KOUNDEL REG	TETIANE	DIMVI
I. Village Characteristics							
Size of Village Population Families or Households	3300 360(F)	4000 300(F)	400 80(F)	4000 400(F)	3000 300(F)	1000 168(F)	1050 100(F)
Schools public (P) Koranic (K) private (S)	1(P)	1(P) Bilingual	2(K)	1(P)	1(P) 1(S) 1(K)	1(P) 1(K)	1(P)
Number Classes	4	3	-----	2, 1 without teacher	3(P) 1(S) 2(K)	3(P) 2(K)	2
Health Clinics	1 dispensary not function	1 dispensary 1 PMI 1 midwife	None	1 PMI	Under construction	None/asked for in '84	None
Pharmacy	None	None	None	None	None	None. Go to Djovoi	None
Markets	Permanent 10 shops	Permanent 12 shops	None	2 markets, 30 shops	1 market, 3 boutiques	None 2 shops	None
Government Shops	Préfet P.T.T Police Forestry	Environmental Protection SONADER	None	None	None	None	None
Access to Roads	Only by boat in rainy season	Difficult in rainy season	Difficult	Dry season road	Dry season road	Good year round	Difficult in wet season
Access to Water	9 wells, 8 salty	4 wells, refill slow	2 wells	6 good wells 10 saline	2 wells, river	2, 1 functional	River
Cooperatives	Coop-perimeter	Coop shops coop-perimeter	----	2 coops 2 gardens	2 (1-73 members)	None/they want perimeter	Yes
Milling Operations	2	4 mills, 2 work	None	3-1 good 1 broken 1 just installed	None	None	None
Gov. Project Interventions	SONADER	SONADER	----	SONADER	SONADER	None	None
Other Projects	----	----	----	Peace Corps	Observation post for the project "Lutte Intégrée"	None	None

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL REO</u>	<u>TETIANE</u>	<u>DINDI</u>
II. Demographic Characteristics							
Tribes	Soninke	Soninke	Peul	Halpoular(+) Moors	Fishing village Halpoular Moors	Peul(+) Moors	Poular
Region/District	Guidimaka	Gorgol	Gorgol	Gorgol	Gorgol	Gorgol	Gorgol
Size of Household	7-20	10-17	11-13	5-30	15	12-16	21
No. of Wives	1-5	2-3	1	2	2	1-2	1
No. of Children	4-10	6-9	3-9	1-13	14	6-12	15
No. of Other Household Adults	1-5 (40)	5-6	4	2-4	----	3	5
Education of Farmer	Read & write Arabic	4 yrs.	----	----	none	none	----
Age of Farmer	39	58	----	----	----	66	----
III. Farm							
Characteristics							
No. of Parcels	1	----	----	1-2	Village Farmers		
No. of Walo Fields M. Mauritania (M) Senegal (S)	0-40 ha.	Yes	Yes	1-5 ha.	Yes	3	Share crop 10% Yes
S.	----	Yes	----	----	----		14 parcels Yes
No. of Falo Fields M.	0-3 ha.	Yes	Yes	0.5 ha.	1200 ha.	3	0 Yes
S.	----	Yes	----	----	----		0 - yes ----
No. of Fonde Fields M.	0-2 ha.	Yes	----	No - yes	Yes	2	No Yes
S.	----	Yes	----	----	----		7 parcels ----
No. of Dieri Fields M.	5-40 ha.	Yes	Yes	2-4 ha.	Yes	3	2-3 ha. Yes
S.	----	None	----	----	----		Yes ----
Types of Cultivation	Dieri Falo Fonde Irrigated Perimeter Walo	Pluvia (Dieri, Bas Fonde) Decure (Walo, Falo) Irri- gated Perimeter Walo innudated 1985-1986.	Dieri	Walo Irrigated Perimeter	----		----

IV. Cropping Patterns
Major Crops Grown

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUHDEL REO</u>	<u>TETIANE</u>	<u>DINDI</u>
	Squash	Samé	Millet	Corn	Sorghum	Sorghum	Sorghum
	Corn	Sorghum	Cowpeas	Samé	Millet	Fellah	Cowpeas
	Samé	Cowpeas	Hibiscus	Fellah	Maize	Cowpeas	Millet
	Sorghum	Melon	Melon	Sorghum	Cowpeas	Corn	Maize
	Millet	Corn	Samé	Tomatoes	Calabash	Melon	Sweet Potatoes
	Cowpeas	Rice	Corn (Makka)	Sweet Potatoes	Watermelon	Soua	Tomatoes
	Manioc	Okra	Squash	Calabash	Squash		
	Watermelon	Sweet Potatoes	Peanuts	Cowpeas	Sweet Potatoes		
	Calabash	Calabash	Sweet Potatoes	Vegetables			
	Peanuts	Millet		Niobougou			
	Sweet Potatoes	Peanuts					
	Okra	Squash					
	Melons	Fellah					
	Tejeke	Sorrel					
	Fellah	Njeniko					
	Tomatoes	Hibiscus					
	Nabane	Nabanne					
	Gnindico						

Length of Fallow for Dieri	2-3 years	3	3	----	----	3 years	----
Dieri Last Planted	1982 1985	1985	----	----	1985	1985	----
Dieri Last Harvested	1982 1985	1985	----	----	1981	----	----
Walo Last Planted	1985	1985	----	1985	1975	1986 (Feb.)	----
Walo Last Harvested	1976 1984	1985	----	1984	1976	----	----
Fonde Last Planted	1982	----	----	----	1975	1986 (Feb.)	----
Fonde Last Harvested	1983	----	----	----	1976	----	----
Sequence of Crops for Perimeters	Corn Citrus Cowpeas Okra Tejere Hibiscus Yam Calabash Watermelon Sorrel Corn (Cold) Corn (Wet)	Sorghum Corn	----	Upstream: Corn + Cowpeas Sandier Perimeter: Rainfed Sorghum Corn + Cowpeas	(1) Rice (2) Maize and Cowpeas Sorghum	----	(1) Sorghum Maize or Rice (2) Maize

V. Irrigation Systems

	----		----		----	Perimeter has been requested/ application made to SONADER. The farmers have to remove the trees.	Share the perimeter with Bovel
--	------	--	------	--	------	--	--------------------------------

	<u>WOMPQU</u>	<u>TOUJEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL RED</u>	<u>TETIANE</u>	<u>DINDI</u>
Type of Perimeter	small	small	----	3 small total 72 ha.	small	small	small
Perimeter Area	60-62 ha.	30 ha.; 16 ha.	----	19-27 ha.	25 ha.	30 ha.	15 ha.
Farmer's Cropped Area	0.25-1.5 ha.	.125-.25 ha.	----	.2 - .45 ha.	.44 ha.	----	0.1 ha.
Pump Origin	U. K.	U. K.	----	U. K. (3)	U.K.	----	U.K.
Pump Make/Size	2; Lister, 2 cyl.	2; Lister HR2	----	Lister 2 cyl.	Lister, 2 cyl.	----	----
Maintenance	SONADER	SONADER + local pumpist.	----	SONADER 2 mech.	SONADER	----	SONADER
Operator	Local pumpist	1000 um/month 10240 um/ season	----	3 operators 2 irrigators 2 extension agents	1	----	Pumpist
Availability of Parts	Difficult, but works. Pump is 1 1/2 yrs.	No problems for 2 years Problems with diesel	----	Fairly good	Reasonable, still delays	----	No problem
Canals Lined	Unlined	Unlined	----	Unlined	Unlined	----	unlined
Condition of Canals	Reasonable good weeds	----	----	Fairly good	In very bad condition	----	----
Increase Rainfall: Abandon/ Stay	Abandon if rains come back	----	----	Stay	Abandon	Abandon	----
VI. Rice	----	Not since 1982	----	No longer grow rice	Planted for the first time in 1985 4.8T/ha.	----	----
Water Application Frequency	----	----	----	----	Inundated all the time	----	Every 7 days
No. of Cultivations Varieties	----	----	----	----	1 received from Senegal	----	1
Other Crops in the Field	----	----	----	Sorghum & corn grown instead	None	----	none
Diseases and Pests	----	----	----	----	None seen	----	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NGUMA</u>	<u>WALI</u>	<u>KOUNDEL</u> <u>REO</u>	<u>TETIANE</u>	<u>DINDI</u>
Inputs Used (Fert. Insecticide, etc.)	----	----	----	----	Insecticides	----	----
Amount	----	----	----	----	fertilizer	----	----
Timing	----	----	----	----	2 sacks UREA	----	----
Fencing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	Branches	----	----
					Villagers	----	----
Land Preparation (Mech. or Man.)	----	----	----	----	Manual	----	----
Timing	----	----	----	----	not leveled	----	----
Planting:Time	----	----	----	----	----	----	----
Who	----	----	----	----	Family	----	----
Weeding:Time	----	----	----	----	----	----	----
Who	----	----	----	----	Takes 10 days	----	----
					Farmer	----	----
Harvesting:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	Family	----	----
Threshing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	Family	----	----
Storage Method	----	----	----	----	Sacks	----	----
Milling	----	----	----	----	----	----	----
Marketed/Consumed	----	----	----	Consumed	Sold to pay	----	----
					debt, rest	----	----
					is consumed	----	----
Use of Straw	----	----	----	----	Burned	----	----
VII. IRRIGATED SORGHUM	----	----	----	Plant	0.16 ha.	----	----
				irrigated			
				sorghum-it is			
				planted in the			
				downstream			
				perimeter under			
				rainfed			
				conditions.			
Yields	----	----	----	----	----	----	----
Water Application Frequency	----	Pump not functional (diesel) rainfed + one inundation (because rain was not sufficient.)	----	2-3 times	About 2 times	----	Every 15 days
No. of Cultivations/Year	----	----	----	1	1	----	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL REO</u>	<u>TETIANE</u>	<u>DINDI</u>
Varieties	----	Fellah Nabaane	----	Local variety	Sané	----	Sorghum
Other Crops in the Field	Bananas Cowpeas Hibiscus	----	----	Cowpeas	Cowpeas	----	Okra Hibiscus
Diseases & Pests	Insects	----	----	----	Insects Aphids	----	Aphids (honey) Grasshoppers
Inputs Used (Fert. Insecticides, etc.)	Fertilizer 3 times	----	----	----	None	----	Fertilizer used
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Land Preparation (type)	----	----	----	----	By hand	----	manual
Timing	----	----	----	----	January	----	----
Planting:Timing	----	July	----	----	end of January	----	July
Who	----	----	----	----	Farmer	----	Family
Fencing:Timing	----	----	----	----	Branches	----	Branches
Who	----	----	----	----	Villagers	----	Villagers
Weeding:Timing	----	----	----	----	Once	----	2-3 times
Who	----	----	----	----	Farmer	----	----
Harvesting:Timing	----	November	----	----	----	----	Oct.-Nov.
Who	----	----	----	----	Family	----	Family
Threshing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Storage Method	Traditional storage bins, dried on the panicle	----	----	----	Stored in house	----	On the panicle
Milling	----	----	----	----	----	----	Pounding by hand-women
Marketed/Consumed	Consumed	Consumed	----	----	Consumed	----	Consumed
Use of Straw	----	----	----	----	----	----	----
VIII. IRRIGATED CORN	yes	yes	----	----	NOTE: for 4 years the farmers planted Maize & Cowpeas twice a year	----	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL RED</u>	<u>TETIANI</u>	<u>DINDI</u>
Yield	800-900 2800 kgs/ha 2000- 2500 kg/ha		----	----	300-1200 kg/ha	----	----
Water Application	Every 10- 15 days	----	----	3 - 5 times	----	----	----
Frequency	3 to 15 times	----	----	Every 15 days	----	Every 15 days	----
No. of Cultivations/Year	1-2		----	1	1 or 2	----	
Varieties	Makka Senegal variety	Local varieties introduced varieties	----	Local variety Own seed from last year	----	----	Local variety
Other Crops in the Field	Cabbage Manioc Hibiscus Okra Cowpeas Calabash Sorrel Sweet Potatoes Lettuce Tomatoes	Cowpeas Okra	----	Cowpeas	Cowpeas	----	----
Diseases & Pests	Grasshoppers Insects Termites Monkey Birds	Green Flies	----	Insects	Stalk Borer and other pests termites	----	insects
Inputs Used (Fert., Insecticides etc.)	UREA 100kgs/ parcel 50 kgs/plant 50 kgs at tassle	Goat manure UREA	----	Superphosphate with sand in the seed hole	Fertilizer and insecticide	----	Fertilizer
Amount	100 kgs/ha 2 weeks after planting	18 kgs/parcel	----	25 kgs UREA, knee high	2 sacks UREA	----	----
Timing	45 days later 2nd 100 kgs 3 days after flooding	----	----	after 3 irrig. 25 kgs UREA	----	----	----
Land Preparation	Manual	Rent tractor (700 um/hour)	----	Manual	Manual	----	Manual
Timing	before planting and watering	before seeding					
Who		----	Men	Men	----	Farmer and men	
Planting;Timing	(1) June-	25 Dec-1 Jan	----	----	Jan-Feb	----	Nov.

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL. REO</u>	<u>TETIANE</u>	<u>DINDI</u>
Who	July (2) Nov.-Dec. Family	Wives helped	----	Family	Farmer	----	Family
Fencing:Timing	Wood	Wood around perimeter	----	Around the perimeter	Branches, around the perimeter	----	----
Who	Family/ coop	Cooperative	----	Villagers	Villagers	----	Villagers
Weeding: No. of Times	2-3 times	2 times by hand	----	At least once	1 or 2	----	2-3 times
Who	family	pay labor 100um day + meals	----	Men	Farmer	----	Family
Harvesting:Timing	(1) Oct-Nov (2) Feb-Apr	May	----	----	April-May	----	Oct.-Nov.
Who	Family	Wives helped	----	----	Farmer	----	----
Threshing:Timing	----	----	----	Not threshed	Not threshed	----	----
Who	----	----	----	----	----	----	----
Storage Method	Traditional storage bins on the cob dried first mice in storage	----	----	One the cob	On the cob	----	On the cob
Milling	Pounding & milling	----	----	----	----	----	Women pounding by hand
Marketed/Consumed	Consumed	----	----	Consumed; a little marketed	Consumed	----	Marketed: fresh heads Consumed Stored
Use of Straw	Animals (own, village)	----	----	Animals	Collect and give to animals	----	----
IX. MARKET GARDENS	----	----	No cooperative market garden	2 excellent gardens	No extension, thus poorly attended & diseased (virus)	----	----
Water Source	River, marigot	Marigot	----	River	River	Wells, since 1954	River
Location	Parcel	Side of marigot	----	Near river	Near river	----	Fonde

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL REO</u>	<u>TETIANE</u>	<u>DINDI</u>
Crops Grown	Carrots Cabbage Lettuce Tomatoes Okra	Cabbage Carrots Onions Tomatoes Lettuce	----	Cabbage Onions Potatoes Vegetables	Cabbages Beans Onions Tomatoes	Cabbage Onions Lettuce Tomatoes Turnips	Tomatoes Eggplant Onions
Marketed/Consumed	Consumed	----	----	Both	Both	Both	----
Independent/Cooperative	Cooperative	Cooperative one for men one for women	----	2 cooperatives	Mixed cooperative	Women cooperative	----
X. RECESSION SORGHUM (Walo)							
Area Grown	3 ha.	----	1.9-2 ha.	3-15 ha.	4 ha. (1 of the farmers interviewed had not planted for at least 4 years)	0.5-1 ha.	0.75-1 ha.
No. of Days Flooded	----	----	30 days	1-2 months	----	1-3 months	----
Varieties	Samé	----	Samé	Samé local variety	Samé	3 Samé varieties: M'Boderi=red Sewil=white M'Balieri=black	----
Other Crops in the Field	Cowpeas	----	----	Cowpeas Watermelon	Cowpeas	Cowpeas Watermelon Corn Squash Citrouille	Cowpeas Watermelon
Diseases & Pests	----	----	Insects damaged total crop. Grasshoppers	Crickets Wild pigs Insects	Insects Termites	Grasshoppers Crickets fungus Green Flies	Grasshoppers Aphids
Inputs Used (Fert., Insecticides, etc., soil preparation)	----	----	Manual	----	----	200 gr. fungicide	No fertilizer
Amount	----	----	----	----	----	----	----
Timing	----	----	----	Manual	Manual	Manual	Before planting weeding 1 time
Planting: Timing	----	----	Nov.	Seed packet	November	Seed packets Oct. 3 times	Nov.-Dec.
Who	----	----	Family	Family	Farmer	Family	----
Fencing: Timing	----	----	----	No fencing	----	Wood	----
Who	----	----	----	----	----	Farmer	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUNA</u>	<u>WALI</u>	<u>KOUNDEL REO</u>	<u>TETIAHE</u>	<u>OUNDI</u>
Harvesting: timing	----	----	November	----	----	----	----
Who	Family	----	Family	----	----	----	----
Threshing: timing	----	----	----	----	----	----	----
Who	Family	----	----	----	----	----	----
Milling	----	----	Pounding by women	----	----	----	----
Marketed/Consumed	----	----	Consumed	----	----	----	----
Use of Straw	Consumed or given away for own cattle	----	Animals	----	----	----	----
Storage	----	----	On the panicle	----	----	----	----
XII. FALO CROPPING PATTERNS	Washed away by river water	Yes in Senegal	----	Farmers interviewed had no Falo	----	----	----
Area Grown	0.6 ha-2 ha.	5000m	----	----	0.2-1 ha.	----	1 ha.
Types of Crops	Corn Okra Squash Tomatoes Sweet Potatoes Melon Hibiscus Cowpeas Zucchini Yams Calabash	Corn Sweet Potatoes Calabash Sweet Potatoes	----	----	Upper Part: Maize Lower Part: S. Potatoes Tomatoes All Over: Cowpeas Watermelon	Corn Cowpeas Melon	Sweet Potatoes Calabash Citrouille Cowpeas
Diseases & Pests	Insects Termite Monkey Birds Aphids	Crickets Caterpillar	----	----	None observed	----	----
Inputs Used (Fert. Insecticides etc.)	none	none	----	----	none	----	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Planting: Timing	----	----	----	----	December	----	----
Who	----	----	----	Farmer with boys	----	----	----
Fencing: Timing	Semi-permanent farmer	----	----	----	Upper part and sides (falo)	----	----
Who	----	----	----	----	----	----	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL REO</u>	<u>TETIANE</u>	<u>DINDI</u>
Storage Method	----	----	----	----	----	----	----
Marketed/Consumed	----	----	----	----	----	----	Consumed
Use of Straw	----	----	----	----	----	----	----
XVIII. DIERI CROPPING PATTERNS	----	----	----	----	One farmer interviewed had not planted for 3 years due to lack of rains and labor	This year not cultivated; farmer occupied by other work	----
Area Grown	----	----	1 ha. unlimited	----	1 ha.	2 ha.	2.5 ha.
Crops Grown	Millet Cowpeas Peanuts Melons	Millet Peanuts Cowpeas	Millet Melon Cowpeas Squash	Sorghum Fellah	Millet Watermelons	----	Souna
Varieties	Fellah Nabaane Souna Nougobou Diapogou	Fellah Nabaane	Fellah Dimeri	Fellah	----	Gnindico Fellah Dimeri Souna Local Varieties: Watermelon, Cowpeas	Souna Watermelons (a little)
Diseases & Pests	----	Crickets	Insects Spanish Fly Grasshoppers Birds	Crickets Animals	----	----	Aphids Grasshoppers
Inputs Used (Fert., Insecticides, etc.)	----	----	None	----	None	----	No fertilizer
Land Preparation	----	----	Manual	----	Manual	----	----
Planting: Timing	Millet, before rains	----	July-August	----	Early June	July	July-August
Who	----	----	----	Family	----	----	Family
Fencing: Timing	----	----	----	----	----	----	Branches
Who	----	----	family	----	----	----	----
Weeding: No. Timing	----	----	2-3 times	3-5 times	2 times	----	2-3 times
Who	----	----	Family	Men	----	----	Family
Harvesting: Timing	----	----	November	----	----	----	----
Who	----	----	Family	Family	----	----	Oct.-Nov. Family
Milling	----	----	----	----	Mortar	----	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEI REG</u>	<u>TETIARE</u>	<u>DINDI</u>
Storage Method	Granery at house in sacks; mice & insects a problem.	----	On the panicle	On the panicle	On the panicle	----	On the panicle
Marketed/Consumed	----	---	Consumed	Consumed	Consumed		Consumed
Use of Straw	----	----	----	Left in fields	Left in fields	----	----
XV. BAS FONDE							
Types of Crops	Sorghum Cowpeas	Fellah Nabaane		----	Planted 3 ha. Sorghum(Fellah)	----	----
Wild Animals & Birds	Don't hunt (wild boars, ducks, geese)	None, because of drought	----	none	Boars, Seacows	----	----
WILD FOODS							
Types	Jujube Balanites Paguiri Baobab	Jujube Baobab	Jujube Balanites Paguiri	----	----	Balanites Jujube Water-lilly Guigilé	Balanites
GUM ARABIC							
Availability	Projet Pol Vert planted gum trees but they died because of drought	Drought killed most of them. 5 kilometers away. Soninke do not allow exploitation	None	None	Trees present in the Dieri	Exists in Dieri Almost all dead	none
Economic	----	----	----	----	----	----	----
Utilization	----	----	----	----	----	----	----
TREES FOR FIREWOOD							
Names	Acacia radjana Gandi Barkewi Koyli Ziziphus Palms for house construction	N'dooki Kelle Thiangui	Acacia Balanites N'Dooki Gawdi	Goninker Gawdi	Acacia nilotic Gawdi	N'dioki Goumi Gawdi Kelle Thiangui Mourlode Planted Neem trees bought in Kaédi	Dodie) Guélodi Balanitese Jujube
CITRUS	Planted around houses but died	None	----	None-have set aside 1 ha. for bananas and fruit trees	None (all died)	None-willing to plant	Tree nursery in Senegal

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL REO</u>	<u>TETIANE</u>	<u>DINDI</u>
BANANAS	Exists	None	----	None	None	None-willing to plant	Tree nursery in Senegal
MANGOES	Planted around house but died	None	----	Few, but not producing	None (all died)	----	Tree nursery in Senegal
DATE TREES	Planted	----	----	----	----	----	----
OTHERS	----	----	----	Not producing palm trees	----	----	Tree nursery in Senegal
LIVESTOCK	Farmers	Village Farmers		Farmers Village	Village Farmers	Village founded for livestock breeding	Village Farmers
Goats: No.	Heavy losses 2-15	2	5	0	300 (includes sheep) drought	4	5-6 400 20 100
Diseases	----	----	----	----	----	Pietain	Tiro Thiartou
Feeding Practices	Extensive with herder	----	----	----	Open pastures	Extensive	----
Sheep: No.	1-10	----	3	0-2	2	Village level	10/20 village level
Diseases	----	----	----	drought	----	300 Bade Nedio Pietain Gale	Tiro
Feeding Practices	Extensive with herder	----	----	----	Open pastures	----	----
Cattle: No.	2-10	----	2	0-3	village: 100 0	village level	5/50 village level
Diseases	----	----	----	Drought	----	'66: 2700 '73 3300 '85 260 Latche Tiro Fetcho Safo Daatsu Bade	----
Feeding Practices	----	----	----	----	open pastures	----	----
Donkeys: No.	1-4	----	1	0	0	----	2-5
Diseases	----	----	----	----	----	----	----
Horses: No.	0-1	----	1	0-1	0	----	1
Diseases	----	----	----	----	----	----	----
Birds	----	----	some	----	----	----	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOUNDEL. REO</u>	<u>TETIANE</u>	<u>DINDI</u>
INTERACTION BETWEEN SEDENTARY FARMERS AND NOMADS	Animals on fields (camels) -damage crops -eating the remains on the fields. Nomads coming from the north migrate south to the river. Not that much interaction.	Severe: conflicts camels grazing fields	Serious problems animals who damage fields are detained.. Selling of milk and meat by herders. Use of by-products of yield.	Not much interaction. -Camels are a big problem. Villagers corral the loose animals and fine the owners for the damage done to the crops. -Camels can eat remains on the field. -Conflict on pass-by to water sources.	-A positive interaction between the villagers and the nomads. -Sell fish and grain for money and milk. -A major problem with camels damaging crops. -Authorities refuse the villagers money for corrals for stray animals.	Competition for water. -Sometimes animals (camels, cows) damage crops. -Do get manure and exchange products. -Animals eat remains on the field.	Animals damaging crops.
FISHING	Yes, for own needs (at night)	Fish from lake only for consumption	----	If the level of river up, they fish for own consumption, if obtain more, share	Commercial fishing with both line and nets. Jan to June is the best time. Yields are very low.	No, fishing is not their occupation.	none
OTHER SOURCES OF INCOME	Emigrants send money. Lot of emigration. Retirement pay	Worked for 25 years on boat in France	Selling milk Selling animals	50% of population (all young men) Elderly depend on it.	----	Lots of migration 70% to France, Zambia, Monrovia, Gabon, Central Africa	-pension -25% emigrants -selling of wood in Senegal
Seasonal Migration	----	----	----	----	about 500 persons West Africa France	--	----
Where	Europe West Africa	----	----	France			
Local Off-Farm Employment	Koranic teacher House construction (children work on farm)	----	----	----	None	----	----
Farm Laborer	----	----	----	----	Herders	----	----
Remittances	Substantial	----	----	From emigrants Pension	Some	Little coming back-low education-low jobs, not well-paid	----

	<u>WOMPOU</u>	<u>TOULEL</u>	<u>NOUMA</u>	<u>WALI</u>	<u>KOINDEL REO</u>	<u>TETIARE</u>	<u>DINDI</u>
CREDIT							
Sources	SONADER Local merchant	Borrow food from merchants no interest	----	SONADER Some with merchants	SONADER Some with individuals (All or most trade in CFA. A lot of trade is done with Senegal.)	family	SONADER
ENERGY SOURCES	Wood Charcoal	----	Wood	Wood	Wood	Wood	Wood
AREAS OF RESEARCH							
Elicited from Farmer Constraints	Older people Insufficient labor. Access to good drinking water. Livestock in field. Wild pigs are significant problem. Machinery Protection (animals) Appropriate material for agriculture. Use of fertilizers. Access to water is important problem. Chief declares when to harvest. Termites Nutgrass	Weeds are serious problem in perimeters. SONADER didn't deliver diesel on time. No crop in rainy season.	Conflict among herders and farmers. Limited fields for cultivation. Drinking water.	Weeds in Dieri Iris a major problem. Insects, pests in general. Lack of water. Cost of inputs. Maintenance of machinery. Perimeters not level. Parcels too small. Walo is the most important. If they over- come insects and animals they can really produce. Soil preparation.	Eastern dike breaks each year with the floods. Perimeter plots are levelled. Perimeter is too small. Plots too small to live off. Lack of education. Often suffering from poor health and the sanitary conditions are unsatisfactory. Reduced quantities of fish in the river. Have poor fishing equipment. Villagers are disappointed with previous projects.	Health facility Poor transport. Need better schools. Isolated. Crops need better protection.	Crop protection. Parcels too small, too small outputs. Lack of tools. Lay-out of parcels.
Interventions	Rice, improved varieties Removal of nutgrass	(Peans) to improve the output of the traditional crops.	Unlock village Creation of roads.	----	----	----	Seeds

Recommendations

WOMPOU

TOULEL

NOUMA

WALI

Control of
insects &
pests.
Find good
pump that
is reliable.
Better crop
practices.
Improved
varieties
for all
seasons.
In 1975
tried aerial
spraying-
worked very
well!

KOUNDEL REO

Would like to
see improved
agricultural
techniques.
Improved and
better fishing
equipment and
techniques.
Would like to
see some tree
research and
extension in
this area.
Need to look
into ways of
eradicating
nutgrass.
Control of
aphids.

TETIANE

Want to develop
marigot with a
dam (or dike).
Want perimeter
+ machines.

DINDI

Improved
varieties
Adapted
tools

APPENDIX B

SUMMARY OF RESULTS FOR FARMING SYSTEMS RECONNAISSANCE SURVEY

Variables	GURAYE	GOURDJOUHA	SILLA	DJOVOI	GANKI	LEKSEIBA	TALHAYA
I. Village Characteristics							
Size of Village Population	-----	-----	1042	6000	1000	-----	1000
Families (F) Households (H)	85-110(F)	156(F)	202(F)	1000(F)	300(F)	1400(F)	120(F)
Schools public (P) Koranic (K) Private (S)	1(P)	0	Under construction	0 1(S)	1(P)	1(P)	1(P)
Number Classes	-----	0	-----	2	2	12	3
Health Clinics	1-no personnel	0	0	1	constructed	1	1 dispensary 1 PMI
Pharmacy	None	0	0	Projected	0	1 private	None
Markets	Household shops	0	Permanent	Permanent, regional 20 boutique	Small, 3 boutique	Permanent	Periodic market
Government Shops	None	0	0	Post Office Customs	0	Post office	None
Access to Roads	All year	All year	Dry season road, river access	Dry season road, river access	all weather	Good	Good
Access to Water	2 wells & river	Wells & river	2 wells	7 wells	3 wells, marigot	9 wells	2 wells
Cooperatives perimeter (P) garden (G)	1(P), 1(G)	none	1(G)	A number of coop.	none	1 cooperative	Garden
Milling Operations	0	0	0	2, 1 rice huller	1	3 mills	none
Gov. Project Interventions	SONADER	None	SONADER	SONADER	None	CTA Red Cross	-----
Other Projects	Previously Peace Corps	none	Forage & Seed project Fruit tree project	CRP1-grain storages 2 bin of 40 T. each	Experiments by by Direction d'Agriculture	USAID Maison des jeunes	-----
II. Demographic Characteristics							
Tribes	Fishing village	Halpoular floor	Halpoular	Halpoular floor Soninke	Halpoular floor	Halpoular floor Soninke	Poular
Region/District	Gorgol	Gorgol	Gorgol	Gorgol	Gorgol	Gorgol	Gorgol
Size of Household	7-11	9-20	7	7-11	8-10	-----	9-13

	<u>GUI RAYE</u>	<u>GOUNDIOUMA</u>	<u>SILLA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TALHAYA</u>
No. of Wives	1-4	1-2	1	1	3-4	----	2
No. of Children	2-4	6	5	7-9	4	----	4-5
No. of Other Household Adults	1-3	2-11	----	-----	0-1	----	1
Education of Farmer	---	---	---	---	---	----	none
Age of Farmer	---	---	---	---	---	----	67
III. Farm							
Characteristics	Farmers	Village Farmers	Farmer	Village Farmers	Village Farmers	----	----
No. of Parcels	----	----	----	2-5	----	----	----
No. of Walo Fields M. Mauritania (M)	0-1	yes 4 ha.	3-5 ha.	yes 0.1-5 ha.	yes 0.75 ha.	----	1 ha (borrowed 10%)
Senegal (S)	0-3	no	7 ha.	yes 7 ha.	no no	----	----
No. of Falo Fields M.	0-3	yes (1-0.2 ha.)	1 ha.	yes 1 ha.	yes no	----	----
S.	0-4	no	---	yes -----	no no	----	----
No. of Fonde Fields M.	0-1	no	---	yes 1 ha.	no no	----	----
S.	---	no	---	yes	no no	----	----
No. of Dieri Fields M.	0-1	yes	2-4 ha.	yes 2 ha.	yes 0-5 ha.	----	1/3 ha.
S.	---	no	---	---	no no	----	----
Types of Cultivation	----	----	----	----	----	----	Walo Dieri
IV. Cropping Patterns							
Major Crops Grown	Sorghum Millet Maize (Corn) Cowpeas Sweet Potatoes Melon	Sorghum Maize Millet Cowpeas Melons Tomatoes	Rice Millet Sorghum Cowpeas Maize Watermelon Tomatoes Hibiscus Onions	Rice Sorghum Millet Cowpeas Watermelon Tomatoes Sweet Potatoes Calabash	Millet Sorghum Maize Cowpeas Watermelons Okra Tomatoes Hibiscus Zucchini	Millet Sorghum Melons Corn Cowpeas S. Potatoes Tomatoes Rainfed Sorghum	Millet Sorghum Melons Cowpeas Okra Corn Hibiscus S. Potatoes Tomatoes Fellah Gnindico Sorrel
Length of Fallow for Dieri	3 years	----	2 years	3 years	2-6 years	----	----
Dieri Last Planted	1985	1985	----	----	1985	----	1985
Dieri Last Harvested	1979	----	----	---	1985	----	1985

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TALHAYI</u>
Walo Last Planted	1978	1985	1985	----	1985	----	1986
Walo Last Harvested	1979	----	1985	----	1986	----	1986
Fonde Last Planted	----	----	----	----	not for 20 years	----	----
Fonde Last Harvested	----	----	----	----	----	----	----
Sequence of Crops for Perimeters	(1) Rice or sorghum (Fellah with Cowpeas) (2) Maize and/ or Sorghum with Cowpeas	No perimeter	(1) Rice (2) Corn	(1) Rice or Sorghum (2) Maize with Cowpeas or Sorghum	No perimeter	----	----
V. Irrigation Systems	----	No perimeter	----	4 small perimeters	No perimeter	none	----
Type of Perimeter	Small	----	Small	Small	----	----	----
Perimeter Area	85 ha. 120 parcels	----	58 ha.	90 ha.	----	----	----
Farmer's Cropped Area	(50 ha. planted) 0.5 ha.	----	1/3 ha.	0.34-0.87 ha.	----	----	----
Pump Origin	U. K.	----	U. K.	U. K.	----	----	----
Pump Make/Size	Lister HR 2	----	Lister HR 2	3 Listers HR 2	----	----	----
Maintenance	SONADER	----	SONADER	SONADER	----	----	----
Operator	3	----	----	----	----	----	----
Availability of Parts	From Kaédi, difficult	----	Difficult to obtain	Difficult to obtain. Pumps are down for weeks at a time	----	----	----
Canals Lined	Earthen	----	Unlined	Unlined	----	----	----
Condition of Canals	Fairly good Canal sides planted with calabash	----	Weeds growing in the canal	Some are reasonably good others filled with weeds	----	----	----
Increase Rainfall: Abandon/stay	----	----	----	----	----	----	----
VI. Rice	A few planted	No perimeter	----	----	No perimeter	----	----
Water Application Frequency	Every 15 days	----	Every 12 days	Every 20 days	----	----	----
No. of Cultivations	1 crop	----	2 crops	1 crop	----	----	----

	<u>GUIRAYE</u>	<u>GOUDIONMA</u>	<u>SILIA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TAJIAYA</u>
Varieties	---	---	IR18 1521208 Jaya	IR18	----	----	----
Other Crops in the Field	none	----	none	none	----	----	----
Diseases and Pests	Borer, Grasshoppers and Birds	----	Stemborers Birds	Birds	----	----	----
Inputs Used (Fert. Insecticide, etc.)	UREA	----	Fertilizer no pesticides but have sprayer	Fertilizers-UREA and Phosphate. Fenitrothion	----	----	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	UREA-15 days after transplanting	----	----	----
Fencing:Timing	Permanent, partly fenced	----	----	Branches	----	----	----
Who	Villagers	----	----	Villagers	----	----	----
Land Preparation (Mech. or Man.)	Manual	----	Tractor	Manual	----	----	----
Timing	----	----	----	June	----	----	----
Planting:Time	----	----	mid-July	mid-August	----	----	----
Who	Family	----	Family	Family	----	----	----
Weeding:Time	----	----	1 month after transplanting	4-5 times	----	----	----
Who	----	----	Family	Family	----	----	----
Harvesting:Timing	----	----	November	mid-December	----	----	----
Who	Family	----	Family	Family	----	----	----
Threshing:Timing	----	----	After harvesting	mid-December	----	----	----
Who	----	----	Family	Family	----	----	----
Storage Method	Sacks in house	----	Sacks in stores	Sacks in house	----	----	----
Hilling	By hand	----	By hand	Hulling	----	----	----
Marketed/Consumed	Consumed	----	Consumed	SONADER & consumed	----	----	----
Use of Straw	Left in the field	----	----	Animals	----	----	----
VII. IRRIGATED SORGHUM	----	No perimeter	----	----	No perimeter	----	----

