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THE FERTILIZER INVESTMENT FOR SOIL FERTILITY RESTORATION PROJECT (SFRP)

PROGRESS REPORT

1989-1990

Submitted

by

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Appendix I. An Outline of Training Programs Conducted for National Collaborators and Farmers, July 1989-July 1990

Appendix II. A Report on the Baseline Survey of the SFRP in the Savanna Region of Togo

A Report on the Baseline Survey of the SFRP in the Maradi Region of Niger

GENERAL INTRODUCTION

This progress report covers the period July 1989 to July 1990. It is made of four integral parts. Part I gives information on the background to the project, concept, and rationale. It also outlines the specific objectives and design and summarizes progress made in the agronomic, agro-economic, and socioeconomic studies, the operation of the Fertilizer Revolving Funds, and in training. Appendix I is a report on training of collaborators. Appendix II contains the complete reports on the Baseline Farm Surveys of Togo and Niger.

Part I

BACKGROUND, CONCEPTS, AND PROGRESS

PROGRESS REPORT

THE FERTILIZER INVESTMENT FOR SOIL FERTILITY RESTORATION PROJECT (SFRP)

For the Period July 1989-July 1990

INTRODUCTION

The agricultural sector dominates the economies of most of the countries of sub-Saharan Africa. Per capita food production declined by over 1% annually during the past two decades. Moreover, average cereal yields in a majority of sub-Saharan countries are well below 1 ton/ha and show a declining trend that, despite the claims of worsening climatic conditions, may be largely attributed to the degradation of soils.

The improvement and maintenance of soil fertility as a means to achieve sustained land productivity is of critical importance for the fragile soils of sub-Saharan Africa. Continuous cropping will almost certainly exhaust sub-Saharan soils through nutrient depletion if no measures are taken to counter the trend. Fallowing for extended periods is a strategy many regions can ill afford because of increasing population density and demand for land. Alternative soil fertility maintenance measures currently being promoted include: crop rotations, agroforestry, crop residue restitution, and the use of manure, soil amendments, and fertilizer.

With a projected food deficit by the year 2000 of nearly 40 million metric tons (mmt) of cereal grain equivalent, there is increasing pressure in sub-Saharan Africa to pursue food self-sufficiency. FAO has estimated that 75% of the increase in food production in the region over this period will have to come from the intensification of production systems. Fertilizers will play a major role in this process. However, sub-Saharan Africa represents 10% of the world's arable land but only one-tenth of the world average for fertilizer consumption.

Sub-Saharan Africa is dependent on imports for most fertilizer needs and is expected to remain dependent beyond the year 2000. Approximate fertilizer consumption is 1.2 mmt compared to indigenous production of only 0.55 mmt. Of domestically produced fertilizer, nearly half is exported, primarily from Senegal and Nigeria. Yet, many countries in Africa possess some of the raw materials for fertilizers and, in principle, with the

exception of potash, could develop the necessary industry to supply the African market. The economic feasibility of this option remains to be determined. However, assuming the most optimistic scenario, it may take several decades before the necessary investments are made to realize this goal.

IFDC Africa

The SFRP should be viewed in the context of other programs at IFDC-Africa (IFDC-A).

To mitigate the continuing problems of food production in sub-Saharan Africa, the International Fertilizer Development Center (IFDC) created IFDC-A in Lomé, Togo. This initiative was made possible through the generous support of a small group of donors. During the past 3 years, IFDC has conducted research and training programs in various areas of the fertilizer sector that addressed many problems including:

- Fertilizer Policy Research.
- Fertilizer Trade and Marketing Research.
- Agro-mineral Research for Fertilizer Development.
- Fertilizer Use in Sustainable Crop Production.
- Soil Fertility Restoration and Fertilizer Adoption.
- Fertilizer Technology Transfer and Training.

Agronomists, soil scientists, geologists, sociologists, economists, and statisticians have organized and participated in these programs. Through this multidisciplinary program, IFDC-A seeks to make fertilizers available to those African farmers who can benefit economically from their use.

IFDC-A is a focal point for fertilizer development programs in sub-Saharan Africa and collaborates with national programs to produce and disseminate information on the judicious use of fertilizer for sustainable agricultural production. A major goal is to assist the development of an indigenous human resource base that can contribute to increased use of modern agricultural inputs. The Center has also initiated a technology transfer program that is comprised of information, documentation, and training activities.

DEFINITION OF THE PROBLEM

Sub-Saharan Africa's high rates of population growth, combined with low-yielding food-production systems based upon shifting cultivation, have resulted in declining per capita food production, increasing food deficits and imports, and deteriorating nutritional levels among the rural and urban poor. Since about the mid-1960s, per capita and food production in sub-Saharan Africa has declined by about 1% per year through mid-1980. Some of the food and population statistics for Africa were reviewed by De Bruijin and Fresco (1989).

Traditionally, shifting cultivation and complex cropping patterns have permitted low yielding but relatively stable SSP food-production systems. Expanding populations (World Bank, 1989), however, have pushed agriculture onto more marginal lands and shortened the fallow periods. Ordinarily, lands under shifting cultivation require between 7 and 15 years to restore soil fertility. But removing land from production for such periods is a strategy that few farmers can afford. FAO (1989) estimates that 70% of the deforestation observed in Africa is directly caused by migrating settlers, who in their quest for food have little interest in the long-term consequences of their behavior.

Between 1961/65 and 1984/86, the area under food crops in sub-Saharan Africa increased approximately 22%, from 45 million to 55 million ha. Of the main food crops of tropical Africa, maize and cassava increased 45% and 36%, respectively, and millet and sorghum increased only by around 10% or less. The increasing relative importance of the high quality foodstuffs, such as rice, sweet potatoes, potatoes, and maize, may reflect the food preferences of the urban consumers resulting in an increase of 7.2 million ha under these crops. The declining relative importance of the small grains and the relative stability in yam and cassava indicate that the food production in the marginal areas where these crops are prevalent is failing to keep up with population growth (De Bruijin and Fresco, 1989). Increasingly, infertile soils are the key production constraint to greater food self-sufficiency in sub-Saharan Africa. Whether sustained food self-sufficiency can be realized without an eventual downward trend in population growth rates remain questionable.

If widespread starvation is to be averted, soil fertility management approaches based on anything other than increased fertilizer use would necessitate massive increases in food imports. IFPRI (Paulino, 1987) has estimated

that, unless recent per capita production trends are radically changed, sub-Saharan Africa will face net deficits in major food crop production of about 50 mmt by the year 2000, which means that the region would only be producing 75% of its total food requirements.

With continuous cropping on the rise, new systems of soil management are needed. Various long-term trials with cereals in West Africa illustrate the rapid decline in soil productivity (Pieri, 1989). The importance of returning crop residues, particularly in the semiarid region where soils are typically low in organic matter, is being evaluated in the IFDC/ICRISAT collaborative effort in Niger. The results obtained to date indicate that the benefits of fertilizer use and restitution of crop residues can be dramatic but may decline with time.

Despite the recognized value of improved seeds and fertilizer for agricultural productivity, these inputs are not readily available to small-scale farmers. Only about 8 kg of fertilizer nutrients are used in sub-Saharan Africa per hectare of arable land, compared to 91 kg/ha in Asia, 92 kg/ha in the United States, and 231 kg/ha in Western Europe. Consequently, average yields remain low; i.e., 1.2 t/ha for maize, 0.9 for sorghum and 0.7 for millet (De Bruijin and Fresco, 1989).

The use of improved varieties in sub-Saharan Africa is also low. For maize, for example, only about 20% of the total area is planted with commercial seed of improved varieties. This low adoption rate is caused by two factors--the limited availability of commercial seed and appropriate fertilizers. Even if improved seed were available, only limited yield advantage would be realized without the complementary use of fertilizer. FAO has estimated that over 50% of future gains in food crop yields will come from fertilizers used in conjunction with improved cultivators and cultural practices. To achieve self-sufficiency in food production, fertilizer consumption in sub-Saharan Africa must be increased from 1.1 mmt of nutrients in 1987 to about 5.7 mmt by the year 2000. Achievement of this target will require a 14% per annum growth rate in fertilizer consumption during the remainder of this century.

Ample evidence exists that cereals respond favorably to fertilizers in Sub-Saharan Africa (Mokwunye and Vlek, 1986: Pieri, 1989) often tripling or quadrupling yields. However, nutrient requirements are different for different crops and environments. Unfortunately, this fact is hardly reflected in current fertilizer recommendations in the region. It is also well established

that rainfall is poorly utilized by crops growing in infertile soils. In years with short rainy seasons, the application of phosphorus may mean the difference between partial or complete crop failure (Bationo and Klaij, 1990). These facts, combined with the urgent need to restore the fertility of the increasingly overexploited lands of sub-Saharan Africa, should provide the needed impetus to the development of the fertilizer sector.

Fertilizer Adoption

The rate of fertilizer adoption in sub-Saharan Africa is limited. While average consumption rates are said to be 8 kg of nutrient per ha, most of this is used on cash crops, such as cotton, cacao, coffee, and oil palm. In fact, many countries have established tied schemes of fertilizer and output marketing, where fertilizer for the cash crop is provided on credit and payment is automatically deducted by a marketing board. However, most African farmers are subsistence farmers first and commercial farmers only if their food needs are met. Every effort is made by farmers to assure sufficient production to carry the family to the next harvest. In the absence of a system promoting fertilizer use on foodcrops such as exists for cotton and groundnut, most farmers assure their food supply through extensive production of food crops, consuming most available land and labor resources.

In contrast to the cash crops, maintenance of soil fertility through the use of fertilizers on staple crops has been considered a risky practice, with value/cost ratios (VCR) being highly variable and dependent on local and regional production. Given the price of fertilizer, which is known at the onset of the season, the VCR is determined by the output per unit of fertilizer and the price per unit output. While the former is largely dependent on rainfall, the latter is determined by grain surpluses or deficits on a regional basis and may fluctuate widely. Thus, it is virtually impossible for farmers to predict the returns on fertilizer investments, a serious disincentive to fertilizer use.

Establishing Sound Fertilizer Policies

African governments are being advised by the World Bank, IMF, and other donors to remove subsidies on fertilizers and foodstuffs. Where such actions have been taken, overall national demand for fertilizers has been substantially weakened, at least in the short run. Certainly, the movement toward equating actual prices with real costs has much merit. Makken (1989)

warns, however, against the sudden abolition of price policies and subsidies and advocates transitory measures, such as temporary import subsidies and regional price maximal, as a first step toward a liberal and competitive marketing system. The objective of such schemes would be the eventual removal of subsidies so that target areas become economically self-reliant in fertilizer procurement.

The high farmgate prices for fertilizer in a nonsubsidized market make it even more important to understand the fertilizer requirements in different soils and cropping systems and to determine the most cost-effective means of meeting these needs.

Clearly, the greatest potential for profitable increases in fertilizer use in sub-Saharan Africa will be high-yielding crops grown in the more favorable production environments. The introduction of fertilizers under such conditions can help to accelerate overall economic growth, alleviate rural poverty, increase the availability of basic food supplies, and lower the real cost of production. Yet, despite these known benefits, fertilizer use may have to be stimulated in the initial years through targeted government subsidies or programs.

The SFRP is a research program that aims to develop a viable program for fertilizer introduction in regions with good production potential. Its ultimate goal is to identify strategies and formulate policies conducive to fertilizer adoption without sustained subsidies.

THE OBJECTIVES OF THE SFRP

Development Objectives

The long-term objectives of the SFRP are to increase the availability of food, increase rural income, and promote agricultural and rural development in Africa through the reclamation and conservation of fertility depleted croplands.

Specific Objectives

The specific objectives of the SFRP are to study the agronomic and socioeconomic viability of using soil amendments and fertilizers as investment strategies in soil fertility restoration and maintenance in West Africa. The terms of reference required the identification of villages in three

agroclimatic and socioeconomic regions of West Africa, where the effectiveness of fertilizer/amendments to maintain or increase productivity over time while preventing environmental degradation will be measured through annual agro-socioeconomic surveys.

To accomplish these objectives, the SFRP is engaged in the following activities:

1. Training of national program personnel to conduct and monitor the soil fertility restoration project in pilot areas.
2. Studying the consequences of use of fertilizers and animal manures on:
   - Soil fertility restoration/maintenance and crop yields.
   - Land use and farming practices.
   - Disposal and use of agricultural production.
   - Income of farmers.
   - Employment.
   - Use of labor, animal traction, and other inputs.
   - The role of women in agricultural development.
3. Studying the effects of agroecological factors on the adoption of fertilizers and soil amendments.
4. Studying farmers' perceptions about constraints to fertilizer/manure use and agricutural production.
5. Dissemination of information generated by the project to national and international organizations involved in agricultural research and development.

THE RESEARCH APPROACH

Agricultural production depends on decisions to use resources of land, labor and capital. Agricultural production is therefore a function of farmers' decisions about the use of the following:

1. A set of fixed factors of production, such as factors that in the short run cannot be changed by farmers' decisions. These factors usually include land, family labor, and capital assets.
2. A set of variable inputs whose use in the short run is determined by farmers' decisions; these inputs include fertilizer, animal manure, pesticides, labor.

Farmers' decisions about the use of fertilizers and manures are therefore affected by several factors, including the following (Thompson and Baanante 1989):

- The availability of fixed factors of production and a set of socioeconomic variables influencing the use of these resources for agricultural production.
- Access to timely and adequate supplies of fertilizers, manures, and other variable inputs and their prices.
- Knowledge of and access to information about the use of fertilizers and manures and agricultural production in general.
- Perceptions of and responses to risk associated with uncertainty on crop yields, responses to inputs, and prices of crop produce.

The ultimate objective of fertilizer field research is to provide information useful for promoting agricultural development through the increased adoption and sustainable use of fertilizers by farmers in selected agro-climatic and socioeconomic environments in West Africa.

The farm-level profitability of fertilizer use is a necessary but not sufficient condition for the adoption and use of fertilizers. Other factors, such as poor fertilizer supply, lack of credit, or lack of knowledge and experience can restrict the adoption and use of fertilizers by farmers, even when profitable (Daramola, 1989; Thompson and Baanante, 1989).

Profitability of fertilizer can be calculated at three different levels of restriction (Baanante, C.A., unpublished):

1. Unrestricted potential profitability is calculated on the basis of crop response observed in on-farm trials (OFT) assuming profit maximization. Fertilizer net added returns or profits per unit of land area and VCRs are calculated as indications of profitability. They are most useful for single crop farming enterprises where other constraints affecting the profitability of fertilizer use do not exist. Economic, financial, and market constraints are not explicitly incorporated in the calculation of these indicators. They are less useful for West African farming enterprises, where a variety of crops are produced, often as intercrops, and priority is often given to certain food crops for household consumption and subsistence.
2. Restricted farm-level profitability of fertilizer use on single crop/intercrop enterprises can be calculated from crop response estimated from cross-sectional farm-survey data and the prices that farmers receive for

crop output and pay for fertilizers. Thus, net added returns and VCRs are indicators of the profitability of fertilizers under given economic, financial, and management constraints as well as constraints in the availability and use of resources and other inputs. These indicators are more reliable and useful than those obtained from OFTs only but still do not take into account the impact of market constraints or farmers' priority for household consumption if the enterprise involves a mixture of food and cash crops.

3. Restricted farm-level profitability of fertilizer use in multiple crop/intercrop enterprises (whole-farm system) can be calculated in the context of a typical whole farm production enterprise with two or more crop/intercrop activities. It involves the implicit inclusion of constraints in resources, such as land and labor, financial means, and markets. It can be calculated by using input/output coefficients and budget data of crops to estimate the profitability of fertilizers by crop and for the whole-farm enterprise. This allows the estimation of the impact of fertilizer use (in one or more crops) on the allocation and productivities of farm resources. This latter approach is most appropriate for multiple-crop enterprises typical of West Africa.

On the basis of this discussion, the efficiency and suitability of field research to evaluate fertilizer and promote adoption depends fundamentally on the type of agriculture and farming enterprise that predominates in the target area of concern. OFTs will suffice in areas of single-crop exploitation, and few economic, market and financial constraints, e.g., irrigated rice growing areas. Fertilizer recommendations based solely on OFTs are often meaningless for farmers in multicrop enterprises where the importance of economic, market, and financial constraints are not properly understood. A broader research approach involving the implementation of OFTs in conjunction with farm surveys and monitoring of on-farm fertilizer/manure options and land use is required where such circumstances prevail, as in the locations of the SFRP. In the context of this broader approach, the following aspects have been considered in the SFRP:

- Prediction of crop response to applied P through the study of residual values in sole and multiple cropping systems should lead to a more efficient use of P resources.
- Restoration of P fertility could be based on moderate dressings over 1-2 years or gradual improvement through smaller annual dressings.

- As much use as possible should be made of indigenous materials and high analysis commercial P fertilizers in soil fertility restoration and maintenance.
- Nitrogen use enhances soil P fertility restoration; K is important but may not be as critical as N and P in the initial stages of soil fertility restoration. Certain other soil parameters, e.g., organic C content and soil acidity which cannot at this stage be studied in depth should at least be monitored.
- Substantial fertilizer use could contribute to intensification of land use (e.g., smaller farm sizes), less deforestation (e.g., less frequent land clearing) and less use of marginal lands (e.g., less use of steep slopes).
- Characterization of land, farms, vegetation, and weather is necessary in the process of the transfer of agrotechnology.

THE STUDY AREA

Location of the Pilot Areas/Villages and Characteristics of the Experimental and Control Villages

The SFRP is being implemented in the humid zone of Ghana, the savanna zone of Togo, and the sahel of Niger in West Africa. This will permit study of the effect of agroecology on fertilizer use.

The pilot areas are within a 40-km radius of the towns of Maradi, Kumasi, and Dapaong (Figure 2 and Table 1). The experimental villages are Tchizon Kouregue, Adjamesu, and Naki Est; the "control" villages are Maiguero, Hwidiem and Kpembona. There are two to three other villages in each pilot area where on-farm trials are being conducted.

The project villages are characterized by (1) having the same major food crops for a given pilot area, (2) well-defined and functional power structures, (3) farmers willing to participate in the SFRP, (4) good contacts with extension agents, (5) soils that are deficient in phosphorus and often in nitrogen and potassium, (6) lands that are potentially productive, and (7) good road networks to markets and fertilizer supplies. The design is intended to facilitate comparisons between users and nonusers of fertilizers.

Research Sites in the Pilot Areas

Listed below are the research sites for agronomic and socioeconomic monitoring in increasing order of plot sizes and complexity of cropping systems.

- Researcher-Managed On-Farm Trials (RMOFT) with plot sizes of 50-100 m^2, located in the experimental and "control" villages.
- Farmer/Extension-Managed On-Farm Trials (FMOFT) with plot sizes of 100-200 m^2, located in the experimental "control" plus two to three other villages in the pilot areas.
- Farmers' fields where fertilizer/manure options are being tested: 0.2 ha to >0.5 ha (this is a function of farm sizes in the three countries and the type of study being conducted; e.g., farmers selected for farm budget studies may have over 2 ha fertilized with a given option). These fields are farmer managed; i.e., minimum tillage and other soil conservation methods may be used.
- Farmers' fields where all decisions including that of use or nonuse of fertilizers/manures are made by farmers with no limit on plot sizes.
- The entire experimental and control villages taken as a whole (e.g., village mapping, interviews of chiefs).

CROPPING SYSTEMS ON THE RESEARCH SITES

As shown in Table 2 multiple cropping systems are included in the On-Farm Trials. Data from these trials will complement previous studies on sole crops. A wider range of crops and cropping systems is being monitored on farmers' fields through the agroeconomic and socioeconomic surveys. Figure 3 gives an idea of some of these crops.