	<u>GUIRAYE</u>	<u>GOUADIOUMA</u>	<u>SILIA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TAJIAYA</u>
Water Application Frequency	2 to 3 hours about 15-30 days	----	----	2-3 times	----	----	----
No. of Cultivations/Year	1 to 2	----	----	some do 2	----	----	----
Varieties	Fellah	----	----	Fellah	----	----	----
Other Crops in the Field	Cowpeas Okra	----	----	Cowpeas Melons Okra Sweet Potatoes Squash Hibiscus	----	----	----
Diseases & Pests	Smut, Grasshoppers, Birds & Animals	----	Borers	Stemborers, Grasshoppers, Birds	----	----	----
Inputs Used (Fert. Insecticides, etc.)	fertilizer: UREA and phosphate	----	UREA	----	----	----	----
Amount	30 kgs/plot. 7.5 kgs/plot	----	200 kg/ha.	----	----	----	----
Timing	----	----	----	----	----	----	----
Land Preparation (type)	Manual	----	Tractor	Manual	----	----	----
Timing	----	----	----	July	----	----	----
Planting:Timing	----	----	First week in July	July. Cut in October for regenerated	----	----	----
Who	Family	----	----	----	----	----	----
Fencing:Timing	Permanent	----	----	Made with branches	----	----	----
Who	Village	----	----	Villagers	----	----	----
Weeding:Timing	Once or twice	----	All at one time	By hand	----	----	----
Who	Family	----	Family	Family	----	----	----
Harvesting:Timing	----	----	----	October & April	----	----	----
Who	Family	----	Family	Family	----	----	----
Threshing:Timing	----	----	----	----	----	----	----
Who	Family	Family	----	----	----	----	----
Storage Method	----	----	----	Stored on the panicle	----	----	----
Milling	Mortar	----	----	Mortar	----	----	----

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>DJOVOI.</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TAIHAYA</u>
Marketed/Consumed	3/4 to all consumed	----	Consumed	Some consumed, some sold to pay debt	----	----	----
Use of Straw	0 to 1/4 sold Collected for animals or left in the field	----	Forage	Some kept for forage, others sold	----	----	----
VIII. IRRIGATED CORN	Dry season crop	----	----		----	----	----
Water Application	5 to 7 times	----	----	4 - 5 times	----	----	----
Frequency	Every 15 days	----	Every 15 days	Between 14-20 days	----	----	----
No. of Cultivations/Year	1	----	1	1	----	----	----
Varieties	Not known	----	Not known	Not known	----	----	----
Other Crops in the Field	Cowpeas Hibiscus	----	----	Cowpeas Sweet Potatoes	----	----	----
Diseases & Pests	Borer Grasshoppers	----	Borers	Insects, especially stalk borers	----	----	----
Inputs Used (Fert., Insecticides etc.)	Fertilizer	----	UREA	Fertilizer, Phosphate UREA	----	----	----
Amount	0-30 kg/plot	----	200 kg/ha.	----	----	----	----
Timing	----	----	----	----	----	----	----
Land Preparation	Manual	----	Tractor & plow	Manual	----	----	----
Timing	----	----	----	just before planting	----	----	----
Who	Men	----	----	Farmer	----	----	----
Planting:Timing	30 days	----	mid-January	Dry, cold season	----	----	----
Who	Family	----	Family	Family	----	----	----
Fencing:Timing	Permanent	----	Branches	Branches	----	----	----
Who	Village	----	----	Villagers	----	----	----
Weeding: No. of Times	1-4 times	----	----	3 to 4 times	----	----	----
Who	Men or family	----	By hand: family	Family	----	----	----
Harvesting:Timing	----	----	----	Mature, determined by family needs	----	----	dry crop 4 mos wet crop 3 mos
Who	Family	----	----	Family	----	----	----

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LERSEIBA</u>	<u>TAIHAYA</u>
Threshing: Timing							
Who	Manual women or family	----	----	----	----	----	----
Storage Method	On the cob, in house	----	----	One the cob, in house	----	----	----
Milling	----	----	Morter	----	----	----	----
Marketed/Consumed	None or 1/4 sold	----	Consumed	Consumed	----	----	----
Use of Straw	Either left in the field or collected for the animals	----	----	Forage	----	----	----
IX. MARKET GARDENS	----	----	----	3 major gardens and many individual gardens	----	----	1 cooperative Each quarter has a garden Each household has a garden
Water Source	River	Well	River (by hand)	River	Well	Wells	----
Location	River side	Concession	Near village	River	Near village	----	Walo
Crops Grown	Cabbage Lettuce Tomatoes Eggplant Onions	Tomatoes Carrots Onions Lettuce Potatoes Eggplant Peppers Mint	----	Cabbage Tomatoes Lettuce plus others	Potatoes Onions Tomatoes Lettuce Cabbage Eggplant	There are several gardens shared by several families. There are also several larger private gardens.	Tomatoes Cabbage Potatoes
Marketed/Consumed	Consumed	Consumed: 90% Marketed: 10%	----	Consumed and marketed	Consumed	----	Consumed
Independent/Cooperative	Women's cooperative	----	----	3 cooperatives & numerous independents	Women's cooperative	----	Cooperative
X. RECESSION SORGHUM (Walo)							
Area Grown	0-2 ha.	1.5-4.2 ha.	12 plots	1.25 ha.	1-1.7 ha.	----	1 ha.
No. of Days Flooded	About 4 months	45-60 days	----	----	1-2 months	----	----
Varieties	Samé	----	Fellah Sewil White Samé Red Samé P'ourdi	Samé Sewil	White Sorghum (Sewil) Red Sorghum	----	Sorghum Cowpeas

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TAIJIAYA</u>
Other Crops in the Field	Melons Cowpeas	Cowpeas Melons	Cowpeas Watermelon Hibiscus	Cowpeas	Watermelon Squash Cowpeas	----	Tomatoes Potatoes Cabbage
Diseases & Pests	Smut Dioumane Grasshoppers Birds	Smut Aphids Termites Crickets	Birds	----	Borer Smut Birds Aphids	----	Grasshoppers
Inputs Used (Fert., Insecticides, etc., soil preparation)	Powder in seed	None	None	----	Seed treatment	----	Manual
Amount	Small	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Planting:Timing	----	mid-November	----	mid-November	September	----	----
Who	Family	Family	----	Family	Family	----	----
Fencing:Timing	----	Wood. In some places none.	----	None	None	----	Manual, wood
Who	----	Family	----	----	----	----	Men
Weeding: No. of Times	----	----	----	Once	Once	----	----
Timing	----	Before soil dries	----	Before soil dries	Men & boys	----	----
Who	Family	Family	----	Family	----	----	----
Harvesting:Timing	----	late February	----	mid-May	March	----	----
Who	Family	Family	----	Family	Family	----	----
Threshing:Timing	----	----	----	----	----	----	----
Who	----	Family	----	----	----	----	----
Storage Method	Sack in house	Grain storage	----	----	In a room on the head	----	Traditional bins, on the panicle
Milling	Mortar	----	Mortar	----	----	----	handmilling
Marketed/Consumed	Consumed	Consumed	Consumed	----	Consumed	----	Consumed
Use of Straw	Animals	Forage	Forage	----	Left in the field, some collected as forage	----	----
XI. RECESSION CORN (Walo)	FARMERS INTERVIEWED DID NOT GROW						
XII. FALLOW CROPPING PATTERNS							
Area Grown	0.3-5 ha.	0-0.2 ha.	0.25-0.5 ha.	0.5 ha.	0-0.6 ha.	----	yes

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TAJIAYA</u>
Types of Crops	Maize Melon Tomatoes Sweet Potatoes Cucurbitacea	Maize Cowpeas Tomatoes Melons	Maize Cowpeas Tomatoes Sweet Potatoes Eggplant Lettuce Turnips Onions	Maize Melon Cowpeas Tomatoes Sweet Potatoes Okra	Maize (Maka) Cowpeas Sorrel Sweet Potatoes Tomatoes Squash	----	Corn Cowpeas Sweet Potatoes Tomatoes
Diseases & Pests	Borer Grasshopper Birds Monkeys	Aphids	Grasshoppers Ladybugs Birds	Birds (Pelicans)	Insects	----	----
Inputs Used (Fert. Insecticides etc.)	----	none	none	none	none	----	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Planting:Timing	----	late November	October (continuous)	mid-October	November	----	----
Who	----	Family	3 adults	Family	Family	----	----
Fenceing:Timing	----	None	Yes, difficult to obtain wood	----	----	----	----
Who	----	----	Men, after recession	----	----	----	----
Weeding: No.	----	Once	----	----	----	----	----
Timing	----	While soil is damp	----	----	----	----	----
Who	----	Family	Farmer	----	Farmer	----	----
Harvest:Timing	----	----	----	January	April	----	----
Who	----	Family	Extended family	Family	Family	----	----
Threshing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Storage	Loose in house	In house	----	----	Store in rooms or in traditional storage bins	----	----
Milling	----	----	By hand	----	----	----	----
Marketed/Consumed	Consumed & sold on the cob	Consumed	Consumed & sold	Consumed & sold	Consumed	----	----
Use of Straw	----	Forage	Forage	----	Forage	----	----

	<u>GUIRAYE</u>	<u>GOODIOUMA</u>	<u>SILLA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TALJIAYA</u>
XIII. FONDE CROPPING PATTERNS							
Area Grown	Farmers interviewed did not grow	Farmers interviewed did not grow	Farmers interviewed did not grow	1.5 ha.	Farmers interviewed did not grow	----	----
Types of Crops	----	----	----	Sorghum Cowpeas Melons	----	----	Corn Fellah Sorghum
Diseases & Pests	----	----	----	----	----	----	----
Inputs Used (Fert., Insecticides etc.)	----	----	----	----	----	----	----
Planting:Timing	----	----	----	Low areas same Walo. The upper area during rainy season.	----	----	----
Who	----	----	----	Family	----	----	----
Fencing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Weeding: No.	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Harvesting:	----	----	----	Different times	----	----	----
Timing	----	----	----	Low area same as Walo. High areas 3 months maturity.	----	----	----
Who	----	----	----	Family	----	----	----
Storage Method	----	----	----	----	----	----	----
Marketed/Consumed	----	----	----	Consumed	----	----	----
Use of Straw	----	----	----	Forage	----	----	----
XIII. DIERI CROPPING PATTERNS							
Area Grown	Farmers interviewed did not grow	No harvest in 1985 due to inadequate rain	2 ha.	2.25 ha.	0.5-3 ha.	7 ha.	3 ha.
Crops Grown	----	----	----	----	----	----	Millet Fellah Melons Cowpeas Okra
Millet & Sorghum	----	Millet	Millet/ Sorghum	Millet	Millet/ Sorghum	Fella Souma	Fellah Ndémari

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>LIJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TALHAYA</u>
Varieties	----	Not known Meion Cowpeas	Souna Fellah Watermelon Cowpeas	Cowpeas Melons	Fellah Okra Cowpeas Sorrel Hibiscus Watermelons	----	----
Diseases & Pests	----	----	Fungus Borers	Birds	Grasshoppers Birds Animals	----	----
Inputs Used (Fert., Insecticides, etc.)	----	none	none	----	none	----	----
Land Preparation	----	----	Manual	----	Manual	----	----
Planting:Timing	----	----	----	mid-July	July	----	July, before rains
Who	----	----	----	Family	Family	----	----
Fencing:Timing	----	----	None	----	None or branches	----	----
Who	----	----	----	----	Family	----	----
Weeding: No.	----	----	----	----	Twice minimum	----	3 times
Timing	----	----	----	----	----	----	----
Who	----	----	Farmer	----	Farmer, men and boys	----	family
Harvesting:	----	----	----	----	----	----	November 120 bgs.
Timing	----	----	----	end of Sept.	----	----	----
Who	----	----	Family	Family	Family	----	----
Milling	----	----	----	----	----	----	----
Storage Method	----	----	In grain bins	----	Stored in bins	----	----
Marketed/Consumed	----	----	Consumed	----	Consumed	----	consumed
Use of Straw	----	----	----	Left in field	Either left in in the field or forage	----	----
XV. BAS FONDE	Farmers interviewed did not plant	Farmers interviewed did not plant	Sorghum Samé Cowpeas	Farmers interviewed did not plant	Farmers interviewed did not cultivate	----	----
Wild Animals & Birds	None	----	----	None	Gazelles Guinea Fowl	----	----

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>DIJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TALHAZA</u>
WILD FOODS							
Types	Jujube Nivobolau	----	----	Jujube Nirobolan Balanites	Jujube Boscia Fruit Gather wild fruits	----	Jujube Djabi Mourtodé Gouboule Guidjilé Paguiri Poxlé Tiapato Goudi Oulo Dahiri Nieko
GUM ARABIC							
Availability	Some in the area	----	----	Some in the area	Lost 70% of the trees	----	used to work it; now forest protected
Economic	Not exploited	----	----	Exploited by Moors	Exploited by Moors	----	----
Utilization	----		----	----	sold in Kaédi (1 tree gives 500gm of gum)	----	----
TREES FOR FIREWOOD							
Names	Gawdi Goumi Guloki Koyli Diadambuni	N'Doki Thiangui Kelli	----	(Tree authority found in the village) Gawdi Kelli	N'Doki Kelli Thiangui Gawdi Goumi Barkewi Boulby	----	Kelli Goudi Kilohe/Kilewe Tiange N'djellabani
CITRUS	few	none	----	Conventional orchard near one of the perimeters.	None There is severe termites problem in the area. Termites destroyed the trees. Had an orchard.	----	----
BANANAS	none	none	----	----	none	----	----
MANGOES	none	none	----	a number of trees Guayana	none	----	----

	<u>GUIRAYE</u>	<u>GOUDIOUMA</u>	<u>SILLA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TALHAYA</u>			
LIVESTOCK	Farmers	Village Farmers		Farmers	Village Farmers		Village Farmers			
Goats: No.	0 - 9	200	5	----	5 - 15	30	0-15	----	31	5
Diseases	----	Tiro		----	----	Tiro		----	----	
Feeding	----	Free grazing		----	Free pastures	Kourel		----	----	
Practices	----	----		----	----	Extensive, free grazing		----	----	
Sheep: No.	a few	100	3	----	----	20	0-7	----	----	
Diseases	----	Tiro		----	----	Tiro		----	----	
Feeding	----	Free grazing		----	Free pasture	Kourel		----	----	
Practices	----	----		----	some forage	Extensive, free grazing		----	----	
Cattle: No.	0	60	1	----	0 - 3	24	0-2	----	----	
Diseases	----	Dioffé		----	----	Dioffé		----	----	
Feeding	----	N'Daaso		----	Free pasture			----	----	
Practices	----	Free grazing		----	and forage	Extensive, free grazing		----	----	
Donkeys: No.	a few	25	2	----	0 -2	10	0	----	----	
Diseases	----	----		----	----	----		----	----	
Horses: No.	0	----	0	----	1	1	0	----	----	
Diseases	----	----		----	----	----		----	----	
Birds	----	----		----	----	----		----	----	
INTERACTION BETWEEN SEDENTARY FARMERS AND NOMADS	Extensive crop damage done by camels, especially in the perimeter.	Villagers buy goats and sheep from Nomads, but sell nothing.		Allow animals to graze after the harvest. Have little interaction otherwise. Animals are destroying crops.	Fairly positive interaction. Water available for all. The major problem is unherded animals destroying crops.	Considerable competition for the available pastures. Nomadic herds use the village wells. The nomadic herds do extensive damage to crops especially in the Dieri.	----	Complementary: grazing exchange Competition: field and garden damage		
FISHING	Used to do a lot of fishing	None		----	Fishing important source of income	Very little fishing. Fish in the Gorgol when it is filled.	----	Sometimes in black Gorgol They buy dried fish.		
OTHER SOURCES OF INCOME	----	One farmer interviewed previously worked as a driver		----	----	Pensions Farmer spends part of year in Senegal as a paper vendor (3-8 mos.)	----	Children herd animals, bring in 600 um/month Bricklayer, selling bricks		

	<u>GUIRAYE</u>	<u>GOUIDIUMA</u>	<u>SILIA</u>	<u>DJOVOL</u>	<u>GANKI</u>	<u>LEKSEIBA</u>	<u>TAJJIAYA</u>
Seasonal Migration	A few	A few	----	Jan. to June	50% are emigrants	----	
Where	Senegal	----	----	Nouakchott Nouadhibou	many in Senegal and West Africa		Nouakchott, France, Kaédi
Local Off-Farm Employment	Fishing	Exploit forest resources	Employment in Kaédi	Builders, tailors, merchants, blacksmiths, fishing	none	----	----
Farm Laborer	Some	----	----	----	Some	----	----
Remittances	Very little	----	----	Some	Some	----	600 um/month
CREDIT							
Source:	SONADER (materials) Within the family	----	SONADER	SONADER Merchants and family	None	----	No association. Family. Merchants in Lekseiba, Kaédi Some people sell wood: 200 um/wagon
ENERGY SOURCES							
	Wood	Wood	Wood	Charcoal and wood. Charcoal production speciality of Noors	Wood	----	Wood Charcoal Manure
AREAS OF RESEARCH							
Elicited from Farmer Constraints	Loose a lot of grain in storage due to rats, mice and termites. Lack of water a serious problem. Perimeter plots are not leveled. Nut grass starting to invade. Inadequate fencing, no materials for it.	----	Distances between the Walo and the Dieri. Have a labor problem. Animals have done extensive crop damage. Perimeter not leveled. Too much time between access to water. Unable or difficult to obtain materials for fencing the perimeter.	Lack sufficient and adequate tools. Labor efficiency low. Lack adequate fences to keep out animals. Pumps break down often and take time to repair. Limitation in the area that can be cultivated. Insect problems: grasshoppers at the end of the rainy season.	Sandstorm destroyed the cowpeas. Insufficient or no fencing. Dam or water control has reduced floods. Birds are a serious problem. Animals destroy the crops. Younger men have emigrated.	Foum Gleita dam is creating water problems. SONADER. Camels. Lack of rain water. Lack of flood water. Inappropriate release of water in Falo. (They planted-water washed crops away).	Want machinery to help cultivate. Dam at Foum Gleita hurt cropping. Access to water. Lack of control over water.

GUIRAYE

GOUDIOUMA

SILLA

DJOVOL

GANKI

LEKSEIBA

TAIJIAYA

gardens.
Unavailability
of parts for
the water pump.
Have no
fertilizer.

the sorghum.
Weeds are a
problem
(nutgrass).
3 years in a row
grasshoppers have
destroyed the
Walo crop.
Lack inputs such
as fertilizers,
insecticides,
seeds (vegetable).
Lack pump for some
of the vegetable
gardens.

Interventions

Improved rice -----
varieties.
Better crop
protection in
sorghum and
millet.
Better seed
treatment
program.
Effective
insecticides
and protection
from insects.
Animal traction
(cheaper) or
motorized
equipment
(which is
quicker) to
improve labor
efficiency.

Require a good
well-planned
perimeter.
Have existing
pumps fixed.
Plant trees
near the
village.

Effective
insecticides,
herbicides
Labor efficient
crop practices.

Higher yielding
varieties for
the Dieri and
Walo.
Improve the labor
efficiency through
appropriate
animal power and
machinery.
Design appropriate
cultivation
equipment for the
Dieri and Walo.
Would like to
grow peanuts.
Would like to see
some water
harvesting and
management.

Complete study
of the
situation.

Better seeds.
Want to grow
more sorghum.
Animals who
give more milk.
Appropriate
vegetables.

SUMMARY OF RESULTS FOR FARMING SYSTEMS RECONNAISSANCE SURVEY

Variables	BOVEL	MAGHAMA	GOUREL DIERI	PALIBA	TOUFDE SIVE	SIVE	M'BAGNE
I. Village Characteristics							
Size of Village Population Families (F) or Households (H)	120 37(F)	---- 1035(F)	1042 200(F)	1000 56(H)	1750 350(F)	1000 300(F)	3000 524(H)
Schools :public (P) Koranic (K) college (C)	1(P)	4 2 (C)	1 Bilingual	None	1 Bilingual	1(P) 1(K)	1(P) 1(S) 1(C)
Number Classes	2	6	1	----	3	3	8(P) 1(S) 5(C)
Health Clinics	None	1 dispensary PMI	1 dispensary PMI (CARITAS)	PMI	1 dispensary No medical person PMI Midwife	1 dispensary 1 CAC	1 (PMI, CAC)
Pharmacy	None	1 private	1 CARITAS	None	None	None	1
Markets	None	Permanent	None	None	6 shops the market located in the village	Periodic 1 day	1 permanent 19 boutiques
Government Shops	None	Post Office Police Office	none	none	PIT Customs Police	----	Police CSA, etc.
Access to Roads	All season	Difficult in rainy season	Good year round	Dry season	Difficult wet season (river)	Difficult wet season	Dry season road
Access to Water	River (2 km)	Wells	2 wells (CARITAS)	1 well, marigot	3 wells, river	River no wells	21 wells (20 private)
Cooperatives	1 (total members 44)	----	1 for irrigation perimeter	1	Coop irrigation perimeter	----	4 plus 1 garden
Milling Operations	None	----	No	None	1 mill	None	3 private
Gov. Project Interventions	SONADER	----	None	None	----	None	Project "Pols Verts"
Other Projects	None	----	CARITAS	CARITAS	----	1 Peace Corps volunteer	None

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'DAGNE</u>
IV. Cropping Patterns	-----	Dieri Walo Falo Vegetable garden	Decrue (Walo, Falo) Pluvial (Dieri, Bas Fonde) Irrigated perimeter	-----	Irrigated perimeter Vegetable gardens	Walo Irrigated perimeter	-----
Major Crops Grown	Sorghum Cowpeas Millet Maize Sweet Potatoes Tomatoes Calabash	Sorghum Cowpeas Corn Calabash Tomatoes Melons Sweet Potatoes Millet Hibiscus Okra Peanuts Watermelon Diappal Boy olé	Samé Cowpeas Melons Sweet Potatoes Calabash Cucumber Fella Souna Watermelon Peanuts Okra Hibiscus Corn Squash Tomatoes Niobougou Dabiri Sorrel	Rice Fellah Sorghum Niobougou Corn N'demiri Cowpeas Samé Sweet Potatoes Calabash Boudi Pumpkin Millet Tomatoes Dene	Rice Guidinico Fella Niobougou Watermelon Cowpeas Corn Other Sorghum Hibiscus Cabbage Lettuce Onion	Samé Cowpeas Corn Sweet Potatoes Calabash Watermelon Rice Tomatoes Pumpkin	Sorghum Maize Cowpeas Millet Sweet Potatoes Calabash Watermelon
Length of Fallow for Dieri	3 years	3 years	2-3 years	none (since 1973)	-----	1-2 years	2-3 years
Dieri Last Planted	1985	1985	1985	1985	-----	-----	1985
Dieri Last Harvested	1985	1985	1985	1985 (roor)	-----	-----	-----
Walo Last Planted	1985	1985	-----	1985	-----	1985	-----
Walo Last Harvested	1986	Crop lost	-----	Crop lost	-----	1985	very little
Fonde Last Planted	not for a long time	-----	1985	none	1985	1985	-----
Fonde Last Harvested	Not for a long time	-----	1985	-----	1985	1985	-----
Sequence of Crops for Perimeters	(1) Maize or Sorghum (2) Maize	-----	Rice (wet season) Corn (dry/ cold season)	Upstream: (1) Corn + Cowpeas Downstream: (1) Rainfed Sorghum (2) Corn + Cowpeas	Rice Corn-Sorghum	Irrigated rice in wet season Sorghum in Fall No dry season Corn Rice	No perimeter

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PLAIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
V. Irrigation Systems	Share the perimeter with Dindi	Watering can	----	68 members	----	----	No perimeter only a garden
Type of Perimeter	Small	----	Small	Small	Small	Small	----
Perimeter Area	25 ha.	----	23 ha.	22 ha.	29 ha: 22 ha. men 7 ha. women	75 ha.	----
Farmer's Cropped Area	0.24-0.27	----	0.23-0.24 ha. 3 parcels	1/3 -1/2 ha.	.25-.50 ha rice 10x20 m vegetable	0.7-0.8 ha.	----
Pump Origin	U. K. 7 yrs. old	----	U. K.	U. K.	2 pumps	U. K.	Garden pump
Pump Make/Size	Lister HR2 2 cyl.	----	Lister HR 2	Lister HR 2 2 cylinder	----	R.V. Lister	2 cyl.
Maintenance	SONADER	----	CARITAS	CARITAS	CARITAS	SONADER	Independent
Operator	1 Villager	----	Villager paid by village: 11,520 um corn 4800 um. rice	2 Villagers well trained	Local villager 7 um/parcel/ month	Villager	1 Villager
Availability of Parts	Pumps were down for more than 1 year	----	No problem	No problems	----	No problem	
Canals Lined	Unlined	----	Unlined	Unlined	Unlined	Unlined	----
Condition of Canals	----	----	----	Reasonable NOTE: Last year they lost crop to animals thus they could not pay debts	----	Very poor	They have requested a perimeter
Rainfall Increases: Abandon/Stay	Abandon	----	----	----	----	----	----
VI. Rice	Farmers interviewed did not grow	----	----	----	----	----	No perimeter
Water Application Frequency	----	----	----	Every 11-15 days (barn irrigated)	Every 10-15 days	Every 8-15 days	

	<u>DOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERT</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
No. of Cultivations	----	----	1	1	1; broadcasting	2	----
Varieties	----	----	TN1 (120 days)	Seed from CARITAS (Caroline)	CARITAS provided vareity	TN1 from Senegal Jaya	----
Other Crops in the Field	----	----	----	Corn Fellah	Cucumber Hibiscus Okra	Eggplant Onions Carrots Lettuce Turnip Sweet Potatoes Pimento	----
Diseases and Pests	----	----	Grasshoppers Cows No diseases	Last year Camels destroyed crops and some of it this year Stemborers Insects Grasshoppers	Insects Stemborers Termites	Crickets Birds	----
Inputs Used (Fert. Insecticide, etc.)	----	----	UREA + phosphate	Phosphate: 50 kgs/ha. UREA	Insecticide powder around edge of field 3 times fertilizer 8 days after transplantating UREA	UREA with seeding Phosphate 10 days after transplant	----
Amount	----	----	(75 kg) (25 ha.)	----	200 kilo/ha.	50 k each parcel UREA Phosphate	----
Timing	----	----	----	After irrigation	----	----	----
Fencing:Timing Who	----	----	Wood Villagers Cooperative	Not good Villagers Cooperative	Wood Cooperative	Individual Farmer	----
Land Preparation (Mech. or Man.)	----	----	----	Manual (men)	Manual, leveling by family July	Manual	----
Timing	----	----	July	----	July	----	----
Planting:Time Who	----	----	Transplanting	Transplanting Family	July-Sept. transplanting Family	Transplanting June Family	----

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PLATTA</u>	<u>TORFDE SIVE</u>	<u>SIVE</u>	<u>M'DAGNE</u>
Weeding:Time	----	----	Manual, 3 times	Manual	2-3 times	Before seeding, 3 times	----
Who	----	----	Farmer	----	Farmer, family	Family	----
Harvesting:Timing	----	----	10 sacks 2 tons/ha November	Manual sickle	Nov.-Dec.	Takes 10-15 days	----
Who	----	----	Family	Family	Family	Family	----
Threshing:Timing	----	----	After drying	----	----	In field during harvest	----
Who	----	----	Family	----	In field by hand	----	----
Storage Method	----	----	In sacks	Traditional bins, in sacks	Paddy	Traditional bins dried out	----
Milling	----	----	No	----	----	----	----
Marketed/Consumed	----	----	CSA bought for 14 um/kilo	Taken by CARITAS to pay debt; they used to consume rice harvest	Consumed small part sold	10% sold 90% consumed	----
Use of Straw	----	----	----	----	----	----	----
VII. IRRIGATED SORGHUM	----	----	----	----	3 plots of vegetable gardens	----	No perimeter
Yields	----	----	----	----	----	----	----
Water Application Frequency	1-3 times	----	----	----	2-5 times 1 season	Every 15 days	----
No. of Cultivations/Year	1	----	----	1	----	1	----
Varieties	----	----	----	----	Local variety	Fellah Local variety	----
Other Crops in the Field	Cowpeas Okra Watermelon Hibiscus	----	----	Corn Cowpeas	Hibiscus Cowpeas Okra Calabash Cucumbers Pumpkin	None	----

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGHE</u>
Diseases & Pests	Aphids Grasshoppers	----	----	Insects Grasshoppers	Insects	Wild Pigs Insects M'batou (in stalk) Birds Crickets	----
Inputs Used (Fert. insecticides, etc.)	UREA fertilizer (10-10-20)	----	----		3 applications: 1 basal 1 UREA	No fertilizer Agricultural Direction sprayed for crickets. Good results	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Land Preparation (type)	Manual	----	----	----	Hand leveling by family	Manual	----
Timing	----	----	----	----	----	----	----
Planting:Timing	June-July	----	----	January: seed packet Family	July	July; seed packets Family	----
Who	Family	----	----	----	----	----	----
Fencing:Timing	Branches	----	----	----	----	Cooperative	----
Who	Villagers	----	----	----	----	Villagers	----
Weeding:Timing	About 2 times	----	----	----	2 times	2 times	----
Who	Farmer	----	----	----	Family	Family	----
Harvesting:Timing	Oct.-Nov.	----	----	----	400 kilo/ 1/4 ha. 1.33 ton/ha	20 November	----
Who	Family	----	----	----	----	Family	----
Threshing:Timing	----	----	----	----	----	No	----
Who	----	----	----	----	----	----	----
Storage Method	----	----	----	----	----	On the panicle Traditional bins	----
Milling	Mortar	----	----	----	----	By hand	----
Marketed/Consumed	consumed, some sold	----	----	----	----	Both-little is sold	----
Use of Straw	Collected for the animals	----	----	----	----	----	----
VIII. IRRIGATED CORN	Farmers prefer to grow Maize twice a year.	None this year	----	----	Yes	----	No perimeter

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL</u> <u>D. TRI</u>	<u>PALIRA</u>	<u>TOUFIE</u> <u>SIVE</u>	<u>SIVE</u>	<u>M'BAMBE</u>
Yield	1200 kg/ha.	----	----	----	----	----	----
Water Application	5 irrigations	----	----	5 times	4-5 times	----	----
Frequency	----	----	----	Every 15 days	4-5 times	----	----
No. of Cultivations/Year	1 or 2 (if possible)	----	----	1	1	----	----
Varieties	Seed from Senegal	----	----	Seed saved; local variety	Local corn	----	----
Other Crops in the Field	----	----	----	Cowpeas	Hibiscus Sweet Potatoes Cowpeas (mixed with corn)	----	----
Diseases & Pests	Crickets (a serious problem) Termites	----	----	Some damage	Insects eating stocks	----	----
Inputs Used (Fert., Insecticides etc.)	Phosphate 20 kg/ha at planting	----	----	----	UREA, granulated fertilizer around plants when are 45-60 cm	----	----
Amount	UREA 20 kgs/plot	----	----	----	3 times	----	----
Timing	At knee height	----	----	----	3rd application, when tassels	----	----
Land Preparation	Manual (farmers plant on hills)	----	----	----	Manual	----	----
Timing	----	----	----	----	----	----	----
Who	Farmer/men	----	----	----	Family	----	----
Planting: Timing	(July) November	----	----	----	----	----	----
Who	Family	----	----	Family	Family	----	----
Fencing: Timing	----	----	----	----	----	----	----
Who	Villagers	----	----	Around the perimeter Villagers	----	----	----
Weeding: No. of Times	2-3 times	----	----	Little to none	2 times	----	----
Who	Farmer	----	----	----	Family	----	----

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
Harvesting: Timing	(October)	----	----	----	70-80 days	----	----
Who	March Family	----	----	Family	after planting	----	----
Threshing: Timing	Not threshed	----	----	None	----	----	----
Who	----	----	----	----	----	----	----
Storage Method	On the cob	----	----	On the panicle	On the panicle dry	----	----
Milling	Morter	----	----	----	----	----	----
Marketed/Consumed	Marketed & consumed	----	----	Consumed, some for sale	Green cons are sold: 5 um/panicle rest consumed.	----	----
Use of Straw	Collected as forage for the animals	----	----	Animals	----	----	----
IX. MARKET GARDENS	----	----	----	Individual plots	5 Plots	----	2 x 1/2 ha. gardens Many small plots
Water Source	River	Wells	----	Marigot	River, pump	River	River, pump
Location	Fonde, riverside	----	----	----	Not far, Fonde	Perimeter	Riverside
Crops Grown	Vegetables Private Garden: Vegetables	Lettuce Cabbage Tomatoes Eggplant Carrots	----	Tomatoes Carrots Lettuce Cabbage	Cabbage Onions Eggplant Potatoes Tomatoes Turnip Corn Cucumbers Hot Peppers	Onions Cabbages Tomatoes Eggplant Hot Peppers Carrots Lettuce Squash	Cabbage Potatoes Tomatoes Lettuce Onions
Marketed/Consumed	Consumed & marketed	Consumed	----	Consumed	Marketed in Nouakchott & Kaédi Consumed: during 4 months	Both; mostly marketed	Both
Independent/Cooperative	1 women's cooperative 1 large private garden (0.7 ha.)	----	----	Independent	Women & men	Independent cooperative within perimeter	1 cooperative established another being formed

	<u>BOVEL</u>	<u>MAGIAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUPE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
X. RECESSION SORGHUM (Walo)	----	----	No yield because of grasshoppers	None, no inundation	----	Inundation is from marigot not river	----
Area Grown	----	46 kilo seed- 10 ha.	2 ha.	2 ha.	----	0.5 ha.	----
No. of Days Flooded	----	less than 1 month	----	----	-	3 months	----
Varieties	----	Samba Souki Sewil Samé Sawaski	Samé	Sorghum Samé	----	Boxeri Sewil Baleri	Samé
Other Crops in the Field	----	Cowpeas	Cowpeas Watermelon Melon	Cowpeas	----	Cowpeas Melons	Cowpeas Watermelon Squash
Diseases & Pests	----	Birds Insects	Dioumane Grasshoppers	Insects	----	Crickets Birds Smut	Aphids
Inputs Used (Fert., Insecticides, etc., soil preparation)	----	----	Seed treatments	----	----	No fertilizer/ pesticides Seeds treated	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Planting:Timing	----	Oct.	November	----	----	Cold/dry season	mid-October
Who	----	Family	Family	----	----	----	Family
Fencing:Timing	----	----	Wood	None animal problem	----	Beginning of season cooperation	Branches
Who	----	----	----	----	----	----	----
Weeding: No. of Times	----	----	2 times	----	----	----	Once
Timing	----	----	----	----	----	----	----
Who	----	----	Family	----	----	Family	Farmer
Harvesting:Timing	----	End of February	May-April	Lost crop in 1985	----	15 March 4-5 months after seeding	----
Who	----	Family	Family	----	----	----	farmer & family
Threshing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Storage Method	----	Mold in storage	On the panicle	----	----	----	On the head (panicle)