AGRONOMIC MONITORING

The major cropping systems in the pilot area of Ghana consist of combinations of one or more of the following crops: maize/cassava/cocoyam/plantain.

The agro-socioeconomic studies of the SFRP therefore focus on these crops. With reference to efficient fertilizer use in multiple cropping

systems there are still research gaps (FAO, 1983), rates and methods of fertilizer application in relation to soil tests and sources to be used to reduce fixation and improve efficiency need further investigation to complement results obtained for sole cropping systems. From a review of all previous work carried out in Ghana, Acquaye (1986) recommended further studies on P sources on benchmark sites in Ghana.

The agronomic work consists of the evaluation of a series of trials installed in 1989 and to continue up to 1992. They are RMOFTs in the experimental and control village, FMOFTs in the pilot area, and fertilizer trials on a relatively large parcel of land in the experimental village of Adjamesu. The work also includes baseline data on land use and water quality of wells. The agronomic monitoring provides data for economic analysis and will be compared with estimates from farm surveys. The data are being incorporated into a data-base management system.

Data on soils and crops for the 1989 season have now been received for the three countries. The statistical analysis for Ghana is complete and a comprehensive report is under preparation. The data for Togo have been processed and put on diskette for statistical analysis. The objectives and some of the results available at the moment of writing this report are outlined below.

Researcher Managed On-Farm Trials

The P fertility of a soil can be restored with one heavy dressing or gradually improved with smaller dressings. As initially proposed by IRAT, the one-time heavy dressing was intended to result in optimum fertility levels for high soil productivity. This first investment fertilization could be considered a public fully subsidized investment that can be followed by annual maintenance fertilizer applications that are more affordable to farmers. This approach is hindered by the problem of severe erosion loss on some sites and high investment costs. In sub-Saharan Africa it has been most successful at research stations (Pieri, 1987).

The IMPHOS procedure (Roche et al., 1980) of estimating corrective P fertilization is not aimed at obtaining maximum yields and can be achieved over 1-2 years. It is less expensive and less prone to erosion loss. It is also followed by maintenance dressings.

Pieri (1987) drew attention to data that shows that the gradual buildup of soil P fertility over 4-5 years of annual applications of 45 kg/ha

P_2O_5 in Madagascar resulted in a maximum cumulative yield equal to 80% of the yield obtained from a one-time dose of 180 kg P/ha.

The optimum rate of basal fertilization depends on soil type ranging from 45 to 68 kg P_2O_5/ha for many upland soils of the West Africa Savanna (Jones and Wild, 1975). Lienart and Nabos (1967) recommended 75 kg P_2O_5/ha for sandy soils in Tarna, Maradi. Based on the procedure of IMPHOS and the results of others, 60-90 kg P_2O_5/ha was estimated as the basal dressing in one to two applications for soils in the three pilot areas of the SFRP. Annual dressing for Ghana, Togo, and Niger are 30, 25 and 20 kg P_2O_5/ha, respectively.

That P fertilizers have a substantial residual value in soils of sub-Saharan Africa is well established. A better understanding of the effects of P sources, year of application, rate of application, and crop residue management on residual values will enable prediction of fertilizer needs for given target yields and soil levels of P under a wide range of conditions. Mathematical models for predicting residual P developed mainly in station and laboratory research are available (e.g., Barrow, 1981; Ayodele and Agboola, 1981). There is current scientific interest in testing, adapting, improving, and developing alternative models.

The objectives of RMOFT are to (a) evaluate direct and residual effects of various P fertilization strategies, (b) monitor soil and crop properties including organic carbon, soil acidity, phosphorus status, and heavy metal content.

The treatments applied in 1989 were P rates of 0-90 kg P_2O_5/ha in Ghana, 0-75 kg P_2O_5/ha in Togo, and 0-60 kg P_2O_5/ha in Niger. The sources included indigenous materials where available. Thus, in Niger, Togo, and Ghana, Tahoua phosphate, a material produced at IFDC Headquarters in Muscle Shoals, Alabama, U.S.A., from the low-cost processing of phosphate rocks mined in Togo are being evaluated. The material is sulfuric acid partially acidulated (50%) phosphate rock. High-analysis materials, such as diammonium phosphate, triple superphosphate, and sulfur-fortified triple superphosphate that could be the fertilizers of the immediate future in West Africa are also being evaluated. The sites are being characterized and classified.

Preliminary results in Ghana indicate that in the initial year of application the high-analysis fertilizers were as effective as single superphosphate containing sulfur. Work conducted in the 1960s indicated that sulfur deficiency in the forest and semideciduous zones was not a problem. It

would seem that this is still true for soils not under intensive cropping. Baseline data (Rhodes and Acheampong, 1988) showed that available S was in most cases adequate.

In concern for restoring P fertility while protecting the environment, levels of selected heavy metals are being monitored before and after fertilizer application. Preliminary results indicate undetectable baseline levels of 0.1 N HCl extractable Cd and Cr in samples from Ghana and Togo, levels of extractable Ni, Zn, and Mn averaged 0.73, 3.06 and 51 ppm, respectively, in Togo. Levels in Ghana were 1.57 ppm Ni and 7.12 ppm Zn.

These elements are being monitored in the grain and stover of maize, millet, and sorghum. Table 3 shows how fertilization in the Savanna region of Togo results in increased biomass production both above and below ground level. The mass of roots reported should be regarded as minimum values. Roots help to bind soil particles and upon decomposition produce organic matter that improves the physical and chemical properties of soil.

In 1990 the plots were split and additional treatments allowed the evaluation of the following: basal P fertilization in 1 year; basal P fertilization in 2 years; annual fertilization; maintenance P fertilization after P fertility is restored; residual effects of 1-year fertilization; residual effects of 2 consecutive years of P fertilization; and crop residue management. There are four RMOFT in each of the three countries. All the above will facilitate the evaluation of mathematical models to predict crop response to P fertilizers over a range of conditions.

Farmer-Managed On-Farm Trials

The farmer/extension-managed trials complement the research-managed trials. There are 18-25 such trials in 3-5 villages in each of the 3 pilot areas. The rates tested in 1989 were 0-80 kg P_2O_5/ha in Ghana and 0-60 kg P_2O_5/ha in Togo and Niger. The objectives are to monitor soil properties, evaluate direct and residual effects of selected rates and sources of P in selected cropping systems, and to relate the responses to variation in soil properties, crop management, and weather. Table 4 shows the results of the analysis for available P of topsoils and subsoils sampled in 1988 in the three project areas. The data show the consistently low levels of available P and the variability between and within project areas. The other equally important objective is to generate data to be used for the economic analysis of P fertilizer use in a situation of adequate levels of N and K. In conjunction

with other research activities of SFRP, the FMOFTS will aid in extrapolating recommendations from the experimental village to the regional level. The plots were split in 1990 to evaluate residual effects.

The Options

Cropping large areas covering over 5 ha of continuous fields managed by about 10 farmers (block demonstrations) has recently been successfully used in developing countries by FAO.

The Sasakawa Global 2000 Project has demonstrated in Ghana substantial crop yield increases resulting from appropriate fertilizer use. It was, however, not designed to collect the array of agro-socioeconomic data to monitor and evaluate the project as in the SFRP.

The objectives of the fertilizer testing were to (a) monitor and evaluate in conjunction with the more detailed soil/crop studies of the OFTs the agronomic consequences of raising soil fertility levels on a village scale with types of compounds and single-nutrient carriers that are easily available within the countries and animal manures where available and (b) generate data for the economic analysis of fertilizer use. The options are randomly assigned in each experimental village with each farmer having an absolute check plot.

The following tables and figures illustrate some of the kinds of information being generated. Figure 4 shows average response of 3-month millet in relay with the intercrop of 6-month sorghum and 6-month millet in Naki-Est. Yields of the two cultivars of millet are added together. In agronomic terms 60 kg N + 35 kg P_2O_5 + 35 kg K_2O/ha formulated with 15:15:15 + urea was the best (total of 3.4 t/ha). One option involving 35 kg P_2O_5/ha + 60 kg/ha as SSP and urea also did quite well. Animal manure plus a moderate dose of SSP (35 kg P_2O_5/ha) also performed well. Table 5 illustrates the low nutrient content of manures. Very heavy rains and inundation during the latter part of the growing season led to lower than expected yields of the long duration crop varieties. Figure 5 is the response of maize to fertilizer options in Ghana. In this case, although 80 kg N + 40 kg P_2O_5 + 40 kg K_2O as 15:15:15 + urea gave the highest yields, there did not seem to be much difference from the other options tested. In 1989, 554 ha and 309 ha were fertilized in Togo and Ghana. It is estimated that grain production in the experimental villages would have exceeded 1,400 t in Togo and 900 t in Ghana. Maize grain yields from a sample of farmers in the control village averaged

2,241 kg/ha. Figure 6 shows that while maize yields tend to increase with distance from dwellings, variability increases as one moves away from dwellings in Adjamesu, Ghana. Management is easier close to dwellings. This contrasts sharply with findings reported in some studies in the Sahel. Table 6 shows levels of animal manure applied on farmers fields under fertilizer testing in 1989. The small quantities of manures used by farmers are evident.

Monitoring Changes in Land Use and Water Quality

The objectives are to (a) investigate the short-term effects of the intensive use of fertilizers on yield slope, plot size, plant population, crop varieties and species, dates of planting, weedings, frequency of land clearing, and the chemical composition of well and stream water and (b) generate data for correlating "measured variables" with farmers' estimates.

Data collection commenced in 1989, but in-country staffing problems did not allow collection of all the required data. Only in 1990 do we expect the complete data to be collected. Preliminary results from a sample of farmers in the experimental village in Ghana (Table 7) indicate that in 1989 slope (gradient) on option plots ranged from 1% to 28% with a mean of 7.8% and standard deviation of 5.2%; age of bush fallow cleared ranged from 0 to 7 years with a mean of 3.6 years and standard deviation of 1.6.

SOCIOECONOMIC MONITORING

Annual Farm Surveys--Purpose, Status, the Future, and Methodology

Central to the socioeconomic studies of SFRP is the longitudinal survey of a panel of 60 farmers in each of the 6 research villages in the three pilot areas. This annual activity is planned for the lifespan of the project with the objective of generating a broad range of socioeconomic data to monitor and evaluate the qualitative and quantitative impacts of project interventions. Table 5 provides demographic and other essential characteristics of the research villages.

The initial baseline survey was completed in Ghana, Togo, and Niger in 1988. It involved a total of 375 farmers, including 133 women. The report on Ghana formed part of the 1989 annual report of the project. The baseline

reports for Togo and Niger have been completed and are shown as Appendix II of this progress report.

The baseline survey has yielded valuable information pertaining to variations in the technical, economic, and sociocultural features of small-scale farms in the pilot areas (Table 8). It has also provided further insights into the variations in farmers' attitudes and perceptions about constraints to agricultural production. For example, despite the general consensus about constraints posed by declining soil fertility for food production in West Africa, the survey revealed that farmers in the semiarid zone, specifically Niger, perceive the problem differently. To them, soil fertility ranks second to lack of water/rain as a prime factor limiting agricultural production in the sahelian environment. The findings from the baseline survey have been used as a basis to sharpen and modify some of the implementation strategies of the project.

The second survey was completed in all six research villages in January 1990 and the data are being processed. The questionnnaire was designed so that data can be classified by gender, compared, and contrasted with the baseline data with the view to assessing the initial impacts of project interventions in the research villages.

Subsequent surveys are planned to generate data to assess, among other things, the changing patterns of resource acquisition and utilization, migratory patterns, and farmers' perceptions of well-being following fertilizer use (Figure 7).

Overall, the methodology has taken the form of a "two-group experimental design" (control and experimental groups) in the light of the duration of the first phase of the project (5 years). The objective here is to limit the number of potential extraneous factors that can confound the data if the studies are limited to the experimental group. In other words, the design is intended to facilitate a comparison of users and nonusers of fertilizer through comparisons that can be made using data from the experimental and control villages.

The participatory research approach involving counterpart staff, community leaders, and farmers in both the experimental and control villages has proved very useful. Participants are very much aware of the purpose of the research and have been very supportive.

Furthermore, farmers in the control villages have been actively engaged in the SFRP through:

- The involvement of farmers who have had some formal schooling as interpreters in the annual surveys.
- The ongoing activity of researcher- and farmer-managed OFTs in the control villages.
- The posting of full-time technical officers in the control villages to supervise the OFTs and assist the general farm population, where necessary, to find solutions to technical problems.

In the following sections selected findings of the baseline surveys in Togo and Niger are summarized.

A SUMMARY OF THE BASELINE FARM SURVEY OF THE SOIL FERTILITY RESTORATION PROJECT (SFRP) IN THE SAVANNA REGION OF TOGO

Demographic Characteristics and Locations of Households

1. The 1988 SFRP baseline data for Togo were collected in the Savanna Region in the villages of Naki-Est and Kpembona. Of the 125 farmers interviewed, 29 were women. The survey generated data on gender; cultural groups; marital status; household location and composition; education; employment; land availability and tenure; the use of machinery; animals, equipment, and credit; sources of information about fertilizers; crop areas and management; the use and costs of fertilizers; organic manures; crop residues; the use and cost of labor; disposal and use of crop production; and finally, the perceptions of farmers about constraints to fertilizer use and agricultural production.
2. The sample households tend to be extended families with age and gender distributions that allow meaningful comparisons between men and women farmers of various ages.
3. The salient feature of schooling in the sample region is that it is minimal, although on the average men have more years of schooling than women. In Naki-Est men report an average of 1.4 years of schooling and women 0.5. The figures for Kpembona are 0.3 years for men and none for women.
4. Men farmers in both villages reported being closer to markets than women. The difference in the distance to markets between men and women is least in Naki-Est (0.3 km) and greatest in Kpembona (1.0 km).

5. The distances to fertilizer stores indicate that men in Naki-Est are the closest (1.5 km) and men in Kpembona the most distant (1.9 km).
6. Women in Kpembona reported their households as furthest from household plots (1.4 km) and women in Naki-Est the closest (0.9 km). In general, and on the average, the household plots in Kpembona are located at a greater distance from the village than in Naki-Est, 1.2 km and 1.0 km, respectively.

Off-Farm Employment

7. The off-farm employment of women farmers and household members substantially exceeds that of men. The total sample figures for 591 persons show that 26% of the men and 47% of the women were engaged in off-farm employment at the time of the survey. The greatest percentage of farmers engaged in off-farm employment was reported by women in Naki-Est (50.0) and men in this village reported the least (19.0). The percentage of off-farm employment among women in both villages is greater than that of men. Thus, Moba-Gourma women in the Savanna Region of Northern Togo are very active in off-farm employment, especially in Naki-Est, the experimental village.
8. Women reported an average of 6.1 months of off-farm employment and men 7.0 months. Thus, although a greater percentage of women than men are employed off-farm, the average duration of that employment is about 1 month less than that of men on an annual basis.
9. For months of off-farm employment, the greatest average is among men in Kpembona (7.1), followed by men in Naki-Est (6.7) and women in Kpembona (6.4). The shortest duration of off-farm employment is among women in Naki-Est (5.8 months). The total sample figures for the two villages show that the average months of off-farm employment in Kpembona (6.7) are somewhat greater than in Naki-Est (6.1).
10. The data for annual off-farm earnings for all farmers and adult household members indicate that the greatest earnings are by men in Kpembona (44,949 FCFA or about US $150), followed by men in Naki-Est (30,880 FCFA or about US $103) and women in Kpembona (22,246 FCFA or US $74). The least off-farm earnings were realized by women in Naki-Est, 13,667 FCFA or about US $46, whose average of months of off-farm employment is the least in the sample (5.8 months). Although the average of months of off-farm employment in Naki-Est (6.1) and Kpembona (6.7) is similar,

average off-farm earnings among farmers are greater in Kpembona (30,444 FCFA or about US $101) compared with those in Naki-Est (18,936 FCFA or about US $63). Gender comparisons of off-farm income show that the mean of annual off-farm income of women (18,396 FCFA or about US $60) is substantially less than that of men (37,935 FCFA or about US $126).

11. Analysis of the data concerning the off-farm employment shows that about 42% of the total sample of farmers were engaged in such employment in 1988. The data by village indicate that the percentage of farmers with off-farm employment is greater in Kpembona (46.2) than in Naki-Est (36.7). Women farmers in Kpembona, the control village, have the highest percentage of off-farm employment (78.6) followed by women in Naki-Est (66.7). Men farmers in Naki-Est are the least engaged in off-farm employment (26.7). The percentage of men farmers with off-farm employment in Kpembona (37.3) exceeds that of Naki-Est. The percentage of women farmers with off-farm employment (72.4) substantially exceeds that of men farmers (32.3) in the Savanna Region of northern Togo.
12. On the average, men farmers with off-farm employment are employed 6.9 months per year off-farm and women farmers 5.9 months. The average of months of off-farm employment among farmers with off-farm employment is highest among men in Naki-Est (7.6) and lowest among women in Kpembona (5.7). Thus, the farmers of Naki-Est, the experimental village, appear to be more involved in off-farm employment than those of Kpembona.
13. The sample average of annual earnings from off-farm employment obtained by farmers with off-farm employment is 37,300 FCFA or about US $124. The average in Kpembona (43,179 FCFA or about US $144) substantially exceeds that of Naki-Est (29,818 FCFA or about US $99). The greatest average of off-farm earnings is observed among men farmers in Kpembona (51,412 FCFA or about US $171), followed by men farmers in Naki-Est (41,583 FCFA or about US $139) and women in Kpembona (30,455 FCFA or about US $101). Women farmers in Naki-Est reported the least earnings from off-farm employment (15,700 FCFA or about US $52/year).
14. For the total sample, 82% of the farmers and adult household members engaged in off-farm employment find such work within their respective villages. Men (89%) and women (100%) in Naki-Est pursue more off-farm employment in the village than in Kpembona where the figures are 68% and 72% for men and women, respectively. The favored place of off-farm

employment outside their own village for men (14%) and women (22%) from Kpembona is Papri, a neighboring village.

15. The most frequent types of occupations of men in Naki-Est are small trade, dressmaking, basketmaking, construction, blacksmiths, and carpenters. These occupations account for about 80% of all occupations pursued by men in the experimental village. Among women in Naki-Est, 15% pursue work in small trade and the great majority (84%) are involved in the work of beer brewing. Thus, the types of off-farm employment of men are much more diverse than those of women in Naki-Est. In Kpembona the occupations of small trade, agricultural labor, carpenter, basketmaking, repair work, and herdsmen account for over 85% of all off-farm employment pursued by men. Among women in Kpembona small trade, beer brewing, and food transportation account for over 90% of all occupations of women. Again, the types of off-farm employment pursued by men in Kpembona are more diverse than those of women.

Characteristics of Farms

16. The data clearly show that men and women predominantly manage their own plots; but more importantly, each gender may manage plots of the other in a cooperative exchange. The total sample figures indicate that the mean number of plots managed by men in the 96 households headed by men is 5.3 and that women manage an average of 2.6 plots among the 52 men farmers who head households and had women managing plots. Men managed an average of 4 plots among the 25 women farmers that had men managing plots and women managed an average of 2.7 plots among the 29 women farmers having women managing individual plots. The figures on the number of plots per farm show that the mean number of plots on farms of men (6.8) and women (6.1) is very similar.

17. Fifty-one men farmers in the control village of Kpembona have an average of 4.6 plots managed by men and 19 have an average of 2.5 plots managed by women. Among women farmers in the control village, 11 have an average of 4.5 plots managed by men and 14 have an average of 2.3 plots managed by women. In Kpembona the mean number of plots on farms of men (5.6) and women (5.9) is more equal than in Naki-Est.

18. Among men farmers in Naki-Est, 45 have an average of 6.1 plots managed by men and 33 have an average of 2.7 plots managed by women. Among women farmers in Naki-Est, 14 have an average of 3.5 plots managed by men and

15 have an average of 3.1 plots managed by women. The data on the number of plots per farm indicate that the mean number of plots on farms of men (8.1) is greater than that of women (6.4).

19. The total sample figures show that 96 men farmers have an average of 3.6 ha managed by men and 52 have an average 0.7 ha managed by women. Among women farmers, 25 have an average of 2.7 ha managed by men and 29 have an average of 0.7 managed by women. The total sample figures also show that the average crop area on farms of men (3.9 ha) is greater than that of women (3.0 ha).

20. Among men farmers in Naki-Est, 45 have an average of 3.6 ha managed by men and 33 have an average of 0.7 managed by women. The average crop area per farm managed by men in Naki-Est (4.1 ha) is substantially greater than that of women (2.7 ha).

21. In Kpembona, 51 men farmers have an average crop area of 3.6 ha managed by men and 19 have an average of 0.7 ha managed by women. Among women farmers in this village, 11 have an average of 3.5 ha managed by men and 14 have an average of 0.5 ha managed by women. The average crop areas of farms managed by men (3.8 ha) are somewhat larger than those managed by women (3.3).

22. It is evident that the majority of land cultivated by men is family owned but among women the majority is individually owned. A striking contrast is evident in that 66% of the area managed by men and only 10% of the area managed by women is family owned. Men also borrow a greater percentage of the land under their management for family use than women, 16% and 5%, respectively. Women are far more likely than men to own land for individual use, 58% and 15%, respectively. Land that is borrowed for individual use by women (58%) also exceeds that of men, a mere 2%. The use of rented land by men and women farmers is minimal, about 1%.

23. Men in Kpembona borrow a greater percentage of the total area under their management for family use than in Naki-Est, 20% and 12%, respectively. About 15% of the total area managed by men in both villages is individually owned. The percentage of the total area that is borrowed by individual men in Naki-Est (4%) and Kpembona (2%) is minimal, as is rented land in Kpembona (1%).

24. Women in Kpembona reported a higher percentage of the total area under their management as family owned compared with Naki-Est, 12% and 9%, respectively. The percentage of the total area managed by women that is

family borrowed (13%) is much greater than in Kpembona (2%). The percentage of the total cultivated area managed by women that is individually owned in Naki-Est (59%) is somewhat greater than in Kpembona (54%).

25. Women farmers in Naki-Est reported a far greater percentage of land under their management as individually borrowed (30%) than women in Kpembona (19%). Land rented for individual use by women in Kpembona accounts for 2% of the total area under their management and in Naki-Est women reported no land as individually rented.
26. The figures for the total sample indicate that the ownership of agricultural equipment is limited to men, specifically to men in Naki-Est. The percentage of women reporting ownership of hand tools (93%) is somewhat less than men (100%). The percentage of women reporting ownership of animals (about 90%) is also less than men (98%).
27. About 16% of the men farmers in Naki-Est reported ownership of agricultural equipment and women reported no such ownership, as did men and women in Kpembona. Men in Naki-Est and men and women in Kpembona all reported ownership of hand tools. However, about 13% of the women farmers in Naki-Est reported no ownership of hand tools.
28. Men in Naki-Est (98%) are somewhat more likely than women (93%) to own animals. The corresponding figures for Kpembona are 98% and 86%, respectively. Concerning hand tools, the data show that the average number of tools owned by men in Naki-Est (4.3) exceeds that of women (2.8); but it should be noted that women generally cultivate a smaller area than men. The same principle applies to Kpembona where men farmers own an average of 4.5 hand tools and women 2.6. The total sample figures show that on the average men farmers own 4.4 hand tools and women farmers 2.7.
29. In both villages the average ownership of animals by men significantly exceeds that of women. The average number of animals owned by men in Naki-Est, about 38, is more than three times that of women, about 11. The same principle applies to Kpembona where men own about 36 animals on the average and women about 12.
30. The total sample figures for farmers show the following summary observations: on the average, men farmers have more formal schooling (0.8 years) than women (0.2 years); the percentage of women (72%) engaged in off-farm employment greatly exceeds that of men (32%); the average crop area per farm for men (3.9 ha) is greater than that of women (3.0 ha); the percentage of men (7%) reporting ownership of agricultural

equipment is minimal but women reported no such ownership; men (100%) are more likely than women (93%) to own hand tools; women on the average own fewer hand tools than men, 2.7 and 4.4, respectively; men (98%) are also somewhat more likely than women (90%) to own animals; and the average number of animals owned by men (37) is about three times greater than the average owned by women (12).

31. The total sample area of 287.4 ha and 443 plots shows an average plot area of 0.65 ha. Women manage a sample area of 20.70 ha or 7% of the total sample area. Men manage a sample area of 266.7 ha or 93% of the total sample area. The total sample average plot area in Kpembona (0.74 ha) is greater than in Naki-Est (0.57 ha).
32. Among men farmers in Kpembona with 179 plots, the average plot area is 0.82 ha based on a sample area of 146.8 ha. Men in Naki-Est with 189 plots show an average plot area of 0.63 ha based on a sample area of 119.9 ha.
33. The 42 plots managed by women in Naki-Est represent a sample area of 11.4 ha and an average plot area of 0.27 ha. The 33 plots managed by women in Kpembona represent a sample area of 9.3 ha and an average plot area of 0.28 ha. Thus, with fewer plots in Kpembona, the total sample area and thus the average plot area are greater than in Naki-Est.

Crops and Cropping Systems

34. In Naki-Est the most frequent crops cultivated by men are cotton, peanuts, and intercropped millet-sorghum. These crops account for 44% of crops on all plots. The favored crops of women in the experimental village are cotton, peanuts, rice, and millet that account for 63% of crops on all plots.
35. The most frequent crops cultivated by men in Kpembona are sole crops of cotton and peanuts and intercrops of millet-sorghum, millet-cowpeas, and millet-sorghum-cowpeas. These account for 60% of crops on all plots. Among women in Kpembona, the favored crops are peanuts, rice, beans, and peanuts-cowpeas. These account for 51% of crops on all plots.
36. Men and women in both villages grow a wide variety of diverse crops. Millet-sorghum (16%), millet-cowpeas (11%), and millet-sorghum-cowpeas are the only crops grown on more than 10% of the total sample area cultivated by men. Other notable crops among men include cotton grown on 9% of the total area cultivated by men followed by six-month (M-6) millet

(8%), peanuts-cowpeas (9%), peanuts (8%), other millet (4%), millet-sorghum cowpea (10%), and other millet intercrops (7%)

37. Among women the crops that are grown on 10% or more of the area cultivated by women include rice (19%), beans (10%), and assorted other crops (16%). Peanuts (9%) and millet-sorghum (9%) are also notable crops among Moba-Gourma women in northern Togo.

38. An interesting contrast is that men in Naki-Est, the experimental village, allocate 51% of the total area under their management to sole crops, but this figure is only 27% for Kpembona. Conversely, men in Naki-Est allocate 49% of the total area under their management to intercrops and other crops, but this figure for men farmers in Kpembona is 73%. The dominant sole crops for men in Naki-Est are cotton (14%), M-6 millet (8%), M-3 millet (8%), and peanuts (9%). The dominant intercrops are sorghum-cowpea (10%) and millet-sorghum (13%). In Kpembona the dominant sole crops for men are cotton (5%), peanuts (7%), and M-6 millet (7%), and the dominant intercrops are millet-sorghum (20%), peanuts-cowpeas (11%), and other millet intercrops (11%).

39. Women in Naki-Est allocate 56% of the area under their management for sole crops and 44% for various intercrops and other crops. In Kpembona women allocate 57% of the area under their management for sole crops and 43% for intercrops. The dominant sole crops for women in Kpembona are peanuts (11%), beans (17%), and millet (16%). In Naki-Est the dominant sole crops cultivated by women are rice (28%), cotton (9%), peanuts (8%), and M-6 millet (7%).

40. The dominant intercrops for women in Naki-Est are millet-sorghum (16%), various other millet intercrops (3%), and millet-sorghum-cowpeas (8%). In Kpembona the favored intercrops cultivated by women are peanuts-cowpeas (10%) and millet-cowpeas (5%).

41. The percentage of the total area cultivated with sole or intercropped millet by men in Naki-Est is 52% and in Kpembona 62%. The percentage of the total cultivated area having sole or intercropped millet among women in Naki-Est (36%) is greater than in Kpembona (28%).

Use of Household and Hired Labor for All Crops

42. The use of household and hired labor for all crops in workdays per hectare in Kpembona (157.4) is very similar to that of Naki-Est (157.8). On the average, Naki-Est used fewer days of household labor than Kpembona,

138.1 (88%) and 143.3 (91%), respectively. In Naki-Est more workdays per hectare (19.7) by hired labor were used on the average than in Kpembona (14.3). Thus, farmers in both villages rely heavily on household labor, especially for the task of weeding. On the average, farmers in Naki-Est also hire more labor for planting than those in Kpembona, 15% and 8% of the total labor used for planting, respectively.

43. For Naki-Est the data clearly show that for all crops women farmers compared with men farmers use more total labor, 187.4 days and 152.2 days, respectively. Women also use a greater percentage of hired labor (17%) than is used by men farmers (12%). Thus, women are somewhat less reliant on household labor than men, 83% and 88% of total average workdays per hectare, respectively.

44. Women in Naki-Est use a greater percentage of hired labor (55%) for land preparation for all crops than men (16%). This principle also holds for the task of planting all crops where 21% of the average workdays for planting involved hired labor by women but only 14% by men. Although men and women rely heavily on household labor, women hire substantial labor and do not perform agricultural activities alone in the Savanna Region of northern Togo.

45. Women in Kpembona also hire substantially more labor than men farmers for the task of land preparation for all crops, 46% of all average workdays per hectare compared with 18% among men farmers. This is also the case for planting where 16% of all labor days for this activity were performed by hired labor for women but only 7% for men. Men in Kpembona used hired labor for 33% of all workdays for this task, but among women this figure is 27%. The total sample figures show that on the average the proportions of household and hired labor used by men and women are very similar.

46. Moba-Gourma farmers in the Savanna Region use a greater percentage of hired labor for peanuts (24%) than cotton (16%). However, the tasks of pest control, fertilizer application, and diverse other activities were performed exclusively by household labor for both crops. Beyond these tasks, the greatest reliance on household labor for both crops is for the task of planting, 86% of all workdays for this task for peanuts and 89% for cotton.

47. Because millet is a subsistence crop, farmers use less hired labor for millet than for the cultivation of peanuts and cotton. There is heavy

reliance on household labor for the production of millet. For all types of millet hired labor is most often used for the tasks of land preparation and weeding.

48. For both villages the use of hired labor for all activities is less for the millet-sorghum intercrop (13%) than for peanuts (24%) and cotton (16%).

49. Labor for land preparation for millet-sorghum is provided primarily by household members who contributed 80% of the total average workdays for this task. Hired labor for planting millet-sorghum (14%) again shows the reliance on household labor for this task. As for the task of weeding millet-sorghum, of all labor days for this task 35% was completed by hired labor. Again, land preparation and weeding for millet-sorghum are tasks for which hired labor is most likely employed.

50. The total labor data show that 30% of the average workdays per hectare of peanuts-cowpeas were performed by hired labor and for the millet-cowpeas intercrop 12% were performed by hired labor. The 30% figure for peanuts-cowpeas is the highest of any crop. Regardless of activity, the percentage of hired labor days for peanuts-cowpeas is always greater than that for the millet-cowpea intercrop. Of all labor used for millet-cowpeas, about 90% was household labor. The labor used for sole crop peanuts and intercropped peanuts-cowpeas shows the lowest percentages for household labor, 76% and 70%, respectively.

Use of Labor by Gender and Activity for All Crops

51. The task of land preparation for all crops in both villages is largely the responsibility of men who performed 91% of the workdays per hectare in Naki-Est and 88% in Kpembona. Children in Kpembona are somewhat more likely than those in Naki-Est to contribute to land preparation work, 8% and 5% of the average workdays per hectare for all crops, respectively.

52. The data for planting work for all crops show some interesting contrasts between men, women, children, and villages. In Naki-Est, the experimental village, women performed 88% of all planting workdays per hectare, men 8%, and children 4%. In contrast, the contribution of men and children in Kpembona is substantial, 22% and 11% of all workdays, respectively. Women in Kpembona are, however, responsible for about two-thirds (67%) of all workdays for planting. Thus, planting is predominantly, but

not exclusively, the responsibility of women in the Savanna Region of northern Togo.

53. Of the average workdays per hectare for weeding for all crops, 70% were performed by men in Naki-Est and 78% in Kpembona. Although weeding is predominantly a task of men, women in Naki-Est performed 24% of the average workdays and women in Kpembona 14%. Children in Naki-Est and Kpembona also contributed to the average workdays for weeding, 6% and 8%, respectively.

54. Harvesting all crops is predominantly an activity of women but with the assistance of men. Of the average workdays of harvesting per hectare, women performed 63% in Naki-Est and 59% in Kpembona. These figures for men are 35% and 30%, respectively. The labor of children for harvesting in Kpembona (11%) is greater than in Naki-Est (2%).

55. The task of fertilizer application for all crops is predominantly, but not exclusively, performed by men. In Naki-Est 51% of the average workdays for fertilizer application were performed by men, 38% by women, and 11% by children. The corresponding figures for Kpembona are 64%, 32%, and 4%, respectively. Women and children in Naki-Est are clearly more involved in fertilizer application work than their counterparts in the control village. Pest control work is done exclusively by men in both villages.

56. The tasks of storage for all crops are rather equitably shared by men and women, especially in Naki-Est where men performed 47% of the average workdays for this activity, women 45%, and children 8%. Women are more active in storage work than men in Kpembona, and men and women in Naki-Est. Specifically, women in the control village performed 52% of the average workdays for storage, men 40%, and children 8%.

57. In Naki-Est 61% of the total average workdays for all crops on plots managed by men were performed by men, 35% by women, and 4% by children. These figures for Kpembona are very similar, 62% for men, 31% for women, and 7% of the average workdays performed by children. Among women farmers in Naki-Est, 37% of the average workdays per hectare were performed by men, 45% by women and 18% by children. The corresponding figures for Kpembona are 43% for men, 54% for women, and 3% for children.

58. The addition of the average labor days of women and children for all crops on plots managed by men in Naki-Est shows that 39% of the average workdays for all crops were contributed by women and children. This

figure for Kpembona is virtually identical, 38%. The figures for the labor of men and children on plots managed by women in are 55% for Naki-Est and 47% for Kpembona. Thus, women farmers appear to benefit from a greater proportional contribution of labor from men and children than men farmers from the labor of women and children. In Naki-Est men perform 61% of the average workdays on plots under their management, and women perform 45% of the average workdays on plots under their management. These figures for Kpembona are 62% for men and 54% for women.

59. The data show that land preparation work for all crops is predominantly the responsibility of men on plots under their management and on plots managed by women. A minimum of 80% of the average workdays for this task were performed by men regardless of village or gender of the plot manager. This labor pattern is reversed for the task of planting.

60. In Naki-Est women performed 92% of the average workdays for planting all crops on plots under their management, 8% were completed by children, and men contributed no days to this task. Women also performed 85% of the average workdays for planting on plots managed by men in Naki-Est, men contributed 11%, and children 4%.

61. The labor principle that Moba-Gourma women are predominantly responsible for planting work in northern Togo also holds for the control village of Kpembona, where women contributed 66% of the average workdays for planting all crops on plots managed by men, men contributed 24%, and children 10%. On plots managed by women in Kpembona women contributed 79% of the average workdays for planting, men 10%, and children 11%.

62. The data for weeding for all crops clearly show that men and women are largely responsible for weeding the plots under their respective management, but men contribute more average workdays to weeding plots managed by women than women contribute to weeding plots managed by men. In Naki-Est 81% of the average workdays for weeding plots managed by men were completed by men, 15% by women, and 4% by children. On plots managed by women in Naki-Est, women contributed 58% of the average workdays for weeding, men 29%, and children 13%. These figures may also be interpreted as showing that 42% of the average workdays for weeding plots managed by women were completed by men (29%) and children (13%). In contrast, on plots managed by men 19% of the average workdays for weeding all crops were completed by women (15%) and children (4%). Thus, men and children contribute far more average workdays to weeding plots

managed by women than women and children contribute to plots managed by men.

63. In Kpembona 86% of the average workdays for weeding all crops managed by men were contributed by men, 6% by women, and 8% by children. On plots managed by women, 70% of the average workdays for weeding were contributed by women, 22% by men, and 8% by children. Again, it is interesting to note that 30% of the average workdays for weeding plots managed by women were completed by men (22%) and children (8%). On plots managed by men in Kpembona, 76% were jointly contributed by women (66%) and children (10%).

64. Harvesting work in both villages tends to be predominantly performed by women. On plots managed by men in Naki-Est 63% of the average workdays for this task for all crops were performed by women, 35% by men, and 2% by children. However, on plots managed by women in Naki-Est women, and women alone, performed all harvesting activities.

65. On plots managed by men in Kpembona 59% of the average workdays for all crops were performed by women, 30% by men, and 11% by children. Interestingly, on plots managed by women in the control village, the average workdays for harvesting were equal among men (50%) and women (50%). Perhaps the contribution of men in harvesting plots managed by women is in exchange for the work of women in planting fields managed by men.

66. The task of fertilizer application for all crops is largely the responsibility of the plot manager. In Kpembona 69% of the average workdays for this task on plots managed by men were performed by men, 26% by women, and 5% by children. Women performed fertilizer application work for 72% of the average workdays on plots under their management, 28% were performed by men, and children did not participate in fertilizer application on plots managed by women in Kpembona.

67. On plots managed by men in Naki-Est 55% of the average workdays per hectare for fertilizer application for all crops were performed by men, 37% by women, and 8% by children. The division of labor for fertilizer application on plots managed by women in Naki-Est shows that children performed 44% of the average workdays for this task and women performed 47%. The fact that children are responsible for 44% of the average workdays for fertilizer application on all crops managed by women and 8% on plots managed by men suggests that training children for this task in the experimental village would be appropriate.

68. On plots managed by men farmers in Naki-Est 49% of the average workdays for storage of all crops were performed by men, 46% by women, and 5% by children. On plots managed by women in the experimental village, 66% of the average workdays for storage were performed by men (33%) and children (33%). Women contribute but one-third (33%) of the average workdays for storage of production from plots under their management. Thus, men are more responsible for storing production from plots under their management than women are for plots under their management, as women receive more assistance from men and children than men receive from women and children.
69. Women and children in Kpembona perform more of the average workdays for storage (62%) of production of all crops from plots managed by men than are performed by men themselves (38%). On plots managed by women in Kpembona men (50%) and women (50%) equally share the average workdays for storage without any contribution from the labor of children. Thus, men in Kpembona contribute more average workdays for storing production grown on plots managed by women (50%) than they contribute to storing their own production (38%).