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
Marketed/Consumed	----	No Walo crop for 3 yrs	Consumed	----	----	Consumed	Consumed
Use of Straw	----	----	----	----	----	----	Collected for fodder
XI. RECESSION CORN (Walo)	Farmers interviewed did not plant Maize in the Walo	----	----	----	----	----	Farmers interviewed did not plant in Mauritania
Area Grown	----	----	----	----	----	----	----
No. of Days Flooded	----	----	----	----	----	----	----
Varieties	----	----	----	----	----	----	----
Other Crops In the Field	----	----	----	----	----	----	----
Diseases & Pests	----	----	----	----	----	----	----
Inputs Used (Fert., insecticides, etc., soil preparation)	----	----	----	----	----	----	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Planting: timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Fencing: timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Weeding: No.	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Harvesting: timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Threshing: timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Milling	----	----	----	----	----	----	----
Marketed/Consumed	----	----	----	----	----	----	----
Use of Straw	----	----	----	----	----	----	----
Storage	----	----	----	----	----	----	----
XII. FALO CROPPING PATTERNS	The farmers had Falo land in Senegal	----	----	----	----	in Senegal	----

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
Area Grown	----	----	1.5 ha.	1-3 ha. around the lake	----	0.8-2 ha.	.25-1 ha.
Types of Crops	Maize Cowpeas Sweet Potatoes Tomatoes	Local Corn Sweet Potatoes Cowpeas Tomatoes Calabash Watermelon Squash Zucchini	Corn Melon Sweet Potatoes Calabash Cucumbers Tomatoes Squash Cowpeas	Corn Sweet Potatoes Cowpeas Calabash Tomatoes Pumpkin	----	Corn Cowpeas Potatoes Calabash Pumpkin	Maize (Macca) Cowpeas Tomatoes Hibiscus
Diseases & Pests	Termites Insects	Insects	----	Grasshoppers N'djournane	----	Birds Crickets N'djournane	Aphids Insects Termites Crickets
Inputs Used (Fert. Insecticides etc.)	----	No	----	----	----	----	none
Land Preparation	----	----	Manual	----	----	----	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Planting:Timing	----	----	November	----	----	----	November
Who	----	----	Family	----	----	----	Farmer & family
Fenceing:Timing	----	----	Wood	----	----	----	Branches
Who	----	----	----	----	----	----	Farmer
Weeding: No.	----	----	2-3 times	----	----	----	1
Timing	----	----	----	----	----	----	----
Who	----	----	Family	----	----	----	Farmer
Harvest:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	family
Threshing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Storage	----	On the panicle	----	----	----	----	----
Milling	----	----	----	----	----	----	----
Marketed/Consumed	Consumed	----	Sell green cobs	Consumed	----	80% sold 20% consumed	Consumed
Use of Straw	----	----	----	Left for animals, some collected for own animals some is sold	----	----	folder for animals

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
XIII. FONDE CROPPING PATTERNS	Farmers say they are unable to plant due to lack of rain	----	----	----	----	----	Farmers interviewed did not plant
Area Grown	----	----	----	----	0.5 ha.	1-3 ha.	----
Types of Crops	----	----	----	----	Fellah Watermelon Cowpeas Bird resistant variety Sorghum Rahaya (Sorghum)	Samé Calabash Pumpkin Cowpeas Sweet Potatoes Corn	----
Diseases & Pests	----	----	----	----	Termites Birds Spanish Fly	M'bato (in stalk) Birds Crickets Aphids Stemborers	----
Inputs Used (Fert., Insecticides etc.)	----	----	----	----	----	Seeds treated no other inputs	----
Planting: Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Fencing: Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Weeding: No.	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Harvesting:	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Storage Method	----	----	----	----	----	----	----
Marketed/Consumed	----	----	----	----	----	Consumed 70% Sold 30%	----
Use of Straw	----	----	----	----	----	----	----
XIII. DIERI CROPPING PATTERNS	The late planted crops suffered badly when the dry winds blew. Reduced yields	----	Rainfed	No, lack of rain	----	lack of rain	1 farmer abandoned his crop because it dried out
Area Grown	1 parcel	Unlimited	1-2 ha.	----	----	3 ha.	not known

	<u>BOVEL</u>	<u>HAGIAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
Crops Grown (Millet & Sorghum)	Millet	----	Millet	----	----	----	Millet
Varieties		Millet Boy Olé Sorghum Fellah Nlogoukou Diappal Baléril	Souna Hibiscus Cowpeas Melon Watermelon Okra	Sorghum Fellah	----	Millet Fellah Watermelon Cowpeas Local variety of Millet	Cowpeas Watermelons
Diseases & Pests	Borer	Birds Insects	Stemborers Birds Grasshoppers	Grasshoppers Insects Animals	----	Stemborer Birds Grasshoppers	Borers
Inputs Used (Fert., Insecticides, etc.)	----	----	None	----	----	----	none
Land Preparation	Manual	Manual	Manual	----	----	Manual	Manual
Planting: Timing	With the first rains	Manual	Before rain, July	----	----	After first rain	With the first rains
Who	----	Family	Family	Family	----	Manual	Farmer & family
Fencing: Timing	----	----	Wood Farmer	None	----	Before seeding Family	None
Who	----	----	----	----	----	----	----
Weeding: No.	2 times	----	2-4 times	----	----	----	2 times
Timing	----	----	----	----	----	After seeding Family	----
Who	Farmer	----	----	----	----	----	Farmer
Harvesting:	When mature	----	200-300 kilos	Lost the crop	----	----	----
Timing	----	----	November	----	----	----	When ripe
Who	Farmer	----	Family	----	----	Family	Farmer
Milling	Mortar	----	----	----	----	----	----
Storage Method	Store in bins (on the panicle)	----	On the panicle	On the panicle, in rooms or in the field	----	----	In the house
Marketed/Consumed	Consumed	---	Consumed	Consumed	----	10% sold 90% consumed	Consumed
Use of Straw	Left in the field for their own animals	----	Left on field	Left on fields	----	----	----
XV. BAS FONDE	----	None	---	Best land for them. More yield with less work.	----	none	Farmers interviewed did not report

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TGUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
Types of Crops	Sorghum (Fellah) Niobougou Cowpeas	Rainfed Sorghum	----	Corn Sorghum	----	----	----
Wild Animals & Birds	Ducks & Geese	----	----	----	----	----	Gazelles Seacow Ducks
<u>WILD FOODS</u>							
Types	Balanites Jujube	Jujube Balanites Fonio	Jujube Balanites Eri	Ducks	Jujube Paguiri Balanites	Baobab Balanites White Millet Jujube	----
<u>GUM ARABIC</u>							
Availability	Numerous; nearby	----	Exists	None	Exists	Much available	None
Economic	The villagers exploit the gum themselves to sell and use	----	No	----	No	Exploited by Moors	----
Utilization	----	----	----	----	----	----	----
<u>TREES FOR FIREWOOD</u>							
Names	----	----	Kelli Gawdi Thiangouli N'dioki	Jujube Gonakier/Gawdi Koyli Combretum	Balanites Gonakier Acacia	Gawdi Koyli	Gawdi Kelli
CITRUS	Yes	----	----	None	None	None	None
BANANAS	None	----	----	None	None	None	None
MANGOES	None	----	----	Some, small	None	None	Some, but do not bear fruit Termites are a severe problem
DATE TREES	----	----	----	----	----	----	----
OTHERS	----	----	----	----	----	----	----
LIVESTOCK	Village Farmers						
goats: No.	200	40	20	200 (village) includes	4-26	5-6 (farmer) used for milk	5-10
	includes						Village Farmers 2000

	<u>DOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>FALIBA</u>	<u>TOUDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
Diseases	----	----	N'diyam Dioffe N'balleri Tiro Fetchio Fulto	Drought	----	----	----
Feeding Practices	Open pastures	Extensive grazing with herder	Extensive grazing	Extensive grazing	----	Extensive grazing	Grazing open pasture
Sheep: No. Diseases Feeding Practices	---- ----	7 ---- herded with goats	see goats ---- ----	0-20 drought ----	village level ---- ----	0-4 ---- ----	2000 ---- grazing open pasture 0-2
Cattle: No. Diseases	60 ----	6 37 ----	200/village Kourel Latche Dasso ----	0-9 drought ----	none ----	8-10 Bade Latche ----	50 ---- 0
Feeding Practices	Open pastures	Herded with others	----	----	----	Extensive grazing	Grazing open pasture and forage
Donkeys: No. Diseases	15 ----	1 3 ----	40 village; 1 ----	1 ----	1 farmer ----	3 ----	15 ---- 0
Horses: No. Diseases	1 ----	2 ----	10 Disego N'boki N'diyam Stomach ache ----	1 ----	Village level ----	1 ----	12 ---- 0
Birds	----	----	----	----	----	----	----
INTERACTION BETWEEN SEDENTARY FARMERS AND NOMADS	No interaction because it is a herding village. Severe problem with unherded camels and donkeys destroying the crops.	Camels aren't problems for crops.	No problem Exchange products. Sometimes small problems.	Camels big problem. Villagers sell fish to the nomads. Welcome the animals after harvest only, but this year the animals ate all the Walo and some of the Falu.	Nomads use stubble (field) Nomads sell animals + milk Camels damage crops.	Competition for water. Nomads animals eat stalks. Manure good for soil. Camels destroy crops. Cows destroy crops. Exchange of products.	Some commercial interaction. Camels are a serious problem. No access to river, only to marigot.
FISHING	None	No	Fish in rainy season (not now-Feb.).	Fishing in the marigot. Sell fish (little fish, catch too early).	No	Rarely; Some for income and home use.	Traditional, but yields are very low. Not commercially viable now.

	<u>BOVEL</u>	<u>MAGIAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
OTHER SOURCES OF INCOME	----	Local merchant operates a mill	Bricklayer Each family has 1 emigrant Charcoal selling	No	Charcoal and Wood selling Ericklayer Selling vegetables	1 member of the family emigrated No other sources	-
Seasonal Migration	Few	----	----	None or little	----	----	Many emigrants from the village in Nouakchott and Senegal
Where	----	----	----	----	----	----	----
Local Off-Farm Employment	None	----	Works for others Exchanges wood for food	Fishing	----	----	In the village
Farm Laborer- Remittances	None Very little	Son spent 7 years in France	----	Some	----	----	Some remittances Pensions
CREDIT							
Sources	SONADER	----	CARITAS Borrow food or money from others in village, no interest.	CARITAS stopped all credit due to indebtedness. Amongst themselves, no real credit.	Projet CARITAS Local merchants (food loans)- They increase the price to obtain money from loan.	Family	Loans from relatives Some loans from the small local commerce
ENERGY SOURCES	Wood (women collect it)	Wood	Wood	Wood	Wood Charcoal	Wood	Wood fuel, mostly from Senegal
AREAS OF RESEARCH							
Elicited from Farmer Constraints	The real problem is the distance between the village and the source of household and irrigation water.	Need better tools for farming. Better water for crops i.e. more reliable source. Need adapted agricultural machinery.	Not enough food. Not enough rainfall. Need equipment for cropping. Village owes CARITAS 2 million um, CARITAS cut them off.	Insect problems. Grasshoppers damage the fields. Destruction of crop by the animals, especially camels (the marigot is a source of water	Overproduction: prices for vegetables are down. Cost of fertilizer too high. Need water pumps, fertilizers, and machines. Stenborers,	Water problems. Grasshoppers. The falo is watered by the marigot. Between Cive and Tokomadji there are 9 marigots.	The lack of/or shortage of food. The lack of water for household use. There is a serious sanitary problem. The lack of fences is

	<u>BOVEL</u>	<u>MAGHAMA</u>	<u>GOUREL DIERI</u>	<u>PALIBA</u>	<u>TOUFDE SIVE</u>	<u>SIVE</u>	<u>M'BAGNE</u>
	Lack of educational facilities. Health problems: no dispensary. Severe problems with insects and birds in the Walo.			invasion was in Sept./Oct.	during the rainy season. Birds a problem. Weeds. Need access to irrigated land. Need equipment to work fields. CARITAS wouldn't let plant 2nd season due to debt problems. As perimeter got bigger water capacity of pump was lower. Onions in storage were lost to fungus.		enter the fields. Need materials to build adequate fences. Lack of adequate extension in the area. There is a labor problem with regards to the amount of land that can be cultivated (labor resource need to be used more efficiently). Much of the crops were either damaged or effected by the hot winds and the sandstorms. Also problem with birds.
Interventions		Better selection of seed varieties.	Research for a variety of short-time and high-output sorghum (Fellah).	Insect control. Water management. Pisciculture.	New seeds. Techniques to improvement the soil.	Need animals resistant to drought, and that have high milk production.	----
Recommendations	Would like to see field trials in trees & vegetables. Research into insect control. Research into methods to improve efficiency in the fields.	----	----	----	----	----	Would like to have improved native or adapted varieties that give high yields. A good seed packet. Improved pisciculture. Be able to obtain better dairy cattle.

BOVEL

Research and
methods to
improve use
of pastures.
Village has
interest in
fruit trees.

MAGHAMA

GOUREL
DIERI

PAJIBA

TOUFDE
SIVE

SIVE

M'BAGNE

Cheaper ways
to obtain water.
Better and
appropriate
equipment to
improve labor
efficiency.
Improve crop
practices.

APPENDIX B

SUMMARY OF RESULTS FOR FARMING SYSTEMS RECONNAISSANCE SURVEY

Variables	FONDOU	SORI MALE	M'BOTO	BABABÈ	BOLO DOGO	N'GOREL	TIENEL
I. Village Characteristics							
Size of Village Population Families (F) or Households (H)	3000-4000 450(F)	560 96(F)	2500 250(F)	9500 1500(F)	408 76(F)	1000 95(F)	3970 391(F)
Schools :public (P) Koranic (K) college (C)	1(P) 1(S)	1(P)	1(P) Bilingual 4(K)	1(P) 1(S) 1(C)	1(P)	1(K)	1(P)
Number Classes	1(P) 1(S)	2	2(P) 2(K)	9(P) 2(S) 7(C)	1	----	2
Health Clinics	1 Dispensary no PMI	1 PMI (Projet CAC)	1 Dispensary PMI	1 PMI (Polyclinic)	None, but Red Cross provides medicines.	1 dispensary 1 PMI 3 midwives	----
Pharmacy	----	----	----	1 private	----	----	----
Markets	Temporary 5 shops	1 permanent	2 markets	1 permanent 50 boutiques	None 1 shop	1 fishmarket 2 shops	----
Government Offices	----	Guard only	----	Arrendisement Gendarmerie PTT Customs	----	----	----
Access to Roads	Good year round	Dry season road	Good year round	All weather road	Good year round	Good	Dry seasc road
Access to Water	7 wells 2 work	1 well River	2 wells 1 works	5 wells	2 wells 1 works River	No wells River	8 wells River
Cooperatives	----	2 (86 & 84 members)	----	3 (2 gardens)	----	1 coop shop	2
Milling Operations	----	----	----	3 private	----	----	----
Gov. Project Interventions	----	SONADER	Forestry project '85	SONADER CSA, CRM	1 forestry project '85	----	SONADER "Pois Verts"
Other Projects	----	None	----	Observation post of Projet Lute Integre, (Laboratory)	----	----	----

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
II. Demographic Characteristics	----	Fishing Village	----	----	----	----	Village is close to Boghé, it relies on Boghé
Tribes	Halpoular	Halpoular	Halpoular Moors	Halpoular Moor 96% 4%	Halpoular (Lao) Moors	Halpoular (Halaybe Bonnabe)	Halpoular
Region/District	Brakna	Erakna	Brakna	Brakna	Brakna	Brakna	Brakna
Size of Household	7	6-16	9-15	13-16	22	9-11	----
No. of Wives	1	1-3	2	1-2	1-2	2	----
No. of Children	5	9-12	2-13	4-10	17	5-8	----
No. of Other Household Adults	----	0-1	4	3	3	----	----
Education of Farmer	----	1 had some informal education, the others had no formal education	None	----	----	Read & write Arabic	Retired military
Age of Farmer	63	----	57	----	----	50	54
III. Farm							
Characteristics	----	Village Farmer	----	Village Farmer	----	----	Village Farmer
No. of Parcels	----	----	----	----	----	----	Yes
No. of Walo Fields M. Mauritania (M) Senegal (S)	3-5	Yes 2-3.45 ha.	3	Yes .56 ha.	1-2 ha. 3-4 ha.	1 ha.	Yes
S.	----	Yes	----	Yes Yes	Yes	----	Yes
No. of Falo Fields M.	1	Yes 0-.5 ha.	3	Yes .75-1 ha.	Yes 1 ha.	5 grows 1	Yes
S.	----	Yes	----	----	----	----	Yes
No. of Fonde Fields M.	Yes	None	2	Yes None	2	Yes	Yes
S.	yes	None	----	None None	----	----	Yes
No. of Dieri Fields M.	1-3	Yes 0-1.25 ha.	0.5 ha.	Yes 1	Several	1	Yes
S.	----	Yes	----	None None	----	----	No

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DAGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
Types of Cultivation	----	----	Decrue (Walo, Falo) Pluvial (Dieri, B. Fonde Fonde)	----	----	----	----
IV. Cropping Patterns							
Major Crops Grown	Demiri Cowpeas Fellah Hibiscus Millet Samé Watermelon Sewil Corn Squash Sweet Potatoes Small Tomatoes Thiotandi Okra Gama Souna Sorghum Watermelon Gnindico	Rice Sorghum Millet Cowpeas Maize Watermelons Tomatoes Melons Nenupheur	Samé Fellah Cowpeas Nioboukou Poudi Peanuts Watermelon Sewil Hibiscus Squash Souna Tomatoes Sweet Potatoes Corn Watermelon Millet	Sorghum Maize Cowpeas Watermelons Sweet Potatoes Tomatoes	Millet Cowpeas Fellah Watermelon Samé Corn Melon Hibiscus Sweet Potatoes Tomatoes Rice Okra Sorrel Demiri Squash Watermelon	Demiri Cowpeas Watermelon Hibiscus Samé Fellah Poudi Corn Sweet Potatoes Watermelon Rice Tomatoes Zucchini Squash	Rice Sorghum Cowpeas Maize Melons Sweet Potatoes Okra Squash
Length of Fallow for Dieri	3 years	Determined by the drought cycles	3 years/crop 3-10 years fallow	3-5 years	----	----	----
Dieri Last Planted	1985	1981	1985	1985	1980	1985	1982
Dieri Last Harvested	didn't 1985	1981	1985	1974	----	----	1982
Walo Last Planted	1986	1984	1986	1985	1986	1985	1985
Walo Last Harvested	1986	1985	1986	1986	----	1986	1986
Fonde Last Planted	----	----	1986	----	1986	----	----
Fonde Last Harvested	----	----	1986	---	----	----	----
Sequence of Crops for Perimeters	-----	(1) Rice (2) Maize	No perimeter	(1) Rice (2) Maize	Rice Corn	Corn Corn	(1) Rice (2) This year trying Sorghum
V. Irrigation Systems	----	2 perimeters	Village is 3 km away from the	84 member cooperative	----	Belonged to CNRADA	----

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIEREL</u>
Type of Perimeter	----	Small	----	Small	Small ('79)	Small	Large
Perimeter Area	----	22 & 16 ha.	----	20 ha.	10 ha.	6 ha. use 4 ha.	4000 ha. 910 ha. planted
Farmer's Cropped Area	----	0.255	----	0.16-0.23 ha.	3 parcels, total area 1000 - 2050 m	150 - 240 m	0.5 ha.
Pump Origin	----	----	----	U. K.	----	U. K. gift of Ministry Rural Development	----
Pump Make/Size	----	2 cyl.	----	Lister HR 2	Lister 6 cyl.	Lister 3 cyl.	Large
Maintenance	----	SONADER	----	SONADER	SONADER	pay SONADER to repair	SONADER
Operator	----	1	----	2 (for rice) 1 (for maize)	Villager: villagers work on his parcel	Villager given extra parcel	SONADER
Availability of Parts	----	Reasonable, still have some delays	----	A severe problem: long delays	Hard to get and expensive	----	----
Canals Lined	----	Unlined	----	Unlined	Unlined	Unlined	Lined & Unlined
Condition of Canals	----	Fair	----	Good. They have requested another perimeter	Weeds	----	Very good. Many secondary canals planned.
Rainfall increases: Abandon/Stay	----	----	----	----	----	----	----
VI. Rice	----	2 plots (1) 480 kgs. (2) 80 kgs.	----	----	Not since 1983	Grow on large perimeter at Boghé .5 ha.	2.45T/ha.
Water Application Frequency	----	Every 15 days	----	7 times	Every 10-20 days	Once a week	kept flooded
No. of Cultivations	----	This year once, sometimes twice	----	1	1, wet season	1	once

	<u>FONDOLU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
Marketed/Consumed	----	Pay SONADER rest consumed	----	Pay SONADER rest consumed	Consumed within family	-----	SONADER to pay debt and for consumption
Use of Straw	----	Collected as forage	----	Collected for the animals	----	----	Collect to feed own animals
VII. IRRIGATED SORGHUM	----	Farmers interviewed did not plant Are interested in planting in the future	----	Farmers interviewed did not plant	----	Never tried	Planting for first time
Water Application Frequency	----	----	----	----	----	----	2-3 times
Cultivations	----	----	----	----	----	----	One
Varieties	----	----	----	----	----	----	----
Other Crops in the Field	----	----	----	----	----	----	Cowpeas
Diseases & pests	----	----	----	----	----	----	----
Inputs Used	----	----	----	----	----	----	None
Land Preparation Timing	----	----	----	----	----	----	Manual January
Planting: timing Who	----	----	----	----	----	----	January Farmer
Fencing: timing Who	----	----	----	----	----	----	Various SONADER
Weeding: timing Who	----	----	----	----	----	----	Farmer
Harvesting: timing Who	----	----	----	----	----	----	Farmer & family
Threshing: timing Who	----	----	----	----	----	----	----
Storage Method	----	----	----	----	----	----	----
Milling	----	----	----	----	----	----	----
Marketed/Consumed	----	----	----	----	----	----	Consumed
Use of Straw	----	----	----	----	----	----	Forage for his animals

	<u>FONDOI</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
Storage Method	----	On the cob in the house	----	On the cob in the house	----	----	----
Milling	----	----	----	----	Pounding by women	----	----
Marketed/Consumed	----	Consumed	----	Consumed	Consumed	Marketed: ear fresh Consumed	----
Use of Straw	----	Forage for the animals	----	Forage for animals	For family animals	Animals	----
IX. MARKET GARDENS	----	----	----	2 gardens	Exists	Small garden by perimeter	3ha. of gardens but only .5 ha. planted
Water Source	wells	River (pump)	Wells	Wells	River	Pump	River (pump)
Location	----	Riverside	Transition zone	Near the village	----	----	Riverside
Crops Grown	Tomatoes Cabbages Eggplant	Cabbages Tomatoes Onions	Cabbages Onions Lettuce Beets Potatoes Carrots	Cabbages Onions Potatoes	Tomatoes Cabbages Potatoes Turnips Carrots Sweet Potatoes Okra Onions	----	Cabbage Carrots Lettuce Mint Yuca Tomatoes Potatoes Fruit Trees
Marketed/Consumed	----	Mainly consumed, some sold	----	Both	Mainly consumed	Both	Both
Independent/Cooperative	----	Cooperative	Women's cooperative	2 women's cooperatives another being formed	Cooperative	----	Cooperative
X. RECESSION SORGHUM (Walo)							
Area Grown	2 ha.	3.5-7 ha.	0.4-1 ha.	0.4-3 ha.	3-6 ha.	----	4-6 ha.
No. of Days Flooded	.5-2 months	----	1-1.5 months	60 days	15 days - 3 months	2.5 months	15 - 90 days
Varieties	Samé Sewil Okra	Samé Fellah	Samé Sewil Samé Black	Samé	Samé	Samé Demiri Poudri Bondeiri	Samé

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABAHE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
Other Crops in the Field	Squash Small Tomatoes Corn Cowpeas Watermelon Poudi Sweet Potatoes	Cowpeas	Cowpeas Corn Poudi Watermelon	Cowpeas Squash Watermelons	Cowpeas	Cowpeas Watermelon	Cowpeas
Diseases & Pests	Crickets Birds Termites Caterpillar Miellee	Fungus Borers Crickets Mites	Termites Crickets Aphids Honey Smut Birds	----	Crickets	Crickets Smut	Crickets ate most of the crop
Inputs Used (Fert., Insecticides, etc., soil preparation)	Seed treatment powder against Grasshoppers	none	Seed treatment (4 kgs.) No fertilizer	----	Seed treatment (1 box for 4 kgs.)	Seed treatment 1 matchbox/ 4 kilos Fenitriothron (insecticide)	Seed treatment
Amount Preparation	----	----	----	----	----	----	----
Planting: Timing	Manual	Manual	Manual	Manual	Manual	Manual	Manual
Who	Oct.-Nov Samé & Cowpeas in same hole Wife & daughters	October	Nov.-Dec. 2 times seed packets	November	November Seed packets	10-15 Oct. season	Sept. & Oct. had to replant
Fencing: Timing	No	----	Branches	None	None	None	Branches Family
Who	----	----	----	----	----	----	----
Weeding: No. of Times	1 or 2	----	2-3 times	2-3 times	2-3 times	1 part once	Once
Timing	----	----	----	----	----	----	2 weeks after planting
Who	Son helps	----	Family	Farmer	----	1 part twice Family	Family
Harvesting: Timing	Not yet, but not good due to pest damage	----	March-April 600 kgs from 2 parcels 1st year	----	March	(16 Feb.) Not good harvest	March
Who	----	----	----	Family	----	Family	Family
Threshing: Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	family
Storage Method	On the panicle	----	Store on head	In house	On the panicle	On the panicle	On the panicle
Milling	----	----	By hand	----	Hand pounding by women	Manual pounding	Mortar
Marketed/Consumed	Consumed	----	Consumed	Consumed	Consumed	Consumed	Consumed

	<u>FONDIOU</u>	<u>SORI MALE</u>	<u>M'EBOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIEHEL</u>
Use of Straw	----	----	Animals	Left in field or collected for animals	Animals	Animals	Collect as forage for animals
XI. RECESSION CORN (Walo)	Falo (Fallow)	Farmers interviewed did not plant this year	Falo (Fallow)	Farmers interviewed did not plant	----	----	Farmers interviewed did not grow
Area Grown	1 ha.	----	----	----	----	----	----
No. of Days Flooded	----	----	----	----	----	----	----
Varieties	Early maturing (2 mos - 10 days)	----	Corn	----	----	----	----
Other Crops In the Field	Cowpeas Squash Sweet Potatoes Tomatoes	----	Zucchini Cowpeas Watermelon	----	----	----	----
Diseases & Pests	----	----	----	----	----	----	----
Inputs Used (Fert., insecticides, etc., soil preparation)	No	----	No	----	----	----	----
Amount	----	----	----	----	----	----	----
Timing	Manual	----	----	----	----	----	----
Planting: timing	November	----	December	----	----	----	----
Who	Family	----	----	----	----	----	----
Fencing: timing	Branches	----	----	----	----	----	----
Who	October	----	----	----	----	----	----
Weeding: No.	3 times	----	2-3 times	----	----	----	----
Timing	----	----	after seeding	----	----	----	----
Who	----	----	----	----	----	----	----
Harvesting: timing	----	----	February	----	----	----	----
Who	----	----	Family	----	----	----	----
Threshing: timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Milling	Hand pounded by women	----	Hand pounded by women	----	----	----	----
Marketed/Consumed	----	----	Both	----	----	----	----
Use of Straw	----	----	----	----	----	----	----

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
Storage	on the heads	----	on the heads	----	----	----	----
XII. FALO CROPPING PATTERNS	----	----	M'Bagne marigot	Some farmers lost all the crop because it dried up	----	----	----
Area Grown	----	0.5-1 ha.	0.4 ha.	0.6-1 ha.	600 m	----	0-4 ha.
Types of Crops	Samé Sewil Fellah Corn Cowpeas Watermelon Pourdri Squash Sweet Potatoes Small Tomatoes Thiotandi Okra	Maize Cowpeas Tomatoes Sweet Potatoes Okra	Corn Cowpeas Tomatoes Pourdri Squash	Maize Squash Cowpeas Watermelons Sweet Potatoes	Corn Cowpeas Hibiscus Melon Sweet Potatoes Tomatoes Watermelon Squash Zucchini Calabash	Corn Cowpeas Pourdri Sweet Potatoes Hibiscus Watermelon Tomatoes Melons Squash Zucchini	Maize Cowpeas Sweet Potatoes Squash
Diseases & Pests	----	Not noticed	----	Aphids	----	----	Did not see any
Inputs Used (Fert. Insecticides etc.)	Seed Treatment	None	Seed Treatment	None	----	----	None
Land Preparation	----	----	----	----	----	----	----
Amount	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Planting:Timing	----	----	December	November	----	----	As river recedes
Who	----	----	Farmer & wives	Farmer	----	----	Family
Fenceing:Timing	----	----	----	----	----	----	Farmer
Who	----	----	----	----	----	----	Farmer
Weeding: No.	----	----	----	----	----	----	Once
Timing	----	----	----	----	----	----	Farmer
Who	----	----	----	----	----	----	Farmer
Harvest:Timing	----	----	end February	----	----	----	----
Who	----	----	Farmer & wives	----	----	----	Family
Threshing:Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Storage	----	----	Store on head	----	----	----	In house or storage bins

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GORÉL</u>	<u>TIENEL</u>
Milling	----	----	By hand	----	----	----	----
Marketed/Consumed	----	Consumed	Consumed	Consumed	----	80% sold 20% consumed	Consumed
Use of Straw	----	forage for animals	animals	----	----	----	forage for animals
XIII. FONDE CROPPING PATTERNS	Didn't grow any this year	Farmers interviewed did not plant	----	Farmers interviewed did not plant	----	----	----
Area Grown	----	----	1.25-2 ha.	----	1500 m	----	----
Types of Crops	Samé Sewil Fellah Corn Cowpeas Watermelon Pourdi Squash Sweet Potatoes Small Tomatoes Thiotandi Okra	----	Samé Fellah Cowpeas Watermelon Hibiscus	----	Samé Cowpeas Melon Fellah Watermelon	Samé Corn Pourdi Cowpeas Watermelon (this farmer only grows watermelon)	Sorghum Cowpeas Watermelon
Diseases & Pests	----	----	----	----	----	----	Grasshoppers Crickets
Inputs Used (Fert., Insecticides etc.)	Seed treatment	----	----	----	----	----	Practically all the crop destroyed by the above
Planting: Timing	----	----	December	----	----	----	----
Who	----	----	Farmer & wives	----	----	----	Family
Fencing: Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Weeding: No.	----	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----
Harvesting:	----	----	----	----	----	----	----
Timing	----	----	March-April	----	----	----	----
Who	----	----	Farmer & wives	----	----	----	----
Storage Method	----	----	On heads	----	----	----	----

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DXXGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
Marketed/Consumed	----	----	Consumed	----	----	----	----
Use of Straw	----	----	----	----	----	----	----
XIII. DIERI CROPPING PATTERNS	----	The village has not cultivated Dieri for the last 5 years	Rainfed	Some farmers lost all their crop for lack of rain	No Millet this year Only traditional Watermelon	Not used for 10 years	Farmers unable to plant (conflict with perimeter-last planted 4 years ago)
Area Grown	.5-1 ha but has 3 parcels not all planted	----	.5-1 ha.	1-2 ha.	----	----	----
Crops Grown (Millet & Sorghum)	Watermelon Cowpeas Hibiscus	----	Watermelon Cowpeas Hibiscus	----	Cowpeas Watermelon	Hibiscus Cowpeas Melon	----
Varieties	Demiri (70 days) Fellah Gnindico	----	Demiri Millet Fellah Niobougou Watermelon Hibiscus	Millet	Fella Millet	Demiri	----
Diseases & Pests	Aphids Termites	----	Grasshoppers Termites Birds	Borer	----	----	----
Inputs Used (Fert., Insecticides, etc.)	Seed treatment, no fertilizer	----	Seed treatment (4 kgs.) no fertilizers	None	----	----	----
Land Preparation	----	----	----	----	----	----	----
Planting: Timing	July	----	August	With first rains	----	----	----
Who	----	----	Farmer & wives	Family	----	----	----
Fencing: Timing	None	----	Branches	None	----	----	----
Who	----	----	farmer	----	----	----	----
Weeding: No.	2-3 times	----	----	----	----	----	----
Timing	----	----	----	----	----	----	----
Who	----	----	----	----	----	----	----

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	<u>FONDOU</u>		<u>SORI MALE</u>		<u>M'BOTO</u>		<u>BABABE</u>		<u>BOLO DOGO</u>		<u>N'GOREL</u>		<u>TIENEL</u>	
TREES FOR FIREWOOD	----		----		----		----		Forestry project: 10 ha. shade 1 ha. fruit		----		----	
Names	Kelli Balanites Gawdi Thiangi		----		Gigéle Namadi Boulby Barkewy Gawdi Planted Neem prosopis (5 ha.).		Balanites Gawdi Gonakier Trees are some distance from the village (25 kms)		Djalanbani Gawdi Balanites Kelli Ebony Jujubu		Gawdi Guellode Jujube Balanites Koyli from Senegal		Gawdi (Acacia nilotica)	
CITRUS	None		None now Last lot did not yield		None		None		None		----		In the garden	
BANANAS	None		Tried but never produced		None		None		None, will be part of forestry project		Existed with research station		None tried	
MANGOES	None		None currently Last group of trees did not yield. Have a severe termite problem		None		None		None		3 trees near house		10	
DATE TREES	----		----		----		----		----		5		----	
OTHERS	----		----		----		----		----		----		----	
LIVESTOCK	Village Farmers		Village Farmer		Village Farmer		Village Farmer		Village Farmer		Village Farmer		Village Farmer	
goats: No.	20	6	Numerous	1	1000	10	700	0-3	80 physiological infirmities	60	0	100	0	
Diseases	----		----		Tiro Fecco Dioffé		----		----		----		Gale, Pietin	
Feeding Practices	----		Grazing open pastures		----		Grazing open pastures		If shortage of food-use sorghum corn rice stalks		----		Open, free grazing	
Sheep: No.	1		Numerous		1000		800		37-40		50		600	
Diseases	----		----		Fecco		----		Goumi N. wandé		----		----	

	<u>FONDOU</u>		<u>SORI MALE</u>		<u>M'BOTO</u>	<u>BABABE</u>		<u>BOLO DOGO</u>		<u>N'GOREI.</u>		<u>TIENEI.</u>	
Feeding Practices	----		Grazing open pastures		----	Grazing open pastures		Sorghum Corn, trice Food shortage		----		Open, free grazing	
Cattle: No.	0		10	1	40	200	0	All died; 200 before drought		All died		20	0
Diseases	----		----		Nedo Thiarou Yeedo M'balere Kourel	----		----		----		Botchelism	
Feeding Practices	----		Grazing open pastures and forage		----	Grazing open pastures		----		----		Open grazing some forage	
Donkeys: No.	1	0	50	0	30	200	0-1	----		3	0	10	0
Diseases	----		----		Juko Tietale Fira	----		----		----		----	
Horses: No.	2		5	0	3	35	0	Use pastures as forage: Belweldi Thiondi Sologopo		2	0	10	1
Diseases	----		----		Juko	----		----		----		----	
Birds	----		----		----	----		----		----		----	

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NOTE: Village donkeys (not herded) are a serious problem in the fields.

INTERACTION BETWEEN SEDENTARY FARMERS AND NOMADS

Moors camels damage the crops.	No interaction	Competition for water out of one well.	Symbiotic existence	Animals (camels, donkeys) eating crops and graze in fields. Exchange millet and rice for butter, meal and milk.	Camels big problem (damage). Nomads come down to buy tea. Exchange other products also.	Little to no positive interaction. Camels cause a lot of damage to their crops
Moors cut tree branches to feed animals	Free roaming camels (unattended) cause heavy damage in the fields.	Animals' damage crops. Nomads sell milk. Nomads buy millet.	Each side respects the law. There is competition for water and pastures. There has been some crop damage but, always settled.			
Exchange wild fruit for millet.						