Use of Labor by Crop

70. Land preparation for sole crops of peanuts and cotton is mainly the responsibility of men who performed 92% of the average workdays for peanuts and 91% for cotton. Children contributed 7% and 9% of the average land preparation workdays for these crops, respectively.
71. Women performed the greatest percentage of average workdays for planting peanuts (74%) and cotton (71%). Men contribute slightly more of the average workdays for planting cotton (20%) than for peanuts (18%).
72. The majority (80%) of the average workdays for weeding cotton is performed by men, 12% by women, and 8% by children. Women contribute a greater percentage of the average workdays for weeding peanuts (24%) than for cotton (12%). About two-thirds (67%) of the average workdays for weeding peanuts is performed by men and 9% by children.
73. Fertilizer application for cotton is predominantly an activity of men who performed 51% of the average workdays for this task while women contributed 38% and children 11%. Other diverse activities for peanuts and cotton were completed exclusively by men.

74. Concerning the average use of labor of men, women, and children for all millet, the data show that the men performed 92% of the average workdays for land preparation and children 8%. Women performed 72% of the average workdays for planting all millet, men performed 21%, and children 7%. The weeding of all millet is predominantly a responsibility of men who performed 80% of the average workdays for this task, women contributed 14%, and children 6%.
75. The harvesting of all millet is most often done by women who performed 58% of the average workdays for this activity, men contributed 36% and children 6%. The storage of all millet is also predominantly, but not exclusively; a task of women who performed 55% of the average workdays for this activity while men contributed 42% and children 3%. Overall, men contributed 58% of the average workdays per hectare for all activities, women performed 37%, and children 5%.
76. Men contribute less of the average workdays for planting M-3 (5%) than M-6 millet (12%) and women contribute less of the average workdays for planting M-6 (80%) than M-3 millet (93%). Although women made no labor contribution to fertilizer application on M-6 millet, they contributed 25% of the average workdays for fertilizer application on M-3 millet. It may also be concluded from these descriptive data that Moba-Gourma women in northern Togo are attracted by, and thus give more attention to, M-3 millet than to M-6 millet, especially for the tasks of planting, fertilizer application, and marketing.
77. Land preparation for millet-sorghum is primarily a responsibility of men who account for 90% of the average workdays per hectare. Women and children account for 3% and 7% of the average workdays, respectively. Women contributed 87% of the average workdays for planting, 5% by men, and 8% by children. But in weeding this intercrop men accounted for 68% of the average workdays, women 20%, and children accounted for 12%. Fertilizer application work is predominantly, but not exclusively, the responsibility of men for millet-sorghum who completed 64% of the average workdays for this task. Women contributed 33% of the average workdays for fertilizer application and children 3%.
78. Women clearly dominate the harvesting of the millet-sorghum intercrop as their labor accounted for 59% of the average workdays for this task. Men accounted for 25% of the average workdays and children 16%. As for

storage work for this intercrop, men accounted for 37% of the average workdays, women 48%, and children 15%.

79. For land preparation the labor of men accounts for an average of 90% of the average workdays in this activity for millet-cowpea intercrops and 99% for the intercrop of peanuts-cowpeas. As with the crops previously discussed, women account for 86% of the average workdays for planting millet-cowpeas and 78% for peanuts-cowpeas.

80. Weeding work for the millet-cowpea intercrop is predominantly a task for men who account for 82% of the average workdays for this task. Women, however, contribute more of the average workdays for weeding peanuts intercropped with cowpeas (33%) than for millet-cowpeas (12%).

Use of Fertilizers

81. In Naki-Est 93% of the men and 27% of the women farmers reported using fertilizer on at least one plot during the survey season. In Kpembona 67% of the men and 31% of the women farmers reported using fertilizer in 1988. The percentage of men and women farmers using fertilizer in Naki-Est (77%) is greater than in Kpembona (60%). It should be noted that the percentage of women farmers using fertilizer in Kpembona (31%) is slightly more than among women in Naki-Est (27%).

82. The figures describing the use of fertilizer prior to the survey year show that 98% of the men and 33% of the women farmers in Naki-Est have used fertilizer in the past. In Kpembona 85% of men farmers and 77% of the women have used fertilizer in the past. Thus, the experience of fertilizer use is most uncommon among women farmers in Naki-Est. The SFRP will provide new experiences about fertilizer use among women in the experimental village. Overall 91% of the men in the sample, 54% of the women, and 82% of the farmers in the sample used fertilizer at least once prior to the SFRP baseline survey.

83. Men (100%) in Naki-Est uniformly cited the lack of money as the reason for not using fertilizer. Women in Naki-Est (90%) are somewhat less likely than men to cite lack of money as a reason for not using fertilizer but more likely (10%) to view fertilizer as unnecessary.

84. In Kpembona, 88% of the men and 100% of the women cited lack of money as the main reason for not using fertilizer. None of the women farmers in Kpembona viewed fertilizer as not needed but 12% of the men farmers cited this reason. For the total sample women farmers (92%) are somewhat more

likely to cite lack of money as a reason for not using fertilizer than men farmers (89%). But men (11%) are somewhat more likely than women (8%) to view the use of fertilizer as unnecessary. Clearly, among both men and women the lack of money is viewed as the principal reason for not using fertilizer.

85. In Naki-Est the sample of men universally cited lack of money as the reason for discontinuing the use of fertilizer. Fewer farmers in Kpembona (93%) cited this reason, but 7% indicated that fertilizer was not available. The lack of money is the main reason offered by farmers for not using or discontinuing the use of fertilizer in the sample region.

86. Considering all crops cultivated in both villages by men and women farmers, 84% of the plots in Naki-Est and 86% in Kpembona received no fertilizer.

87. Men farmers are somewhat more likely than women to use fertilizer on their plots because 84% of the plots managed by men, but 92% of those managed by women received no fertilizer. For both men and women farmers, cotton plots are most likely to receive fertilizer and plots with M-6 millet least likely.

88. The average rate of 15-15-15 application for all crops was 92 kg/ha with a 64% variation. These figures also show substantial variation in the rate of application of 15-15-15 by crop. For the millet-sorghum intercrop, an average application of 83 kg/ha with a 71% variation was observed.

89. The average rate of application for urea for cotton is 49 kg/ha with a coefficient of variation of 40%. That is the lowest variation observed in the use of urea for any crop or intercrop. Cowpeas show a similar rate of application of urea (45 kg/ha) with a coefficient of variation of 45%. The use of this fertilizer for other crops shows an average rate of 58 kg/ha with a very substantial variation of 101%. For all crops receiving urea, the average rate of application is 49 kg/ha with a coefficient of variation of 45%.

90. The use of SSP in the sample region is limited to peanuts as a sole crop and the intercrop of peanuts-cowpeas. The average rate of application of this fertilizer for peanuts is 61 kg/ha with a substantial variation of 91%. For the intercrop of peanuts-cowpeas the average rate of SSP use is 67 kg/ha with a substantially lower coefficient of variation of 50%. The

average rate of use of this fertilizer for all crops is 64 kg/ha with a 52% variation in this rate.

91. The use of the complex fertilizer NPKSB is primarily on cotton and cowpeas. For cotton the average rate of application is 141 kg/ha with a variation in the rate of 33%. For cowpeas these figures are 136 kg/ha and 38%, respectively. These coefficients of variation are among the smallest of the crops in the sample.

92. The percentage of farmers using generic manure in Naki-Est (82%) is greater than in Kpembona (62%). This is also the point for the use of household refuse by 12% of the farmers in Naki-Est and 9% in Kpembona. The percentage of farmers in Kpembona using manure from sheep and goats (11%) is greater than in Naki-Est. The percentage of men and women farmers reporting the use of generic manure (3%) is about equal, 72% and 71%, respectively.

93. The percentage of women farmers using organic manure during the survey season was less than men, 25% and 80%, respectively. Stated differently 20% of the men farmers and 75% of the women farmers reported not using organic manure during the survey season.

94. Women farmers (100%) are more likely than men farmers (80%) to report the limited availability of organic manure as a constraint to use.

Credit

95. The percentage of farmers using agricultural credit is greater in Naki-Est (80%) than in Kpembona (34%). The data further show that the percentage of men using credit (64%) is about twice that of women (31%). Disregarding gender and village distinctions, 56% of the farmers in the sample used credit. Men in Naki-Est are the most frequent users of credit and women, in general, the least.

96. The figures for the sources of credit used by gender show that women (56%) are far more likely than men (10%) to borrow money from family members and friends, but again the base numbers are small. The figures also show that men (87%) are far more likely to use credit from SOTOCO and DRDR than women (33%). Although the use of credit by women from these sources is limited, women are clearly not excluded from SOTOCO-DRDR loans.

97. The percentage of women who tried to obtain a loan but failed to receive one (30%) is greater than that of men (12%). Overall, 82% of those not using credit did not attempt to obtain a loan.

Use of Crop Output

98. More than 90% of the main crop products of all crops are grown for household consumption: 96% in Naki-Est, 97% in Kpembona, and 96% in the total sample. Less than 5% of the crops in both villages are grown for the dual purposes of household and sale.
99. The single greatest use of straw is for building material: 61% in Naki-Est, 71% in Kpembona, and 65% for the total sample. The use of straw for groundcover in Naki-Est (32%) exceeds that of Kpembona (19%) and the total sample (26%). The least use of straw is for animal feed: 7% in Naki-Est, 10% in Kpembona, and 9% for the total sample.
100. Men (98%) are somewhat more likely than women (91%) to use main crop products for household consumption. Nine women (33%) in the sample reported using crop byproducts for animal feed. No men reported such use. Men (26%) and women (26%) are equally likely to use crop byproducts for groundcover.
101. Men (74%), perhaps owing to their greater involvement in building, are more likely than women (41%) to use crop byproducts for building material. Sixty-six percent of the total sample reported the use of byproducts for this purpose.
102. The favored use of peanut straw (88%) is for animal feed. Straw from rice (71%) and millet (27%) is a crop byproduct mainly used for groundcover. The favored building materials are straw from millet (73%) and sorghum (12%).
103. Finally, in regard to the disposal of crop production, 78% of all sales were made by farmers who cultivated the particular crop and 22% by the wives of farmers. All of the crops were sold within the villages rather than at distant locations.

Sources of Agricultural Information

104. A greater percentage of farmers in Naki-Est (84%) than in Kpembona (66%) view agricultural information from cooperatives as very helpful and somewhat helpful. In contrast, farmers in Kpembona (34%) are about twice as likely as those in Naki-Est (16%) to view information from cooperatives

as not helpful or report uncertainty about the value from this source. A similar pattern holds for perceptions about information from cooperatives by gender. Specifically, a greater percentage of men (79%) and of women (59%) farmers view information from cooperatives as very helpful and somewhat helpful, but women (41%) are about twice as likely as men (21%) to view information from cooperatives as not helpful or of uncertain value. Although 75% of the total sample view agricultural information from cooperatives as very or somewhat helpful, men in Kpembona and women from both villages are most likely to view information from this source as not helpful or of uncertain value.

105. Farmers in Naki-Est (90%) and Kpembona (92%) view information from extension workers as very helpful and somewhat helpful. However, women (66%) are less likely than men (95%) to view such information as very helpful. Overall, 91% of the total sample perceive information from extension workers as very helpful or somewhat helpful.

106. Farmers in Kpembona (90%) are much more likely than those in Naki-Est (57%) to view information from other farmers as very helpful. More farmers in Naki-Est (31%) than in Kpembona (5%) view such information as only somewhat helpful. There is a small gender difference about perceptions of the value of information from other farmers; 90% of men and 96% of women farmers view information from this source as very helpful or somewhat helpful. Overall 92% of the total sample view information from other farmers as very helpful or somewhat helpful.

107. Women in Naki-Est (80%) are most likely to receive no annual visits from extension workers followed in descending order by women in Kpembona (46%), men in Kpembona (19%), and men in Naki-Est (16%). Overall, about one-third (34%) of the farmers in the total sample reported no extension visits during the 1988 cropping season.

108. The numbers and percentages of farmers receiving one extension visit per year are minimal. Specifically, men (11%) in Naki-Est are most likely to report one visit followed in descending order by women in Kpembona (8%) and men in Kpembona (4%). Overall, 7% of the sample reported receiving only one extension visit during the survey season.

109. Interestingly, women in Kpembona (46%) are most likely to receive between 2 and 4 extension visits per year followed in descending order by men in Naki-Est (44%), men in Kpembona (40%), and single women farmers in

Naki-Est (7%). Overall, 38% of the sample reported receiving between 2 and 4 extension visits in 1988.

110. Men in Kpembona (29%) and men in Naki-Est (25%) reported receiving between 5 and 10 extension visits. Interestingly, 13% of the women in Naki-Est but none in Kpembona reported receiving between 5 and 10 extension visits. Overall, 22% of the total sample received between 5 and 10 extension visits during the 1988 cropping season. The number of farmers receiving 10 or more extension visits is very minimal.

111. Within the total sample 22% of the farmers reported owning a radio, but this figure obscures gender differences on this point. Men (27%) in Naki-Est reported the highest percentage of radio ownership followed by men in Kpembona (23%). Women in Kpembona (21%) are more likely to report radio ownership than women in Naki-Est (7%).

112. Overall, 10% of the sample reported having access to a television. However, women in Kpembona (21%) reported the greatest access to television followed in descending order by women in Naki-Est (13%), men in Kpembona (12%), and men in Naki-Est (4%).

Constraints to Agricultural Production and Fertilizer Use

113. Among all farmers in Naki-Est, regardless of gender, the lack of rain is perceived as the second most important constraint to agricultural production. But farmers in Kpembona perceive pests and diseases as greater constraints to production than the lack of rainfall that is ranked third in this village.

114. Farmers in Naki-Est and women in the total sample view poor field maintenance as the fourth most important constraint to agricultural production. Farmers in Kpembona view poor field maintenance as the fifth most important constraint in their village, but men in the total sample accord this constraint as least important and thus it is ranked seventh.

115. Lack of fertilizer is viewed by farmers in Naki-Est and men in the total sample as the sixth most important constraint to agricultural production. Men in Kpembona rank lack of fertilizer as the fourth most important constraint and women in the total sample rank it as fifth in importance on a scale of relative importance of constraints (SRI).

116. Other constraints, such as a lack of money for inputs, strong winds, flooding, lack of fallow, and lack of animal traction, are perceived as the least important constraints to agricultural production by farmers in

Naki-Est and women in the sample. The other constraints are viewed by farmers in Kpembona as sixth in relative importance and fourth by men in both villages.

117. It is important to note that although all farmers in the sample view low soil fertility as the major constraint to crop production, the lack of fertilizer to correct this problem is not ranked highly in importance. The SFRP is designed to demonstrate to farmers the benefit and contribution of fertilizer in increasing soil fertility and thus crop production.

118. Farmers in Kpembona cite the distance to a fertilizer dealer as the third most important constraint, but farmers in Naki-Est rank this factor as fourth in importance on the SRI of constraints.

119. Farmers in Kpembona perceive a lack of rain as the fourth most important constraint to fertilizer use, but farmers in Naki-Est rank this factor as third on the SRI.

120. A lack of knowledge about fertilizer use is perceived as the fourth constraint in relative importance by women in the sample but is ranked fifth by farmers in Kpembona, sixth by farmers in Naki-Est, and least important on the SRI by men in the sample.

121. High fertilizer prices are not perceived as a constraint in Naki-Est but are ranked fourth on the SRI in Kpembona. Women, who rank high prices as fifth on the SRI, view this constraint as more than men who rank it as sixth.

122. Women and farmers in Kpembona perceive other factors such as a lack of labor, insecure land tenure, lack of seeds, and small plot sizes as sixth on the SRI of constraints to fertilizer use. Farmers in Naki-Est and men in the sample view these constraints as more important on the SRI and rank them fifth.

A SUMMARY OF THE BASELINE SURVEY OF THE SOIL FERTILITY RESTORATION PROJECT IN THE MARADI REGION OF NIGER

Demographic Characteristics and Locations of Households

1. A stratified random sample of 129 farmers, including 37 women from the villages of Tchizon and Maiguero in the Maradi Department of Niger, was interviewed in 1988, the initial year of the Soil Fertility Restoration

Project (SFRP). The survey generated data on gender; cultural groups; household location and composition, education, and employment; land availability and tenure; the use of machinery, animals, equipment, and credit; crop areas and management; sources of information about fertilizers; the use and cost of fertilizers, organic manures, and crop residue; the use and cost of labor; disposal and use of crop production; and finally, the perceptions of farmers about constraints concerning fertilizer use in particular and agricultural production in general.

2. The households of sample farmers are generally comprised of nuclear families. But households in Tchizon, the experimental village, tend to be larger and are more likely to have extended family members than households in Maiguero, the control village.
3. Among farmers and their adult household members the number of women exceeds men, and women are generally younger than men; but men have twice as many years of formal schooling. This suggests that, as in the past, opportunities for formal schooling for rural Hausa women have not improved in recent years.
4. Regardless of gender, farmers buy household goods and agricultural inputs from the nearest market centers where farm produce is sold. Due to lack of public or commercial transportation, farmers rely on transportation by foot and sometimes farm animals. Farmers in Maiguero and Tchizon are about equal distances from a large market center, 35 km and 36 km, respectively.
5. There are no significant differences between men and women with regard to distances from households to household or individual plots. However, women who manage plots in Tchizon are likely to be more distant from their plots than their counterparts in Maiguero.

Off-Farm Employment

6. No women farmers in the sample reported are engaged in off-farm employment. Apparently household chores, such as food preparation, tending children, and watering animals preclude women from engaging in off-farm work. Seclusion is also a factor in minimal off-farm employment of women. A significant proportion of men farmers (35%) engage in off-farm employment for periods ranging from 2 to 9 months/year. Men in Maiguero, the control village, are more likely to be engaged in off-farm employment but are employed for a shorter duration and consequently earn less than

men in Tchizon. In Tchizon, the majority (54%) of off-farm employment is in the village of residence. In contrast, 84% of off-farm employment in Maiguero is outside the national territory, specifically in northern Nigeria.

7. The ability of men farmers in Tchizon to realize off-farm earnings is evident in that although twice as many men farmers in Maiguero engage in off-farm employment compared to Tchizon, men farmers in Tchizon earn over twice as much (48,222 FCFA or US $163) as their counterparts in Maiguero (21,700 FCFA or US $73).

Characteristics of Farms

8. Aside from the household plots that are predominantly managed by men, each gender may manage plots of the other.
9. There are significant differences in the number of plots and the crop area per farm managed by each gender. On the average, men manage three times (7.5) as many plots as women (2.5). The average crop area on farms managed by men (9.9 ha) is about five times greater than that of farms managed by women (2.1 ha).
10. Unlike several societies in West Africa, where custom prohibits the sale of farmland, a significant 13% (38.5 ha) of the total sample area in Tchizon managed by men was acquired through direct purchase.
11. Very few plots are borrowed or rented. Ninety-eight percent of a total of 280 plots (987 ha) is family-owned (75%) or owned by the individual plot manager (23%).
12. The average area cultivated by men farmers exceeds that of women farmers. The largest average crop area is observed among men in Tchizon (12.0 ha), followed by men farmers in Maiguero (7.3 ha), women farmers in Tchizon (2.9 ha), and women farmers in Maiguero (1.5 ha).
13. The data indicate clearly that family-owned plots comprise the largest portion (90%) of the area managed by men farmers. The area managed by women farmers is somewhat equally divided between family-owned (52%) and individually-owned plots (47%) but men reported only 8% of the area under their management as individually owned.

Equipment, Tools, and Animals

14. The ownership of agricultural equipment such as seeders and mist-blowers is limited to a few men farmers in Maiguero. Farmers generally use

locally made hand tools, and the distribution of tools between men and women is such that women are at no particular disadvantage in access to the most important tools such as hilaires and dabas.

15. Men (85%) and women (87%) farmers in the two villages own animals, but on the average men own about twice as many animals (7.1) as women (3.3).
16. Virtually all farmers, regardless of gender, own hand tools with men farmers somewhat more likely than women farmers to report ownership. All men and women in Tchizon reported hand tool ownership, but men in Maiguero (97.5%) are somewhat more likely than women (95%) to own hand tools.
17. The percentage of farmers owning animals varies by gender and village. In Tchizon, a greater percentage of men farmers (92%) than women farmers (82%) own animals. But in Maiguero these figures are 75% and 90%, respectively.

Crops and Cropping Systems

18. The sole crop of millet (46%) and other millet-based intercrops (37%) account for 83% of the cropping systems on 309 plots sampled. The most important food crop after millet is sorghum. In the experimental village of Tchizon, millet and sorghum as sole crops or a basis for other intercrops account for 92% of the crops on 153 sample plots. The corresponding figures for Maiguero are 99% on 157 plots.
19. An interesting contrast is that men and women farmers in Tchizon allocate 7% of all plots in the village for the cultivation of cowpeas, but this crop is hardly grown in Maiguero. Instead, farmers in Maiguero grow mainly peanuts as a legume that is grown only by a few men farmers in Tchizon.
20. The total sample figures show that the average size of 309 plots included in the sample is 1.56 ha. The average plot area for men is 1.77 ha and 0.81 ha for women.
21. Millet is a very important grain for farmers in Hausaland. Approximately one-half (49%) of the total sample area or 235.1 ha was allocated to the sole crop of millet. Men farmers allocated a greater percentage of their total crop area to the sole crop of millet (51% or 213 ha) than women (39% or 21.9 ha).
22. Women allocate a higher percentage of their total crop area for sorghum (14%) than men (10%). Although the difference may not appear

significant, it should be noted that the average plot area for sorghum among men (1.48 ha) is greater than that of women (0.80 ha).

23. Women in Maiguero allocate 43% of the total area under their management to the millet-sorghum intercrop, but this intercrop is not cultivated by women in Tchizon.

Use of Household and Hired Labor for All Crops

24. Farmers in both villages rely heavily on household labor for farming activities. Specifically, on the average 99% of all workdays per hectare are performed by household labor in Tchizon. The corresponding figure for Maiguero is 96%. Thus, farmers in Maiguero are slightly more likely to use hired labor than those in Tchizon.

25. There are striking differences between men and women farmers about total labor used in workdays per hectare between the two villages. In Tchizon, women use twice as many average workdays per hectare for all crops (41.2) as men (20.2). By contrast, in Maiguero, the total labor use in workdays per hectare for women (22.5) is slightly less than that of men (27.9). For the more demanding task of weeding, for example, on the average, women in Maiguero use 8.5 workdays/ha compared with 14.0 workdays for men.

26. There are significant differences between the two villages in the average total labor used per hectare by farmers for all crops and intercrops. For the sole crops of millet and sorghum and the millet-sorghum intercrop farmers in Tchizon, on the average, use 26.3, 33.7, and 11.9 workdays/ha for all activities, respectively. The corresponding figures for the three cropping systems in Maiguero are 29.2, 26.3, and 27.0 workdays/ha. Thus, farmers in Tchizon use fewer workdays per hectare for the sole crop of millet and the millet-sorghum intercrop but more workdays per hectare for the sole crop of sorghum than farmers in Maiguero.

Use of Labor by Gender for All Crops

27. Regardless of village, crop, or gender of plot manager, farmers in the sample depend mainly on household labor for all agricultural activities. The maximum contribution of hired labor for all activities and all crops is 6% of the average workdays in Maiguero.

28. A comparison of the labor contributions of men and women for all crops by village shows that work is more equally shared by men and women in

Maiguero who contributed 48% and 46% of the average workdays for all crops, respectively. For Tchizon this labor contribution for men is 60% and 32% for women.

29. In Tchizon the percentages of average workdays contributed by men (47%) and women (44%) for all activities on plots managed by women are more equal than on plots managed by men, 65% and 28%, respectively.

30. In Maiguero the men and women are the main contributors of labor for all activities for all crops on plots under their respective management. On plots managed by women 27% of the average workdays were contibuted by men and 72% by women. On plots managed by men these percentages are 64% and 28%, respectively.

31. The labor contributions of children were largely for the activities of planting, weeding, and harvesting. On the average, children are more likely to labor on plots managed by men than on plots managed by women. Between 5% and 10% of all workdays for all activities, regardless of crop-mix or cropping system, were performed by children.

Use of Fertilizers

32. Approximately one-third (32%) of the farmers in the sample used fertilizer during the survey year. Slightly more than one-half (52%) of the sample farmers in Tchizon used fertilizers, compared with only 10% in Maiguero.

33. Although men are more likely than women to use fertilizers, there was a remarkable 12% increase between women who used fertilizer in the past (7%) and those who used it during the survey season (19%). Women farmers in Tchizon (41%) are more likely to use fertilizers than their counterparts in Maiguero (nil).

34. Limited financial resources are one of the main constraints to fertilizer use in the study area. Eighty-four percent of farmers who have not adopted fertilizers cited lack of money as the main constraint. Farmers in Tchizon (96%) are more likely than farmers in Maiguero (64%) to cite lack of money as a reason for not using fertilizer.

35. In Maiguero, 29% of the farmers cited weeds as the main reason for discontinuing fertilizer use. Fewer farmers in Tchizon cited this reason (4%).

36. Fertilizer use is more elaborate in the experimental village than in the control village. Approximately 13% of all sampled plots in Tchizon

received fertilizers during the survey year. Only 1.6% of the plots in Maiguero were fertilized.

37. The average rate of SSP applications for various sole crops and intercrops in Tchizon was 75.1 kg/ha compared with 41.4 kg/ha in Maiguero. Urea was applied at the average rates of 31.6 kg/ha and 27.5 kg/ha in Tchizon and Maiguero, respectively.
38. The use of ground Tahoua phosphate rock is limited to the sole crop of millet in Maiguero, and the sole crops of millet and sorghum and other millet intercrops in Tchizon. The average rate of application of this fertilizer is 100 kg/ha in Maiguero and 18.5 kg/ha in Tchizon.
39. The use of 15-15-15 and TSP is limited to Tchizon where the average rates of application were 45.8 and 32.0 kg/ha, respectively.
40. The most popular method of fertilizer application used by farmers in the study area is broadcasting (64.3%) followed by point placement (15.1%), and sidedressing (11.9%). Banding is the least used method of fertilizer application.
41. In the two villages 86% of the farmers used organic manure during the survey cropping season. The percentage of farmers who used manure was slightly higher in Maiguero (88.3%) than in Tchizon (83.1%).
42. Among the few farmers who did not use manure, lack of transportation and nonavailability of manures were the two main reasons cited.

Use of Credit

43. Regardless of gender, the use of agricultural credit is very minimal in the study area. Only 5% of sample farmers used agricultural credit and virtually all farmers borrowed from a friend or a family member. It is worthy to note that 97% of farmers who did not use credit made no attempt to obtain a loan during the survey cropping season.

Use of Crop Output

44. The greater proportion of agricultural production is reserved for household consumption. In Tchizon, 85% of the millet production and 80% of sorghum were exclusively designated for household use. The corresponding figures for the two crops in Maiguero are 72% and 97%, respectively. However, a remarkable 80% of the peanut crop and 12% of all crops' output in Maiguero were exclusively for market sale. In Tchizon, only 8% of the cowpea production or 4% of all crops were sold.

Thus, farmers in Maiguero are somewhat more market-oriented than those in Tchizon.

45. The responsibility for crop sales mostly rests with farmers. This is the case for 90% of the total sample--88% for farmers in Maiguero and all of the farmers (100%) in Tchizon. The favored places for the sale of crops are the nearest small market towns. In Tchizon, 83% of farm produce marked for sale was sold in nearby Tchadua (4 km); the remainder (17%) was sold in the village. Farmers in Maiguero sold 87% of their produce destined for the market in Gabi (3 km).

Sources of Agricultural Information

46. Farmers in the two villages generally have a positive perception of agricultural cooperatives. However, farmers in Tchizon (97%) are more likely than those in Maiguero (67%) to view agricultural information from cooperatives as very helpful. A similar pattern holds for perceptions about information from extension workers. Specifically, virtually all farmers in Tchizon (97%) and 91% of those in Maiguero perceive information from extension workers as very helpful. But farmers in Maiguero (5%) are more likely than those in Tchizon to be uncertain about the value of agricultural information from extension workers.

47. In excess of 90% of farmers in the two villages view agricultural information from other farmers as very helpful or somewhat helpful, but again 8% of farmers in Maiguero, mostly women, are uncertain about the value of agricultural information from this source.

48. The pattern is somewhat the same with regard to agricultural information from fertilizer dealers. Farmers in Tchizon (3%) are more likely than those in Maiguero to view information from this source as not helpful.

49. A significant proportion of farmers in the study area have access to extension services. Only 9% of farmers in the sample did not receive extension service visits. However, farmers in Tchizon are better served by extension service workers. In Tchizon 7 out of 10 farmers, compared with one-half of farmers in Maiguero, received more than four extension service visits during the survey year. The visits were more frequent among men than women farmers.

50. Overall, men and women in each of the two sample villages have about equal access to agricultural information through radio and television, but farmers in Tchizon (84%) are more likely to have seen television

programs about fertilizers than those in Maiguero (41%). The greatest ownership of radios is among women in Tchizon (41%), followed by men in Tchizon (23%), and finally, men (8%) and women (5%) in Maiguero.

Constraints to Agricultural Production

51. The data clearly show that regardless of gender, farmers perceive lack of rain as the most important constraint to agricultural production in the study area.
52. Low soil fertility is perceived by men in Tchizon, the experimental village, as the second most important constraint to crop production. Among women in Tchizon and all farmers in Maiguero, regardless of gender, pests and diseases are perceived as the second most important constraint to agricultural production.
53. Other constraints, such as weeds, strong winds, and lack of money to purchase inputs, are perceived by women farmers in Tchizon and Maiguero as the third most important constraint to crop production, but these factors are viewed by men farmers in Tchizon as fourth in relative importance.
54. Finally, women in the study sample cite low soil fertility as the least in relative importance of all constraints identified.

Constraints to Fertilizer Use

55. Regarding constraints to fertilizer use, farmers in Tchizon perceive inadequate rainfall as the second most important constraint after lack of money to purchase fertilizers, but this factor is ranked third in Maiguero. However, farmers in both villages are unanimous about their inadequate knowledge about fertilizers as the fourth most important constraint to fertilizer use.
56. Lack of fertilizer is viewed by farmers in Tchizon as the third most important constraint to fertilizer use. But it seems this does not pose any problem for farmers in Maiguero who apparently have access to supplies from nearby Nigeria, however irregular.

Econometric Analyses

57. Parameter estimates of millet production functions indicate the following: overall productivity was not significantly different between villages. Thus, "holding constant" other factors included in the models,

millet yields in Tchizon were not significantly different from the yields in Maiguero.

58. Regarding gender, a somewhat higher level of productivity is evident for men farmers. However, the coefficients are not statistically significant. Therefore, the hypothesis that men and women farmers have the same level of overall productivity cannot be rejected.

59. The use of fertilizer had a positive and statistically significant effect on millet yields. The coefficients of fertilizer use variables were statistically significant at the 0.01 level of significance.

The coefficient of the linear model shows that, "holding constant" other factors included in the model, millet yields of farmers using fertilizer were 564 kg/ha higher than the yields of farmers not using fertilizer.

60. Coefficients of the labor use variable in the linear and logarithmic models are estimates of the average productivity of labor and of the elasticity of crop yields with respect to labor use, respectively. These coefficients are statistically significant at the 0.01 level of significance and show that the average productivity of a workday of labor is equivalent to about 18 kg of millet or approximately FCFA 600. The estimated elasticity of millet yields with respect to labor (0.6) indicates the percentage change in yields associated with a 1% change in the use of labor; i.e., on the average a 10% increase in labor use is associated with about a 6% increase in millet yields.

61. The low magnitude and lack of significance of the coefficients for the variable crop area per farm show that millet yields are not significantly affected by farm size. That is, there is no indication of economies or diseconomies of scale in millet production.

Estimates of the functions of farmers' income indicate the following.

62. Gross income of farmers from millet production and total household income were somewhat higher in Maiguero than in Tchizon. Differences between villages were statistically significant in levels of gross income from millet but not in total household income.

63. Men have higher levels of income than women farmers; however, holding constant other factors (use of labor and fertilizer, and crop area per farm) the gender of the farmer does not have a significant effect on household income.

64. Fertilizer use, intensity of labor use (workdays per hectare), and crop area per farm are the most important determinants of household income. The coefficients of these variables are statistically significant at the 0.01 level of significance in all models.

65. The coefficient of the dummy 0-1 variable for fertilizer use shows that the use of fertilizer increased the gross annual income of farmers by about FCFA 127,000-144,000/household.

66. Coefficients of the intensity of labor use variable (workdays per hectare) show that on the average a workday per hectare of cultivated land increased the annual income per household by about FCFA 7,000, and that the elasticity of household income with respect to labor use is about 0.6.

67. Coefficients of the variable for crop area per farm in the linear models show that the gross annual income of farmers per household increases by about FCFA 29,000/ha of cultivated land. That is, holding other factors constant, an additional hectare of millet increased gross household income of farmers by FCFA 29,000/year. The coefficients for this variable in the logarithmic models show elasticities of income with respect to crop area. Because these coefficients are not significantly different from 1, household income increases in the same proportion as the crop area per farm, thereby, no significant economies or diseconomies of scale are evident.

Estimates of the labor use models for Maiguero and Tchizon indicate the following.

68. Gender had a statistically significant impact on labor use in the village of Maiguero where men farmers are apparently using more labor per hectare on millet than women. Differences in labor use were not significant in Tchizon.

69. In both villages the use of fertilizer and the off-farm employment of farmers did not have significant effects on the levels of labor use per hectare of millet.

70. Coefficients estimating the effect of the variable area cultivated per farm on the intensity of labor use were negative and statistically significant in both villages. Use of labor per hectare decreases with the area cultivated per farm. Thus, there is an inverse relationship between the intensity of labor use (workdays per hectare) and the total area cultivated by farm. In Maiguero the elasticity of labor use per hectare with respect to the area cultivated per farm was -0.45. These results may be explained by the presence of constraints in the availability of family labor and for the hiring of labor during periods of high labor demand.

Farm/Crop Budgets

FAO (1974) stipulated a VCR of 3 as the minimum profitability to be expected from fertilizer use. Their analysis, however, did not take into consideration the additional costs of fertilizer application and harvesting. The preliminary SFRP FMOFTs of 1988 showed VCRs of less than 3 (direct effects only) when all costs including unsubsidized costs of fertilizers were considered.

It was observed during several field trips to Tchizon, Niger, that although the price of millet was low, farmers were prepared to pay the cost of fertilizers. These observations confirmed the need to consider the economics of fertilizer use beyond direct effects on single food crops, that is, from the perspective of the whole-farm situation and residual values.

Crop and farm budgets are useful tools for farm income analysis and are intended to facilitate the following:

1. Assessment of the importance and role of the main constraints (financial, land availability, labor requirements, input supply, storage, sale) that may limit fertilizer use and crop production.
2. A better understanding of the impact of improved crop management and fertilizer use practices on the whole-farm profitability of crop production.
3. Evaluation and comparison of fertilizer use options in terms of cropwise and whole-farm profitability.
4. Monitoring changes in farm income on an annual basis.

The farm budget studies commenced in 1989 with the study of maize/cassava systems in Ghana, millet/sorghum in Togo, and millet/cowpea in Niger

and were expanded in 1990 to include cash crops. Results from these studies will complement those from the annual socioeconomic surveys.

FERTILIZER REVOLVING FUNDS

Farmers were encouraged to use fertilizer materials according to a few P fertilization strategies on large tracts of land to improve the fertility of nutrient-depleted soils. This was initially accomplished by providing subsidized fertilizers as a social investment. In 1990/91, when lower doses of P fertilizers are needed, fertilizer testing will be reduced to smaller plots under intensive cropping. Fertilizers for large tracts of land will be purchased from the revolving fund or by credit. For small-sized on-farm trials fertilizers will remain gratis.

- The funds may provide a mechanism to gradually remove fertilizer subsidies and minimize the effects of the policy change on farmers.
- The long-term goal is to create a dependable source of funding for fertilizer use on a sustainable basis in the pilot areas.
- As a village-level activity, the process of disbursement of and reimbursement to the fund has been organized by farmers under the management of a popularly elected committee. Liaison services are provided by the in-country coordinator who also serves as a technical adviser to the management committee.
- The initial impetus for the creation of the fund in each of the three experimental villages was provided by the SFRP.
- The following are the first-year reimbursement procedures to the fund representing the cost of fertilizer delivered in 1989.

  Ghana: 50% of the cost of fertilizer--cash.

  Togo: 50% of the cost of fertilizer--cash (25%), and produce (25%).

  Niger: 100% of the cost of fertilizer--cash.

  The higher proposed rate of reimbursement in Niger was due to the fact that farmers in Tchizon have a history of involvement with agricultural development projects and in obtaining credit for fertilizer use.
- The project will monitor the activities of the farmers' associations and the operation of the fund through the annual surveys. So far FCFA 9.113.000 has been reimbursed into the Farmers' Association's bank account in Maradi, Niger. In Togo the first sale of grains (reimbursed

to the Farmers Association) to a company, Togo-Grain, has brought in some FCFA 966.000; reimbursement in cash is currently FCFA 348.000. In Ghana, the situation is less optimistic; farmers were reported to be holding stocks in anticipation of higher market prices.

A problem with the revolving funds is that farmers in all three zones initially thought that SFRP, being a research project, would provide gratis fertilizers. However, the cooperative in Niger is working toward at least 100% reimbursement in 1990 with an added interest on the loan, provided that the yields are good.

TRAINING OF COLLABORATING STAFF

Below is an outline of the objectives, activities, and numbers of persons trained through SFRP efforts. More detail on this topic is provided in Appendix I.

At IFDC-Africa

The objective has been to train senior-level personnel in the design of agro-socioeconomic studies and drawing up of budgets to go with the plan. These have mainly taken the form of workshops in Lomé.

In-Country Agronomic Studies

The objective has been to train senior-, middle-, and junior-level personnel on designing agronomic studies and collecting crop and soil data. Personnel of the Ministry of Agriculture not directly involved in the SFRP are always invited to participate.

Socioeconomic and Agro-Economic Studies

The training involves all national staff working with the SFRP and focuses on the collection and analysis of socioeconomic data. Training on the collection of data on crop prices, costs, and losses during maize storage, crop and farm budgets, etc., are also being conducted. A total number of 196 participants benefited from the various training programs during the period under review.

Training of Farmers

The training of farmers is organized and supervised by the in-country coordinators and support staff. Through village meetings, small group discussions, and field demonstrations approximately 850 farmers in the 3 experimental villages received informal instruction on fertilizer handling, short-term storage and application, improved crop husbandry practices, and prevention of postharvest losses.

EXPECTED OUTPUT

It is of extreme importance in evaluating progress made in the SFRP to note that although the project contract was signed in 1987, fieldwork commenced in 1988 in the form of preliminary OFTs/demonstrations and baseline farm surveys. A major but incomplete program of field activities was launched in 1989, and data for 1989 are still being received. Only in 1990 do we expect to have a full field program.