	<u>FONDJOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIENEL</u>
FISHING	In rainy season for consumption	Traditionally it is a fishing village Now they fish about 1 hour a day The river yields very little fish	In rainy season for consumption	Do part time fishing for household consumption	Important throughout year October best time Will sell if they catch more than they can eat Fishing village	Very important to village Sell to other villages October best time, just after rainy season	Fishing was important, but is no longer worth it If they have a good catch, will sell
OTHER SOURCES OF INCOME	Use to be a janitor in Dakar	----	Lot of migrants Nkt, France Germany, U.S. 18-35 yrs:80% sell milk (wives)	----	Fishing Pension	10% of village migrated Many work in Senegal	----
Seasonal Migration	Migrate after harvest	Numerous emigrees: 17 in France and about 100 in West Africa	----	30% of the village men elsewhere in West Africa	----	----	Involve many of the young, active persons in the village
Where	----	----	----	----	----	----	----
Local Off-Farm Employment	Wood selling	Charcoal producers	----	In the village	----	Work for SONADER-guard. Koranic teacher	Many work in Boghé, Nouakchott and Senegal
Farm Laborer-Remittances	---- Son sends money Pensions	---- Rely on the remittances Some pensions	---- 30-80 um/day for milk sold Brother sends him money Remittances from emigrants important to his village: Development fund from emigrants helps build mosque, well dispensary, and school. Pension	---- ----	---- ----	---- ----	some ----

	<u>FONDOU</u>	<u>SORI MALE</u>	<u>M'BOTO</u>	<u>BABABE</u>	<u>BOLO DOGO</u>	<u>N'GOREL</u>	<u>TIEREL</u>
CREDIT							
Sources	No credit association. Family members work in other villages.	SONADER (materials) Loans given by local merchants.	----	SONADER (materials)	Have coop shop but don't give credit	Coop shop will lend money, sugar and rice Sell sorghum to coop in Feb/March Buy rice or sorghum in Sept/Oct.	SONADER none other
ENERGY SOURCES	Wood fuel mostly from Senegal	Wood fuel and charcoal collected by the women and children	Wood fuel	Wood fuel and some charcoal	Wood fuel: Gawdi Balanites Djalaubane Grewia bicolar	Wood fuel	Wood fuel and charcoal
AREAS OF RESEARCH							
Elicited from Farmer Constraints	Need pump for well. Need fences. Lack material for making fences. Water to irrigate.	The lack of water for irrigation is a serious problem. Grasshoppers, crickets and other insects have badly damaged crops. Boars have damaged crops. The amount of labor and the age of farmers is a constraint. There is no extension with regards to fruit tree (or orchard). The rice cycle is too long. The farmers consider	Water access. More education. Lack of food in March-June. Tools to work land with. Need fertilizer. Want a dam in marigot (built 1 but washed away). Women want grinding mill.	Lack of adequate and appropriate material and equipment to reduce the labor burden and improve its efficiency. The irrigated area is very limited. The lack or deficiency in the availability of household and drinking water.	Want to expand perimeter, it is small. Crickets are real problem in Walo. Pump broke down. Problem with SONADER and fertilizer and gasoil-didn't pay SONADER. Too many parcels, pump doesn't have capacity. Lack of millet seeds and overall seed shortage. Tools to cultivate.	Lack of food. Machinery or tools for labor. Motor pump. Want Peace Corp. Fence. Tools for garden.	Insufficient food in the village. Lack the production input. Garden pump is too old (7 years) and broken down. They have not seen any effective research in 5 years.

Recommendations or Interventions

FONDOU

Early maturing varieties; they have fellah and cowpeas, dimeri in 70 days Thioandi: 60-70 days. Especially want rapid varieties of sorghum.

SORI MALE

of extension help a serious factor contributing to the overall low production.

Would like varieties that require less water. Better methods to control the insects and birds. Better disease control. Appropriate machinery and crop techniques to improve the labor efficiency. Develop crop varieties (rice in particular) that have short maturing cycles.

M'BOTO

Need short season on corn. Find a way to build a dam in marigot. Find productive varieties to make production sufficient for consumption in village.

BABABE

Would like to have a high-yielding short cycle rice variety in order to ensure 2 crops per year in the perimeter. Fellah varieties with increased yields and that are bird resistant. Improved millet varieties. Would like to see some forage research. Would like to see reforestation in the Walo with appropriate and fast growing trees for firewood.

'BOLO DOGO

Early maturing varieties. To get back the varieties they've lost i.e. millet. Control of water. Protection of crops.

N'GOREL

Perfect at Boghé wants research to focus on early maturing varieties. Vegetable seeds Millet

TIENEL

They want high yielding varieties with short cycles. Want high yielding rice varieties. Would like to see direct sowing of rice instead of transplanting. Welcome crops systems trials in order to have two crops per season (at present are trying rice and sorghum).

SUMMARY OF RESULTS FOR FARMING SYSTEMS RECONNAISSANCE SURVEY

Variables	OLO OLOGO	DARFL. BARKA	DAR ES SALAM	N'BAR WADJI/ KAJRE	TEKANE	GANI
I. Village Characteristics						
Size of Village Population	2000	1440	1980	700-800	2200	1500
Families (F) or Households (H)	304(F)	180(F)	198(F)	115(F)	350(F)	200(H)
Schools :Public (P) Koranic (K) College (C) Private (S)	1(P)	1, Bilingual	1(P)	1(P) under construction	1(P) 1(K) 1(S)	1(P) 2(K)
Number Classes	3	3		3	8(P) 10(K)	2
Health Clinics	1 (PHI, projected)	1 dispensary	1 (not equiped)	----	1 PHI	1 fully operational
Pharmacy	----	None	----	----	Projected	----
Markets	Permanent 1 boutique	Permanent 6 shops	----	----	Permanent 12 boutiques	Permanent 3
Government Shops	----	District-Chief Agriculture Extension	----	----	Arendissement, plus numerous others	Gendarmery Customs Others
Access to Roads	Dry season road	Bad in rainy season	Fairly good year round	Dry season road, otherwise river access	Dry season road, water access	Dry season road
Access to Water	5 wells (2 saline)	6 wells 1 drinking water	River only	3 (not used)	6 wells and marigot	3 wells, river
Cooperatives	----	Women's coop	Several	2	1; 90 members	----
Milling Operations	----	No	1 (broken down)	0 (use the one in Dar Es Salam)	1 1 Rice huller	3 for Sorghum 3 for Rice
Gov. Project Interventions	Did have SONADER	SONADER	SONADER	SONADER	SONADER (Base)	SONADER
Other Projects	Peace Corps	Italian Project for perimeters CARITAS-wells	Peace Corp	Peace Corp	----	Croissant Rouge Peace Corp
II. Demographic Characteristics						
Tribes	(Rundown Village)	----	----	Very poor village	Prosperous Town	----

	<u>OLO OLOGO</u>	<u>DIKHEL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WADII/ KATRE</u>	<u>TEKANE</u>	<u>GANI</u>
Region/District	Brakna	Brakna	Trarza	Trarza	Trarza	Trarza
Size of Household	----	10-12	9-10	15	20	15
No. of Wives	----	1-2	1-3	2	3	1
No. of Children	0	6-10	8-9	6	18-20	10
No. of Other Household Adults	----	0-2	----	5	5-6	4
Education of Farmer	Partially educated	Reads/writes little	No formal education	No formal education	Educated	----
Age of Farmer	65	late 40's	53	40	48	----
III. Farm						
Characteristics	Village Farmer	----	Village Farmers	Village Farmers	Village Farmers	Village
No. of Parcels	Yes	3 total .7 ha.	----	----	----- Owners	----
No. of Walo Fields M. Mauritania (M) Senegal (S)	Yes	Yes	Yes 2 ha.	Yes None	Yes 3 fields large land holdings	Yes
S.	Yes	----	Yes 9 ha.	Yes Yes	Yes Large holdings	None
No. of Falo Fields M.	Yes	No	Yes 2 ha.	Yes ---	Yes 1 field 900 m.	Yes
S.	Yes	----	None	----	Yes Yes	Yes
No. of Fonde Fields M.	Yes	Yes	Yes	Yes	Yes 1 ha.	Yes
S.	Yes	Yes	Yes	----	Yes 0	None
No. of Dieri Fields M.	Yes	No	None	Yes None	Yes 0	Yes
S.	No	----	None	Yes Yes	Yes 0	None
Types of Cultivation	----	----	----	----	----	----
IV. Cropping Patterns						
Major Crops Grown	Maize Sorghum Millet Cowpeas Tomatoes Okra Squash	Dendi Sorghum Watermelon Okra Cowpeas Rice Sambé Muscov Muscov	Sorghum Cowpeas Sweet Potatoes Squash Makka Sowedatta Throtandi Veip	Rice Sorghum Maize Cowpeas Peanuts Watermelons	Rice Maize Sorghum Cowpeas Melons Sweet Potatoes Okra Zucchini	Rice Cowpeas Sorghum Millet Maize Squash Zucchini Okra

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WAJJI/ KAIRE</u>	<u>TEKLE</u>	<u>GANI</u>
		Corn Sweet Potatoes Zucchini Tomatoes Melons	Beleye Pourdi Samba Souki			Hibiscus Tomatoes Watermelons Sorrel
Length of Fallow for Dieri	----	----	----	5 years	----	----
Dieri Last Planted	1981	----	1950's	1981	----	1982
Dieri Last Harvested	1979	1973	----	1979	----	----
Walo Last Planted	1985	----	1985	1985	1985	1985
Walo Last Harvested	1986	1975	1986	1986	1986	1986
Fonde Last Planted	1970	----	----	1970	----	----
Fonde Last Harvested	1970	1983	----	1970	----	----
174 Sequence of Crops for Perimeters	Previously grew rice, now grows nothing. Note: 1 perimeter last planted in 1981, the other in 1984	Used to do 2 seasons	Rice	1) Rice	Rice	(1) Rice vegetables and corn
V. Irrigation Systems	2 perimeters	----	3 perimeters		3 perimeters	About 1 perimeter
Type of Perimeter	Small	Large: 1985	Small	2 small 1 small	Small	Small
Perimeter Area	total 43 ha.	250 ha.	3x20 = 60 ha.	25x35 20	28-10-20	22+50+3+5 +3+20+17+ (51)= 171 ha.
Farmer's Cropped Area	0.1-0.1 ha.	.2-.7-5	0.16 - 0.4 ha.	0.225 0.265 0.25	13 parcels	0.16 ha.
Pump Origin	U. K.	France Italy	2 Italian 1 Dutch	2:1&4 years CAPRARI	(2) Italian (1) German	Italian British German
Pump Make/Size	Lister HR 2	Agrom; vm	VMS (2 cyl) 2 cyl	all 2 cyl	2 cyl	1 & 2 cyl
Maintenance	SONADER	SONADER	SONADER	SONADER	SONADER	SONADER & private maintenance

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'DAR WADJI/ KAIRE</u>	<u>TEKANE</u>	<u>GANI</u>
Operator	None	Local pumpist	3	2 1	2	Various
Availability of Parts	Very difficult	Difficult	SONADER provides (out of Tekane)	Difficulty in obtaining parts Have had no pump trouble	Easily available	From Rosso
Canals Lined	Unlined	Unlined	Unlined	Unlined	Earthen, unlined	Unlined
Condition of Canals	Deteriorating Note: 1 private perimeter of 25 ha. last planted in 1978	Irrigate some parts by gravity	-----	Fair/ good	Good	Poor
Rainfall increases: Abandon/Stay	----	----	----	----	----	----
VI. Rice	Have not planted rice due to lack of funds and functioning pumps.	1983 last time	0.4 ha.	Kaire 9 sacks=.81 tons others =.9 tons	Farmers have grown rice for approx. 19 years	0.66 ha.
Water Application Frequency	----	Every 10-15 days	Every 17 days	Keep flooded	Every 2-4 days	Every 15 days
No. of Cultivations	----	1-2 times	Once/year	One	One	Once/year
Varieties	----	TNA IKP	Chiuchungway IKP Tishun Native TN1	Did not know	Tistjun Native TN1 TTW IKP	TTW IKP KSS
Other Crops in the Field		Cowpeas Vegetables Sorrel Okra	None	None	None	None
Diseases and Pests	----	Insects Crickets Wind Borer	Borers	Birds and animals were a problem	Epis blanc Borers Grasshoppers Other Insects	Borers Insects
Inputs Used (Fert. Insecticide, etc.)	----	UREA + phosphate first after transplant, second rice heading. Some not aware of use of fert.	Fertilizer 2 applications 50 kgs 0.4 ha. after transplant and at heading	UREA: 1.5 sacks/parcel	One farm had insecticide but did not use it. Ammonium Phosphate (P) UREA (U) 250 kg/ha.	Phosphate: 45 kgs/plot UREA: 25 kgs/plot

	<u>OLO OLOGO</u>	<u>DAREI. BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WADJI/ KAIRE</u>	<u>TEKANE</u>	<u>GANI</u>
Amount	----	----	----	----	----	----
Timing	----	----	----	----	----	----
Fencing:Timing	----	Dam; dike	----	None	----	None
Who	----	Do fence Cooperative	----	----	Villagers	----
Land Preparation (Mech. or Man.)	----	Manual, used to use tractor	Manual	Manual	Manual - group work	Manual
Timing	----	----	----	April-June	Takes 2 months	Men & labor
Planting:Time	----	----	June-July	September	September: Some broadcasting	July-August
Who	----	----	Family	Family	Farmer & laborers	Family
Weeding:Time	----	Manual, 2-3 times (1) after first application fertilizer	----	----	2-3 times	Used STAM (a selective herbicide)
Who	----	Family	----	Farmer	Farmer & labcrers	----
Harvesting:Timing	----	End of Oct. 7-20 sacks	Obtained 27 scaks	January	It takes 3 weeks	October
Who	----	----	Family	family	Farmer & laborers	----
Threshing:Timing	----	----	----	----	----	Right after harvesting
Who	----	----	----	Family	SONADER	----
Storage Method	----	----	In sacks in stores	In sacks in the house	In sacks at home	In sacks
Milling	----	----	----	----	----	Mechanical
Marketed/Consumed	----	Consumed	To pay SONADER: 53 sacks The rest is consumed	To SONADER: 1 sacks The rest is consumed	To SONADER and for consumption	Marketed in Rosso, CSA Part consumed
Use of Straw	----	For animals	----	Burned	Collected for the animals	----

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAP WADJI/ KATIFE</u>	<u>TEKANE</u>	<u>GANI</u>
VII. IRRIGATED SORGHUM	Perimeters not planted	Some grew it SONADER wouldn't let them	Farmers interviewed did not plant	Farmers interviewed did not plant	Farmers interviewed did not plant	Some farmers planted as wind breaks for vegetable gardens
Yields	----	----	----	----	----	----
Water Application Frequency	----	----	----	----	----	very little does not do well like rice
No. of Cultivations/Year	----	----	----	----	----	----
Varieties	----	----	----	----	----	----
Other Crops in the Field	----	----	----	----	----	in the gardens
Diseases & Pests	----	----	----	----	----	----
Inputs Used (Fert. Insecticides, etc.)	----	----	----	----	----	----
Amount	----	----	----	----	----	----
Timing	----	----	----	----	----	----
Land Preparation (type)	----	----	----	----	----	by hand
Timing	----	----	----	----	----	----
Planting:Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Fencing:Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Weeding:Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Harvesting:Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Threshing:Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Storage Method	----	----	----	----	----	----
Milling	----	----	----	----	----	----
Marketed/Consumed	----	----	----	----	----	----
Use of Straw	----	----	----	----	----	----
VIII. IRRIGATED CORN	Perimeter not planted	----	Farmers interviewed did not grow	Farmers interviewed did not grow	Farmers interviewed did not grow	Farmers interviewed did not grow

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WADJI/ KAIRE</u>	<u>TEKANE</u>	<u>GANI</u>
IX. MARKET GARDENS	(1) 1.5 ha (2) .25 ha	----	Converting a 20 ha. perimeter to a garden	Garden	---	----
Water Source	(1) River-by hand (pump down) (2) Well by hand	Marigot, motor pump	River	Pump from river	River (pump)	River (pump)
Location	(1) Riverside (2) By village	----	Near the river	Riverside	Riverside	Near the river
Crops Grown	Cabbage Carrots Onions Potatoes plus other vegetables	Cabbage Lettuce Eggplant Tomatoes Onions	----	Onions Lettuce Cabbage Potatoes	Cabbage Potatoes Beans Onions Tomatoes	Potatoes Corn Tomatoes Onions Cabbage Hibiscus 2.5 ha (private perimeter) Tomatoes
Marketed/Consumed	Consumed	----	----	Marketed	Marketed & consumed	Marketed in Rosso and Nouakchott
Independent/Cooperative	2 coop's (1 Halpoular 1 Moors) pump has 1 cyl.	----	----	Same pump as for the perimeter	Cooperative	Private and cooperatives women have 6 ha. of gardens
X. RECESSION SORGHUM (Walo)	----	Not inundated	----	Farmers land in Senegal	----	----
Area Grown	2-15 ha.	----	1-5 ha.	----	2.5-3 ha.	3 ha.
No. of Days Flooded	15-90 days from July	----	2 months	----	30-50 days	----
Varieties	Samé Red Samé White Thiotandi	----	Fellah Samé Sewil N'Daneri Sanbo souki Dabity Mariam Faty	----	Samé Fellah	Sanbo Souki
Other Crops in the Field	Cowpeas	----	Millet (Thiotandi)	----	Cowpeas	Cowpeas Watermelons Squash Zucchini

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WAJJI/ KATRE</u>	<u>TEKANE</u>	<u>GANI</u>
Diseases & Pests	Smut Insects Birds Animals	----	Smut Crickets Camels	----	Aphids Grasshoppers Other insects	Insects Worms Birds Winds a serious problem
Inputs Used (Fert., Insecticides, etc., soil preparation)	Seed treated Also washed seed in urine (against smut)	----	Seed treatments 1 matchbox 4 kgs. Insecticide 50 kgs. around the field	----	None use treated seed	Seed treatment only (packets)
Amount	----	----	----	----	----	----
Timing	----	----	----	----	----	----
Planting:Timing	Sept.-Oct.	----	October	----	November takes 2 weeks	November
Who	Family	----	Family &/or wives	----	Farmer & men	Family
Fencing:Timing	None	----	None	----	None or branches	None
Who	----	----	----	----	Farmer	----
Weeding: No.	1 or 2	----	none	----	8 person days/ 2.5 hours	during two months
Timing	Nov.-Dec.	----	----	----	1-3 times	----
Who	Farmer, men & boys	----	----	----	Farmer &/or laborers	Family
Harvesting:Timing	Mid-Feb to March	----	Later part of Feb.	----	----	----
Who	Women or family	----	Farmer & family	----	Family	Family
Threshing:Timing	----	----	----	----	----	----
Who	----	----	----	----	----	Family
Storage Method	----	----	Stored on the heads	----	On the panicle	On the panicle or sacks
Milling	Morter	----	By the mill	----	----	----
Marketed/Consumed	Consumed	----	Consumed	----	Consumed/ shared	Consumed
Use of Straw	Collect as forage for animals	Collect as forage for animals	----	----	Collect as forage for animals	----
XI. RECESSION CORN (Walo)	Farmers interviewed did not grow	----	Farmers interviewed did not grow	Farmers interviewed did not grow	Farmers interviewed did not grow	Farmers interviewed did not grow

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WADJI/ KAIRE</u>	<u>TEKANE</u>	<u>GANI</u>
XII. FALO CROPPING PATTERNS	Falo last planted 15 years ago	----	----	----	----	----
Area Grown	1 ha.	----	60m X 60m	----	Up to 2 ha.	----
Types of Crops	----	----	Maize Cowpeas Sweet Potatoes Watermelons Squash	Maize Cowpeas Watermelons	Sometimes Cowpeas alone Others: highest Maize & Cowpeas Lowest- Sweet Potatoes	Sweet Potatoes Tomatoes Cowpeas Maize Squash Zucchini Okra Sorrel Hibiscus Makka
Diseases & Pests	----	----	----	Insects Aphids	Insects	Termites
Inputs Used (Fert. Insecticides etc.)	----	----	None	None	None	None
Land Preparation	----	----	----	----	----	----
Amount	----	----	----	----	----	----
Timing	----	----	----	----	----	----
Planting: Timing	----	----	----	November	November over two months	----
Who	----	----	----	Family	Farmer	----
Fenceing: Timing	----	----	----	Inadequate branch	----	----
Who	----	----	----	Farmer	----	----
Weeding: No.	----	----	----	Once	Once	----
Timing	----	----	----	----	----	----
Who	----	----	----	Farmer	Farmer & laborers	----
Harvest: Timing	----	----	----	----	----	----
Who	----	----	----	Family	Family	----
Threshing: Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Storage	----	----	----	----	----	----
Milling	----	----	----	----	----	----
Marketed/Consumed	----	----	Consumed	Consumed	Consumed; surplus shared.	----

	<u>OIO OLOGO</u>	<u>DAREI BARKA</u>	<u>DAR ES SALAM</u>	<u>N'DAR WAJJI/ KATIE</u>	<u>TEKANE</u>	<u>GANI</u>
Use of Straw	----	----	Some as forage for the animals, the rest left in the field	Fodder for animals	Collected as forage for animals	----
XIII. FONDE CROPPING PATTERNS	Last Planted 15 years ago	Didn't plant	Farmers interviewed did not plant Fonde	Villagers have not planted Fonde for at least 15 years	----	Farmers interviewed have not planted Fonde for several years
Area Grown	----	----	----	----	Not known	----
Types of Crops	----	----	----	----	Sorghum (Fellah) Watermelon Cowpeas Squash	----
Diseases & Pests	----	----	----	----	----	----
Inputs Used (Fert., Insecticides etc.)	----	----	----	----	None	----
Planting: Timing Who	----	----	----	----	----	----
Fencing: Timing Who	----	----	----	----	----	----
Weeding: No. Timing Who	----	----	----	----	----	----
Harvesting: Timing Who	----	----	----	----	----	----
Storage Method	----	----	----	----	----	----
Marketed/Consumed	----	----	----	----	----	----
Use of Straw	----	----	----	----	----	----
XIII. DIERI CROPPING PATTERNS	Farmers interviewed did not plant Last planted 5 years ago	Haven't plant since 1973.	Farmers interviewed did not plant.	Farmers land in Senegal. Last planted 4 years ago.	Farmers interviewed did not plant	Farmers interviewed did not plant mainly because of the severe bird problem
Area Grown	----	----	----	----	----	----
Crops Grown (Millet & Sorghum)	----	----	----	Fellah	----	----

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WAJJI/ KAIRE</u>	<u>TEKANE</u>	<u>GANI</u>
Varieties	----	----	----	Watermelons Peanuts Cowpeas	----	----
Diseases & Pests	----	----	----	----	----	----
Inputs Used (Fert., Insecticides, etc.)	----	----	----	----	----	----
Land Preparation	----	----	----	----	----	----
Planting: Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Fencing: Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Weeding: No.	----	----	----	----	----	----
Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Harvesting:	----	----	----	----	----	----
Timing	----	----	----	----	----	----
Who	----	----	----	----	----	----
Milling	----	----	----	----	----	----
Storage Method	----	----	----	----	----	----
Marketed/Consumed	----	----	----	----	----	----
Use of Straw	----	----	----	----	----	----
XV. BAS FONDE	Farmers interviewed did not plant	----	Farmers interviewed did not plant	Farmers interviewed did have such land	Farmers interviewed did not plant	Farmers interviewed did not plant
Wild Animals & Birds	Boars Gazelles Monkeys	----	Monkeys	Boars Jackals Monkeys	Boars damage crops Ducks eat the grains. Boars Jackals Ducks	----
WILD FOODS						
Types	Jujube Balanites	Fonio Balanites Jujube Gigélé Tabbe Pamiri	Jujube Balanites Tamarins Paguiré (Fonio)	Children collect wild fruit Balanites Jujube	Small wild fruit. Balanites	Balanites Jujube

	<u>OLO OLOGO</u>		<u>DAREL BARKA</u>		<u>DAR ES SALAM</u>		<u>N'BAR WADII/ KAIRE</u>		<u>TEKANE</u>		<u>GANI</u>	
LIVESTOCK	Village Farmers		Village Farmers		Village Farmers		Village Farmers		Village Farmers		Village Farmers	
goats: No.	60	0	100	7	100 (village) includes sheep	100	0	200	0-4	----	----	1
Diseases	----	----	Physiological infirmities Growth on mouth		Physiological	----	----	----	----	----	----	----
Feeding Practices	Open grazing		----		Food shortage Extensive grazing	Open grazing		Open pasture grazing		----		----
Sheep: No.	20	11	50	----	(see goats) Meteorisme	0	0	300	0-6	----	----	2
Diseases	----	----	----	----	Food shortage; extensive grazing	Open grazing and forge		Open pasture grazing		----		----
Feeding Practices	Open grazing		Extensive open grazing		----	----		----		----		----
Cattle: No.	32	9	20	----	50 none none	2	0	100	0-5	----	----	0
Diseases	----	----	Tousser		Food shortage extensive grazing	Open grazing and forage		Open pasture grazing		----		----
Feeding Practices	Open grazing mainly		Open grazing		----	----		----		----		----
Donkeys: No.	30	1	10	1	4	----	10	2	20	0	----	0
Diseases	----	----	----	----	----	----	----	----	----	----	----	----
Horses: No.	4	0	6	----	20	----	7	0	50	0-2	----	2
Diseases	----	----	----	----	Nasal congestion Stomach ache problems	----	----	----	----	----	----	----
Birds	----	----	----	----	----	----	----	----	----	----	----	----
INTERACTION BETWEEN SEDENTARY FARMERS AND NOMADS	Positive interaction with the nomads. The camels badly damaged the Walo. Also, they contaminated the water.		Serious problems cattle and camels doing crop damage.		Nomads camels do extensive crop damage.		There is competition for resources. Camels do considerable damage in the Walo and the perimeters.		They have no problems with nomads that have small animal herds. They have serious problems with camels that have destroyed up to 60% in the Walo and 10% in the perimeters.		The farmers allow the nomads herds to graze the stubbles, but nomads animals have been causing considerable crop damage.	
FISHING	They claim there are no fish in the river to		Fish (not many) in marigot.		Fishing is important to the village, but now there		No fishermen in the village.		Fishing exists Very little is caught In past 5 years		----	

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WADJI/ KAIRE</u>	<u>TEKANE</u>	<u>GANI</u>
			fish. Best time to fish is Nov.- Dec. when floods recede.			
OTHER SOURCES OF INCOME	Some milk is sold. Main source is charcoal.	Repair radio and watches	----	----	----	----
Seasonal Migration	More than 30% of the village migrate.	Some go to Rosso Senegal Boghé Mkt to work	30% of the village migrate to Nouakchott Rosso, Nouadhibou and Dakar	70% of the village have migrated to Nouakchott and Senegal	Many emigrants: 50% mainly functionaries and students to Europe, USA & West Africa	----
Local Off-Farm Employment	Charcoal production	Charcoal production is very important source of income	Some charcoal production	----	some	Sale of fish
185						
Farm Laborer- Remittances	None	---- some	Yes, some remittances	Some remittances pensions	A number work as laborers Some remittances Pensions	Pensions
CREDIT						
Sources	SONADER none other	Borrow food from merchants at no interest. SONADER	SONADER (materials)	SONADER Relicent in giving at present because cooperatives have over 400,000 um debt. Some commercial credit.	SONADER for materials. Up to 690,000 um per crop No carry over debt.	Obtained credit in Nouakchott
ENERGY SOURCES	Wood fuel Sell charcoal	Wood fuel Charcoal	Wood fuel	Wood fuel	Wood fuel and some charcoal	wood fuel

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'HAR WADJI/ KATRE</u>	<u>TEKANE</u>	<u>GANI</u>
AREAS OF RESEARCH						
Elicited from Farmer Constraints	<p>The major problem is the indebtedness of the cooperative. Thus no perimeters had been planted. Lack of water (drinking water). The village is isolated in the rainy season; it is inaccessible. Pumps are broken down and lack equipment to work the fields properly. They do not have the means to keep the pumps functioning or to maintain them. Lack of food is a serious problem. Birds and animals (boar) devastate their crops. Perimeters are not level and are now in bad shape.</p>	<p>Water pumps are not functional. Need machinery (tractors) for soil preparation. Need fence around perimeter. Food shortage SONADER would not let them grow sorghum. Insects are a problem.</p>	<p>Need more education. Size of the plots are too small. They have a salt problem. (salinity) with the dry season crop. Run out of forage between April and June. Do not have adequate fishing equipment. Lack adequate food. Health problems: dispensary lacks equipment. Need machinery and reliable pumps to extend plots.</p>	<p>The major constraint is the indebtedness of the cooperative. There is not enough food. The lack of education and educational facilities for the village. They have many health problems. The Walo has a serious weed problem.</p>	<p>Food shortage Irrigated plots are too small or insufficient to live off. Lack the means and equipment to work effectively. The yearly debt is a problem especially with regards to land proprietorship. Require more education. Much of the Walo was damaged by grasshoppers. Lack adequate fencing to keep animals out of the fields.</p>	<p>Birds are a serious problem. Require machines in order to improve the labor efficiency per area cultivated. SONADER plots are too small to live off. Price of rice is too low. Need fences and/or fencing material. The animals are a serious problem. Many people do not want to grow 2 crops/year because of the fear of over exploiting the soil. Problem with prompt payment for rice- have to wait up to 2 months with CSA.</p>

	<u>OLO OLOGO</u>	<u>DAREL BARKA</u>	<u>DAR ES SALAM</u>	<u>N'BAR WADJI / KAIRE</u>	<u>TEKANE</u>	<u>GANI</u>
Interventions	Require short-cycle and high yielding crops, so they can have 2 crops a year. Would like to see crops that require little water. Need equipment to improve the labor efficiency.	----	----	----	----	----
Recommendations	----	----	Need salt tolerant crop or variety of corn. Look into the cultivation practices: place corn and sorghum on the side of hills.	Require improved varieties of rice sorghum cowpeas maize. Improved dairy cattle.	Require a high yielding, short cycle samé. Improved maize, sorghum, cowpeas, varieties. Research into pisciculture. Need effective and affordable herbicides and insecticides. Seed packages with seeds treated with fungicides. The means to make the land more productive and labor more effective.	The farmers would like to have early maturing varieties. Want vegetables that mature at different times of the year. Would like to have types or varieties of vegetables that transport well.

APPENDIX C

TIMING OF CROPPING ACTIVITIES

JAN FEB MARCH APRIL MAY JUNE JULY AUGUST SEPT OCT NOV DEC

Irrigated Rice

Land Preparation

Transplanting

Harvest

2nd

1st

2nd

1st

2nd

1st

Irrigated Sorghum

Land Preparation

Planting

Harvest

2nd

1st

2nd

1st

Irrigated Corn

Land Preparation

Planting

Harvest

2nd

1st

2nd

Dieri Corn

Planting

Harvest

APPENDIX C

TIMING OF CROPPING ACTIVITIES

JAN FEB MARCH APRIL MAY JUNE JULY AUGUST SEPT OCT NOV DEC

Recession Sorghum

Land Preparation

Planting

Harvest

Recession Corn

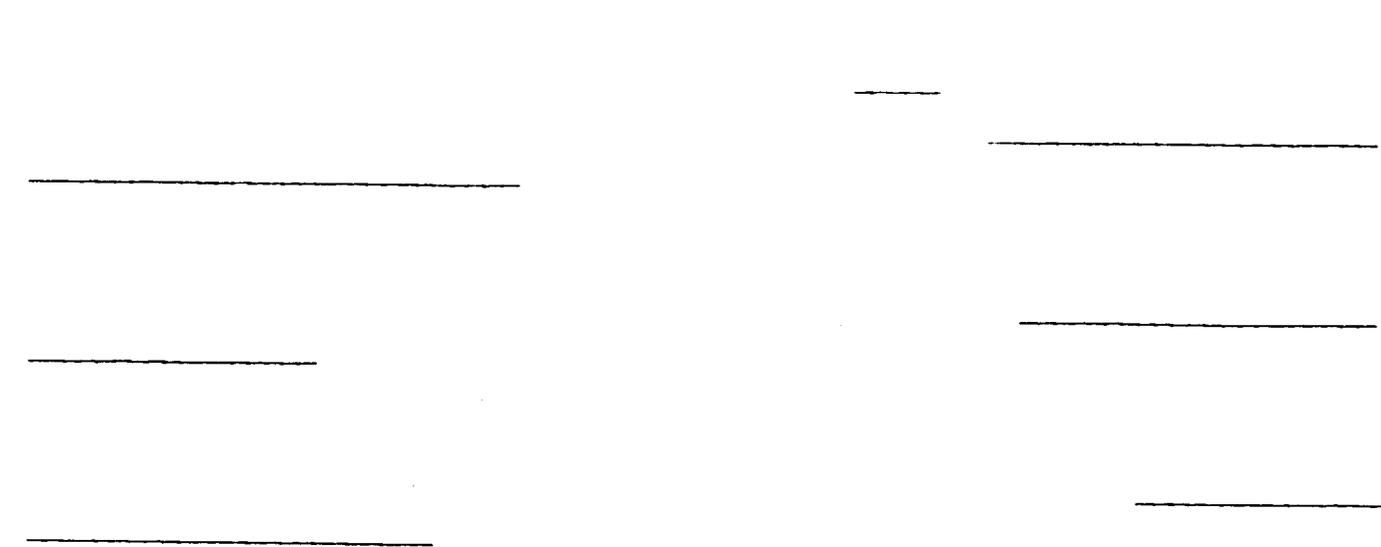
Planting

Harvest

Falo Farming

Planting

Harvest



APPENDIX E

SUMMARY OF CONSUMPTION SURVEY RESULTS

Variables	SILLA	DJOVOL	TALHAYA	LEKSETBA	WOMPOU	WALI	TOULEL
I. Access to Markets	Small center 8 women	Large center 100 women	Periodic market	----	Market functions as a regional center	2 markets	1 market
Type of Market	Permanent	Permanent	Only when something for sale	Permanent	Permanent	Permanent	Permanent
Products Sold	Fish (dry, fresh) Little Tomatoes Melon Diahadyé Eggplant Cowpea Cowpea leaves Milk Onions Rice Rice (unpeeled) Salt Dried onions Sorghum Okra	All vegetables Fish Meat Cereals (NOTE: Fish important source of revenue in village)	Some vegetables Dry fish	----	Meat (cow, sheep) Onions Sorghum Corn Millet Okra (dry) Okra (fresh) Eggplant Cowpea (fresh) Cowpea (dry) Flat cake	Oil Rice Tomatoes Maggi cubes Pepper	----
II. Items Purchased Daily	Rice Bread Milk Fish Sorghum Coffee Tea Vegetables (only when own garden doesn't produce i.e, lack of water)	Vegetables Bread Coffee Tea Maggi cubes	Rice Sorghum Bread	Meat (1/2 to 1 kilo- 7 persons) Rice Millet Fish (mostly dry) Sorghum	If women don't have gardens- they buy vegetables	----	----
Items Purchased Every 2-3 Days	Sugar Oil	Sugar Salt Oil	Peanuts (from Senegal) Sugar Coffee Tea Oil	----	----	----	----

	SILLA	DJOVOI.	TAI.HAYA	LEKSEIBA	WOMPOU	WALI	TOULEI.
III. Food Items Shared	----	No	No	No	Yes Surplus of meals are given to other family members	No	Yes food product
With Whom	----	----	----	----	----	----	village
When	----	----	----	----	----	Always	----
IV. Food Items Exchanged	----	Different products	Exchange or credit for goods	No	----	Yes	----
What	Tomatoes	----	Money	----	Millet Sorghum	Millet Sorghum	----
Items Exchanged For	Rice	Milk	Milk	----	Milk Fish Jujube	Milk	----
With Whom	Other women	Village	Herders	----	Herders/ Senegalese	Other villages	----
When	Daily	----	After harvest	----	----	----	----
V. Gardens Characteristics	1 ha 100 women 300 meters from the river. First year of garden along the river (falo).	1 ha maize 4 ha vegetables 80 women (10-40 years) Old women (volunteers) water the garden. They get vegetables for it. Men gave land to the women. When there are large tasks (seeding, weeding, harvesting, making canals etc. all women come to help.)	1 coop 1 garden for each 1/3 village 1 garden each family.	First year for garden	Some women have gardens near the marigot.	Women work on two parcels	First year for this area land did not belong to anyone. To start, each woman paid 20 um for seeds
Organization of Labor	Each woman responsible for a parcel	Cooperative	----	Each woman cultivates own parcel	No	----	Cooperative