A team of consultants hired by USAID recently visited IFDC-Africa and used the 1988/89 progress report to stipulate the following criteria for project evaluation:

- Adequate number of training sessions and number of personnel trained, and collaborators organizing supplementary in-house training programs.
- Useful data-base management system established for use by IARCs and NARs.
- Sound recommendations produced in the form of technical papers, annual reports, bulletins, newsletters, and focused documents tailored for policy makers.

Several technical reports are expected to be produced from data collected in 1990 and include (a) reports produced since 1988, (b) a report to be completed within the next 3 months, and (c) technical papers being prepared for publication.

Reports Produced Since 1988

1. An Exploratory Survey of the Soil Fertility Restoration Project Pilot Area in the Ashanti Region of Ghana (1988).
2. Progress Report for 1987/88 on the Soil Fertility Restoration Project (1988).

3. An Exploratory Survey of the Soil Fertility Restoration Project Pilot Area in the Savanna of Togo (1989).
4. Agronomic Evaluation of the 1988 On-Farm Trials in the Kumasi and Maradi Pilot Areas (1989).
5. Draft Report on the Economic Analysis of the 1988 On-Farm Trials in Ghana (1989).
6. Progress Report for 1988/89 on the Soil Fertility Restoration Project (1989).
7. A Report on the Baseline Survey of SFRP in the Ashanti Region of Ghana (1989).
8. A Report on the Baseline Survey of SFRP in the Savanna Region of Togo (1990).
9. A Report on the Baseline Survey of SFRP in the Maradi Department of Niger (1990).

Report to Be Completed Within the Next 3 Months

Report on the 1989 Agronomic Monitoring in the Pilot Area of SFRP in the Ashanti Region of Ghana.

Technical Papers Under Preparation for Publication

1. Regional Variations in Labor Use by Men and Women Farmers in West Africa.
2. Gender Differences in Farm Characteristics in West Africa.

OPERATING PROBLEMS

Implementation of the SFRP at an Irrigated Site

Previous progress reports of the SFRP indicated that preliminary surveys were being conducted to identify suitable areas to implement the project in an irrigated area. Three irrigation projects in West Africa were evaluated. In Ghana the Dahwenya project was in the process of receiving funds from EEC for rehabilitation. In Benin the Deve Project was being rehabilited by a team from China. In Togo an irrigation project funded by CARE appeared well organized and the impact of SFRP would have been minimal. Thus it was decided to postpone work on an irrigated site.

Niger

Following the appointment of a new Minister of Agriculture in Niger, M. Goah (In-Country Coordinator), M. Kadi (Agro-Economist) were replaced by A. Ndiaye (Entomolgist/Coordinator) based in Maradi (the pilot area) and M. Abba (Agro-Economist) based in Niamey. Activities in the field came to a halt for some months. This seriously affected the quality of data collected. It was not possible to complete an exploratory survey report for Niger because of a lack of adequate data. Due to local administrative bottlenecks, the five motorcycles purchased by IFDC-A in 1988 for use by the field assistants were not cleared at the end of August 1990.

Togo

Mr. Abo, Direction Générale du Dévéloppement Rural, who had been assisting the interim in-country coordinator in the village-level activities and supervision of the fertilizer revolving funds, was transfered to the Société Togolaise du Coton.

Unusually heavy rains in the latter part of 1989 in the Savanna resulted in flooding of fields and relatively poor performance of long-duration varieties.

Ghana

The research assistant (socioeconomic studies) resigned and the research assistant (agronomic studies) was transferred. Unsteady rains delayed the planting of RMOFTs and very low reimbursement to the fertilizer revolving fund.

ACTIONS TAKEN TO OVERCOME PROBLEMS

1. Full-time project staff (Dr. E. Rhodes, Dr. K. Acheampong and Mr. D. Pouzet) made several visits to the pilot areas to meet with administrators, train staff, and monitor field activities.
2. The newly appointed Managing Director of IFDC, Dr. D. Parbery, accompanied by Dr. P.L.G. Vlek, former Director of IFDC-A, and Dr. A. U. Mokwunye, then Coordinator of Agronomic Research and present Director of IFDC-A, visited Mr. S. Bawa, Director of INRAN Niger, to

discuss problems in the implementation of SFRP. Following their visit a new coordinator was named.

3. Dr. Rhodes had communications and meetings with the Director, Institut National des Sols, and the Director, Direction Générale du Développment Rural Savanes. Following these meetings Mr. T. Thiem was appointed as replacement for Mr. P. Abo.

Plans for 1990/91

1. No significant changes in the workplan of 1989/90 are foreseen. The agro-socioeconomic studies will continue as planned.
2. Studies will be undertaken to monitor and evaluate the revolving funds.
3. It is envisaged that in addition to papers that will be prepared for the project's workshop, the following SFRP technical reports will be completed in 1991:
    1. A report on the 1989 agronomic monitoring in the pilot area of SFRP in the Ashanti Region of Ghana.
    2. A report on the 1989 agronomic monitoring in the pilot area of SFRP in the Savanna Region of Togo.
    3. A report on the 1990 agronomic monitoring in the pilot area of SFRP in the Savanna Region of Togo.
    4. Farm survey (1989) of the SFRP in the Savanna Region of Togo.
    5. Farm survey (1989) of the SFRP in the Ashanti Region of Ghana.
    6. Farm survey (1989) of the SFRP in the Maradi Region of Niger.
    7. Economics of fertilizer use in the Savanna region of Togo, Ashanti region of Ghana, and Maradi region of Niger. Analysis of the SFRP OFTs.
    8. An analysis of the whole-farm profitability of fertilizer use in selected locations of Togo, Ghana, and Niger. Based on crop and farm budget data.

ADMINISTRATION AND STAFFING

The project is under the overall administrative supervision of the Director of IFDC-A. The following staff members are working on the project:

IFDC-A Staff

- Dr. E. R. Rhodes, Agronomist/Team leader of IFDC-A staff.
- Mr. D. Pouzet, Agro-Economist.
- Dr. K. Acheampong, Rural Sociologist.
- Mr. D. Pierre, Soil Chemist (staff of Agronomy Program, IFDC-A, on part time with SFRP).
- Mr. K. Alognikou, Research Assistant.
- Mr. A. Sakiti, Research Assistant.
- Miss A. N'danou, Research Assistant.
- Miss A. Pierron, short-term Research Assistant/Trainee from IRAT/CIRAD.

IFDC Staff Based at IFDC Headquarters

- Dr. C. Baanante, Economist.
- Dr. J. Henao, Biometrician.
- Dr. T. Thompson, Rural Sociologist.

The above three specialists are all senior staff members of the Agro-Economic Division and serve the SFRP in an advisory capacity on a part-time basis.

National Collaborating Staff

Ghana

- Mr. S. Opoku, Extension Specialist/Coordinator, Ministry of Agriculture, Kumasi.
- Mr. E. Dennis, Soil Scientist (Fertility), Soil Research Institute, Kumasi.
- Mr. P. Agyili, Soil Scientist (Pedology), Soil Research Institute, Kumasi.

Togo

- Mr. F. Dali, Agronomist/Interim Coordinator, Institut National des Sols, Lomé.
- Mr. K. Abalo, Regional Officer, Institut National des Sols, Dapaong.
- Mr. T. Thiem, Conseiller en Coorpération, Direction du Développement Rural, Dapaong.
- Mr. D. Koussa, Agro-Economist, Institut National des sols, Dapaong.

Niger

- Mr. A. Ndiaye, Entomologist/Coordinator, Institut National de Recherches Agronomiques du Niger, Maradi.
- Mr. A. Zarafi, Agro-Economist, Institut National de Recherches Agronomiques du Niger, Maradi.
- Mr. M. Abba, Agro-Economist, Institut National de Recherches Agronomiques du Niger, Niamey.

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Table 1. Physiodemographic Characteristics of the Sample Regions

Characteristic	Region		
	Ghana	Togo	Niger
Geographical location	Central	Northern	South-central
Elevation (m, range)	250-300	200-400	400-440
Rainfall (mm/year)	1,600	900	500
Mean annual temperature (°C)	26	28	27
Vegetation	Secondary forest	Sudan savanna	Sahel savanna
Historical land use	Bush fallow	Intensive cropping	Intensive cropping
Main food crops	Maize, cassava, plantain	Millet, sorghum, peanuts, cowpea	Millet, sorghum, cowpea
Population density (km^2)	70-85	85-100	30-40

Table 2. Cropping Systems (1989/90) in the On-Farm Trials

Zone	Trial Management	Cropping Systems
Ghana	RM OFT	Sole maize, maize/cowpea relay crop
	FM OFT	Sole maize, maize/cassava/cocoyam intercrop
Togo	RM OFT	Millet/sorghum intercrop
	FM OFT	Millet/sorghum/cowpea intercrop
Niger	RM OFT	Millet/cowpea intercrop
	FM OFT	Millet/cowpea intercrop

RM - researcher-managed trials.
FM - farmer-managed trials.

Table 3. Effect of Fertilization on Crop Residue Production of Millet/ Sorghum Intercrops in Savanna Region of Togo

Crop	Treatment			
	Absolute Check	P Check	SSP	Togo PAPR50
	(kg/ha)			
Millet				
Roots	446	1,069	1,527	1,612
Stalks	747	1,656	3,015	2,210
Leaves	336	315	1,235	1,084
Chaff	65	216	525	271
Sorghum				
Roots	196	303	566	639
Stalks	537	815	1,699	1,166
Leaves	125	204	381	392
Chaff	142	174	126	275

Note: SSP and Togo PAPR50 were applied at 70 kg P_2O_5/ha. The P check, SSP, and Togo PAPR50 plots received urea at 60 kg N/ha and KCl at 35 kg K_2O/ha.

Table 4. Average Baseline "Available" Phosphate Levels in Random Sites in Villages of SFRP

Extractant	Depth	Kumasi Pilot Area, Ghana				Dapaong Pilot Area, Togo				Maradi Pilot Area, Niger			
		Adjamesu	Hwidiem	Boamang	Anyinasuso	Naki-Est	Kpembona	Kowampit-Bong	Ogaro	Tchizon	Maiguero	Nwala	Zaboua
Bray 1 ($mg\ kg^{-1}$)	0-20 cm	4.08	6.95	6.01	3.12	4.24	1.89	9.44	3.17	1.70	3.18	3.44	0.82
	20-50 cm	2.36	4.74	1.99	2.77	2.69	1.70	6.21	4.65				
Olsen/Dabin ($mg\ kg^{-1}$)	0-20 cm	12.32	16.36	12.72	10.35	4.79	3.55	7.55	7.04				
	20-50 cm	4.59	7.84	5.07	6.07	6.56	25.76	3.07	27.71				

Approximate critical level in topsoils--Bray 1 = 10 $mg\ kg^{-1}$.
Olsen/Dabin = 25 $mg\ kg^{-1}$.

Table 5. Materials Being Evaluated in SFRP

	N	P_2O_5	K_2O
	- - - - -	-(%) - - - -	
15:15:15	15	15	15
KCl			60
Urea	46		
Sulfate of ammonia	21		
Triple superphosphate		48.3	
Triple superphosphate--sulfur		36.0	
50% SAB Togo partially acidulated phosphate rock		27.5	
Tahoua phosphate rock		28.0	
Single superphosphate		19.0	
Diammonium phosphate	18.1	46.5	
Cattle manure Togo	0.61	0.11	2.88
Sheep/goat manure Togo	1.53	0.09	6.96
Poultry manure Togo	1.99	0.79	2.64
Compost/household refuse Togo	0.22	0.06	3.36

Note: Note all materials are being evaluated in each country or in each trial.

Table 6. Use of Manure on Fields Under Fertilizer Testing in 1989

Region	Village	Quantity Used	Area Manured	Area Available for Option Testing	Total Area Fertilized
			(ha)		
Togo	Naki-Est	26.5	5.3 (1.0)	554	554
Ghana	Adjamesu[a]	-	-	309	309
Niger	Tchizon[b]	88.2	57.5 (6.4)	1,014	1,014

a. Very little manure is produced in the humid zone of Ghana.
b. Figures in the last two columns for Niger are provisional; actual testing begins in the 1990 cropping season.

Notes:
- Figures in parentheses are rounded percentages of portions of the area available for fertilizer testing that were manured.
- The soil P restoration trials involving manure consisted of 30-35 kg P_2O_5/ha SSP + 5 t/ha manure.

Table 7. Variability of Maize Grain Yields, Slope and Age of Bush Fallow Cleared on Option Plots; Adjamesu 1989

	Fallow (y)	Slope (%)	Grain Yields Option Plots (kg/ha)	Grain Yields Check Plots (kg/ha)
N	57	81	120	760
$\bar{X}$	3.6	7.8	3,342.7	1,799.5
S	1.6	5.2	1,055.1	919.9
R.	0-7	1-28	1,321-5,317	741-4,867

Table 8. Mean Sociodemographic Characteristics of Farmers and Characteristics of Farms by Region and Gender

Region	Gender	N	Age	Schooling	Household Size	Number of Plots	Crop Area per Farm	Fertilizer Use (1988)	Ownership of Equipment	Ownership of Hand Tools	Ownership of Animals[a]	Off-Farm Employment
			(years)				(ha)	(% of farmers)				
Ghana	Men	54	39.0	7.8	6.4	1.9	0.3	21	7.4	100.0	50.0	30
	Women	67	41.8	4.1	5.8	2.0	0.2	9	0.0	94.0	49.0	30
	Total sample	121	40.6	5.7	6.0	1.9	0.3	14	3.3	96.7	50.0	30
Togo	Men	96	45.7	0.8	11.1	3.8	0.7	79	7.3	100.0	98.0	32
	Women	29	40.0	0.2	8.9	2.5	0.3	29	0.0	93.1	90.0	72
	Total sample	125	44.4	0.7	10.6	3.5	0.7	68	5.6	98.4	96.0	42
Niger	Men	80	43.5	2.2	8.9	3.0	1.9	34	6.5	98.9	85.0	35
	Women	31	42.1	0.0	4.2	2.2	0.9	19	0.0	97.3	87.0	0
	Total sample	111	42.8	1.5	7.6	2.7	1.7	32	4.7	98.4	85.0	26

a. Ghana: Mainly poultry.
Togo: Mainly pigs, goats, and poultry.
Niger: Mainly sheep, goats, cattle, donkeys, camels, and poultry.

Fig 1. LINKAGES BETWEEN RESEARCH COMPONENTS, SOME OUTPUTS AND PROJECTIONS

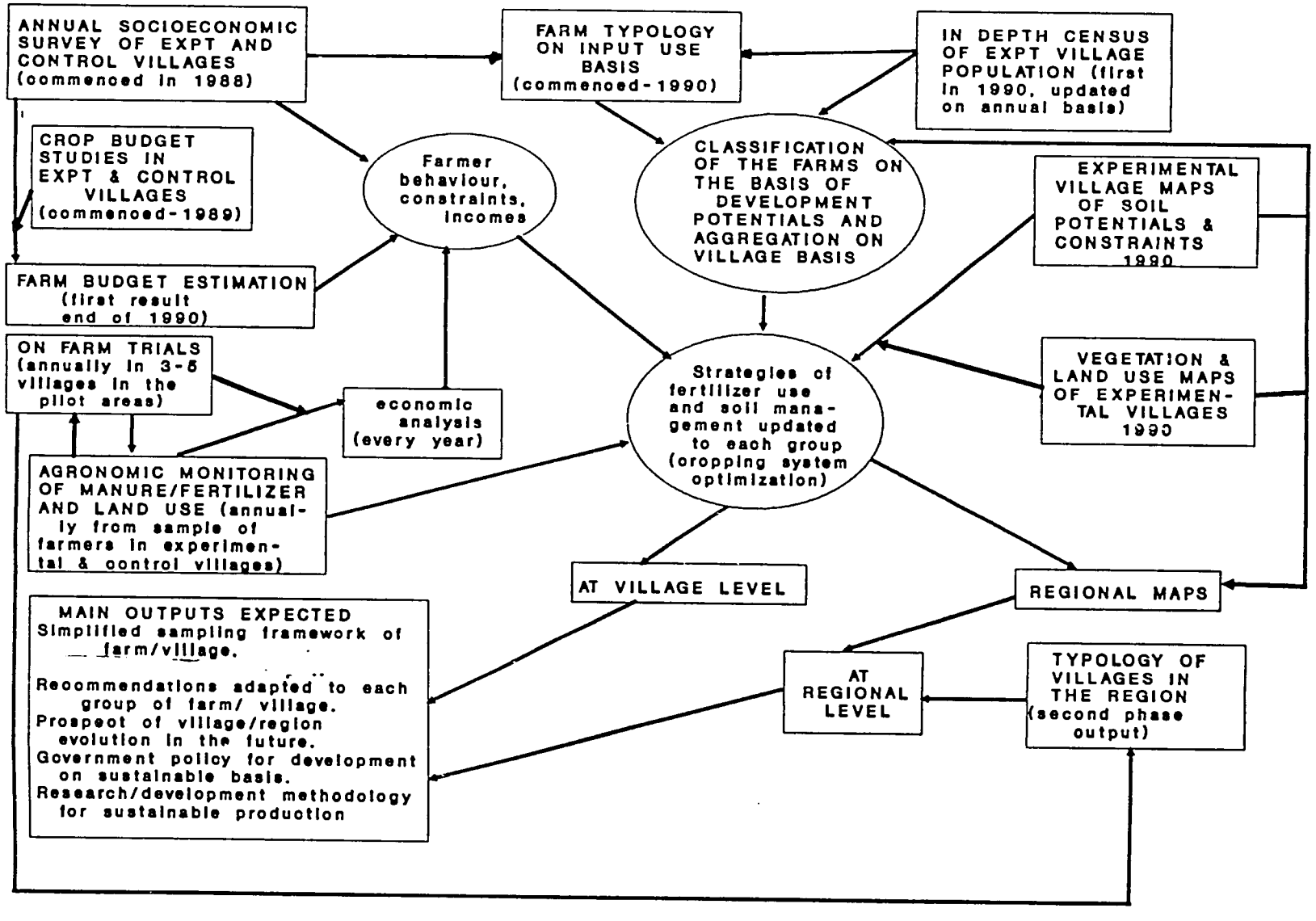
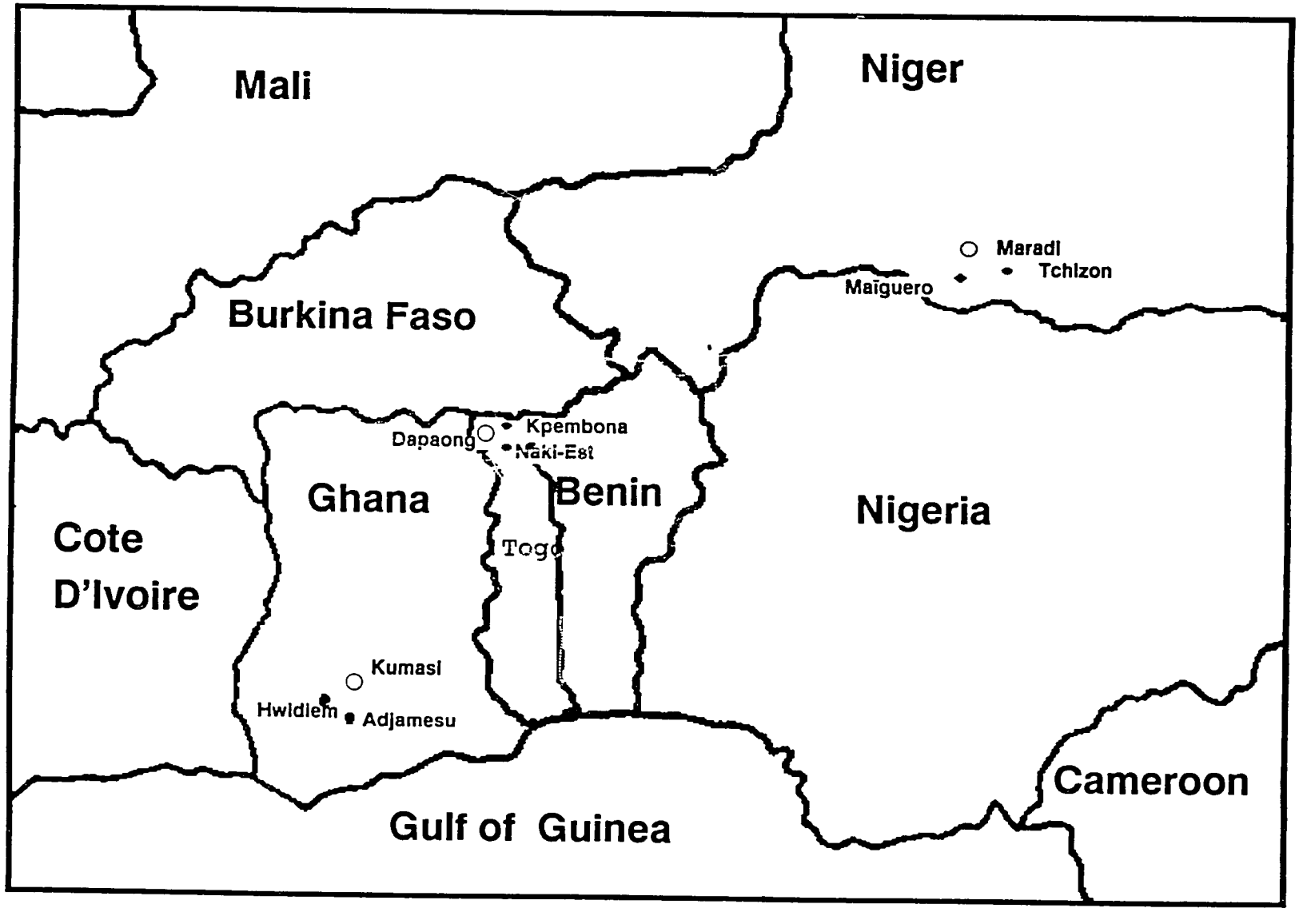


Fig 2. **Location of Research Regions and Villages**



○ Regional Capital

● Research Village

Fig 3. EVOLUTION OF THE AGRO-ECONOMIC PROGRAM

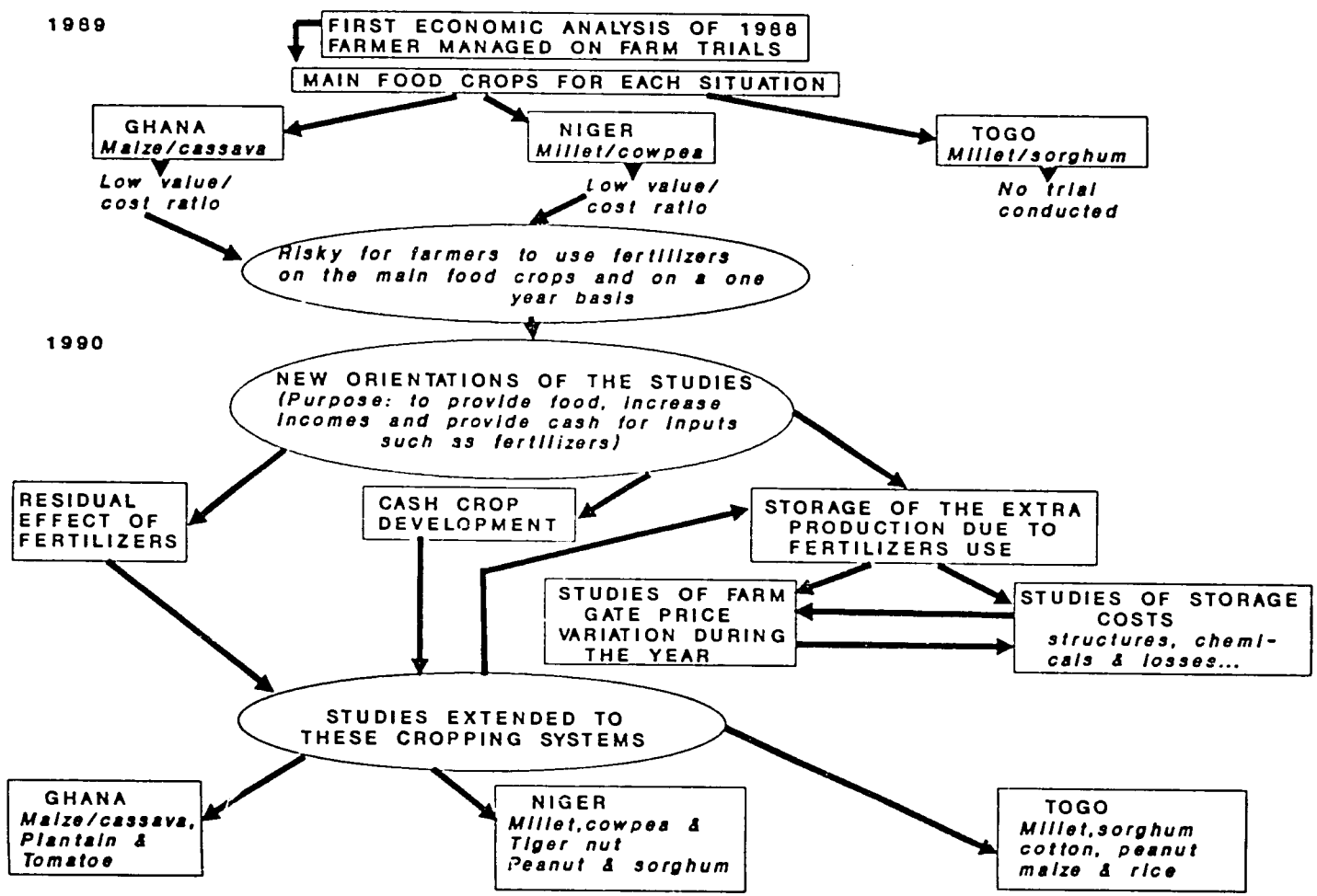


Fig 4. Soil Fertility Restoration Fertilizer Options Evaluation. Togo

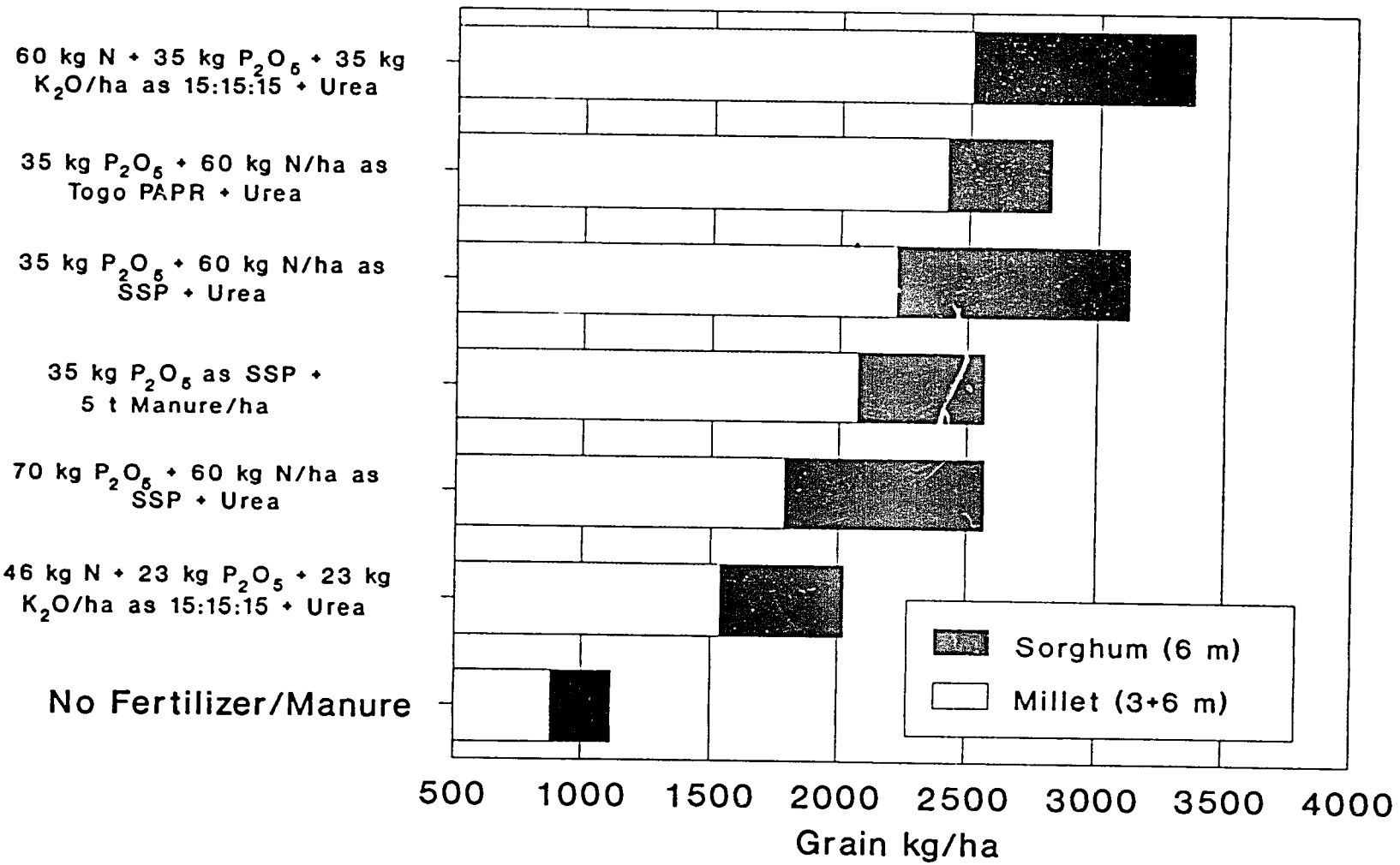


Fig 5. Soil Fertility Restoration
Maize Yield Analysis
Village Level Fertilization

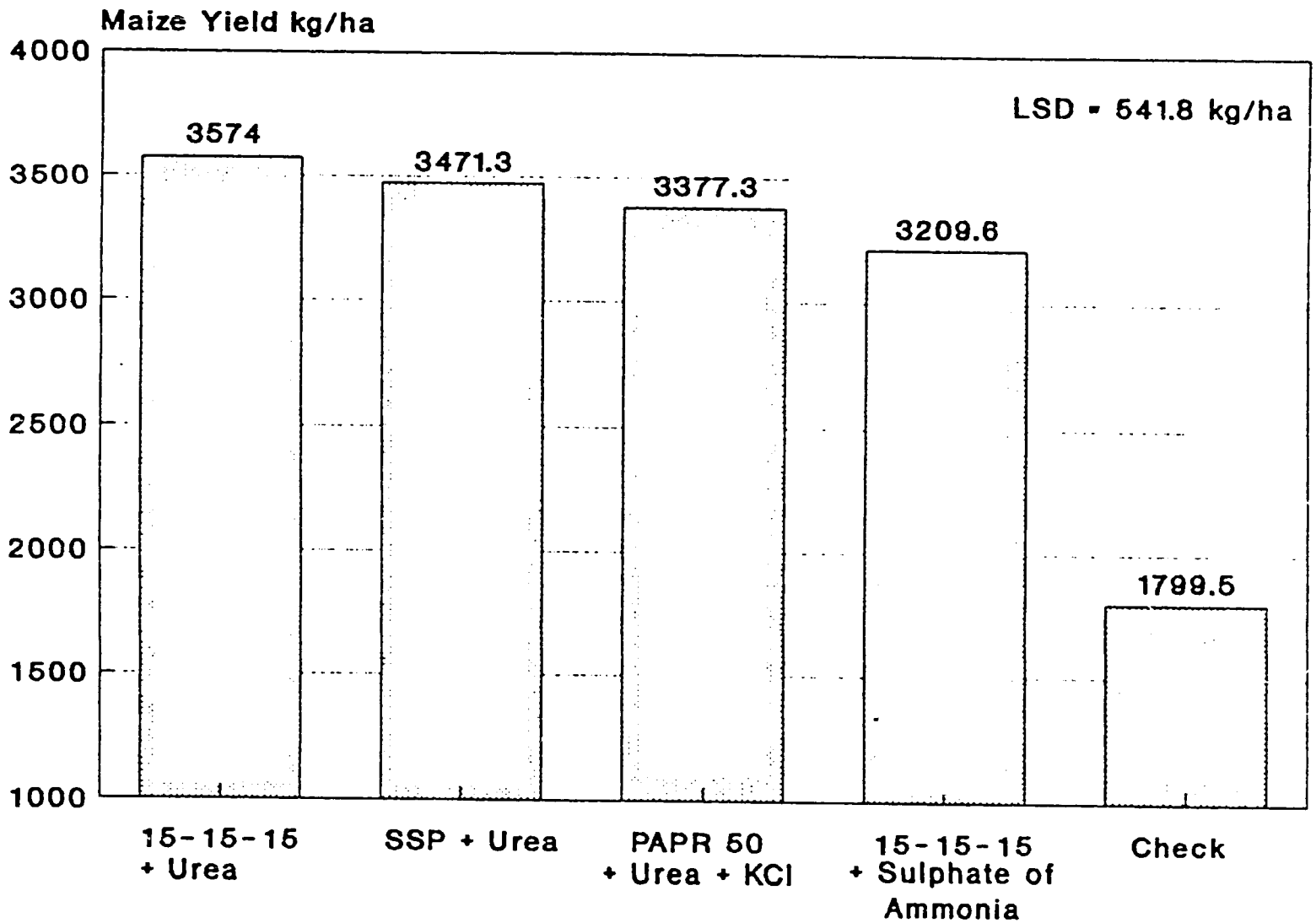


Fig 6. Soil Fertility Restoration.Ghana
Maize Yield Analysis
Distance From Village Evaluation

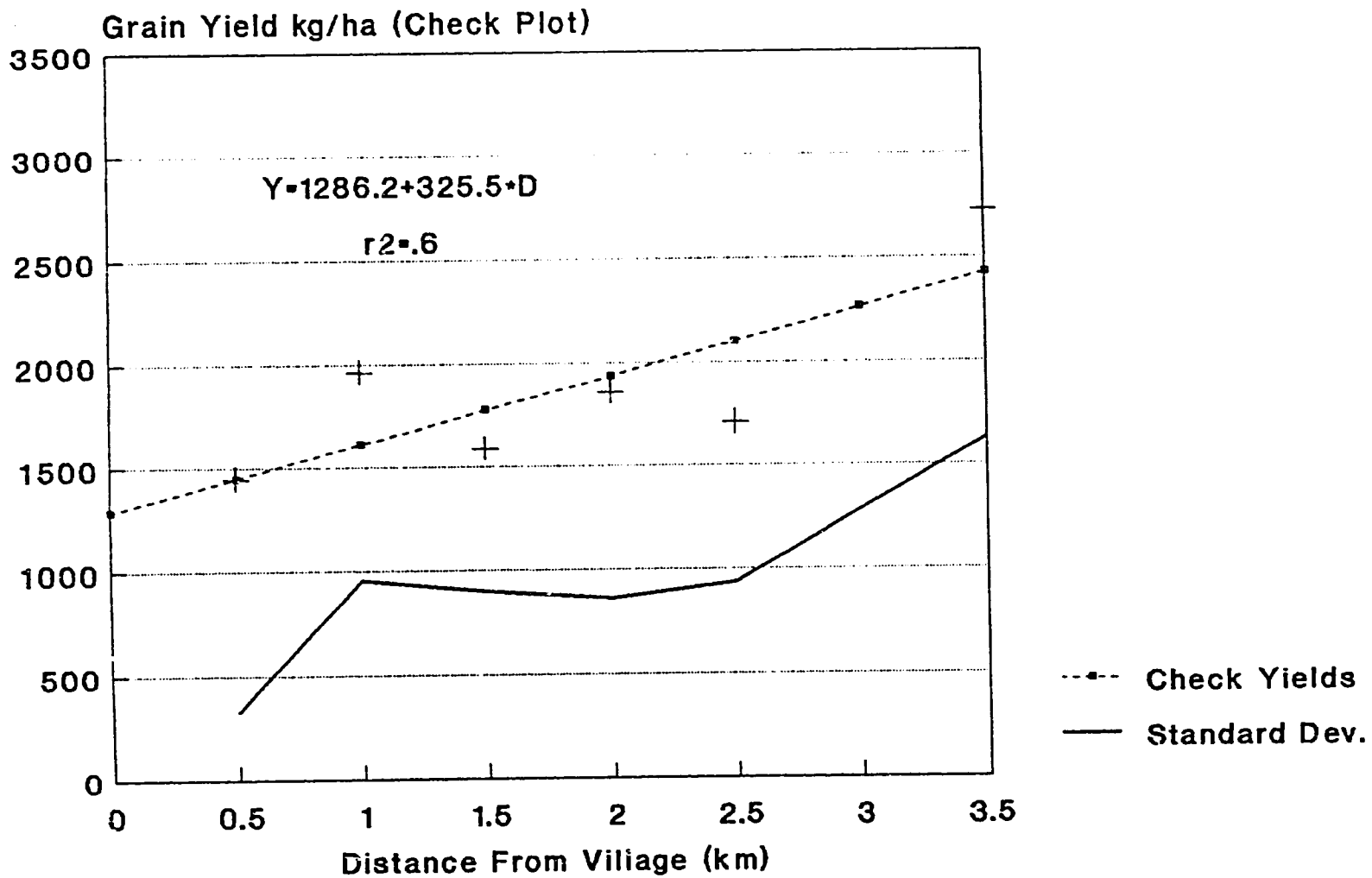


Fig. 7

SCHEDULE OF SOCIOECONOMIC SURVEYS 1988 - 1992

Activity | **Purpose**

Training in Social Survey ⟷ **Baseline Survey (1988)**

- Validate Results of Exploratory Survey
- Baseline agro socioeconomic data for project monitoring and evaluation

. Project Fertilizer delivery ⟶

. Farmer Association (FA) Fertilizer Revolving Fund (FRF) ⟶ **Farm Survey I (1989)**

Evaluate:

- Initial Impacts of Project Interventions
  - Crop Yields
  - Labor use
  - Harvest Utilization and disposal

. Village Census ⟶ **.Farm Survey II . Focus Interv. FRF 1990**

Assess:

- Emergent patterns of resource (land, labor etc) acquisition and utilization
- Operations and performance of FA and FRF
- Demographic structure of sample villages

Farm Survey III 1991

Examine:

- Differential impacts of Project
- Levels of Fertilizer use
- Farmers Investment Behaviour
- Changing roles of women.