	SILLA	DJOVOL.	TALHAYA	LEKSEIBA	WOMPOU	WALI	TOULEL.
Individually Managed Plots	No	No	Yes	No	Yes	1 for family 1 for coop.	No
Vegetables Grown	Cabbages Onions Carrots Turnip Sweet Potatoe Tomatoes Lettuce Milo Eggplant Hibiscus Mint Beet	Maize Tomatoes Hibiscus Cabbages Cowpea Salad Onions Eggplants Parsley Sorghum (Fellah, Samé) Maize	Carrots (white & orange) Turnip Lettuce Cabbage Onions Potatoes Mint Millet Maize	Lettuce Carrots Beets Tomatoes Cabbages Peppers Onions	Potatoes Lettuce Tomatoes Cabbages Carrots Turnip Eggplant Onions Parsley Cowpea	----	Salads Okra Peanuts Carrots Tomatoes Cabbages, Vegetables in cold season, Peanuts & Okra in wet season
Season	Cold season	cold and rainy	cold	cold	cold	cold	cold and wet
Yield	10,000 um/yr.	'62-83: 80,000 um '83-84: 90,000 um '84-85: lost crop.	-----	till now: 1000 um	-----	----	----
Amount Consumed	Half	Half (or private selling)	Consumed	Half	Consumed	Consumed	Part for consumption
Amount Sold	Half	Half: money in in coop fund	No	Half: money in coop fund	Small part	Products sold are from coop parcel	Part for selling
Where	Local market	Local market	----	Local market	Local market	----	Local market
Items Exchanged	Among women	No	No	No	No	----	----
Source of Water	Hand carried from river 300 meters away	River American motor pump (Peace Corps) 1 cyl.	Gorgol Noir or marigot	Wells	Marigot	River	Marigot
Special Remarks	Water transported on head	'83-84 yield sorghum & maize: 100 kilo	Began growing vegetables in last 2-3 yrs.	Water shortage in well	----	Shortage of water, Shortage of seeds	formerly they bought vegetables from Senegal

	SILLA	DJOVOL	TALHAYA	BEKSEIBA	WOMPOU	WALI	TOUIEL
Garden Constraints	Water transportation. Not all available land is cultivated. Lack of tools	Birds Insects Weeds Repair pump Crop loss	----	Shortage of water Shortage of money	----	Water source far away from garden Insects Lack of tools	----
VI. Women and Agriculture	Yes	----	On family fields	On family fields	Own field. Garden	----	----
Access to Land (owned or borrowed)	Land for garden inherited by women	----	----	----	Yes, part on family field. Harvest for women.	----	----
Crops Grown	Millet Rice Maize Sorghum	----	----	Rainfed sorghum Cowpea Tomatoes Melon	1) Peanuts local rice indigo okra 2) Millet	----	----
Consumption/Marketed	----	----	----	----	If yield is high, they sell surplus	----	----
Constraints	First crop in garden dried out. Animals	----	Birds	----	Camels Birds	----	----
VII. Gathered Food Kinds	----	No vegetables There are: Jujubes Balamites Guigilé "Pintades", kind of chicken, sold in town	Fruits: Mourtorde Guigilé gigélé Potté gougoulé Jujube Tree leaves: Oulo Tiatato Small grains: paguiri, n'dairi. Tabbé Previously, they exploited gum arabic, now it is restricted.	Previously: Jujube Gum arabic Nothing now	There used to be many baobabs, now dead. There are some jujubes, mourisianka but most of it is eaten by camels	----	----

	SILLA	DJOVOL.	TALHAYA	LEKSEIBA	WOMPOU	WALI	TOULEI.
Quantity	----	Very little	Small quantities but important during hunger periods	None	Small	----	----
Where	----	bushes	tabbé in marigots	----	Only when they find food on the way to the fields.	----	----
Season	----	Fruits during rainy season	Fruits in rainy season Grains in dry season	Rainy	Rainy	----	----
Fishing	Yes	Yes	Only when water	No	No	Only when water in river	No
Where	River	River	Gorgol Noir Marigot	Fish imported	----	Not at this time	----
VIII. Free Food Frequency	----	Once every 2-3 months	1-2 times a year	Once a year	Once a year distributed to small family units (3 persons)	----	once a year
Most Recent Access	----	----	----	----	Oct/Nov '85	----	Nov '85
Quantities	----	6-8 kilo red sorghum	50 k sorghum 5 k. milkpowder 5 lb. butter	50 k sorghum 5 k milkpowder 5 lb. butter	1 sack corn 2 buckets oil/ butter 1 sack cereals 1.5 sack milkpowder	----	5 k butter 50 k cereals 5 k. milk for family with 10-11 children
Organization	----	----	C.S.A. (Comm. Sécurité Aliment.)	Government	----	----	Government
Where	----	2 large storage bins in village	----	yes, original storage bin	original storage bin	yes	----
Products Stored	----	cereals cowpeas	----	Sorghum Millet	Millet Sorghum	----	----
Method	----	----	----	on the panicle	on the panicle	----	----

	SILLA	DJOVOI	TALHAYA	LEKSEIBA	WOMPOU	WALI	TOULEI
Quantity	----	----	----	----	Depends on size of harvest and rainfall. If harvest is significant, storage ends when next season starts.	----	----
Duration of Supplies	-----	-----	-----	2 months after harvest	----	in May or June	----
Losses	----	----	-----	no	no	----	-----
How	----	-----	----	----	----	----	-----
X. Meals (Composition)							
Breakfast	Coffee Bread White rice	8:00, coffee and bread	7:00, coffee and sugar 10:00 couscous (rice or millet) and cowpea leaves. Then goat or sheep milk if available	Coffee or tea Bread	Sometimes coffee Quinkéliba Millet + milk + sugar	Coffee and bread with butter, if there is money	7:30 bouillie coffee if there is money
Lunch	Rice with fish (Thiébonndjen)	1:00, rice with fish Millet with fish Cowpeas, Tomatoes, Carrots	12:00-2:00 rice with fish	Rice with meat Rice with fish (rarely)	Rice and meat (cow/sheep/goat, rarely camel!) They seldom eat fish	Gniri: sorghum or millet or rice (pounded) with fish or or meat	12:00 rice fish or meat Days without fish or meat then they eat bouillie
Dinner	Couscous (millet) and fish couscous (millet) and cowpea couscous (rice) couscous (sorghum)	9:00, Couscous (millet, corn, sorghum) + fish + Cowpea leaves couscous + Milk	8:00-9:00, Couscous millet or sorghum + fish + cowpeas leaves + dry fish + peanuts	Couscous with meat Couscous with cowpea leaves Couscous with milk (and sugar if it is powder or canned milk)	Couscous with meat, and cowpea leaves milk afterwards	Couscous + cowpea leaves + fish couscous + meat couscous + milk	8:00, millet + fish cowpea leaves dry fish + peanuts, Millet and cowpea grain
Other Meals	No	No	No	No	5:00-6:00, bouillie (millet) or white rice	No	5:00, bouillie (millet) or rice

	SILIA	DJOVOI.	TAI.HAYA	LEKSEIBA	WOMPOU	WALI	TOULEL
Snacks	Mango stems Tea	Mango stems Maize stems Cake with tomato suace if hungry and money available	Mango stems	No	Mongo stems Don't drink tea or coffee. Cakes if you have money and you are hungry.	Mango stems drinks fritters, tea peanuts	fritters with sugar + oil fritters + sauce of toma- toes, onions couscous & butler + dry fish
Frequency		Not often	----	----	----	----	----
Major Dishes and Ingredients	Rice with fish Rice, oil, tomato sauce, Cabbage, Fresh fish, Salt, pepper, Carrots, Turnips	Rice with fish Sorghum or millet with fish Couscous (millet, sorghum or corn) + cowpea leaves + fish + oil N'demiri	Rice with fish Couscous with cowpea and dry fish. Rarely fresh fish available	Rice with meat Rice + tomatoes onions + oil + meat + salt	Rice with meat	Rice and fish Batter of millet with milk Couscous (samé) with cowpeas leaves + fish couscous with meat	Cowpea grains in sauce for couscous millet + cowpea leaves + oil + batter of peanuts and dry fish
XI. Food Preferences Meat/Fish	----	Meat	1) meat (small animals) 2) fresh fish	fish	Grains are more important than vegetables or fish	Samé with fish	----
Staple Preferred	Millet	Millet	1) millet 2) sorghum	Rice	All types'	Samé They don't like rice	Millet Rice
Reasons	They like couscous they even pound rice to get couscous	Taste	Taste	Taste and availability	-----	Sorghum Millet Rice	----
Dominate Staple	Sorghum Millet Maize	Sorghum Maize Rice Millet	Millet Maize Rice Sorghum	Sorghum Millet Samé	Millet Maize Sorghum	Samé	Rice Millet
Food Preferred if More Money	Millet	Meat	Fresh fish Meat	Rice with fish (fresh)	Fish	----	Fresh fish and millet
Preferred Dish	Couscous (millet)	Couscous (millet) Fish Cake, cowpea Tomatoes, fish and carrots	Couscous and meat. Couscous and milk	Rice with meat	Mafé, millet Rice Thiébondjen		Couscous

	SILLA	DJOVOL	TALHAYA	LEKSEIBA	WOHPOU	WALI	TOULEI
XII. Seasonal Aspects of Food	----	----	They rarely eat meat, goat or sheep, (once/year). They sometimes eat chicken	----	----	----	----
Hungry Periods	----	Summer till rainy season	-----	Rainy season	Rainy season	April	----
Foods in Short Supply During Each Season	----	Dry: No vegetables. Hungry from last dry season to rainy season All sorts of food shortages during dry season	Many animals die in dry season No milk	Rainy season shortages of fish or meat	Rainy season shortage of fish (bad access to roads)	All sorts of food in short supply in dry season	Cold season fish and meat shortages
Source of Money to Purchase Food During Hungry Periods	----	Emigrants Merchants: little credit, (money or goods) Some women sell: soap, olives, sugar	Emigrants (not much) Seasonal labor or migration	----	----	----	----
Foods by Season Dry/Cold	Vegetables, (In the past, harvest was enough) Maize	From March on: sweet potatoe mellon	Vegetables Millet Rice + dry fish, maize (nearly finished)	----	Vegetables	----	vegetables
Dry Hot	-----	-----	rice + dry fish	----	----	they plant cowpea grains to obtain leaves	----
Wet	rice	cereals	jujube; small grains	meals based on milk	sometimes fish in the marigot	----	rice, peanuts okra, millet (small portions)
Main Staples by Season Dry Cold	maize	----	----	----	millet, corn, sorghum	----	millet rice
Dry Hot	----	----	----	----	----	----	----
Wet	rice	cereals	----	----	rice	----	----

	SILISA	DJOVOI.	TALHAYA	LEKSEIBA	WOMPOU	WALI	TOULEI.
XV. Fuelwood Who Collects	----	men	men, women and children	----	women, men and children	----	----
When	----	----	when you need it or you buy it	----	if no money to buy	----	----
Where	----	----	bushes buy wood or charcoal	far away	----	far away	----
Price	----	women buy it, or send out their husbands to gather it. Same for charcoal	fuelwood: 200 um/ donkey cart	5 pieces of wood/10 um	400 um/ donkey cart	300 um/ donkey cart	----
XVI. Mills Access to Mills	none	2 mills for sorghum 1 mill for rice	None	3 mills	2 mills	3, only 1 functions	4, 2 are working
Costs	-----	-----	-----	-----	4 mill, 15 um	-----	-----
Hand Pounded	press st. into grains in fields, to flour at home	-----	in fields	women at home Some women pound themselves some go to mill	home	-----	-----
XVII. Time Schedule/Day Milling	-----	-----	-----	-----	to make flour all women go to mill	-----	-----
Meals	-----	-----	1 1/2 hours big meal	-----	breakfast 1 hour lunch 2 hours dinner 2 hours	1 1/2-2 hours	-----
Gardens	each day 6 hours	during big tasks: all day. Other days: 1 hr.	-----	waiting hours by well	women who have gardens: afternoon	afternoon	-----
Fields	morning or afternoon	2 hours	all day chasing birds	-----	afternoon	-----	-----
Marketing Activities	morning	morning	none	-----	-----	---	-----
Water	-----	-----	-----	1-2 hours each time	3 hours	---	-----

	SILLA	D.IOVOL.	TAIHAYA	LEKSEISA	WOMPOU	WALI	TOULEL
Fuelwood	----	----	Sometimes when you don't buy it	----	----	----	----
XVIII Health of Children and Mothers	no PHI no Dispensary	PHI Dispensary	Dispensary	Dispensary Traditional midwives	No PHI Dispensary without equipment. If medical problems they go to Selibaby or Senegal	Dispensary Traditional midwife	PHI for 1 year
Care of Children	mothers and older girls	-----	mothers, or other adults	-----	-----	----	----
Duration of Breast Feeding	-----	2 years, unless pregnant	1-2 years	1 1/2 years	1 year	1 year	1-1.5 years
Weaning Foods	----	no	no	no	no	none	normal food little proportions
Begin Weaning	----	from 2 years old, normal food	1-2 years normal food	----	after 1 year	----	from six months
Food for Child When Mother Has No Breast Milk	----	normal food, in little quantities and bouilli and milk	normal food + bouillie, milk, sugar, rice when very young	----	mothers nearly always have milk	milk bouilli	child will die unless you have money to buy tinned milk to make bouilli. Only when mother is dead another woman will give milk to the child
Food for Non-lactating Women	----	no special food	no special food	no special foods	batter of cowpeas (grains) + butter	----	no special food
Food for Lactating Women	----	no special food	cousous with leaves of cowpeas (boiled) + peanuts. Sorghum + rice powder (steamed) fish	no special foods because of lack of means	rice with cowpeas (batter) + butter	----	no special food. Evening meals are good for milk production. lunches are not.

	SILHA	DJOVOL	TALHAYA	LEKSEIBA	WOMPOU	WALI	TOULEL
Food for Pregnant Women	----	right before birth, eating less help deliver baby easier	----	----	only when diet is prescribed	none	----
Food for Women Just Giving Birth	----	little meat, milk, bouillie rice soup with milk and sugar	if money: soup and meat; millet flour, milk	no	bouillie with meat, rice with batter of cowpeas (grains) + butter	none	if money, soup with meat
Occurrence of Diarrhea	----	regular	frequent, 2 or 3 times a month	not often	often		----
Season	----	----	Sept-Nov	----	always	----	----
Food Used To Treat Diarrhea Episodes	----	Rice water usual food	----	Rice water Sour milk Bread	----	----	----
Infant Mortality	-----	44%	----	----	not high	----	not high
Seasonality	----	----	Sept-Nov most of children die	----	----	----	no
Cause of Death	----	----	diarrhea	----	Hepatitis	----	----
Ratio of Children Who Are Alive to Children Who Are Dead	----	6:4 9:2 5:6 4:2 2:3 1:2 5:2 3:6	----	2:2	8:1 1:00 1:0 2:1	----	9:1 6:0 9:0 10:0 4:7 mother had no milk
Most Important Illness	----	----	----	----	Measles Hepatitis	----	----
Constraints and Areas of Research	Animals in fields (not in garden, women built a fence) Tools Motor pump Canals Seeds Extension service Help with insects	No third yield in garden because of lack of material. Extension service. Tools Help preparing the soil. Weeds Want a tractor and motorpump.	Pump for gardens Fencing Vegetable seeds Soil fertilizers	Lack of means to cultivate a perimeter. Water shortage Lack of technical assistance. Tools for watering.	Women want assistance with new gardens and fences. Lack of water a problem. Canals a problem.	Maintenance of pumps. Shortage of water. Insects	----

SUMMARY OF RESULTS OF THE CONSUMPTION SURVEY

Variables	DAREL BARKA	OULO OULOGO	M'BAR/WADJJEKATRE	DAR ES SALAM	GANI	TEKANE
I. Access to Markets						
Location	yes	yes	no	no Women go to Senegal (especially in hungry period)	yes along the river	eastern part of village
Type of Market	permanent	permanent	----	----	permanent 20 women	permanent
Products Sold	Cabbage Carrots Hot Peppers Eggplant Cowpea leaves Hibiscus leaves Baobab leaves Salt Maggi cubes Milk Fish Potatoes Peanuts Cowpeas Corn Sorghum	Dry and fresh fish Tomatoes Onions Corn Cowpea Melons Little Tomatoes Sweet Potatoes	Sometimes people from elsewhere come to sell produce Bananas Dry Fish	----	Sweet Potatoes Cabbages Tomatoes Rice Onions Melon Cowpea Peanuts Dry Fish Fresh Fish Tomato (Puree)	Meat etc. they sell everything, a very large market
II. Items Purchased Daily	Bread Flour Corn Millet Sorghum Potatoes Sweet Potatoes Cowpea Peanuts Watermelon Fresh or dry fish Milk	Oil Fish Cowpeas Vegetables etc.	Tea Tobacco (1 woman smokes pipe) Oil Milk powder Sugar Salt Hot Peppers	Oil Tea Sugar Coffee Fish In Senegal: Canned Tomatoes Peanuts Onions	----	Normal purchases
Items Purchased Every 2-3 Days	Sugar Tea Coffee Oil	----	Soap Bananas Henna Snuff	----	----	----
Money spent daily	----	----	----	----	----	----
III. Food Items Shared	----	no	yes, sometimes		yes food	no

	DAREL BARKA	OLO OLOGO	M'BAR/WADJII/KAIRE	DAR ES SALAM	GANI	TEKANE
With Whom	----	----	food or money (borrowing) family or neighbors	----	----	
When	----	----	if you have nothing to eat	----	in times of food shortage	----
IV. Food Items Exchanged	----	no	----	----	----	----
What	----	----	----	Rice	money	rice
Items Exchanged For	----	----	----	Other products e.g. milk	milk	Milk Sorghum Salt Fish Gathered food
With Whom	----	----	----	shop or other people	Peuls	outsiders
When	----	----	----	----	2-3 times/week	----
V. Gardens Characteristics	Almost all village women work in garden. 120 women started it in 1976. In April 1985 women paid 100 um to coop fund for another vegetable field started in Oct. 85. 2 ha. Before 84 carried water on head	130 women 1.5 ha.	For 3 years they have a garden at the side of the river. This year not yet sowed they are waiting for seeds (aid from outside) But they already asked the men to irrigate their field with motorpump. They had to pay them 7500 um	275 women	Gardens got a lot of foreign aid. 2 vegetable gardens each 3 ha. 67 women work in both gardens	2 coop gardens: 1) 126 women 2) 19 women 1 ha. vegetable 3 ha. vegetable and rice 3 ha. Rice divided in 3: 1/3 sold money in coop fund (to buy seeds and tools) 1/3 is consumed 1/3 is stored (onions) for selling later when times are difficult

	MOULI BASSA	OLD MOULI	M'DAK/WADJI/KATRE	DAR ES SALAM	GANI	TEKARE
Organization of Labor	All work is done together 1 big parcel	Each woman has own parcel	----	Each woman has 2 parcels: 1 for coop 1 for herself	They work all together	----
Individually Managed Plots	no	----	----	----	----	----
Vegetables Grown	Cabbages Tomatoes Lettuce Okra Sweet Potatoes Cowpea Onions Potatoes	Tomatoes Cabbages Carrots Turnips Potatoes Cowpea Salad	Not harvested this year	Cabbages Onions Turnips Carrots Tomatoes Beets Eggplant Salad Potatoes Sweet Potatoes Peanuts Cowpeas Mint Watermelon	Cabbages Tomatoes Onions Turnips Sweet Potatoes Lettuce Corn (formerly tomatoes but soil is bad)	Cabbages Carrots Turnips Tomatoes Beets Eggplant Okra Lettuce Sweet Potatoes Melon Corn
Season	cold season	----	----	----	dry/cold/wet	dry/cold/wet
Yield	Coop fund used for purchases and garden costs	----	First year mostly consumed	----	last 2- 3 years no high output, high costs	126 women: 72,000 um
Amount Consumed	partly consumed	mainly consumed	mainly consumed	partly consumed	partly consumed	----
Amount Sold	Partly sold This year 3 sacks potatoes money for coop fund	Small amount for sale-too much went bad	Small amount is sold	Partly sold Surplus money in coop fund	Partly sold	All for sale (large vegetable garden)
Selling Where	Sometimes in village, sometimes women go to Nouakchott	Local market	Lack of transport to sell	Rosso (80 km)	Rosso, Nouakchott or local market Women go by themselves	----
Items Exchanged	----	----	----	----	----	----
Source of Water	Marigot Motorpump (Lister 1 cyl) from French Embassy in '84	River Motorpump (Lister 2 cyl)	River, carried on head	River, motorpump from men, women pay for diesel	River	Marigot (garden) river (rice fields) 3 motorpumps
Special						

	DAREI. BARKA	OLD OLOGO	M'BAR/WADJI/KATRE	DAR ES SALAM	CANI	TEKANE
Irrigated Perimeters	not planted	not planted	----	----	yes	yes
VII. Gathered Food Kinds	Paguri Jujube Balanites Guiglé Before they had bananas, citrus and mango, but died lack of water in '84 Drinking water was more important Gum arabic died or didn't give gum	Jujube Balanites (Small amounts)	Jujube Balanites Children and women collect them 3-4 years ago they tried fruit trees but didn't work because of termites	Jujube Baobab Pain de signe Balanitese Waterlily Fonio Paguri (Small amounts)	Jujube Balanites	Jujube Balanites Mango Daabé
Quantity	----	----	----	----	----	----
Where	Dieri	Balanites/ nearby Jujube/far away	----	----	----	Often other people bring in small quantities
Season	wet season	wet season	wet season	wet season	----	wet season but because of drought not much
Fishing	Few villagers fish	Little fishing in wet season	no fishing	traditional	little fishing	traditional fishing
Where	----	River During dry season fish from Senegal or Boghé	Fishermen come to sell dry fish	River (at the moment insufficient) In wet season surplus	river	river and marigot
VIII. Free Food Frequency	3 times/year	once/year	sometimes every 4-6 months	To all women of the coop	once/year	no
Most Recent Access	Sept 85	----	Dec. 85	Feb. 86	Nov. 85	----

	DEBEBE	DEB DAWA	DEB BAR/WADDE/NAIRE	DAR ES SALAM	GANI	TEKANE
Quantities	----	----	50 kgs. Red Sorghum 5 kgs. milk 5 lb. butter	46 sacks (50 kgs.) of rice 34 boxes of oil 34 sacks of milk (25 kgs/each) 3 sacks dry fish Blankets Clothes	1 sack Sorghum (50 kgs.) 5 liters oil 5 k. milk	----
Organization	----	Government	Government	Red Cross	Government	----
IX. Storage	yes	no yield to store	yes	yes	----	----
Where	----	----	in houses	----	in house	----
Products Stored	Corn seeds for next season, no other storage	----	Rice (unpolished) not much, SONADER took most plus rice yield has failed	Unpolished rice	Sorghum, on the panicle Rice in sacks Corn in sacks	Rice Potatoes Cowpea
Method	----	----	in sacks	in sacks	----	----
Quantity	----	----	for 4.5 months (another person)	----	----	3 storehouses in the village Only little quantities of cowpeas in family houses
Duration of Supplies	----	----	----	----	4-5 months	December
Losses	----	----	only if they keep it too long	----	yes	yes
How	----	----	insects	----	Insects Caterpillars (they use powder against them)	Water Rats
X. Meals (Composition) Breakfast	Coffee Tea, or Quinquiliba	Tea and bread Coffee and bread Tea with peanuts	8:00 Bassi (very find couscous) with or without milk	Coffee and bread Coffee and couscous Coffee and milk	7:30 Couscous (no coffee, no money for it) rarely bread	Tea or Coffee Bread Couscous and milk Rice porridge

	DAR EL DARRA	OLO OLOGO	M'BAR/WADII/KATRE	DAR ES SALAM	GANI	HEKANE
Lunch	Rice with dry or fresh fish and some vegetables	Rice or sorghum (Samé) or millet with dry or fresh fish White rice and milk Cake and milk	2:00-3:00 Rice with cowpea and watermelon and oil (or sorghum, wheat or fonio) Not always ingredients	Rice and fish (dry, fresh) White rice and milk Rice and cowpea	1:30 Rice with fish (dry or fresh) Batter (of corn) with milk Sweet Potatoes with fish or meat	Rice and Fish Batter of Sorghum Rice and Mafe-Sauce
Dinner	Couscous with cowpea leaves Couscous with milk Couscous with meat	Couscous (Samé) and fish or cowpea grains White rice	7:00-8:00 Couscous and squash and cowpea (rarely fish or meat) Batter of sorghum or millet Porridge of sorghum or rice	Couscous and milk Couscous and fish White rice and milk	Couscous with fish (plus cowpea if no fresh fish) If there's no couscous they eat sweet potatoes Batter of sorghum, cowpea plus oil	Couscous (Rice) and cowpea leaves Mafe Couscous and meat or fish Salad and Fish
Other Meals	----	----	----	----	----	----
Snacks	Fritters (made of wheat) Fresh milk	no Corn if available	Biscuit Peanuts Watermelon Corn If they can, they eat everything there is	Drinks Milk	no	Tea and peanuts Tea and Fritters Bread Milk (if available)
Frequency	----	----	----	----	----	----
Major Dishes and Ingredients	Milk based products	Rice with fish Rice with cowpea leaves Couscous and cowpea leaves Couscous and fish Cake and milk	Zrirz: churned milk with water and sugar Is always offered to guest before drinking tea They like to drink it all day At the moment they eat more sorghum than rice	Couscous and fish Rice and fish	Sweet Potatoes and fish or meat Also Turnips Carrots Cabbages Lettuce Batter of pounded corn plus cow-milk	Couscous and cowpea leaves Sometimes they use cabbages instead of cowpea leaves Salad and fish Lettuce Tomatoes Sweet Potatoes Eggs Peppers Oil Vinegar Grilled fresh fish in oil with pepper, Maggi cubes, salt

XI. Food Preferences

Meat/Fish

Staple Preferred

Reasons

Dominant Staple

Quantities Consumed

DAREI. BARKA

OLO OLOGO

M'BAR/WADJJI/KATRE

DAR ES SALAM

GANI

TEKANE

meat above
fish

fishermen
prefer fish
Meat (goat
and sheep)
is preferred
above fish

They like
vegetables
meat above
fish (goat
and sheep
above cow)

Big fish
above little
fish

Fish above meat

Sané
Fellah

Sorghum
Rice

Millet/Sorghum
above rice.
Sorghum above
millet.
Rice above corn

Sané (men)
Rice (women)

taste

Sorghum
because of
taste, habit,
knowledge of
cultivating.
Rice is
harder
to cultivate
and
eating sorghum
is healthier
than eating rice.
Rice also needs
fish, tomatoes
and vegetables.
Sorghum needs
only sugar, is
easier to prepare.
Rice preparation
is not easy.

Millet: taste
plus increasing
quantity plus
vitamins
Rice is easier
to pound
Corn is
difficult
to pound

Now they pound
rice to prepare
couscous

Millet

White and Red
sorghum
Rice

Rice
Sorghum

They rarely
eat meat
Rice once/day
61 persons:
for lunch
10 kgs. Millet
or sorghum
for dinner:
10 kgs.
couscous

Once/month
meat
once/week
dry fish
7 persons
3 kgs.
couscous

Rice twice
a day
Rare eat meat

3 kgs. lunch/
3 kgs. dinner/
10-15 persons
meat (goat or
chicken) once/
2 months

They don't eat
much meat
Rice twice/day

	DIARRA	OLD DIARRA	M'BAR/WADJI/KATRE	DAR ES SALAM	GANI	TEKARE
Food Preferred if More Money	----	----	Meat Milk Millet Sorghum Fish Chicken Tomatoes	Meat	Meat	They have enough money, they prefer rice with fish
Preferred Dish	----	Rice with fish	For lunch: sorghum with meat For dinner: Batter (sorghum) with milk Couscous with meat	----	----	Cowpea grains
XII. Seasonal Aspects of Food						
Hungry Periods	Dec-Feb March July-Sept (transport problem)	Feb-Sept.	Wet season After they planted rice July-Sept. Feb is also difficult	June-Oct.	wet season May-Oct.	----
Foods in Short Supply During Each Season	Before harvest is difficult period, but this time, they have nothing so the year is difficult.	Feb-Sept. Fish, meat and other products	July-Sept. Milk Sorghum Oil Watermelon Corn Feb: No Sorghum because of weeds, no corn No milk No tomatoes	June-Oct. all products in shortage	In wet season food shortages and village is isolated Transport via river is expensive	Hot/dry season: Fish Rice Vegetables Meat
211						
Source of Money to Purchase Food During Hungry Season	Wet season to Senegal help yield wild food Family sends money. Borrow food from merchants. Sell charcoal. Men will sell animals.	----	Emigrants send money Making mats Making cushions Sell them in NKH, Rosso, buy raw materials in Ghana They buy food on credit from	----	Storage Jujube Selling clothes to purchase what available (rice and cowpea are more expensive then)	----

(Feb.)
2600 am/
goat so
family can
buy 50 kg
rice and
some oil

Foods by Season
Dry/Cold

Cowpea
Watermelon
Paguiri
Vegetables
Milk

Vegetables

Dry/Hot

Wet

Products
from
marigot
Watermelon

October:
milk and
fish

milk

Rice
Dry Fish
Couscous and
milk

Season
Dry Cold

Corn
Rice

Rice
Millet
Red Sorghum

Rice

At the moment
they eat more
rice. Sorghum
will be
harvested in
March-April

Dry hot

Wet

Number of Meals Eaten
by Season
Dry Cold

they don't
always have
3 meals

3

normally 3,
but sometimes
they don't
eat in the
evening

3

3

Dry Hot

Wet

XIII. Food Habits
Who Eats With Whom and
Order of Eating

Men and
women
apart

1st men
2nd children
3rd women

1st men
2nd women

1st men
2nd children
3rd women

Men
Women (with
children til
6 years)
children (6
10 years)
same time

1) men and
young men
2) children
3) women and
young women

Most Important Meal

lunch

lunch

lunch

	DAREI BARKA	OLO OLOGO	M'BAR/WADJI/KATRE	DAR ES SALAM	CAHI	TEKANE
XIV. Water						
Source	6 wells	3 wells	Use to be 3	River	3 wells	6 wells
Uses	sometimes dry	1 works	traditional	for all uses,	River	Marigot
Location	River last	River water is	wells, now	5-10 minutes	all uses	all uses
	year not	used more	dirty		village is	Wash clothes in
	enough.	often, takes	Since dam		along the	Marigot
	Water supply	less time	is ready		river	
	is better	River only	they drink			Wells: 2-50 meters
	this year.	wait	river water			Marigot: 5 minutes
	When well dry,	10 min. At well				
	they go	they wait up to				
	outside	2 hours				
	village,					
	dig wells					
	(2m) water					
Seasonal Access						
	dry season	all seasons	----	----	all seasons	all seasons
	difficult					
How Often						
	----	twice/day	----	----	12 times/day	----
XV. Fuelwood						
Who Collects	----	women	women	women	women	women
When	Some	They prefer	Once in two	Takes a lot	----	It takes all
	people	to use	days	of time: 2		day so often
	make	charcoal	Sometimes on	hours, so		they buy wood
	charcoal.	when they	back, sometimes	most of the		
		can pay it.	donkey.	time they		
		Otherwise		buy it.		
		they search				
		fuelwood.				
Where	----	----	----	----	Mauritania	----
Price	----	1 sack	----	5 pieces/	----	200 um/wagon
		charcoal		10 um		
		costs				
		140 um				
XVI. Access to Mills	No mills	No mills	No mill.	Women had	Yes,	Maybe, but
			Sometimes	bought mill;	private:	women interviewed
			they go	broke down, then	3 for sorghoum	didn't use them
			elsewhere to	repaired.	2-3 for rice	
			grind, but	75% paid by		
			transport is	Peace Corps		
			needed to	25% women		
			go elsewhere.			
Costs	-----	----	3 um/kilo	-----	2-6 um/kilo	----
			plus 50 um			
			transport			

	DAREL BARKA	OLD OLOCO	M'BAR/WADJI/KAIRE	DAR ES SALAM	GARI	TEKANE
Hand Pounding		----	Most of the time they pound by hand at home	While mill is broken they pound at home	All interviewed women pound themselves, at home or in the field while bird watching Mill is too expensive	----
XVII. Time Schedule	----	----	There are days they work There are days they don't do anything (In contrast with women from other villages)	----	----	6:00 they wake up
Milling	----	----	----	----	2 hours/day	a lot of time
Meals	----	2 hours	----	2 hours big meal	----	2-2.5 hours one big meal
Gardens	morning	----	morning/ afternoon	----	morning	morning and afternoon
Fields	morning or afternoon	----	----	----	sometimes all day sometimes morning only	----
Marketing Activities	----	----	----	----	----	----
Water	----	----	3 times/day 1.5 hours	2 times/day	morning 6 times from river afternoon 6 times	----
Fuelwood	----	If can't buy charcoal then 2-3 hours to collect.	every 2 days: 4 hours	----	2-3 hours	----
XVIII. Access to Health Facilities	dispensary PHI	----	no dispensary no PHI no midwife	----	1 dispensary 2 midwives (traditional) 2 male nurses	CAC
Who Takes Care of Children	----	----	Sisters or Grandmothers Mother takes children with her Older brothers and sisters	----	Children below 6 years stay home with adult girl Others go with mother in field to help and to	

					learn how the work has to be done both boys and girls	
Duration of Breast Feeding	----	1.5 years and 2 years if mother not pregnant	2 years unless pregnant	1.5 years	1.5-2.5 years	2 years
Weaning Foods	----	----	----	----	Mothermilk plus some porridge of cowpea for the rest of the children no special food	----
Begin Weaning	----	----	From 1 year on they start eating normal food	From 6 mos they begin giving porridge	----	----
Food for Child When Mother Has No Breast Milk	----	Fresh milk Porridge	Goat milk powder milk (No breast of other women, although Moors)	Fresh milk	Cow milk plus sugar Milk powder	Fresh milk Porridge Milk powder
Food for Non-lactating Women	----	----	Batter of sorghum Milk Butter	----	Peanuts and cowpea leaves	----
Food for Lactating Women	----		no special or extra food	----	no special food	----
Food for Pregnant Women	----	----	----	----	no special food	----
Food for Women Just Giving Birth	----	First week: hot milk porridge white rice If mother looses too much blood she gets roasted meat	----	----	Porridge	During one month: Porridge of millet, meat and soup Potatoes Rice with fish Normal dishes
Occurrence of Diarrhea How Often	----	yes often	yes very often	exists not often	yes	exists not often
Seasons	----	when river	----	----	wet season	----

		rises				
Food Used to Treat Diarrheal Episodes Practices	----	Rice water Baobab Fruit lemonade	Tamarin Baobab fruits tree leaves	Rice Water Baobab fruit	Water with sugar and salt Doctors forbade use of traditional tree leaves If worse go to dispensary	Guigilé: pounded tree leaves in sour milk Baobab fruits Rice water
Infant Mortality	-----	not very high	high	not very high	Low, only during wet season worse	----
Seasonality	----	----	----	----	wet season	----
Cause of Death	----	----	Eye illness Hunger Not able to stand Measles Whooping Cough	----	Diarrhea	----
Ratio of Children Who Are Alive to Children Who Are Dead	----	----	6:2 (young women) 5:6 (old women)	----	----	----
Most Important Illness	----	Malaria especially during wet season	Adults: Rheumatism fever Eye illnesses Stomachaches Over worked people	Malaria Jaundice	Whooping Cough Measles	----
Constraints and Areas of Research	In dry season they use to have water shortage. The 3 wells fell dry and also the river didn't have water. This year the river is better. Also, they built 3 new wells this year. In the past	Water problem for garden since pump broke down. Want seeds. They want varieties (Sorghum, Corn, Cowpea) which will increase output. Fence Tools	Food shortages. They want a dispensary. At this moment (Feb.) they are thrifty and buy rice, millet and red sorghum which is aid-food that is sold for cheaper prices.	With an irrigated perimeter they think they can better overcome the hungry period from June-Oct.	Sale of vegetables is difficult, they go to Rosso and Nouakchott. They didn't make much money because they have to pay the pumpist (last 2-3 years).	Difficult to find market for their products (surplus). Women don't have real debts, women are rich. Lack of a mill. They want to expand perimeters. Problem of keeping the crops. Market for crops is difficult to find. Animals eating the crops. They want on the sides of their perimeters: Sugarcane Bananas Mango

they went
outside the
village (if
water shortage)
to dig holes
(2 meters)
for water.
Women here also
milk the animals
(a man would
never do this).
Lack of transport
for the vegetables.
In town they are
too cheap (over
production).
Women have
paid 5000 um
to construct
garden.
6000 um for
diesel.
2000 for
hiring use
of motorpump.
In corn field,
dirty well.
Well in
vegetable
garden has
to be
constructed,
already
started.

Research is necessary
to look at the possibilities.
There is a shortage of
milk, meat and fish.
In normal times they
drink a lot of milk

APPENDIX F

SUMMARY OF RESULTS OF THE CONSUMPTION SURVEY

Variables

	M'BAGNE	M'BOTU	SORI MALE	BOLO DOGO	BABABE	N'GOREL	TIENEL
I. ACCESS TO MARKETS							
Location	Yes	2 markets	1 market	1 market	1 market	No. Market is 2 km away.	No. Market in Boghé, 2-3 kms. Women go each day.
Type of Market	Permanent	Permanent	Temporary Only when women have time.	Temporary	Permanent	----	----
Products Sold	Rice Tomatoes Carrots Cabbages Sweet peppers Hot peppers Fish Meat	Vegetables Sometimes meat Dry fish.	Oil Tomatoes Onions Fish Hot peppers Maggi cubes	Fish (dry & fresh)	Meat Fish (fresh in ice from Houakchott) Tomatoes Oil Salt Onions Hot peppers Sweet peppers Maggi cubes	Fish Tomatoes Cabbages Onions Lettuce Eggplant Carrots Peppers Oil Rice	Meat (rare) Fish Rice Tomatoes Oil Pepper Maggi cubes
II. ITEMS PURCHASED DAILY							
Items	Rice Oil Fish/Meat Sweet peppers Tomatoes Carrotss Cabbages Hot peppers	Oil Tomatoes Dry fish Onions Black pepper Hot peppers Sugar Rice Maggi cubess Coffee Milk	Tea Coffee Sugar Usually, they don't buy vegetables or rice	---	Usual purchases. CSA sells wheat for less money.	Rice Fish (dry & fresh) Tomatoes Sugar Tea Coffee Maggi cubess Cabbages Lettuce Carrotss Eggplante Onions	
Articles Purchased Every 2-3 days	Sugar Tea Coffee	Soap Whitewash	----	----	----	----	

	M' BAGNE	M' BOTO	SORI MALE	BOLO DOGO	BABABE	N'GORE!	TIENE!
Money spent daily	Husband gives her money or millet to buy ingredients.	300-1000 um/day for 20 people	50-200 um	----	----	----	40-100 um each day
III. FOOD ITEMS SHARED	No	Yes Millet, sometimes money	No	---	No	---	No
With Whom	----	Family	----	----	----	----	----
When	----	If there is enough	----	----	----	----	----
IV. FOOD ITEMS EXCHANGED	No	----	No	Yes, but they pay	No	Yes	No
What	----	----	----	Millet Rice	----	Tea	Millet
Items Exchanged For	----	----	----	Butter Milk Meat	----	Milk	Jujube
With Whom	----	----	----	Nomads	----	Nomads	Nomads
When	----	----	----	----	----	--	dans le
V. GARDEN CHARACTERISTICS							
	340 women	Men and women in one garden. Womens garden has 200 women (all village women). In addition to 1 large common parcel, each has her own for family needs.	100 women. In addition to large common parcel, each has own parcel for family needs.	The garden is far from the village and is 3 years old. Peace Corps looks after the garden each week.	3 coops for the gardens: A) 100 women B) 100 women C) 700 women (first year)	Garden started in 1973. Individual and common parcels. Common parcel harvest is divided in 3: 1/3 sold, money in coop fund (to buy seeds and tools); 1/3 is consumed; 1/3 is stored (onions) to sell later when times are difficult.	181 women

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOGU	BABABE	N'COREL	TIENEL
Source of Water	River, 120 meters from garden Transport on head	Well. Each day 24 women water the garden twice a day	River	River	River motor pump	River 1-2/week They can use mens pump, but most of the time, carry on their head.	River, with motorpump
Special Remarks	----	Fund is used to buy seeds and a mill.	They have a motor pump but they don't have money to repair it.	----	----	----	----
Garden Constraints	They have a motorpump, but no tube for water transport. Seed shortages.	----	----	Problem with carrying water	----	Water carrying is too heavy Animals damage crops. Grasshoppers	Old motorpump repair cost: 40,000 um
VI. WOMEN AND AGRICULTURE							
Access To Land (Owned/Borrowed)	----	yes	yes	yes	yes	yes	yes
	There are women who inherited land	There are few women owning land	Inheritance	Borrow when husband is away, or husband gives wife a part.	Inheritance	Inheritance from husband or father Women get part of husbands land to cultivate.	Inherited land (rare)
Crops Grown	----	Dieri in wet season	Dieri: Hibiscus Millet Fonde + Walo: Sané Cowpea Citrouille Tomatoes Falo: Corn Citrouille Cowpea Tomatoes Calabash	From June: Walo: Sorghum Dieri: Millet On her own parcel woman does all the work herself. She also works on husbands. At the edge of the irrigated perimeter, women gro tomatoes and okra.	Walo Falo Fonde Dieri	(Walo is family field) Falo: Corn Cowpea Sweet Potatoes Melon Tomatoes Hibiscus	Women don't have "own" fields thats why they want another garden to grow corn, millet and rice.
Consumed/Marketed	-----	----	Both	-----	----	Consumed	----
Constraints	----	----	----	----	----	Grasshoppers	----
Irrigated Perimeters	No	No	Yes	Yes	Yes	Yes	Yes

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOGO	BABABE	N'GOREL	TIENEL
VII. Gathered Food Kinds	No, because of drought.	They have a nursery-garden in village with gum arabic trees Jujube Guigilé Balanites	None	Jujube Balanites	Jujube (small quantities)	Balanites Jujube	Jujube (rare) They planted trees: Mango Acacia Gum Arabic First year they have flowers
Quantity	----	----	Small quantities but important during hungry period.	----	----	----	----
Where	----	----	----	Dieri	Around village	Senegal	----
Season	----	July-Sept. wet season	----	wet season	Nov.-Dec.	wet season	----
Fishing	Very little traditional	Traditional during wet season for consumption	Village for consumption and selling In dry season less fish, so not much for sale	Village	no	----	no
Where	River	----	River	River. Women sell the fish or dry them to sell later.	River is far away	----	----
VIII. Free Food Frequency	Once a year	Not yet this year	Every 1 or 2 months.	----	Different organizations A) 3 times/year B) each month C) 2 times/year	formerly several times a year, now less	once a year
Most Recent Access	----	July 85	----	----	2 weeks ago	Sept. 85	----

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOGO	SABABE	N'GREL	TIEREL
Quantities	----	50 kgs. cereals 5 kgs. milk 5 lb. butter/ oil	for village: 6 sacks (50 kgs) cereals 12 boxes butter 4 sacks (25 kgs) milk 3 blankets	----	A) 1 sack cereals 5 kgs. milk powder 5 lb. butter/ oil B) 2 kgs. milk 1 lb. oil 4 kg. Sorghum C) 3-4 sacks cereals 1-2 sacks milk	50 kgs. wheat 5 lb. butter/ oil 5 kgs. milk	50 kgs. cereal 5 k. milk 5 lb. butter
Organization	Government	Government	Each month Red Cross Each 2 months Government	----	A) CSA (government) B) CAC C) Red Cross	Government	Government
IX. Storage Where	In granary at home.	Traditional storage bins	Traditional storage bins	----	At home	----	none
Products Stored	Sorghum Millet Corn Cowpea- leaves dried	Millet Sorghum (on the panicle) Cowpeas Beets (in sacks)	Sorghum Millet	----	Sané Cowpea-grains Millet	Onions in sand apart in airy room	none
Method	----	----	----	----	----	----	----
Quantity	----	Not much. When millet, cowpea and watermelon seeds ended, bins are empty til wet season.	----	----	----	----	----
Duration of Supplies	3 or 4 months	Beets for 10 days; other things only a month.	2 months	----	1.5 - 2 months	----	----
Losses	----	yes	little	----	----	----	----

	M'BAGNE	M'BOTO	SORI MALE	BOLD DOGO	BABABE	N'GOREL	TIENEL
How	----	Mice They use poison against them	Ants, but quantity stored is so little that it isn't a problem	----	Rare and Mice	Rats and Termites	----
X. Meals (Composition)							
Breakfast	Tea or coffee with bread	8:00 coffee tea or lipton (western tea) bread if money couscous & milk	Coffee and bread Coffee and couscous and cowpea leaves	----	Coffee and Bread Coffee and Porridge Couscous and milk	Coffee and bread Couscous Tea afterwards	Coffee or tea and bread or quinkeliba (tea)
Lunch	Rice with meat/fish	1:00, Millet and dry fish. Rice and dry fish (sometimes fresh fish). Pounded Rice and milk. (& sugar if money).	Rice with dry or fresh fish Rice with meat (rare)	Rice and dry fish and cowpea-grains, tomatoes, and hibiscus leaves. Batter of powdered sorghum, cowpea and oil.	Cake and fish (rare) Rice and fish (rare) Rice and meat	If have money buy fish. Porridge (of corn, wheat, or rice). Rice and dry fish or millet and dry fish with vegetables.	Rice with dry or fresh fish
Dinner	Couscous with cowpea leaves or meat or milk	9:00 Couscous (of Millet if available otherwise rice) and cowpea leaves and milk or crushed rice with milk (and sugar if money) or batter of sorghum with oil and tomatoes	Couscous with fish and cowpea leaves Couscous with meat (rare)	----	Couscous with Cowpea leaves Couscous and milk	Couscous with cowpea leaves Porridge (Corn or Wheat) Couscous with cowpea grains	Couscous with cowpea White rice with milk
Other Meals	Fritters between breakfast and lunch Peanuts & tea between lunch and dinner	None	Sometimes children eat earlier in the evening (8:00) The adults eat afterwards	None	None	----	----

	M' BAGNE	M' BOTO	SORT MALE	BOLD DOGO	BABABE	N' COREL	TIENEL
Snacks		No fritters at this time because lack of flour No other snacks	None	----	None	None, even the children don't eat snacks because they don't have money for it	None
Frequency	----	----	----	----	----	----	----
Major Dishes and Ingredients	Rice with fish/meat Batter of Sorghum or millet + sauce Millet with cowpeas	Millet with dry fish: Millet, oil, dry fish and vegetables (beets, cabbages) if money. Other times with tomatoes	Rice with fish and vegetables	Batter of pounded Sorghum and Cowpea (very fine) They put oil and pulverized hot peppers in the middle	Rice with fish cake of Sorghum or wheat or millet with meat or milk Cake most of the time made of wheat	Couscous with Cowpea grains Couscous from Corn, Sorghum, Rice, Wheat Cooked Cowpea in Water-salt Just mixing the grains with Couscous	Rice with fish (mostly dry fish) Rice with milk Couscous with Cowpea leaves Meat is too expensive
XI. Food Preferences Meat/Fish	Meat above fish (sheep, goat) Fresh fish from river	They eat more fish although meat (sheep, goats) is preferred over fish and cattle	Fish above meat	Fish above meat	Meat above fish (goat)	Fish above meat Fresh fish above dry	Fishermen prefer fish; others prefer meat. Fresh river fish above dry or sea fish Meat above fish (goat and sheep above cow)
Staple Preferred	Rice	1) Millet (Souma) 2) White Sorghum (seuil) 3) Red Sorghum (samé) 4) Corn	Rice	----	Millet Fellah	Samé and Corn	Samé over rice
Reasons	Taste	Taste	----	----	Taste	Taste and quantity of samé increases while pounding	Taste and habits (rice introduced, less tasty but takes less time)
Dominate Staple	Sorghum Millet Corn Rice	Rice	Millet + Sorghum (White) Rice	----	Millet	Samé Rice	Black Sorghum White Sorghum Fellah Rice

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOKO	BABABE	N'COREI.	TIENEL.
Quantities Consumed	Millet Sorghum once/day Rice once/day.	Millet or Rice 5 kgs./ day (20 persons) Millet: twice/ day Rice: once/ day	Rice once a day Millet or Sorghum once/day	----	Millet once or twice/day 4 kgs. grains/ day for 16 persons	No meat	once/day Sorghum, Rice 7 kgs. Rice 7 kgs. Sorghum for 20 persons
Food Preferred if More Money	1) Rice 2) White sorghum 3) Millet 4) Samé 5) Corn	Millet or Fellah (taste) Rice Fish and Meat	Meat (now only when festivals)	----	Meat Potatoes Oil Rice Fish		Fresh fish for lunch meat for dinner
Preferred Dish	----	Millet-based meals	Rice with fish	Fresh fish		Couscous with Cowpea grains	Rice with fish
XII. Seasonal Aspects of Food							
Hungry Periods	dry/hot season	March-July	from June	May-July	April-July	Oct-Dec Feb-March June-July	wet season
Foods in Short Supply During Each Season	No fish and meat in dry season	To obtain food during the wet season is difficult, but they can manage better than between March-July	From June on all food is in short supply.	Feb-April is less difficult than May- July because of small harvest from fields and Walo.	April-July fish and meat shortage	Oct-Dec is most difficult because of hunger and cold	During wet season no access, so shortages of all products
Source of Money to Purchase Food During Hungry Season	----	Emigrants	Emigrants send money so they can buy food in Senegal	Selling dry fish. Women making pagnes. Sometimes son sends money, but not often. Selling fish to buy rice and tomatoes. Women can get credit from coop fund if husband is away. Selling nicest. boubou or earrings.	----	----	----

	M'BAGNE	M'BOTO	SORI MALE	BOLD DOGO	BAHABE	N'COREL	TIENEL
Foods by Season Dry /Cold	Vegetables, till April	----	----	Feb: Gulglié Small yellow fruits Vegetables	Heat	Vegetables	Dry fish
Dry/Hot	-----	-----	----	They buy millet and rice in Boghé and Senegal Pound corn and dry fish	----	Melons Cowpeas	----
Wet.	----	Millet Sorghum Milk Fresh Fish	----	Grains from dieri and roots from marigots are given to children. Fish	----	Jujube Balanites	White rice or porridge from wheat
Main Staples by Season Dry/Cold	----	A very small quantity of millet, only for dinner.		Feb: Corn Rice	Millet Wheat	Feb: Rice Corn Sané	Rice Sorghum
Dry/Hot	----	Rice	----	Sorghum Corn	----	Sané Corn	----
Wet	----	----	----	----	----	End of wet. season: Rice Sorghum	Rice
Number of Meals Eaten by Season Dry Cold	----	3-Now and then they don't prepare evening meal; too tired of getting water and pounding.	3	----	3	3	3
Dry Hot	----	----	----	----	----	----	----
Wet	----	----	----	----	----	----	----
XIII. Food Habits Who Eats With Whom and Order of Eating	1) men 2) big children (8-10) 3) little children 4) women	Men Women and little children boys (6-10 years) girls (6-10 years) boys (10-15 years) girls (10-15 years) all eat at same time	1) men 2) children 3) women	1) men 2) women	1) fathers with sons 2) mothers with daughters	1) men apart. strangers apart children (boys & girls apart) 2) women	everybody together

	M'BAGNE	M'ROTO	SORI MALE	BOLO DOGO	BABABE	N'GOREI.	TIENEI.
Most Important Meal	Lunch is major meal	----	All meals important	----	All meals important	----	Lunch
XIV. Water							
Source	21 wells	2 wells,	river, (they	river	5 wells	River is near	8 wells
Uses	19 work	1 works	are creating	Villagers	2 work	the village.	5 work for
Location	for all uses	marigot, washing	a well)	prefer to	20-600 meters	River water	drinking and
	30 minutes walking	clothes during rainy season	15 minutes away	drink river water above well (taste)		for all uses.	household
				2 wells		Sometimes go well 1.5-2 km away.	river for washing clothes
				1 works			
Seasonal Access	All seasons	Well: all seasons	All seasons	All seasons	Dry season no access	Not in June-July	All seasons
How Often	----	5-7 times/day	twice/day	4 times/day	waiting hours (1.5 hours)	8 times/day	2 times/day
XV. Fuelwood							
Who Collects	don't gather	----	women	----	men and women	women	men women children
When	----	----	Every day women go for her own needs.	----	It takes 8 hours, they sell it because its so far (people pay a good price for it).	Every day	People go out to find wood for 8 hours and sell it in the village
Where	----	----	----	----	----	In Senegal 4 km.	Far
Price	3 pieces of wood/ 7 um	----	----	----	450-500 um/wagon	----	10 um/4 pieces
XVI. Access to Mills	3 private	none	none	none	3 private	none 2 kms. away	none
Costs	----	----	----	----	5 um/kg.	If you have money, you use the mill.	----

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOGO	BABABE	N'GOREL	TIENEL
Hand Pounding	----	Sometimes pounded in field while watching for birds. Also prepare meals in field. At home when there's no millet they pound rice. Daughters help.	Both	----	----	Both, in the field if working there	At home
XVII. Time Schedule	----	Too much work to do each day	----	5:00-6:00 they wake up work all day go to bed at 11:00	----	busy from early morning til evening	----
Hilling	----	2.5 hours/day	----	----	----	----	----
Meals	1-2 hours a big meal	----	2 hours/a big meal	----	2.5 hours a big meal	----	2 hours big meal
Gardens	--	afternoon to carry water costs hours of time	twice a day	in the morning and in the afternoon	----	morning to carry water takes lot of time	----
Fields	----	----	Women who are in the fields all day don't cook, they pound while in the fields	----	----	----	----
Marketing Activities	----	----	----	----	----	each morning selling and buying things in market 2 km. away	each day women go to market in Bèghé 2-3 kms away
Water	----	5-7 times/day	twice/day	4 times/day	2 times/day takes a lot of time because of waiting hours	8 times/day	1 hour
Fuelwood	----	1-2 hours/day	1 hour/day	----	----	2 hours/day	usually they buy it

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOGO	BABABE	N'GOREL	TIENEL
XVIII. Access to Health Facilities	----	1 dispensary PHI, since 10 days no pharmacy	----	No dispensary Girl in village trained by Red Cross gives advice, medicines and a place for sick children. Each sick or malnourished child goes there every day to eat in the morning and to get vitamins. All village women contribute to the place.	CAC (food aid for children under 3 years) Dispensary PHI	PHI with 3 women each w/3 months education.	No health clinics, they go to Soghé
Who Takes Care of Children	----	If there are older children (16+) they take care of little children. Otherwise, mother takes children (until 10) with her. She always takes baby (until 2) with her	----	-----	-----	Other women or older children	----
Duration of Breast Feeding	2 years unless pregnant	1.5 years	2 years	----	1.5 years	1.5 years	1-1.5 years
Weaning Foods	bouillie and canned milk	No real weaning foods	----	----	----	none	----
Begin Weaning	----	From 8 months start eating couscous or rice	----	----	----	After 1.5 years they start eating normal food	----
Food for Child When Mother Has No Breast Milk	----	Cow or goat milk. Porridge	Porridge Milk from animals	----	Milk from animals Porridge	No special food only breastmilk. No money for other food There was a baby who's	Fresh milk Porridge

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOGO	BABABE	N'GORZI. mother died during birth they gave it powdered milk.	TIENEI.
Food for Non-lactating Women	----	no special food	----	----	----	----	----
Food for Lactating Women	----	No special food	----	----	----	No special food	----
Food for Pregnant Women	No special food unless pregnant woman is prescribed to eat special food. No salt, sugar & grease.	No money for special food	No special food only when a diet is prescribed	----	----	No special food	----
Food for Women Just Giving Birth	----	porridge (millet flour is the best) Rice	no special food	----	porridge and meat in the first week after that period normal food	porridge	soup porridge meat
Occurrence of Diarrhea How Often	yes not often	yes often	yes often	yes not always	yes often	yes often	exists not often
Seasons	----	----	----	----	----	June-July when river fills	----
Food Used to Treat Diarrheal Episodes Practices	rice sour milk	Ganidan (strong medicine) Charcoal Tree leaves and flour and water: boiled child drinks it	Baobab fruits Lemonade Rice water Porridge of tree leaves and millet and water child drinks it	Breast feeding women eat tree leaves For older children she chews the leaves and gives the fluid to the child (Mourtodie)	Rice water Baobab fruit lemonade	Go to the dispensary in Boghé: Ganidan charcoal (at this time, a lot of adults also with diarrhea) Or they give fresh butter or tree leaves (boiled) to children.	Rice water PMI

	M'BAGNE	M'BOTO	SORI MALE	BOLO DOGO	BABABE	M'GOREL	TENEL
Infant Mortality	-----	-----	-----	-----	-----	not high at the moment	-----
Seasonality	-----	-----	-----	-----	-----	-----	-----
Cause of Death	-----	-----	-----	Heat (children on mothers back in the field) Diarrhea	50% diarrhea Measles Chicken Pox	"natural"	-----
Ratio of Children Who Are Alive to Children Who Are Dead	-----	5:2 7:2 6:2	-----	3:2	-----	3:0 4:4 4:0 7:2	-----
Most Important Illness	-----	Tuberculosis Measles (1 month ago vaccination team in village 3 times)	Malaria	malnutrition	Diarrhea Measles Chicken Pox These illnesses cause 50% of death	they can cure the illnesses by now	children have been vaccinated and are fairly healthy.
Constraints and Areas of Research	They need tools for the garden. Lack of transport. Fences. Insect problem. They want improved seeds.	Water problems. Not enough food for self- consumption. Women are saving money obtained from selling vegetables from the garden to buy a mill but they still don't have enough (now have 10,000 um) They only drink water from the well not from the marigot. For the garden they use the well. That takes hours because there's only one well (waiting your turn).	Costs of motorpump are higher than production output. Lack of fence. Lack of mill. Pounding is time consuming activity. They can't do other work in the meantime. Garden is too small. Shortage of tools. Problem of insects and termites.	They want a motorpump in the garden. Carrying water from the river is too much work. Also, in the village they have too much work to do. They want a mill.	Water shortage in wells. Costs of motor pumps are too high in comparison with harvest. Tools. Irrigation tools.	Although the village cultivates the small and large irrigated perimeters, the work is futile; villagers are short of food (they had to pay 15,000 um to SONADER). Constraints in garden: Grasshoppers Donkeys Goats Cows damaging the crops Their fence needs to be repaired. Carrying the water is too heavy. They want their own motorpump. Now they have to use the men's	New motorpump (current one 6 years old) Seeds Insecticides They don't want another garden for corn, millet and rice (with motorpump).

M' BAGNE

M' BOTO

SORI MALE BOLO DOGO

BABARE

N' COREL

TIENEL

pum 1-2 times/week.
Women pay for the
diesel.
Rest of the week
water is carried on
their heds.
Need tools for
the garden.

SUMMARY OF RESULTS OF THE CONSUMPTION SURVEY

Variables	TAGAH	PALIBA	SIVE	KOUNDEL. REG	TETIANE	BOVEL.	FONDOU
I. Access to Markets							
Location	no market (market in Maghama 7 kilo away)	no market	1 market	yes	no market Women go to Djovol or Guidilon Women sell and buy among themselves.	no	yes
Type of Market	----	----	Periodically, not during rainy season	Permanent	----	----	not each day, but often
Products Sold	----	----	----	Fish Tomatoes Cabbages Onions	----	----	----
II. Items Purchased Daily							
Items Purchased Daily	Vegetables fish rice (with money sent by parents	Sometimes they go to the market in Maghama once/week or once a month. They buy oil and tomatoes.	----	normal purchase	Sugar Coffee Salt Milk Oil/1/2 liter/day Tomatoes Onions Maggi cubes Rice 2/kgs/day	----	Coffee Sugar Tea Rice Oil Fish (or meat Vegetables
Items Purchased Every 2-3 Days	----	Onions, Bread, Tea, Sugar, Coffee, Rice. No products sold in village.	Fish (dry + fresh) from Senegal or Nouakchott.	----	----	Items are bought once a week or once a month in Djovol	They go to Roufiouat (village) to buy fish
Money spent daily	----	----	----	----	Women can't tell; sugar 100 um/week When they use millet they use less oil than with rice.	----	200 um/day
III. Food Items Shared							
Food Items Shared	no	no	----	no sharing	Sometimes Expect to get it back later (rice, money or meals).	no sharing	----
With Whom	----	----	----	----	Neighbors	----	----

	TAGAH	PALIBA	SIVE	ROUNDEL REO	TELLANE	BOVEL	FORBOH
When	---	----	----	----	----	----	----
IV. Food Items Exchanged	yes	no	----	----	no	----	----
What	Rice, Orka, Millet	----	----	Milk	----	Milk	Millet
Items Exchanged For	Milk and butter	----	----	Cereals	----	Other foods	Jujube Small amt. of gum.
With Whom	within village	----	----	----	----	people in Djovol	Moors
When	February Sometimes rest of the year	----	----	----	----	----	----
V. Gardens Characteristics	100 women, 1 garden. This year no seeding. The pump does not work, and there is no fence. Last year, camels ate the crop. Before this it was a productive garden. Each family has own garden.	No garden. No cooperative. CARITAS stopped irrigated perimeters because of debts.	40 women in cooperative garden. Also, each has a small garden for herself.	63 men and women	This is the first year for the garden.	They had a coop garden with neighbor village, but they had quarrel, it was never settled.	Well in the garden. . Women started the garden. Learned from neighbors (village). New well was paid by the women (partly by credit from emigrant fund)
Organization of Labor	----	----	All the work is done together.	Each has his/her own parcel	All women work in the garden.	----	Costs: 100,000 um 50,000 is paid back. They asked for help. Each woman has own parcel
Individually Managed Plots	○ Family	----	Some women have individual garden.	No	No	----	----

	TAGAH	PALIBA	SIVE	KOUNDEL REO	LETIARE	BOVEL	FORPOD
Vegetables Grown	Cabbages Carrots Cassava Hot pepper Lettuce Tomatoes	----	Tomatoes Cabbages Turnips Onions Lettuce Carrots	Cabbages Onions Lettuce Tomatoes Carrots Hot peppers Turnips	Lettuce Cabbage Turnip Tomatoes Carrots Onions	----	Cabbages Onions Tomatoes Carrots Turnips Eggplant Lettuce Potatoes
Season	cold	----	----	dry/cold	dry/cold	----	----
Yield	----	----	'84: 8000 um (2-3 ha)	----	1st year.	----	----
Amount Consumed	Consumed	----	----	Consumed	Only tomatoes and onions	----	Part is consumed
Amount Sold	No	Formerly harvest, was consumed and sold.	Products are sold. Net profits: 30% fund, 70% women.	Sometimes small amounts sold to buy other food.	Garden is starting to produce enough to sell.	----	Part is sold
Where	----	----	Market	----	----	----	Village
Items Exchanged	No	----	No	----	----	----	----
Source of Water	----	----	River. They share pump and costs (diesel) with men.	River, with motorpump	2 times a day by hand, water from well	----	----
Special Remarks	They want to start the garden again.	----	This is first year with pump. Last year carried water on head.	----	They received seeds from CNRADA.	----	Women made wooden fence themselves.
Garden Constraints	Fence Motorpump	Shotage of water, materials, seeds.	----	Lack of material; want expan- sion	No tools (to sprinkle) they use cans with holes. Everything is done by hand.	----	----

	TAGAH	PALIBA	SIVE	KOUNDEI REG	TETIARE	BOVEL	FONDON
VI. Women and Agriculture							
	On family fields	On family fields	Yes	Women work in family fields	Own, borrowed or family fields.	Women work in family fields	Women only cultivate land when she is alone.
Access to Land (owned or borrowed)	----	----	Inheritance	----	Women have inherited fields. Women without men have own fields. If husband away, woman cultivates. When husband returns he can take it back or they divide the land	----	Inheritance When man is away
Crops Grown	----	----	Falo: cowpeas, potatoes, corn, tomatoes, okra, hibiscus, cotton. Irr. Perim: rice, sorghum Dieri: water-melon millet	----	Sorghum Millet sané	----	Vegetables Cowpea - Millet Sorghum
Consumed/Marketed	----	Sometimes they sell small amount of sorghum have some money.	Consumed and some sold each day in Kaedi or Senegal (potatoes & cotton).	----	The yield of men's field is shared. Nothing is sold.	Yield is for consumption, not enough to sell	----
Constraints	----	----	Motorpump broken, harvest was lost.	----	----	----	----
Irrigated Perimeters	----	----	----	----	----	----	----
VII. Gathered Food Kinds	Jujube Balanites Eri Diabbé	Jujube (seldom)	Jujube Baobab White blackberry Haco Oulot	Gum arabic Gomiker	Jujube Balanites Guigilé (roots) Gum arabic (Nearby gum trees are dead) Planted "neem"	No	Balanites (small amounts).

	TAGAH	PALIBA	SIVE	KOUNDEL REO	DEHARE	BOVEL	LORDOU
Quantity	----	----	----	----	Tree (bought in Kaedi) which gives grains but they don't eat it.	----	----
Where	Lushes	bushes	----	Dieri, and bushes	Guigilé (in marigot, others in bushes, close and far away.	----	----
Season	Rainy season (only when there is a lot of rain)	Rainy season	Rainy season	Rainy season	One month a year (end of rainy season)	----	----
Fishing	No	Traditional with line	Some traditional fishing with nets.	Important activity for village	No fishing	No fishing	Rainy season
Where	----	Marigot	River There used to be more fish in the river.	----	----	River, 2-5 km away	----
VIII. Free Food Frequency	Twice a year in 1985	3 times a year	----	none	once	Every three months	----
Most Recent Access	1985	----	----	----	----	----	last year
Quantities	50 k sorghum 5 k powdered milk, 5 lb oil/ butter	50 k sorghum 5 k powdered milk 5 lb. butter/ oil	----	----	6 sacks of corn, each 45 kgs.	1/2 kg wheat or sorghum each person. 1 1/2 lb butter & 1 kg milk each family.	1 sack red sorghum, 5 kgs powder milk; biscuits 5 lb oil/ butter.
Organization	Government	Government	----	----	----	----	Government
IX. Storage	Yes	No cereals to store	----	No	Yes, in traditional storage bins	No	Yes, in traditional storage bins
Where	Traditional storage bins	----	----	----	Millet and sorghum on the panicle, corn on the head.	----	Sorghum, millet (on the panicle) maize on the

	TAGAH	PALIBA	SIYE	KOUNDEL. REO	TETIARI	BOVIE.	TOABOU
Products Stored	Sorghum & millet, on the panicle. Grains (seeds for next year).	Dry "fish-balls"	Rice in sacks, sorghum on the panicle	----	----	----	head (dried) cowpea (dried)
Method	loose, in sacks	----	in house	----	rice in sacks	----	----
Quantity	----	Enough for when there are no fish in the marigot.	250 kgs. rice 150 kgs. sorghum	----	All yield consumed. Before drought, filled bins	----	1/2 storage bin
Duration of Supplies	----	----	----	----	After 1 or 2 months storage ended. At the moment, bins are empty.	----	After 1 or 2 months. Bin is empty for 3-4 months.
Losses	Yes	No	Yes	----	Yes	----	Yes
How	Small animals. Food doesn't hold longer than 6 months.	----	Termites	----	Insects, mice, crickets	----	Mice Crickets
X. Meals (Composition)							
Breakfast	7:30 coffee + bread (if they haven't had dinner), otherwise only coffee Bouillie for the children.	Coffee with bouillie or white rice.	7:00 coffee, couscous + cowpea leaves, couscous + milk, bouillie.	Coffee and bread	8:00-9:00 (schoolgoing children earlier) couscous & milk	Coffee or bouillie or couscous + milk	8:00-8:30 coffee & bread, or remainders from evening; couscous, etc.
Lunch	1:00-2:00 rice with fish or meat millet + fish. If no meat or fish, then bouillie + milk.	Rice with dry fish, rice with fresh fish	2:00-3:00 rice + fish	Rice with fish Millet with fish	12:00-1:30 crushed rice with fish or meat	Batter of millet and butter. Rice with fish (rarely).	2:30-3:00 batter with tomatoes + oil + hibiscus. Rice, with dry or fresh fish. Batter with fish and vegetables or watermelon.

	IAGAH	PALIBA	SIYE	ROUND. RED	LEHARE	BOVEI	LODOP
Dinner	8:00, couscous + cowpea leaves couscous + fish or meat couscous + cowpea couscous + beans and peanuts.	Couscous (fella) + fish, couscous (fella) + milk.	5:00, couscous + cowpea leaves.	Couscous with cowpea leaves.	8:00-9:00 couscous with milk (made from milkpowder or tinned milk since cows and goats died).	Couscous with cowpea leaves, couscous with milk (meat only when festivals).	9:00 couscous with cowpea leaves and milk and meat (seldom).
Other Meals	No	----	----	10:00 couscous with cowpea leaves.	----	----	----
Snacks	Mango stems	Boiled cowpeas. Beans (seldom)	No, don't have money for it.	Milk	No snacks	Milk	No snacks but tea. Children chew sorghum stems.
Frequency	----	Especially during rainy season	----	----	----	3 times a day	----
Major Dishes and Ingredients	Rice with fish. Couscous with cowpea + peanuts.	Batter of millet + dry or fresh fish. Rice + dry/fresh fish, millet + fish + cowpea leaves.	----	Milk everyday from goats, couscous (sorghum) + cowpea leaves, millet with fish. Millet + fish and oil.	Nieri (crushed milk + sorghum + meat + fish) Rice + fish (without vege- tables, only tomatoes and onions). Couscous + milk, couscous + cowpea leaves + milk or cowpea water or flour or water, melon seeds when meat then oil used	Millet and milk-based products	Kodde Millet + milk + sugar Batter with fish or fish, Couscous with cowpea leaves.
XI. Food Preferences Meat/Fish	Fish, dry or fresh Lettuce Fish over meat	Fish over meat	----	Meat over fish, No meat preference (no camel). Meat only hen a festival	Meat above fish	----	meat above fish

	TAGAH	PALIBA	SIVE	KOUNDEL RED	LEFIARE	BOVEL	London
Staple Preferred	Sorghum, Millet over rice Women prefer rice	Rice	----	Millet Rice	1st millet 2nd rice	Rice	Rice for lunch, Millet for dinner, Samé
Reasons	since the drought, no millet available and rice takes less time to prepare.	Because it is a nice combination with fish. They only have fish.	----	----	Taste and habit (although it is more work, rice if it is available).	----	Rice: less time to prepare. Millet for the taste. samé: increase quantity when pounded
Dominant Staple	----	Sorghum Millet	----	Sorghum Rice	Rice Millet	Millet Rice Cowpea	1) samé 2) corn
Quantities Consumed	12 kilo sorghum a day for 22 people	----	----	----	They seldom eat fish and meat . 2 kgs rice/day	They eat more millet than rice because its cheaper.	They seldom eat meat (cow goat or sheep). Samé twice/ day.
Food Preferred if More Money	Rice and fresh fish.	----	----	Rice , meat Millet	Millet, rice Fish and meat	----	Samé, Rice Fish, meat, oil (depends on price).,
Preferred Dish	Men: couscous Women: rice and fish.	----	----	Rice or millet with fish	Lunch: rice with fish, Dinner: couscous from millet (otherwise they pound the rice).	----	Kodde
XII. Seasonal Aspects of Food							
Hungry Periods	Feb-April	June rainy season	February rainy season	----	wet season, February	dry/hot season	----
Foods in Short Supply During Each Season	Cold season: no millet and corn. No money to buy food.	----	-	No fish in dry season	----	During dry/hot season nearly everything	----

	FAGAH	PALIBA	SIVE	KOUNDEL RED	LETTANE	BOVEL	TORDOU
Source of Money to Purchase Food During Hungry Season	They sell rice and sorghum to get money for oil, etc. Parents sent money or food.	----	Sometimes credit between parents or neighbors. Fish Sometime sell a goat - 600-700 little one - 1000 big one.	----	Selling wild fruits during rainy season.	----	Sometimes emigrants send money. Sell cloth. Borrow from family, women selling gold.
Foods by Season							
Dry Cold	Millet, rice vegetables	----	Vegetables, corn. March-June biggest yield of falo.	Bouillie from millet. Rice with milk. Batter of millet & hibiscus leaves.	Couscous with milk. Rice with fish or meat. Cowpea leaves	----	Vegetables with rice and fish or meat.
Dry Hot	-----	Cowpea leaves	Cowpea, corn, okra, potatoes	----	Couscous + green leaves (oulô) Cowpea + dry fish	----	----
Wet	Some gathered food.	----	Jujube, baobab, white blackberry, oulot, haco	----	Cowpea, wild fruits, green leaves, guigilé, watermelon, squash	----	Batter of millet + melon + cowpea. Batter of flour + milk.
Season							
Dry Cold	Corn (this year no corn). Sorghum	----	Rice Sorghum (after October)	----	Millet, rice, sorghum	----	----
Dry Hot	----	----	----	----	Millet	----	Rice, millet (if available)
Wet	Rice	----	----	----	----	----	----
Number of Meals Eaten by Season							
Dry Cold	3, but sometimes no dinner. No money, or too tired of hand pounding.	3	3, always	4	3	3	----
Dry Hot	----	----	----	----	----	----	----
Wet	-----	----	Fewer meals, but eat what is found in bushes.	----	----	----	----

XIII. Food Habits

	TAGAH	PALIBA	STVE	KOUNDEL REO	LEHANE	BOVEL	LONDOL
Order of Eating	1) men strangers 2) children women (women serve the men dishes water, etc.)	1) men 2) children 3) women	men and women apart (same time)	1) men 2) children 3) women	women, men and children (4-10 years old) eat apart but at same time	1) men 2) children 3) women	1) women and girls (1-5 yr) 2) men and boys (1-5 yr) 3) children (5-10 years)
Most Important Meal	Dinner	Lunch	----	All meals (breakfast, lunch, dinner) are important	----	All meals are important	Lunch and dinner most important. Missing breakfast is possible
XIV. Water Source Uses Location	2 wells	1 permanent well marigot	No wells, all water from river	2 wells (not cemented) River, for all use.	2 wells; one works. Government constructed them.	No wells, river water for all use.	7 wells, but only 2 working. One in garden, other for all uses.
Seasonal Access	All seasons	10-15 meter (well) 200-300 meter marigot	----	Wells are far away. River: 50m-1km	----	----	----
How Often	----	----	----	----	----	2 times/day 2-5 kilometers	8-10 times a day well is in village
XV. Fuelwood Who Collects	children	Women	Women	Women	Women & girls and (rarely) boys	Women	Sometimes children sometimes men, some- times women
When	Every day	Every day	Every day	Every day	Every day	Every day for own necessities	everybody for own necessities once in 2 or 3 days. Some have cows, use dried manure
Where	Far	----	Not far	Not far	----	----	----
Price	----	----	----	100 um/wagon	----	----	only sold sometimes

	TAGAH	PALIBA	SIVE	KOUNDEE RED	TELIANE	BOVEL	LORDOU
XVI. Access to Mills							
	There is a mill in Maghana	No	No. Mill in Senegal	No mills	No mills In Djovol (10 km) to far.	No mills	No mills
Costs	20 um/4 kilo	----	----	----	----	----	----
Hand Pounding	Home	Home	----	----	Every day pound millet and other grains, at home. Pound what is needed for meal.	----	Every day for meals, at home.
XVII. Time Schedule							
	takes a lot of time	----	Pounding sorghum: 4 kilo/2 hours Peeling rice: 4 kilo/5 hours	----	Every day they pound.	----	----
Milling	----	----	----	----	----	----	----
Meals	----	----	Daughters prepare meals while mother in fields, All meals 4 hours to prepare. Morning/afternoon	----	3 hours/day	1 1/2 hour for a big meal	3 1/2 hrs each day
Gardens	----	----	----	----	----	----	----
Fields	----	----	----	----	----	----	----
Marketing Activities	----	Takes a lot of time to go Maghana.	----	----	----	Go to Djovol to sell the milk from their animals 2 times a day.	----
milked from Water	----	----	8 times/day to river=1/2-1 km. away, at least 3 hours	----	9 times/day	2 times/day 3 hours	"all day" busy with carrying water
Fuelwood	----	----	Not far: 1.5 hr/day	1/2 hr/day	Each day takes at least 1 hr.	1/2 hour/day	----
XVIII. Access to Health Facilities							
	PMI Pharmacy Dispensary (CARITAS)	----	Dispensary CAC		No dispensary no PMI (they asked for it twice, refused till now) no pharmacy	no health clinics or pharmacy	dispensary. They buy medicines themselves in Bogué No PMI

	TAGAH	PALIBA	SIVE	KOHNDI. RED	TETIARE	BOVEL	FONDOR
Who Takes Care of Children	----	----	----	----	Grandmothers, older daughters, herself while older daughters go out. Children often at home alone. Littlest child always on back.	----	Older children look after little children.
Duration of Breast Feeding	1 1/4 - 2 years	2 years	1-2 years	2 years, unless woman pregnant, then she stops immediately	2 years unless pregnant	1 year	2 years, unless pregnant
Weaning Foods	from 1 year old they start eating millet	normal food	normal food	no special food	milk, couscous + salt + sugar between 1-4 years old	1-2 years; milk from animals	----
Begin Weaning	----	----	----	From 2 years normal food	From 1 year small amounts of normal food.	From 2 years, normal food	----
Food for Child When Mother Has No Breast Milk	milk from goats or cows	----	----	Bouillie Goat milk	Milk (powder, tinned) distributed Goat milk	----	Everything child eats. Starts with fresh cow- or goat milk (till 1 1/2 mo.) + always breast. After that, creamed milk.
Food for Non-lactating Women	no special food	no special food	no special food	----	----	----	cowpea batter of millet rice bouillie, but it doesn't always help
Food for Lactating Women	no special food	no special food	no special food	no special food	Some of the women drink milk, or eat bouillie, or cowpea leaves	no special food	----
Food for Pregnant Women	no special foods	no special foods	----	----	----	no special food	----

	TAGAU	PALIBA	SIVE	FOUNDEI REO	HEIARE	BOVEI	FORBON
Food for Women Just Giving Birth	They don't have money to prepare special meals.	---	Only if money. Bouillie Soup with meat cowpeas	Meat Soup Bouilli This during one week. After that period normal food.	Millet Bouillie Boiled milk + sugar, rarely meat	no special food	bouilli (made of flour) gossi (of millet)
Occurrence of Diarrhea How Often	----	often, and dehydration	children get diarrhea because animals drink from river	yes often	yes from time to time	yes often	yes always
Seasons	----	-----	----	----	----	----	
Food Used to Treat Diarrheal Episodes Practices	Charcoal No tra- ditional remedies	Fresh milk monkey bread	Bouillie Boabab fruits, no oil, they go to clini- pensary. Traditional cures: falladje, tamar laoniande, djiloki, noko	Rice water	"Sisters of health" bring in medicines. Don't use traditional remedies, although they know them	Biscuits & fresh milk, curdled milk, cream of milk for the small children	Mother has to eat leave of each certain tree. Younger women prefer modern medicines.
Infant Mortality	not high	no "statistics" available	----	----	----	----	----
Seasonality	----	----	----	----	----	----	----
Cause of Death	----	----	----	----	----	----	----
Ratio of Children Who Are Alive to Children Who Are Dead	1:0 5:2 7:2 10:2 5:0 2:12 (miscarriage).	----	----	----	4:0, 5:2, 5:0	----	----

	TAGAH	PALIBA	SIVE	KOUNDEL REO	TELIANE	BOVIE	TORDOU
Most Important illness	----	diarrhea and dehydration	----	when breast feeding is stopped suddenly that causes illnesses, vomiting, diarrhea	malaria (treatment: biscuits + milk (carton) baobab-leaves guava-leaves	diarrhea, vomiting (treatment: doki leaves + salt & water	houses are dirty.
Constraints and Areas of Research	There's not enough food malnutrition. Women want to start garden again. They need: fence, motor pump for themselves. (Formerly they could use the motorpump of the men, but only when the men used it themselves) Women want a mill, it's too much work and takes too much time to pound by hand.	no storage (except fish balls) because there is nothing to stock. Each day the women take some sorghum heads or millet from the field to prepare meal of that day. During hot dry season they plant cowpeas grain to obtain leaves only to eat. (vegetable nutritior). Transport problem: no car, no donkey. They have to find means to find water to start a garden: well or motor-pump, fence. There's a camel problem. CARITAS closed pumps because they didn't pay debts.	lack of time from 5:00 till 10:00 they are busy on fields and in household and market. In evening they want to work extra to improve health facilities. Teacher said that women have a hard time.	expansion of perimeters for more output. Improved fishing tools. Material, tools for agriculture	Food shortages. They want health facilities. Gorgel is seen as a privileged region so people get less food aid. They forget the poor villages. Women really want a mill, they like pounded grains to make cous-cous. They want to open a CAC, but demand has not yet been answered. Hygiene is necessary. They also want a PMI, demand is refused twice, Djewol had priority. They want to produce enough food for own consumption	with regards to the garden: they need a motorpump, seeds, material to work with, tools	they want to explore gum arabic. Well in women's garden has to be repaired. Women want mills, wells, and PMI and CAC

APPENDIX F

MAURITANIA FOOD INVENTORY

Food Item	How Acquired?					Form of Storage		Seasonal Variability	How Prepared	Food Frequency		Special Foods	Consumed by				
	P	H	B	E	D	T	P			Day	Week		T	R	I	C	P
<u>Cereals</u>																	
Bread (wheat)		X						permanent	flour, salt, water in the oven. Old dry bread pounded + hot water + sugar								
Commercial Child's Cereal	NONE																
Maize	X	X	X				sacks	cold season	couscous batter + cowpeas + dry fish	1							X
Milled Rice		X					sacks	cold season	rice + fish	1-2							X
Millet (grain)									couscous batter	1-2							X
Millet (flour)																	
Semolina																	
Sorghum (grain)									fresh, on the fire								
Sorghum (flour)																	
Wheat (flour)																	
Other									fritters	to sell							C
<u>Root Staples</u>																	
Potatoes		X					sacks	hot/dry season	with meat	1							X
Sweet Potatoes		X					sacks	hot/dry season	with meat	1							X
Other																	

P=Purchase, H=Home, B=Both, E=Exchange/Share, D=Donations, T=Type, P=Preservation/Processing, T=Taboo, R=Ritual, I=Introduced, C=Children, P=Pregnant/Lactating, F=Female non-P, M=Male, All=No Distinction Made.

MAURITANIA FOOD INVENTORY

Food Item	How Acquired?					Form of Storage		Seasonal Variability	How Prepared	Food Frequency		Special Foods			Consumed by				
	P	H	B	E	D	T	P			Day	Week	T	R	I	C	P	F	M	All
<u>Pulses</u>																			
Cowpeas		X					sacks	wet season	instead of meat	1-2							X		
<u>Peanuts</u>																			
<u>Watermelon Seeds</u>																			
<u>Other</u>																			
<u>Fish</u>																			
<u>Canned Fish</u>																			
Dried Fish		X	(Nouakchott/ Kaedi)						batter couscous	1-2							X		
Fresh Fish		X	(Senegal)						on rice with boiled fish	depends on money available							X		
<u>Meat</u>																			
Beef		X								rare							X		
Camel																			
Game																			
Goat		X	(They associate to buy a Goat together)							rare							X		
Mutton		X	(Milk & Butter)							rare							X		
<u>"Tichtar" (Dried Meat)</u>																			
<u>Other</u>																			
<u>Poultry</u>																			
Chicken		X																	
Eggs (Not Likely)		X								not often to sell							X		

MAURITANIA FOOD INVENTORY

Food Item	How Acquired?					Form of Storage		Seasonal Variability	How Prepared	Food Frequency		Special Foods			Consumed by				
	P	H	B	E	D	T	P			Day	Week	T	R	I	C	P	F	M	All
<u>Milk</u>																			
Fresh Milk		X																	
Powdered Milk	X								mixed with water		depends on money available								
<u>Sour Milk</u>																			
Tinned Milk/Creamed	X																		
Other									put on hair		sometimes								
<u>Oils and Fats</u>																			
<u>Animal Fat</u>																			
Ghee	X																		
Palm Oil	X							bottles			sometimes								
Peanut Oil	X										1 (1/4-1/2 liter)								
Other											1 (100 um/liter)								
<u>Fruits</u>																			
Bananas-Apples-Oranges	X																		
Dates		X																	
"Jujube"											sometimes								
<u>Melons</u>																			
"Pain de singe" (Baobab Fruit)																			
"Toug"																			
Mandarin, Pineapple	X																		

MAURITANIA FOOD INVENTORY

Food Item	How Acquired?					Form of Storage		Seasonal Variability	How Prepared	Food Frequency		Special Foods			Consumed by				
	P	H	B	E	D	T	P			Day	Week	T	R	I	C	P	F	M	All
Vegetables																			
Beets																			
Cabbage		X						cold season	boiled for rice and fish	1-2									
Carrots		X						cold season	boiled for rice and fish	1-2									
Eggplant		X						cold season		1-2									
Greens, Introduced																			
Greens, Local																			
"Hacco" (Cowpea Leaves)		X							sauce, with fish										
"Laalo" (Baobab Leaves)																			
Lettuce		X								1, if available									
Okra																			
Onion		X	X				in sand: dried apart	cold season		2									
Squash																			
Sweet Peppers																			
Tomato		X	X					cold season		1-2									
Turnips			X					cold season											
Water Lily Seeds and Bulbs ("Ninuphan")																			
Watermelon			X					wet season	boiled; with meal										
Pepper		X																	

MAURITANIA FOOD INVENTORY

Food Item	How Acquired?					Form of Storage		Seasonal Variability	How Prepared	Food Frequency		Special Foods	Consumed by					
	P	H	B	E	D	T	P			Day	Week		T	R	I	C	P	F
Other																		
"Bissap" tea		X						dried			during Ramadan							
Sugar		X																
Tea		X																
Coffee		X									1							
											1							

APPENDIX G

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	PALIBA	SIVE	KOUNDEL REO	GANI	TEKANE
CEREALS					
Bread (Wheat)			10/piece		10-15/piece
Maize					10/3 heads
Milled Rice				20/can	
Millet (grain)			20/kg.		40/2 kg.
Millet (flour)					
Semolina					
Sorghum (grain)			20/kg.		40/2kg.
Sorghum (flour)					
Wheat (flour)					30/kg.
Other					
ROOT STAPLES					
Potatoes					50/kg.
Sweet Potatoes			10-20/pile	30/pile/ kg.	20/pile
Other					
PULSES					
Cowpeas			4/pile	5/teaglass 20/tin	50/kg.
Peanuts				10/tin	60/kg.
Watermelon seeds					25/2kg.
Other					
FISH					
Canned fish					
Dried fish			15/2 piece	little: 10/handfull 20/3 piece big: 20/piece 100/3 piece	70/kg.
Fresh fish			15/5 little	20/handfull	35-70/kg.
MEAT					
Beef					120/kg.
Camel					
Game					
Goat					140/kg.
Mutton					140/kg.
"Titchtar" (dried meat)					

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

PALIBA SIVE KOUNDEL GANI TEKANE

POULTRY

Chicken

Eggs

Duck

200-350/
piece

5/piece

400/2 piece

MILK

Fresh milk

Powdered milk

Sour milk

Canned milk

45/liter

150/kg.

10/glass

350/big can

75/little

Other

OIL & FATS

Animal fat

Ghee

Oil

Peanut oil

Other

FRUITS

Bananas

Dates

Melons

Pain de signe

Other

Oranges

Melons

5-10/piece

120/kg.

20/2kg.

40/2kg.

5/piece

10-40/piece

VEGETABLES

Beets

Cabbage

Carrots

Eggplant

Greens, introduced

1-10/piece 20/piece

10/pile

40/kg.

5/pile

5-10/piece

parsley 2/

pile

Greens, local

"Hacco" (cowpea leaves)

"Laalo" (baobab leaves)

Lettuce

Okra

Onion

Squash

Sweet peppers

Tomato

Turnips

5/pile

4-5/piece

60/kg.

5/.25kg.

10/pile

5/pile

5/pile

5/pile

60/kg.

5/slice

10/pile

5/pile

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	PALIBA	SIVE	KOUNDEL REO	GANI	TEKANE
Waterlilly seeds & bulbs					
Other					
Melon					5/slide
Tomato-puree					10/little portion
Pepper					5/spoon
OTHER					
Maggi cubes					
Sugar					170/bread
Tea (special)					90/box
Tea (normal)					75/box
Coffee					
Soap					

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	WOMPOU	WALI	BOLO DOGO	TCULEL	TAGAH
CEREALS					
Bread (Wheat)		10/piece			
Maize	50/4 kg.				24/kg.
Milled Rice					35/kg.
Millet (grain)	50/4 kg.	15/kg.			24/kg.
Millet (flour)					
Semolina					
Sorghum (grain)	50/4 kg.	20/kg.			24/kg.
Sorghum (flour)					
Wheat (flour)					
Other					
ROOT STAPLES					
Potatoes					
Sweet Potatoes		10/pile			
Other					
PULSES					
Cowpeas		20/kg.			
Peanuts		100/kg.			
Watermelon seeds					
Other					
FISH					
Canned fish					
Dried fish		200/kg.			50-100/kg.
Fresh fish		100-500/kg.		40/kg.	20/10 little
MEAT					
	80/kg.	100/kg.	exchanged with rice and millet	100/kg.	
Beef					100/kg.
Camel					
Game					
Goat		150/pile			120-130/kg.
Mutton		150/pile			120-130/kg.
"Titchtar" (dried meat)					
Other					

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

WOMPOU WALI BOLO DOGO TOULEL TAGAH

POULTRY

Chicken
Eggs 100-150 piece

MILK

Fresh milk exchanged
with rice
and millet

Powdered milk 100/kg.

Sour milk

Canned milk 100/tin

Other

OIL & FATS

Animal fat

Ghee

Oil

Peanut oil

Other

FRUITS

Bananas

Dates

Melons

Pain de signe

Other

VEGETABLES

Beets

Cabbage

Carrots

Eggplant

Greens, introduced

Greens, local

"Hacco" (cowpea leaves)

"Laalo" (baobab leaves)

5/pile

Lettuce

5/piece

Okra

Onion

Squash

Sweet peppers

Tomato

10/pile

Turnips

Waterlilly seeds &

bulbs

Other

Pepper

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

WOMPOU

WALI

BOLO DOGO

TOULEL

TAGAH

OTHER

Maggi cubes
Sugar
Tea
Coffee

Soap

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	TETIANE	BOVEL	FONDOU	M'BAGNE	M'BOTO
CEREALS					
Bread (Wheat)				5-10/ piece	
Maize					
Milled Rice	40/kg.				35/kg.
Millet (grain)				20/kg.	80/4 kg.
Millet (flour)					April 50 Wet season 70
Semolina					
Sorghum (grain)				20/kg.	
Sorghum (flour)					
Wheat (flour)					
Other					
ROOT STAPLES					
Potatoes					
Sweet Potatoes				10/pile	
Other					
PULSES					
Cowpeas				10/pile 100/kg.	
Peanuts					
Watermelon seeds					
Other					
FISH					
Canned fish					
Dried fish				10/pile	70/kg.
Fresh fish				80/kg.	
MEAT					
Beef				100/kg.	
Camel					
Game					
Goat					
Mutton					
"Tichtar" (dried meat)					
Other					

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	TETIANE	BOVEL	FONDOU	M' BAGNE	M' BOTO
POULTRY					
Chicken				100-150/ piece	
Eggs				10/piece	
MILK					
Fresh milk					
Powdered milk	100/kg.				
Sour milk				10/glass	
Canned milk	120/kg.			85/box	
Other					
OIL & FATS					
Animal fat					
Ghee					
Oil					100/liter
Peanut oil					
Other					
FRUITS					
Bananas					
Dates					
Jujube					
Melons					
Pain de signe					
Other					
VEGETABLES					
Beets					
Cabbage					
Carrots				10/piece	
Eggplant					
Greens, introduced					
Greens, local					
"Hacco" (cowpea leaves)				5/pile	
"Laalo" (baobab leaves)				10/pile	
Lettuce					
Okra				5/pile	
Onion					5-10/piece
Squash					
Sweet peppers					
Tomato				10/pile	150/kg.
Turnips					
Waterlilly seeds & bulbs					
Other					
Pepper					5/spoon

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	TETIANE	BOVEL	FONDOU	M' BAGNE	M' BOTO
OTHER					
Maggi cubes					5
Sugar					
Tea					
Coffee					280/big tin 75/little tin
Soap					40

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	SORI MALE	DOJOVCL	TALHAYA	LEKSEIBA
CEREALS				
Bread (Wheat)	5-10/piece			
Maize	20/3 heads		40/kg.	20/kg.
Milled Rice		30/kg.	35/kg.	33/kg.
Millet (grain)	20/kg.		100/4 kg.	80/4 kg.
Millet (flour)				
Semolina				
Sorghum (grain)	20/kg.	25/kg.	80/4 kg.	20/kg.
Sorghum (flour)				
Wheat (flour)				
Other		paddy 15/kg.		
ROOT STAPLES				
Potatoes				
Sweet Potatoes	10/pile			
Other				
PULSES				
Cowpeas	10/.5 kg.			
Peanuts	60 kg.			
Watermelon seeds	10/.5 kg.			
Other				
FISH				
Canned fish				
Dried fish	10-20/pile	20/little fish	80/kg.	
Fresh fish	20-40/pile	15/little fish	30/kg.	80/kg.
MEAT				
Beef			120/kg.	90/kg.
Camel				
Game				
Goat				
Mutton				
"Titchtar" (dried meat)				
Other				

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	SORI MALE'	DOJOVOL	TALHAYA	LEKSEIBA
POULTRY				
Chicken				
Eggs				
MILK				
Fresh milk				
Powdered milk				
Sour milk		1/.5 glass		
Canned milk				
Other				
OIL & FATS				
Animal fat				
Ghee				
Oil				
Peanut oil				
Other				
FRUITS				
Bananas	Exchange with Senegal			
Dates				
Melons				
Pain de signe				
Other				
VEGETABLES				
Beets				
Cabbage				
Carrots	5/pile			10/handfull
Eggplant		5/piece		
Greens, introduced				
Greens, local				
"Hacco" (cowpea leaves)				
"Laalo" (baobab leaves)	5/pile			
Lettuce				
Okra	5/pile	2/5 pieces		
Onion		green:2		
Squash	.5/kg.	1/piece		
	Tomatoes exchanged with .5/kg. Millet			
Sweet peppers				
Tomato		2/30 little 2/3 big		
Turnips	10/pile			

FOOD PRICES BY VILLAGE
ALL PRICES IN UM

	SORI MALE	DCJOVOL	TALHAYA	LEKSÉIBA
Waterlilly seeds & bulbs				
Other				
Melon		5/slice		
Cowpeas-beans		2/5 pieces		
Pepper				
OTHER				
Maggi cubes				
Tea				
Sugar	170/pain			
Tea	30/teaglass			
Coffee				
Soap				
Salt		1/spoon		

APPENDIX H

RECIPES

Couscous

Couscous can be made from millet, sorghum, rice or corn. The grains are first pounded, then a small amount of water is added and rubbed until a grainy form is obtained. The couscous is then steamed in water. The size of the couscous is determined by how much work (rubbing) is done.

Couscous with Cowpea Leaves (Lathiry e haco)

Prepare couscous using millet or sorghum. Add a small amount of powder made from baobab leaves. To make the sauce, boil meat or fish together with cowpea leaves and some salt and stir until cooked. Add a batter made of pounded peanuts. Cook 10-15 minutes and serve over the couscous.

Couscous with Cowpea Grains

Prepare a fine couscous using millet or sorghum. Boil cowpea grains with salt until they are cooked. Serve over couscous.

Cowpeas Boiled in Water (Nire)

Boil cowpeas in water with salt until cooked. During the wet season this is an important snack.

Cowpeas Roasted in Sand

Make a fire until it has become charcoal. Remove the charcoal and put the cowpeas in the sand and cover with hot sand. Roast until cooked.

Red Beets

Boil in water. Beets are often eaten with lettuce and potatoes.

Bassi

Bassi is a very fine couscous eaten with milk and, sometimes, sugar.

Kodde

Kodde is pounded millet, milk and sugar cooked together until it resembles porridge. Kodde is regarded as a delicacy.

Millet and Milk

Pound millet and cook in water until it is a batter. Pour milk over it and serve.

Oil-Tomato Sauce

Prepare sauce of fried tomatoes in oil. Serve over a batter of pounded sorghum and cowpeas.

Mafe (Traditional)

Mafe is a sauce made of pounded dried baobab leaves, cooked in water until it is a sauce. Bits of dried fish or meat are sometimes added. It is served with a batter of pounded sorghum, boiled in water with salt until it becomes a batter.

Mafe (Modern)

Cook together in water okra, tomatoes, dried fish or meat, hot peppers, pepper, garlic, bay, salt and maggi cubes. Serve as above.

Mafe with Rice

Boil rice. Make a sauce of meat or fish, tomatoes, onions, hot peppers and okra in oil. Add peanuts pounded until they are greasy. The sauce will be semi-liquid. Serve with the rice.

Rice with Meat

Boil tomatoes, onions, meat and salt in oil and water for 30-45 minutes. Wash the rice and steam it on top of the other ingredients until water is absorbed. Mix together and serve.

Couscous with Meat

Prepare millet or sorghum couscous. Boil meat, tomatoes, onions and salt in oil. Serve on top of couscous.

Couscous with Fish

Prepare couscous. Boil dried fish and vegetables in water. Serve over couscous.

Millet with Fish (M'djameri)

Pound millet and steam. Fry fish in oil for a few minutes. Boil available vegetables and add the fish. Serve over millet.

Rice with Fish (Thiebou djen)

Steam rice slowly for several hours. Add some oil and tomato paste. Fry some fish (fresh) in oil. Boil vegetables such as cabbage, carrots, turnip, sweet potatoes, eggplant, hot peppers, garlic in water. If using dried fish, boil it with the vegetables. Put the vegetables on top of the rice and the fish on top of the vegetables.

Porridge

Boil pounded millet in water. Pour off the water and serve with milk and sugar.

Fritters

Make a batter of flour and yeast. Fry small quantities in hot oil. Fritters can be eaten with sugar or salt, or a sauce made of tomatoes and hot peppers that has been cooked in oil.

Pancakes

Pancakes are made with flour, yeast and water and baked. Served with sugar or salt.

Rice/Millet/Sorghum with Meat or Fish (Gniri)

Grind rice, millet or sorghum and steam. Serve with boiled meat or fish.

APPENDIX I

GATHERED FOOD

Guigile (Pulaar); Waterlily

The fruits of the guigile are dried and then pounded. They are soaked in the river for five days, and cooked for 2 to 3 hours in boiling water.

Quinquelibá (Pulaar)

Tree leaves used to make tea. They are boiled in water until it is a red color.

Potte Guidjile (Pulaar)

Small fruits from a tree (*Boscia senegalensis*).

Mourisiánka (Soninke)

Small fruit.

Eri (Pulaar)

Small fruits on trees (*Sclerocarya birrea*).

Mourtode (Pulaar: Gonakier; French: Balanites)

Yellow fruits on a tree (*Balanites aegyptiaca*) somewhat bigger than the jujube.

Diaabe (Pulaar); Jujuge (French) (*Zizphus mauritania*).

Small orange fruits with seeds and semi-hard skin.

N'Éoki (Pulaar); Baobab or Pain de signe (French) (*Adansonia digitata*)

Fruit that is eaten or dried, pounded, and thinned with water to make lemonade.

Diabbe (Pulaar) Tamarin (French) (*Tamarindus indica*)

Small sour fruit.

Tabbe (Pulaar)

A root that looks like a potato. Found in flooded areas (marigots). Usually prepared on charcoal.

Paguri (Pulaar); Fonio

Small wild grains found in the dieri similar to millet grain. It requires a lot of work to separate out the good grains. Although the quantities are usually small, paguri is an important gathered food. When found in the walo, it is considered a weed.

N'dayri (Pulaar)

Similar to millet grain and is found under water. The grains are dried and pounded.

Tjapato and Oulo (Pulaar)

These are green leaves from various trees that are used as vegetables.

Nearly all the foods described above are found during the wet season. Others growing in or under water are found months later.

APPENDIX J

TRADITIONAL REMEDIES AND TREATMENTS

Guigile (Pulaar); Waterlily

Leaves are dried and pounded, and milk is added. It is used for gripes and constipation. The roots are used for rheumatism.

Hot knife

People will make small cuts with a hot knife on areas where the rheumatism hurts.

Sasante (Soninke)

The leaves are dried and pounded, and used to wash the body when there is a fever.

Maka Kesse (Soninke)

Also used for fever like Sasante.

Dogui (Pulaar)

Used for vomiting, it is mixed with curdled milk, salt and water.

Paguri (Pulaar)

Small grains that help cure diabetes.

N'Boki (Pulaar); Baobab or Pain de signe (French)

Fruit, often in powdered form, is mixed with water as a remedy against diarrhea.

Gombo Dielokhone (Soninke)

The milky leaves are boiled in water and eaten for diarrhea.

Gossi (Pulaar)

Millet or rice is boiled in water for diarrhea.

Diabbe (Pulaar)

Small sour fruit for diarrhea.

Mourtode (Pulaar); Gonakier (French); (*Balanites agyptiaca*)

When a child has diarrhea, the mother chews the leaves and gives the sap directly to the child.

Other tree leaves which are used similar to Mourtode:

Falladje (Pulaar)
Laoniande (Pulaar)
Djeloki (Pulaar)
Doko (Pulaar)
Teidouma

The following tree leaves are prepared in the way described below:

Ngiagotte (Pulaar)
Toultou (Pulaar)
Fatera (Pulaar)
Djarkoti (Pulaar)
Dene Redi (Pulaar)

All these leaves are boiled with flour (millet) and water.

APPENDIX K

LIST OF TREES AND THEIR USES

Species	Local Name			Uses
	Pulaar	Soninke	Maure	
<i>Acacia nilotica</i>	Gawdi	Diebe	Amouraye	Dominant species in the depressions. Flooded by seasonal rainfall and along the washes of Dieri. The pods are used as feed for sheep and goats. Its wood is used due to its strength and its resistance to <u>scylophage</u> attacks. The pods are full of tannin and are used by traditional tanners. Powder from these pods is known to have aseptic qualities. It is a very good firewood.
<i>Combretum glutinosum</i>	N'Dooki	Tefe	Tikifitt	This tree is found in many arid lands. It is found in monotype groupings on sandy soils but also on lateritic and on skeletal soils. Its leaves and bark are used for therapeutic purposes such as for gastric problems and gingivitis. Its sap is very adhesive and is used for the treatment of tooth cavities. It also is a source of firewood.
<i>Balanites aegyptiaca</i>	Mourtoki	Sekhere	Taichott	Adapted to various types of soils, this tree is usually found just above the upper limit of flooding of the Fonde. Its fruits are well liked by inhabitants of the valley. Its wood is used to make handles for tools (axes).
<i>Acacia albida</i> = <i>Faidherbia albida</i>	Thiaski		Avraraye	The flowering and foliation of this tree occur during the dry season. This tree is liked by herders who find in its leaves the only green feed available for their herds during the dry season. It is a protected species.
<i>Pterocarpus lucens</i>	Thiangui		Sangara	Firewood; construction; leaves for green feed.

LIST OF TREES AND THEIR USES

Species	Local Name			Uses
	Pulaar	Soninke	Maure	
<i>Ziziphus mauritiana</i>	Diaabe		Sdes	Appreciated fruits; construction; leaves for green feed.
<i>Acacia senegal</i>	Patuki		Aouar	Arabic gum.
<i>Adansonia digitata</i>	N'Boki		Teidouma	Leaves for human consumption; fibers for rope-making.
<i>Acacia radiana</i>	Thiluki		Talha	Pods for animal feed; firewood.
<i>Sclerocarya birrea</i>	Eri			Fruits; wood used to construct mortar and pestle; firewood.
<i>Capparis decidua</i>	Goumi		Ignin	Toothpicks; firewood.
<i>Salvadora persica</i>	Goudi		Aferchi	Firewood.
<i>Commiphora africana</i>	Baddi			Toothpicks; sap is used to make incense.
<i>Grewia bicolor</i>	Kelli		Nijijji	Fruits; firewood.
<i>Tamarindus indica</i>	Diabbe			Fruits.
<i>Myrtragina ineimis</i>	Koili			Construction.
<i>Acacia ehrenbergiana</i>	Temi		Tamat	Fruits (pods); animal feed.
<i>Borassus flabellifer</i>	Doubbi			Fruits; construction.
<i>Hyphaene thebaica</i>	Guellioki			Fruits; construction
<i>Acacia seyal</i>	Bulbi			Pods for animal feed; bark used in traditional tanneries.
<i>Bauhinia rufescens</i>	Namadi			Pods for animal feed.

LIST OF TREES AND THEIR USES

Species	Local Name			Uses
	Pulaar	Soninke	Maure	
<i>Calotropis procera</i>		Bamwami		Construction; not a good source of firewood.
<i>Boscia senegalensis</i>		Guidjile		Fruits; firewood.
<i>Sterculia setigera</i>		Bobori		Firewood.
<i>Capparis</i> spp.		Guumi		Firewood.
<i>Dalbergia melanoxylon</i>		Jalambaani		Wood for artwork; firewood
<i>Bauhinia reticulata</i>		Barkeewi		Animal feed.
<i>Acacia vereck</i>		Alluki		Weed used to manufacture boats.

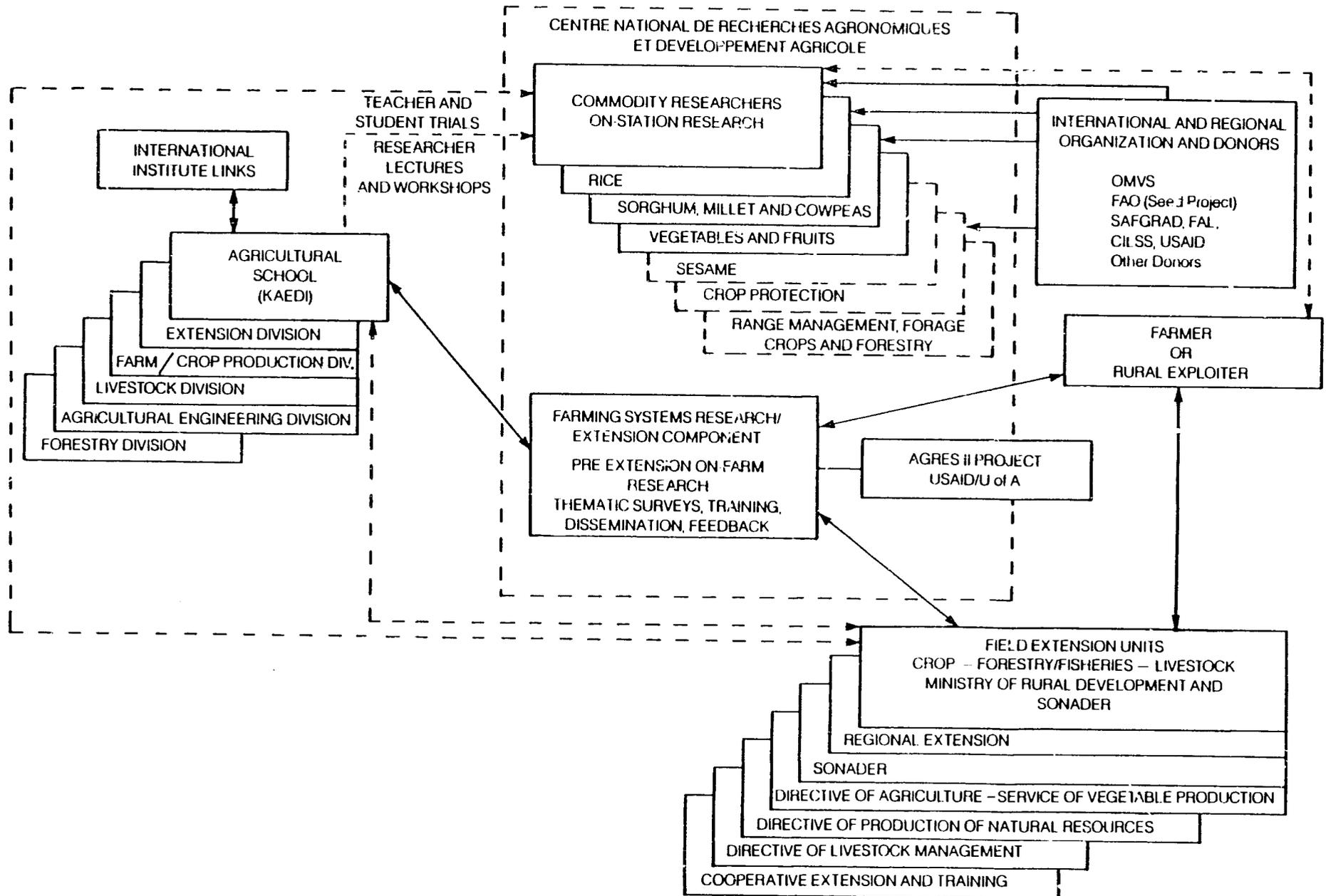
APPENDIX L
ANIMAL DISEASES

Pulaar	Hassania	French	English
<u>All Species</u>			
N'Daaso	Jayha	Trypanosemiase	Trypanosomiasis
Jappo		Oreille Tombante	
Beebi		Filariose Oculaire	Filariasis of the Eye
Safo	Saafa	Fievre Aphteuse	Foot and Mouth Disease
Sayo		Rage	Rabies
Haande		Abces Parotidien	Parotidean Abscess
Lawre		Abces Sous-Cutane	Subcutaneous Abscess
Dadol		Phlebite de Veine Digitee	Digitated Vein Phlebitis
Besngu		Stomatite	Stomatitis
Nedio	Bougoychiche	Botulisme	Botchelism
Bakkale		Brucellose	Brucellosis
Tiro	Jrab	Gale	Scab, Mange
Reedu Muusoru	Takhma	Mal de Ventre	Intestinal Problems
Nawande		Plaie	Wound, Sore
Latche		Botulisme	Botchelism
<u>Cattle</u>			
Bade = Caaru	Boudemya	Peste Bovine	Cattle Plague, Rinderpest
Cartu Baleejo	Boudreya	Coccidiose Bovine	Cattle Coccidiosis
Kuurel	Boudreya	Charbon Symptomatique	Symptomatic Anthrax

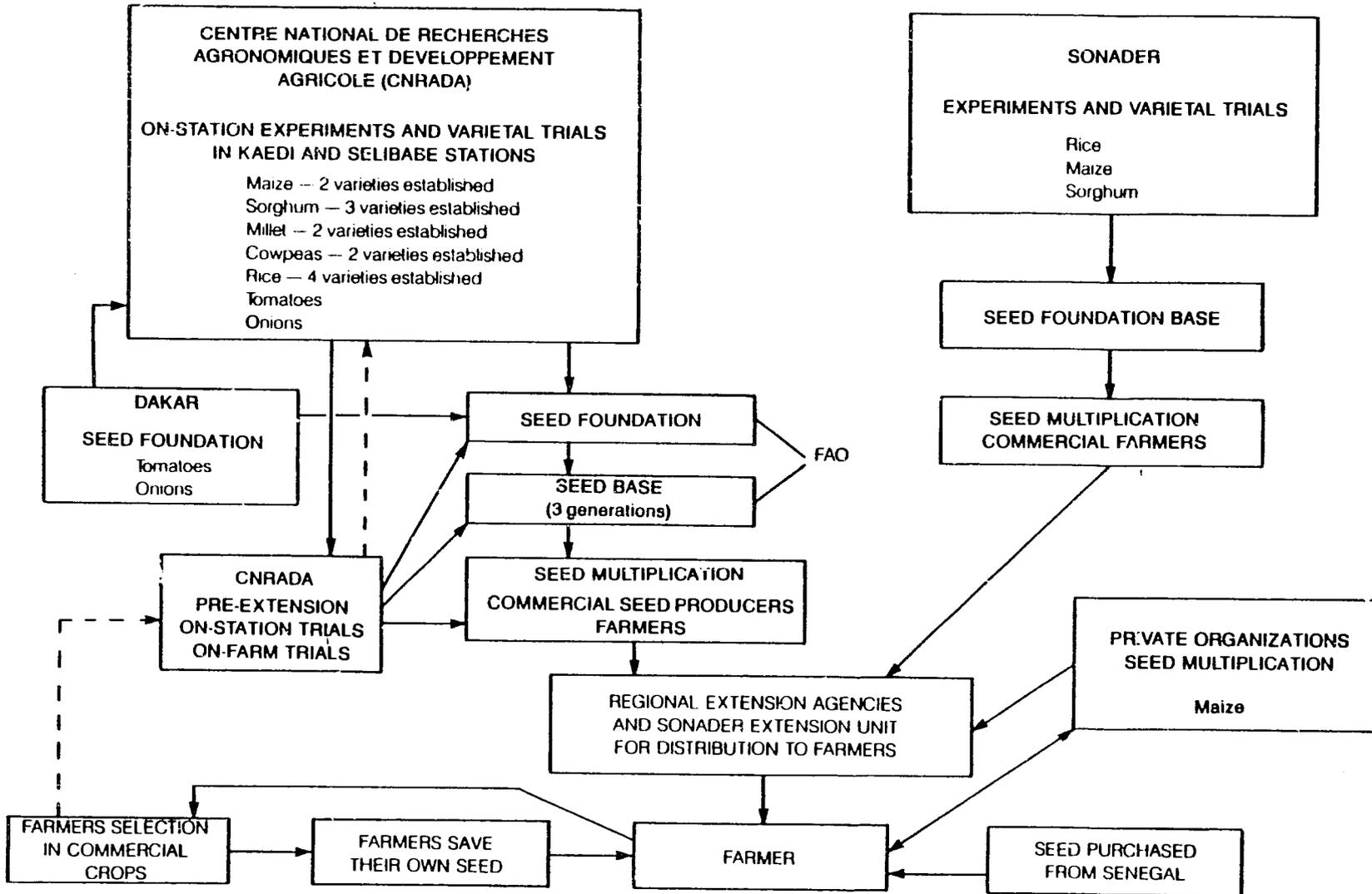
ANIMAL DISEASES

Pulaar	Hassania	French	English
<u>Cattle (cont.)</u>			
Dioffe		Peripneumonie Contag Bovine	Contagious Bovine Pleuropneumonia
Dɔamal		Charbon Bacteridien	Bacterial Anthrax
Yeedo	Bougleib	Peripneumonie Contag Bovine	Contagious Bovine Pleuropneumonia
<u>Goat and Sheep</u>			
Fecco		Pietin	Foot Rot
NDiyam		Hydropisie du Pied	Foot Dropsy
Filto		Intoxication Alimentaire	Food Poisoning
Saanitere		Gale	Scab, Mange
<u>Horses and Donkeys</u>			
Juko	Barouche	Rhume, Pasteurellose, Gourme	Cold, Pasteurellosis, Strangles

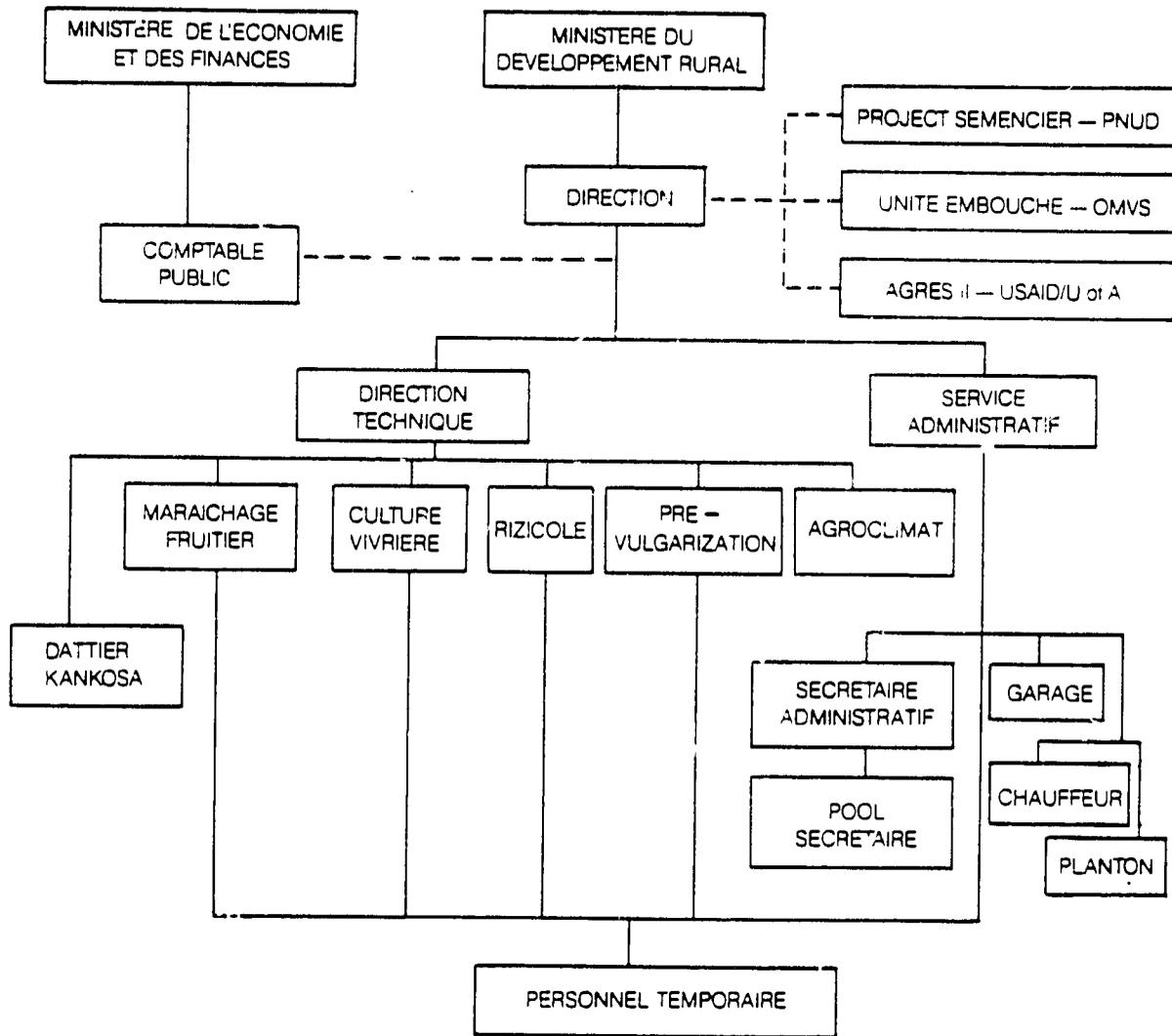
RESEARCH, EXTENSION AND EDUCATION LINKAGES



MAURITANIAN SEED PRODUCTION ACTIVITIES



ORGANIZATIONAL CHART OF CNRADA



Source: Taken from Diagnostic Du Centre National De Recherches Agronomiques et de Développement Agricole (CNRADA): Recommandations à L'Institut de Recherche, Published by Permanent Interstate Committee for Drought Control in the Sahel, Aout 1984, Annexes (2), B-1.

APPENDIX P

Meteorological Data

KAEDI STATION

1985 MONTHLY AVERAGES

Months	Max Temp °C	Min Temp °C	Ave Mean Temp °C	Rainfall mm/Day	Sunlight Hrs/Day	Humidity %	Wind Velocity cm/sec	Evapotran- spiration mm/Day	
J	1.	29.7	17.7	23.7	—	05.5	34	070.5	07.6
	2.	29.2	16.5	22.9	—	07.5	23	132.4	09.2
	3.	32.0	17.4	24.8	—	06.1	28	070.7	07.9
F	1.	35.8	20.3	28.1	—	06.6	18	115.6	10.5
	2.	36.6	19.7	28.2	—	09.0	16	112.6	11.4
	3.	36.0	24.1	30.1	—	00.0	14	110.6	11.3
M	1.	35.7	23.7	29.7	—	05.0	12	118.7	11.6
	2.	33.6	22.5	28.1	—	03.1	27	119.2	10.7
	3.	39.5	24.4	32.0	—	08.5	19	141.6	16.2
A	1.	40.3	26.0	33.2	—	06.3	14	102.8	14.4
	2.	38.2	24.1	31.2	—	07.1	16	107.6	14.7
	3.	39.0	23.6	31.3	—	07.9	19	107.8	14.5
M	1.	40.7	26.0	33.4	—	06.3	7	154.8	15.9
	2.	41.9	26.0	34.0	—	08.8	20	135.4	18.3
	3.	43.7	29.2	36.5	—	06.3	26	097.4	18.1
J	1.	43.1	30.2	37.0	—	03.0	27	129.0	17.3
	2.	40.4	27.3	33.9	—	04.7	31	132.8	15.9
	3.	38.4	26.7	32.6	01.1	03.4	44	134.7	13.7
J	1.	38.2	26.5	32.3	0.7	05.2	39	110.9	13.9
	2.	34.8	25.5	30.1	02.2	02.8	55	104.8	09.1
	3.	34.9	25.3	33.1	45.5	06.6	67	101.2	09.1
A	1.	35.9	26.0	30.9	24.3	08.7	59	075.8	09.7
	2.	35.0	25.6	30.3	14.6	06.2	60	090.7	09.4
	3.	33.4	24.4	31.9	41.5	06.3	64	121.3	09.9

KAEDI STATION
1985 MONTHLY AVERAGES

Months	Max Temp °C	Min Temp °C	Ave Mean Temp	Rainfall mm/Day	Sunlight Hrs/Day	Humidity %	Wind Velocity cm/sec	Evapotran- spiration mm/Day	
S	1.	34.3	25.0	29.7	33.0	06.4	67	083.7	07.0
	2.	36.7	26.1	31.4	04.8	07.3	57	082.0	10.1
	3.	38.4	26.3	32.4	03.8	04.6	47	096.0	10.3
O	1.	39.3	26.9	33.1	—	05.1	40	050.7	13.4
	2.	39.5	26.3	32.9	—	02.0	29	047.5	10.9
	3.	36.4	23.5	31.8	—	03.8	24	041.9	10.6
N	1.	39.5	19.2	29.4	—	09.6	22	034.2	10.7
	2.	37.3	22.4	29.8	—	08.1	23	069.0	10.8
	3.	36.1	19.9	28.0	—	0	16	052.8	09.6
D	1.	34.2	22.0	28.1	—	06.3	10	082.4	10.9
	2.	26.0	16.1	21.0	15.9	05.2	34	087.6	09.2
	3.	29.3	18.7	26.4	—	06.9	33	097.5	09.0

APPENDIX Q

STATION: KAEDI

TABLE OF MONTHLY SOIL TEMPERATURE

AVERAGES FOR 1985

Months		0cm °c	10cm °c	20cm °c	50cm °c	100cm °c
J.	1	26.4	24.7	25.8	26.7	28.0
	2	27.5	26.7	26.1	27.0	28.3
	3	29.2	27.2	26.8	27.2	28.0
F.	1	33.6	29.5	28.9	28.7	29.2
	2	33.2	30.6	29.8	29.8	29.7
	3	33.9	31.3	30.6	30.6	30.5
M.	1	33.9	31.6	30.8	30.9	30.9
	2	34.3	31.3	30.7	31.0	31.0
	3	40.1	35.8	33.2	37.0	32.4
A.	1	39.5	36.2	34.6	34.1	33.2
	2	38.8	35.5	34.5	34.5	33.9
	3	40.1	35.6	34.6	34.4	34.2
M.	1	41.3	37.3	35.9	35.3	34.5
	2	42.3	38.9	37.5	36.6	35.5
	3	43.7	40.3	38.6	37.5	36.3
J.	1	41.9	40.0	38.8	37.9	36.9
	2	37.7	38.0	37.9	37.5	36.8
	3	36.9	37.6	37.2	37.0	36.6
J.	1	36.4	36.1	35.8	35.8	35.7
	2	33.6	35.1	34.9	35.4	35.4
	3	34.4	33.5	33.1	33.5	34.3
A.	1	36.4	35.5	34.7	34.7	34.8
	2	36.4	35.5	34.7	34.7	34.8
	3	34.3	32.2	31.9	32.9	32.0

STATION: KAEDI

TABLE OF MONTHLY SOIL TEMPERATURE

AVERAGES FOR 1985

Months	0cm °c	10cm °c	20cm °c	50cm °c	100cm °c	
S.	1	34.8	32.3	30.0	34.3	34.1
	2	37.6	35.4	35.9	35.5	35.4
	3	39.6	36.9	36.2	36.0	35.7
O.	1	38.7	36.4	35.9	35.6	35.6
	2	37.3	36.4	35.9	35.6	35.6
	3	33.3	31.6	30.8	31.3	34.9
N.	1	35.9	33.5	32.5	33.1	33.9
	2	34.6	38.5	32.0	32.6	33.1
	3	32.2	30.8	30.1	30.9	32.2
D.	1	30.5	29.2	29.7	30.6	31.7
	2	24.0	24.3	24.9	27.2	29.6
	3	25.8	24.8	25.0	24.5	28.0

APPENDIX R

Pulaar Agricultural Seasons

<u>Name</u>	<u>Description</u>
<u>Thiedo</u> (March to May or June)	This is the hot dry seson.
<u>Demminare</u> (June to July)	This is the time when the rains first begin and the trees begin to sprout.
<u>NDongou</u> (July to August/September)	This is the actual rainy season.
<u>Cowle</u> (September to October)	This period marks the retreat of the flood when recession agriculture can begin and also the coming of the harmatton winds from the Sahara.
<u>Daboude</u> (November to February)	This is the cool dry season.

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APPENDIX T

List of People and Institutions Contacted

Institutions

USAID, Nouakchott

CNRADA (Centre de Recherche Agronomique et de Developpement Agricole)

Ministry of Rural Development

- Direction of Protection of Natural Resources
- Direction of Livestock Production
- Direction of Agriculture

SONADER

Direction de la Sante

Peace Corp

FAO

Office of the Governor of Brakna Region

Office of the Governor of Gorgol Region

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Donald E. Miller - Director USAID, Nouakchott

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Janice Wescott - USAID, Nouakchott

Jill Hilbert - USAID, Nouakchott

Teresa Fogelberg - USAID, Nouakchott

Harouna Hanaf - USAID, Nouakchott

Mamadou Diarra - Director of CNRADA

Ba Mamoudou Yero Besse - Head of Division for Rice Production

Ba Maradon Lamine - Head of Division for Vegetable and Fruit Research

His Excellency Mr. Messaoud Ould Boulkheir - Mauritania Minister of Rural Development

His Excellency Mr. Mohammad Lemine Ould Abdi - Secretary General (MRD)

Ba Bocar Soule - Technical Advisor (MRD)

Housseynou Fall - Director Genie Rural

Mohameden Babah - Director General SONADER

Dahmoud Ould Terzouk - Director Protection de la Nature

Mohammed Abdallah ould Abdurrahmane - Deputy Director of Agriculture

Dr. Limame - Director of Animal Husbandry

Mrs. Ba - Director of PMIs

The Governors of Gorgol, Guidimaka, Brakna and Trarza Regions

The Assistant Governors of Gorgol, Guidimaka, Brakna and Trarza Regions

The Prefects of the Kaedi, M'Bagne, Bababe, Boghe and Maghama Departments

The Chefs of Arrondissement of Wompou, Lekseiba, Tekane, Toufde Sive and Darel Barka

Dr. Lam Hamady - Director of ENFVA (Agricultural School)

Agriculture Officer of M'Bagne, Tekane

Mr. Guisset - SONADER

Tajidine Dendou - OMVS Research Director

Jean Core - FAO Seed Multiplication Project

Ge Baker - FAO Seed Multiplication Project

Stefan Buzdugan - Director, Partners for Productivity

John Balis - USAID, Dakar

Richard Caldwell - USAID, Dakar

Jon Andersen - USAID, Dakar

Jean LeBloas - USAID, Dakar

Alfred Schultz - USAID, Dakar

Alex Cunard - USAID, Dakar

APPENDIX U

ITEMS RELEVANT TO THE COST OF PRODUCTION OF THE
CEREAL CROPS

IRRIGATED RICE, MAIZE, AND SORGHUM

02-01-1986

1. Basic Data

- Villages small irrigated perimeters
- Average area: 20 hectares
- Average proportion of cultivated soils: 120%/year
- Implementation and guidance of Sonader
- Inputs provided by Sonader
- Prices and costs according to the agreements with funding agencies.

1. Unit price of agricultural inputs (02-01-1986)
(Ouguivas - UM)

Items-----	Unit-----	Unit cost---	Real Price-----
Diesel	: liter :	34	: 34
Engine oil	: liter :	160	: 160
Seeds	: kg :	18	: 35
Fertilizers	: kg :	24	: 24
Pesticides	:Ft./ha :	200	: 200 per season
Spare parts	:Ft./ha :	1000	: 1000 per season
Mechanical	: :		:
Cultivation	:Ft./ha :	2000	: 2000 per season

Labor	: Day :	180	:

PS: The value of the labor/day is slightly over the minimum wage (21.45 UM/hour) in the following calculations:

2. Number of Labor/day/ha (hand labor)
- Rice 200
 - Maize/Sorghum 90

The debt granted to the farmers is broken as follows:

Shor-term (%) (inputs)	8.5 (recommended by the FND)
Medium term (%) (motopump)	8.5 (appropriated by Sonader)

The financial charges from the Gouvernement/Sonader (e.g., debts investment charges) are not taken into account.

4. Water needs per delivery head (m3/ha) and corresponding diesel oil consumption

Crop	Need m3/ha	Pump discharge	Number Hours	Consumption liters of diesel oil
Rice	13000	270	48	220
Maize/Sorghum	6400	270	23	105

Base: motopump of average power of 20 horses
- Average consumption of 0.23 liter/Hp

5. Cost of the pump

Average cost of a GMP	420,000 Um (*)
Reimbursable in 3 yearly instalment	164,446 UM
i.e., hectare/year	8,222 UM

(*) 1985: 350,000 UM. This cost takes into account the adjusted price effect of inflation since January 1985.

II. Fixed and Variables Costs

Fixed Costs per hectare

1. SONADER/GOVERNMENT

Land preparation/ Supervision	Ft./year	7667	1	6389
- Personnel	Ft./year	9000	1	7500
- Vehicles	Ft./year	4558	1	3798
Housing	Ft./year	1040	1	867
Maintenance	Ft./year	521	1	434
Financial charges	Ft./year	P.M.	1	0

Item-----Unit--Unit/Price---Quantity---Proportion
engaged
1.2 (120%)

Total fixed costs Sonader/Government:

-per year 22,786
-per season 18,998

2. Farmer

Annual payments	Ft./year	8222	1	6851
Land rent	Ft./year	P.M	1	0
Financial charges	Ft./year	P.M	1	0

Total fixed costs Farmer

- per year 8222
- per season 6851

3. Total Fixed Costs per hectare

-per year 31,008
-per campagne 25,839

Variables Costs for a Farmer/per Crop/and per hectare
per season

Item-----	Riz-----		Maize-----		Sorghum-----	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
		UM		UM		UM
Diesel oil (liters)	220	7480	105	3570	105	3570
Engine oil (liters)	6	960	3	480	3	480
Seeds (kg)	40	720	25	450	10	180
Fertilizers (kg)	260	6240	120	2880	120	2880
Pesticides (Ft)	1	200	1	200	1	200
Spare parts	1	1000	1	1000	1	1000
Mechanical cultivation	P.M	0	P.M	0	P.M	0
Financial charges	1/2 yr	706	1/2 year	365	1/2 year	353

Expenses excluding labor		17306		8945		8663

Labor	200	36000	90	15200	90	16200

Total		53306		25145		24863

Total costs per hectare

Total costs farmer (1)	60157	31996	31714
Subsidies (2)	680	425	170

Fixed + variable costs

Total Sonader/Farmer (3)	79825	51409	50872
--------------------------	-------	-------	-------

- (2) The difference between the cost of seeds to the farmer and the real cost is supported by the Government.
The fertilizers will be sold at the cost price.
- (3) Cost of production per cultivated hectare to the Government.

III. Output price per kg of cereal in Ouguiya for different assumptions of yield

1. Items: Total Expenses Farmer

	-----RICE-----		-----MAIZE-----		-----SORGHUM-----	
	Yield	Cost per kg/ha	Yield	Cost per kg/ha	Yield	Cost per Kg/ha
Average Yield	3000	20.05	1500	21.33	1000	31.71
	3500	17.19	2000	16.00	1500	21.14
	4000	15.04	2500	12.80	2000	15.86

This table only considers the production costs at the farmer level.

2. Items: Total costs Sonader and Farmer

Average Yield	3000	26.61	1500	34.27	1000	50.87
	3500	22.81	2000	25.70	1500	33.91
	4000	19.96	2500	20.56	2000	25.44

This table includes all the costs of production at the government level.

APPENDIX V

TOPICS OF INQUIRY

Farming Systems Research Reconnaissance Survey of the Senegal River Valley

GENERAL VILLAGE QUESTIONS

1. Village characteristics

A. Size of village (number of households or population)

B. Institutional development

Schools

Market (periodic or
permanent)

Access to water

Health clinic

Other government offices

Access to roads

Milling operations

2. Demographic characteristics

Ethnic affiliation

Tribe

Other social

distinctions

Subtribe

3. A. Kinds of crops grown (e.g. sorghum, millet, neibe, watermelon,
vegetables, citrus, groundnuts)

B. Sequence of crops

C. Length of fallow

D. Indicators for determining when land can be fallowed

E. If rains returned, would farmers de-emphasize irrigated agriculture
and return to rainfed farming

4. Irrigation system

General characteristics

Type of perimeter (large or small)

Perimeter area

Cropped area

Location on river (fonde, walo, other)

Soil type

Source of water

Water lifting method

a. pump origin/brand

b. pump size/capacity

c. maintenance program

d. power source

e. parts availability

f. operation (village operator; SONADER; other)

5. Wild foods
 - Kinds (names)
 - Uses
 - Where found
 - Tree crops
6. Gum arabic
 - Availability
 - Economic utilization
7. Trees used for firewood
 - Names
8. Citrus (orchard vs. garden)
 - Economic utilization
9. Bananas
 - Economic utilization
10. Mangoes
11. Interaction between sedentary farmers and nomadic groups
 - Complementary
 - Grazing of crop residue
 - Manure for fields
 - Products sold to farmers
 - Products sold to nomads
 - Competitive
 - Grazing in fields before harvest
 - Competition for water
 - Communal grazing resources
12. Migration routes of transhumants
13. Wild game
 - Availability
14. Fishing
 - Traditional fisheries (location)
 - Fishing patterns
 - Importance of fish in diet (fresh vs. dried)
 - Marketing (sales and purchases)

15. Other sources of income

Off-farm employment

- Seasonal migration (other agricultural schemes,
urban employment)
- Local off-farm employment (shops, mills, itinerant trading
government employment, charcoal manufacture)
- Arts and crafts
- Farm labor
- Remittances
- Where have most migrants gone and why
- How many have left
- How many have returned
- Other enterprises

16. Credit

Sources

- Credit associations
- Government loans
- Relatives or local merchants
- Cooperatives
- Others

Terms (period, interest, grace)

Loan justification (social, production improvements, sickness,
home improvement)

17. Consumption

A. Food preferences

- Crops
- Meat

B. Food habits

- Who eats with whom
- Number of meals (timing and composition)
- Main meal
- Order of eating

C. Foods by season

D. Culturally prescribed foods (infants, lactating women, elderly)

E. Food distribution programs

- Free food
- Food for work
- Market stabilization

18. Health

Government-provided medical services
Traditional medical practices

19. Environment

Energy sources and amount consumed daily (charcoal, wood, manure)
Location of resources consumed
Energy costs (price or effort for gathering in terms of hours per day)
Secondary impacts of exploitation (erosion; sand encroachment)
Local reforestation projects
Preferred trees
Preferred locations for plantings
Shelterbelts and shade trees
Have well levels changed (ask women)

20. Project interventions in area

21. Constraints elicited from farmers

22. Possible interventions

SPECIFIC HOUSEHOLD QUESTIONS

1. Composition of household (participants on the family farm)

Adults
Education of household members

Children
Outmigration

2. Farm characteristics

A. Access to land (land tenure inquiries)

Irrigated land (size of holding)
Falo
Fonde
Decrue (number of plots)
Dieri
What is considered good land?

3. Field size

(May be determined by amount of seed used, but some verification of field sizes must be done by pacing or measurement)

4. Family field vs. individual fields

Cropping patterns

5. Crops grown

A. Rice

Size of parcel(s)
Irrigation techniques

Continuous or intermittent inundation
Water application frequency
Cropping seasons (number of cultivations)

Varieties (names, characteristics, sources, selection criteria, growing period)

Local
Introduced

Disease and pests

Inputs used - fertilizer, pesticides (how applied; when)

Land preparation - plowing (how; when); other (i.e., disking, harrowing)

Planting (methods, timing, who, man-days, constraints, intercrops, replanting)

Birdwatching (methods, timing, who, man-days, constraints)

Fencing (methods, timing, who, man-days, constraints)

Weeding (methods, timing, who, man-days, constraints)

Harvesting (methods, timing, who, man-days, constraints)

Post-harvest (methods, timing, who, man-days, constraints), including: drying, storage, threshing, milling

Control of output - who, and portion given to family head
Linkages with other crops

- B. Other crops (corn or sorghum) (pursue cropping pattern questions when appropriate)

Types

Growing periods

Diseases and pests

Inputs used (fertilizers; pesticides)

Irrigation techniques (inundation, water application frequency, furrow or flood)

Land preparation (plowing - how and when; other techniques)

Planting (methods, timing, who, man-days, constraints, replanting)

Weeding (methods, timing, who, man-days, constraints)

Harvesting (methods, timing, who, man-days, constraints)

Post-harvest, including drying, storage, threshing, milling (methods, timing, who, man-days, constraints)

Portion marketed

6. Market gardens

- A. Water source
- B. Lifting method
- C. Water application method (timing and amount)
- D. Location
- E. Crops grown
- F. Inputs used
- G. Land preparation
- H. Marketed portion
- I. Independent or cooperative organization

7. Recession agriculture (decrue)

Sorghum

Area grown

Site selection (number of days flooded; number of years cultivated)

Number of plots, size of plots and tenure arrangements

Varieties (name, characteristics, source, selection criteria, growing period)

Local

Introduced

8. Other crops in decrue (pursue cropping pattern questions when appropriate)

9. Falo cropping patterns

Area grown

Site selection (number of days flooded; number of years cultivated)

Number of plots and tenure arrangements

Type of crops (names, characteristics, source, selection criteria, growing period)

Local

Introduced

Diseases and pests

Inputs used (fertilizer; pesticides)

Land preparation (tilling or preparing soil before planting)

Planting (methods, timing, who, man-days, constraints, intercrops, replanting)

Bird watching (methods, timing, who, man-days, constraints)

Fencing (methods, timing, who, man-days, constraints)

Weeding (methods, timing, who, man-days, constraints)

Harvesting (methods, timing, who, man-days, constraints)

Post harvest, including drying, storage and threshing (methods, timing, who, man-days, constraints)

Portion marketed and income received

Use of stocks

Grazing use

10. Fonde cropping patterns (other than small perimeters)

Area grown

Site selection (number of days flooded; number of years cultivated)

Number of plots and tenure arrangements

Type of crops (names, characteristics, source, selection criteria, growing period)

Local

Introduced

Diseases and pests

Inputs used (fertilizer; pesticides)

Land preparation (tilling or preparing soil before planting)

Planting (methods, timing, who, man-days, constraints, intercrops, replanting)

Bird watching (methods, timing, who, man-days, constraints)

Fencing (methods, timing, who, man-days, constraints)

Weeding (methods, timing, who, man-days, constraints)

Harvesting (methods, timing, who, man-days, constraints)

Post harvest, including drying, storage and threshing (methods, timing, who, man-days, constraints)

Portion marketed and income received

Use of stocks

Grazing use

11. Dieri cropping patterns

Millet

Area grown

Site selection (number of years cultivated)

Number of plots and tenure arrangements

Varieties (names, characteristics, source, selection criteria, growing period)

Local

Introduced

Diseases and pests

Inputs used (fertilizer; pesticides)

Land preparation (tilling or preparing soil before planting)

Planting (methods, timing, who, man-days, constraints, intercrops, replanting)

Bird watching (methods, timing, who, man-days, constraints)

Fencing (methods, timing, who, man-days, constraints)

Weeding (methods, timing, who, man-days, constraints)

Harvesting (methods, timing, who, man-days, constraints)

Post harvest, including drying, storage and threshing (methods, timing, who, man-days, constraints)

Portion marketed and income received

Use of stocks

Grazing use

12. Other dieri crops

Area grown

Site selection (number of years cultivated)

Number of plots and tenure arrangements

Type of crops (names, characteristics, source, selection criteria, growing period)

Local

Introduced

Diseases and pests

Inputs used (fertilizer; pesticides)

Land preparation (tilling or preparing soil before planting)

Planting (methods, timing, who, man-days, constraints, intercrops, replanting)

Bird watching (methods, timing, who, man-days, constraints)

Fencing (methods, timing, who, man-days, constraints)

Weeding (methods, timing, who, man-days, constraints)

Harvesting (methods, timing, who, man-days, constraints)

Post harvest, including drying, storage and threshing (methods, timing, who, man-days, constraints)

Portion marketed and income received

Use of by-products

Grazing use

13. Baffou (depressions in dieri)

Types of crops grown

14. Livestock

A. Goats

Number
Feeding practices (free or controlled)
Diseases and mortality

B. Sheep

Number
Feeding practices (free or controlled)
Diseases and mortality

C. Cattle

Number
Feeding practices (free or controlled)
Diseases and mortality

D. Donkeys

Number
Feeding practices (free or controlled)
Diseases and mortality

E. Poultry

Number
Feeding practices
Diseases and mortality

F. Horses

Number
Feeding practices (free or controlled)
Diseases and mortality