. Village Census ⟶ **Community / Farm Survey 1992**

Socioeconomic Impact Assessment (ex-post):

Assess Changes in:

- Food Production and consumption levels
- Patterns of Land Use
- Status and Future of FA & FRF
- Demographic Structure
- Migratory Patterns
- Resource acquisition, and utilization
- Income levels
- Off Farm employment
- School Enrolment, service availability, etc.
- Perceptions' of wellbeing

APPENDIX I

AN OUTLINE OF TRAINING PROGRAMS CONDUCTED FOR NATIONAL COLLABORATORS AND FARMERS, JULY 1989-JULY 1990

INTRODUCTION

Strengthening the capacity of collaborating national research and extension personnel to: (a) monitor and evaluate ongoing pilot projects and (b) acquire the skills to initiate and execute similar projects of soil fertility restoration and maintenance as components of national agricultural development policies and programs in the near future are essential to the short- and long-term goals of the SFRP.

When field technicians have difficulty in calculating fertilizer rates or communicating effectively with farmers, it is easy to understand why a special effort should be made to train and support collaborating national research and extension personnel.

It is against this background that workshops, field days, and other formal and informal on-the-job training programs are part of annual workplans of the SFRP and organized for collaborating national research and extension personnel. Since farmers are the ultimate beneficiaries of such programs, ideas and issues that are discussed at the workshops are generally farmer oriented.

This report outlines the purpose, content, and format of workshops/seminars, and other informal on-the-job training programs organized for the SFRP counterpart staff in Ghana, Togo, and Niger during the 1989/90 project year.

Training Schedule and Participation

For the effective use of materials, knowledge, and skills acquired from the training most of the training sessions were scheduled to coincide or to immediately precede particular activities for which the particular knowledge and skills are needed. In other words, the scheduling of most training activities for each zone of SFRP was guided largely by the cropping calendar in that zone. Thus, preplanting training sessions, for example, were conducted in Ghana and Niger during the months of January and May, respectively, to coincide with the beginning of the cropping seasons in the two zones.

Table 1 summarizes the schedule of training activities and level of participation by country and Annex 1 shows a list of training participants at one of the training sessions conducted in Kumasi, Ghana.

Table 1. Schedule of Training Activities and Number of Participants by Country (July 1989-July 1990)

Country	Training Activity	Training Period[a]	Number of Participants
Ghana	Preharvest	Aug. 2- 4, 1989	27
	Farm survey	Oct. 3- 6, 1989	11
	Crop budget	Oct. 23-26, 1989	3
	Workplan w/shop	Nov. 27-29, 1989	6
	Preplanting	Jan. 16-19, 1990	27
	Village census	Feb. 26-29, 1990	6
Togo	Crop-budget	Jul. 10-13, 1989	4
	Preharvest	Aug. 15-18, 1989	19
	Farm survey	Oct. 26-28, 1989	17[b]
	Workplan w/shop	Dec. 11-13, 1989	6
	Preplanting	Mar. 20-22, 1990	14
	Village census	Jan. 2- 5, 1990	8
Niger	Preharvest	Sep. 18-22, 1989	16
	Crop budget	Oct. 1- 7, 1989	4
	Farm survey	Nov. 21-24, 1989	9
	Village census	Dec. 17-24, 1989	4
	Workplan w/shop	May 2- 5, 1990	3
	Preplanting	May 24-27, 1990	12

a. The periods specified represent the duration of the formal training. The practical component for most of the activities ran through the entire growing season.
b. Includes four farmers with some formal schooling, three of whom served as interpreters during the farm surveys.

All collaborating national research and extension personnel were eligible to participate in the training programs. However, the scope and, to some extent, the specialized nature of some topics required that training in specific skills be restricted to a small group of people who were directly responsible for particular work. Thus, training in data collection for crop budget studies, which involved fortnightly visits to a relatively small sample of farmers, was restricted to fewer than five counterpart staff in each location of SFRP.

Training Facilitators and Methods

IFDC-A/SFRP scientists and the leadership of collaborating national research (Soil Research Institute) and extension institutions (Ministry of Agriculture) led the training sessions in all the three locations of SFRP. In

a few instances, however, subject-matter specialists, in particular from the Department of Cooperatives and Postharvest Technology Unit, were invited to lead in some discussions and offer practical demonstration lessons, respectively (See Annex 2 for a list of training facilitators).

Methods used in the training sessions were generally eclectic, including a balanced mix of theory (lectures) and practice (fieldwork), due largely to the multidisciplinary and multlifaceted nature of SFRP. In the main, one or a combination of the following approaches were used depending on subject-matter content, experiential background of participants, and training location:

- Workshops/group discussion--cooperative.
- Case studies and lectures--trainer-dominant.
- Role-play, surveys, and field demonstration--learner-dominant.

Training Activities

1. Preparation of Workplan and Budget

The objective was to improve the skills of participants in the design of workplans and budget to support in-country programs. Participation was, however, restricted to senior-level counterpart staff (the in-country coordinators and their immediate assistants).

Activities at the workplan workshop centered on:

- Appraisal of all in-country field programs initiated during the year.
- Evaluation of in-country equipment and supplies.
- Preparation of workplans and budget for the ensuing year, 1989/90.

Overall, 15 persons benefited from three workshops that were organized in Lome at different time periods for senior-level counterpart staff from Ghana, Togo, and Niger. Each of the three workshops lasted for about 3 days.

2. Preplanting Training

As the name implies, this activity marked the beginning of the SFRP 1989/90 field programs in the three zones, hence, scheduling was guided by the cropping calendar operative in each zone. The objective was to explain in significant detail and train participants for the series of preplanting and postplanting activities outlined in the workplans. All counterpart senior and support staff were eligible to participate in both the agronomic and socioeconomic components of the training.

(a) Agronomic Aspects--The agronomic part of the workshop had a theoretical (formal/classroom) and followup practical component. The former focused on the following:

- Review of work done in 1988/89.
- Design and field layout of P option plots, farmer-managed and researcher-managed on-farm trials.
- Soil sampling and characterization.
- Calculation of fertilizer rates and methods of fertilizer application.
- Fertilizer storage.
- Field observation and data collection.

Copies of protocols designed in collaboration with the in-country coordinators at the workplan workshops were made available to participants and discussed in significant detail. Guidelines and recording materials for the range of agronomic variables to be monitored were also provided for use at appropriate times during the cropping season.

With regard to the practical component, participants were given the opportunity at appropriate times during the cropping season to practice some of the skills and knowledge acquired during the formal training sessions. All activities were supervised by IFDC/SFRP scientists and senior members of counterpart staff.

(b) Socioeconomic Aspect--To get farmers to adopt and use agricultural technologies, such as fertilizers on a sustainable basis. The change agent should be able to perceive farmers' problems, develop good relations with farmers, communicate effectively, and offer timely and useful advice. Unfortunately, a significant proportion of counterpart staff have had very little or virtually no training in the social sciences. Therefore, materials for the socioeconomic aspect of the training were designed to correct some of these deficiences. Specifically, this aspect of the training program was designed to enhance participants' understanding of:

- The essential elements and processes in the transfer of fertilizer-use technology.
- The sequence of change agent roles, possible areas of role strain and role conflict, and how to circumvent them.

Flip charts, case studies, excerpts, and relevant data from the 1988 baseline survey were used to explain the process of innovation diffusion with special emphasis on how the change agent can influence the rate of

adoption at each stage of the diffusion process. In addition, relevant reference and supplementary reading materials (see Annex 3) were made available to participants after detailed discussion of their contents and other related issues. Fifty-three counterpart staff participated in three preplanting training programs organized separately in each of the three locations of SFRP.

Crop Budget Studies

Attempts to understand the impacts of fertilizer use on crop production should logically include a relatively in-depth and continuous assessment of how alternative interventions would impact on the farming household. Obviously, this would require the collection of data beyond the conventional socioeconomic variables.

Therefore, the objectives of the training program in crop budget studies were: (a) to explain to participants the rationale behind the range of agro-socioeconomic variables to be monitored during and after the cropping season and (b) how to organize and collect reliable and valid information from the study sample. In this regard, participants were formally trained in:

- Interviewing and recording techniques.
- Demarcation and measurement of subplots.
- Use of scales to measure crop yields.
- Methods of collecting labor data and food prices at the market and farmgate.

Subsequent informal on-the-job training for selected counterpart staff emphasized the need for precision in recording information on forms provided (Annex 4). The activitiy continued throughout the entire growing season.

Preharvest Training

As a logical followup to the preplanting training program, the objective of the preharvest training seminars was to train participants on: (a) methods of collecting yield data and soil samples from trial plots, and (b) state-of-the art techniques to minimize post-harvest losses. To this end, the discussions and pratical demonstrations, among others, focused on:

- Demarcation of subplots.
- The use of scales and moisture-meters.
- Management of crop residue.

- Postharvest soil sampling and characterization.
- Problems of soil erosion on trial plots.
- Postharvest crop management.

The practical aspect of the training, which lasted several days, included the collection of soil samples from trial plots, drying and weighing of yield samples, and the management of crop residue. These were supervised largely by senior members of counterpart staff.

Concerning postharvest crop management, subject-matter specialists were on hand in Ghana and Togo to lead training participants through improved techniques to minimize postharvest losses through the use of indigenous materials.

Village Census and Farm Survey

The purpose of the training for the two separate activities was to improve the interviewing skills of the participants while ensuring the collection of valid and reliable data for project monitoring and evaluation. Since several counterpart staff members, regardless of project location, have had virtually no formal training in socioeconomic surveys prior to the inception of the SFRP, all were eligible to participate in both the theoretical and practical aspects of the training.

Participation in the actual surveys was, however, restricted to participants who performed well at the practice interviews that followed the formal training sessions. In Togo, a few farmers who had the potential to be selected as interpreters were invited to participate in the training. Topics discussed at the training sessions included the following:

- Purpose of socioeconomic surveys in the SFRP.
- Shortcomings of the 1988 baseline survey.
- Techniques of interviewing:
    - interviewing skills.
    - reading the questionnaire.
    - handling probing and contingency questions.
    - recording responses.
    - confidentiality.
    - Practice interviews.

Participants were instructed on the need to (a) arrange and honor appointments with farmers and (b) select a suitable location and how to

conduct themselves during the interview. They were also tutored on how to win the confidence of farmers and establish a good rapport during the interview.

The difficulty in obtaining accurate data on "culturally sensitive" variables, such as number of children ever born, number of animals owned, off-farm earnings, crop output, etc., from farmers is well-known. Therefore, participants were tutored in the use of unobtrusive methods as well as indigenous weights and measures to extract and record information.

The practical aspect of the training was designed to identify and correct individual deficiencies during the actual farm and census surveys. Completed questionnaires were reviewed as they were turned in and individual shortcomings emanating either from misreading/misinterpretation of the questionnaire, or "misrecording" of responses were discussed and corrected. Overall, 33 counterpart staff members, including three farmers from Togo who served as interpreters during the surveys, benefited from the training.

Training of Farmers

Training at this level in all three locations of SFRP was organized and supervised by the in-country coordinators. However, there was some occasional backstopping by IFDC-A/SFRP scientists.

The objectives were: (a) to advise and demonstrate to farmers how to use recommended technologies and (b) to learn at first hand actual farmer conditions and needs in the process of adopting the recommended fertilizers.

At specific time periods during the year, field days, village meetings and small group discussions, and scheduled visits to farmers' fields and experimental plots were organized by the in-country coordinators and their support staff during which one or a combination of the following skills were taught:

- Fertilizer handling and storage.
- Fertilizer application.
- Storage and use of improved seeds.
- Postharvest crop management.

In Ghana and Togo, postharvest technologists were invited to advise and guide farmers on the construction of improved storage structures for cereals (maize, millet, sorghum) and other farm produce. An estimated 850 farmers from the three zones benefited from these learning activities.

CONCLUSION

Two years of fieldwork has clearly established that training support on a continuing basis is absolutely essential at all levels to improve the professional competence and confidence of national collaborators of the SFRP. Efforts by the project in this regard have been very useful and rewarding. Many useful lessons are being learned. The training/workshop format, for example, encouraged integration of lectures, small group activity, and fieldwork. In this way, the teacher was no longer "merely the one who teaches," but one who is also taught during the dialogue with students.

It would, however, be difficult to measure the effectiveness of the series of workshops and training activities in quantitative terms. Nonetheless, preliminary examination of the 1989/90 field data available suggests a significant improvement over the previous year's work with regard to quality, although there is still room for improvement. Also, there are indications that the frequency of contact has improved considerably in the study villages and, above all, there is an increasing awareness among collaborators about the interdependence of research and extension in programs of agricultural research and development, in particular, those that deal with technology evaluation and transfer.

Annex 1

SOIL FERTILITY RESTORATION PROJECT

PRE-HARVEST TRAINING AND FIELD VISITS

August 2 - 4, 1989

List of Participants

Name	Station	Position
1. Baffour A. Michael	Adjamesu	Technical Officer (TO)
2. E. Gyamfi-Mensah	Adjamesu	T. O. Min.of Agri.(MOA)
3. A.B.Mensah	Adjamesu	T. O. (MOA)
4. James Doku	Adjamesu	T. O. (MOA)
5. Peter Amoako	Boamang	T. O. (MOA)
6. K. Boateng Dankwa	Kumasi	Research-Asst. (MOA)
7. E. R. Rhodes	IFDC-A, Lome	Agro./Team Leader
8. D. Pierre	IFDC-A, Lome	Soil Scientist
9. K. Acheampong	IFDC-A, Lome	Sociologist
10. P. K. Gyapong	Adjamesu	T. O. (MOA)
11. Asamoah A. K.	Anyinasuso	T. O. (MOA)
12. E. A. Aquaye	Kumasi	Research Asst. (MOA)
13. I. A. Arthur	Kumasi	Post-harvest Technologist. (MOA)
14. A. T. Halm	Soil Research Institute (SRI)	Director
15. E. Ampofo Akuffo	SRI Kwadaso	Laboratory Technician
16. R. Nuhu Issaka	SRI Kumasi	Asst. Research Officer (ARO)
17. Daniel Allotey	SRI Kwadaso	A.R.O
18. K. O. Asubonteng	SRI Kwadaso	Research Officer (RO)
19. S. Boah	SRI Kwadaso	A.R.O.
20. J. Osei Kwabena	SRI Kwadaso	Chief Techn. Officer

21. S. Nkrumah	SRI Kwadaso	S.T.O (Lab.)
22. S. Kyei Baffour	SRI Kwadaso	S.T.O (Field)
23. Mary J. Asiedu	Kumasi	T.O. (MOA)
24. Kingsley Nkrumah	Hwidiem	T.O. (MOA)
25. E. A. Dennis	SRI Kwadaso	S.R.O
26. Faustina Mensah	Kumasi	S.T.O (MOA)
27. P. Agyili	SRI Kwadaso	Pedologist

Annex 2

SOIL FERTILITY RESTORATION PROJECT

TRAINING OF COUNTERPART STAFF

LIST OF FACILITATORS

IFDC - AFRICA/SFRP

Dr. E. R. Rhodes, Agronomist/Team Leader

Mr. D. Pouzet, Agro-Economist

Dr. K. Acheampong, Rural Sociologist

Mr. J. Lamers, Extension Agronomist

Mr. K. Alognikou, Research Assistant (Agronomy)

Mr. A. Sakiti, Research Assistant (Sociology)

Miss A. N'Danou, Research Assistant (Agro-Economics)

GHANA

Mr. S. Y. Opoku, Agronomist/In-Country Coordinator

Mr. P. Agyili, Pedologist

Mr. E. A. Dennis, Soil Scientist

Mr. K. Dartey, Chief Technician

Mr. I. Arthur Post-Harvest Technologist

TOGO

Mr. F. Dali, Soil Scientist/In-Country Coodinator

Mr. P. Abo, Extension Agronomist

Mr. K. Abalo, Agronomist

Mr. D. Koussa, Agro-Economist

NIGER

Mr. M. Gaoh, Soil Scientist/In-Country Coordinaror

Mr. M. Zarafi, Agro-Economist

Mrs. H. Zarafi, Sociologist

Mr. B. Abdouramane, Agri. Advisor/Cooperatives

Annex 3

SOIL FERTILITY RESTORATION PROJECT

PRE-PLANTING TRAINING

ADDITIONAL ROLES OF THE TECHNICAL OFFICER (CHANGE AGENT)

January 16-19, Kumasi, Ghana

Handout 1

SOIL FERTILITY RESTORATION PROJECT (SFRP)
ADDITIONAL ROLES OF THE TECHNICAL OFFICER

INTRODUCTION

Our effort to transfer fertilizer use technology to farmers should be seen as a cooperative enterprise involving the change agency (IFDC-A), the change agent (Technical Officers (TOs)) and the client system (the farmers) See Fig 1. Our success will therefore depend upon the extent to which we understand and perform our respective roles. In this regard, the TO will be required to perform other activities in addition to providing the vital link between IFDC-A/SFRP and the farmers. Following is an outline of some of the additional roles the TO is expected to play.

1. Develop need for behavior change:

One of the initial tasks of the TO in the fertilizer-use technology transfer process is to appreciate and impress upon farmers the need to modify their farming practices. Although farmers are most of the time aware of their problems, they need to be constantly reminded about the need for behavior modification. It is therefore very important for the TO to discuss with, and remind farmers about some of the negative consequences of the current farming practices. It is also essential for the TO to reason with farmers why some of the known alternatives of solving the problem of declining soil fertility (eg. land

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fallow) may not be feasible in the current circumstances. In so doing it is equally important to impress upon farmers that they are capable of confronting the problem through judicious use of chemical fertilizers and soil amendments.

2. Establish credibility with farmers:

Having convinced farmers about the crucial role fertilizers can play in solving the problem, the TO must build on the rapport established with farmers. Success in this endeavor will depend largely upon the extent to which farmers perceive you as credible and competent. The TO also needs to develop empathy for farmer's needs and problems. By all means you must be accepted by the farmers before they accept the technology being promoted.

Farmers look for two forms of credibility in the TO: <u>competence credibility</u> (ie, the degree to which farmers perceive you as knowledgeable about the proposed solution to the well-identified problem), <u>safety credibility</u> (ie., the degree to which farmers perceive you as trustworthy). To a large extent the project has helped to establish the latter (safety credibility) through the 1988 On-Farm-Trials and the subsequent Field Day. Also, the fact that some of you are "field testing" /using the various fertilizer combinations recommended for farmers will also help to allay some of the fears and scepticisms of the "doubting Thomases". You can also demonstrate and enhance further your competence credibility by

thinking through with, and suggesting workable solutions to such common problems as rapid weed growth, that farmers may encounter in their fields. Quite often farmers will approach you with problems whose solutions may not be readily available. On such occasions it will be advisable to confer with your immediate supervisors or national coordinator before you suggest any solution to the problem at hand. Determining the recommended fertilizer combination for different plot sizes, for example, is one area where farmers may soon put your competence credibility to a test. It is better to provide a delayed but correct solution to a farmer's problem than an instant but unworkable solution.

3. **Create and sustain intent to change in the farmer:**

Since a great deal of the effort of the TO is mainly directed at assisting the farmer to change or, at least modify his/her farming practices, it will be very helpful for the TO to motivate an interest in the fertilizer-use technology being transferred. Again, this can be done by constantly emphasizing the positive aspects of fertilizer use while you help to find solutions to emergent problems. The TO's success in this task is largely determined by the frequency of interaction with, or visits to the farmer.

Also, remember that at this stage the farmer is in the process of taking a stand about the importance of fertilizer use, therefore you have to help clear any doubts on the farmer's mind. Working through opinion leaders in the village, peer

networks, or small groups can be very helpful in this regard. Again remember that your success in this task will depend on the frequency of interaction you have with the farmers.

By all means, communication with the farmer should be a two-way process. The farmer should be seen as a professional who would not like to be dictated to. The TO is more likely to succeed in this crucial role by listening to rather than dictating to the farmer.

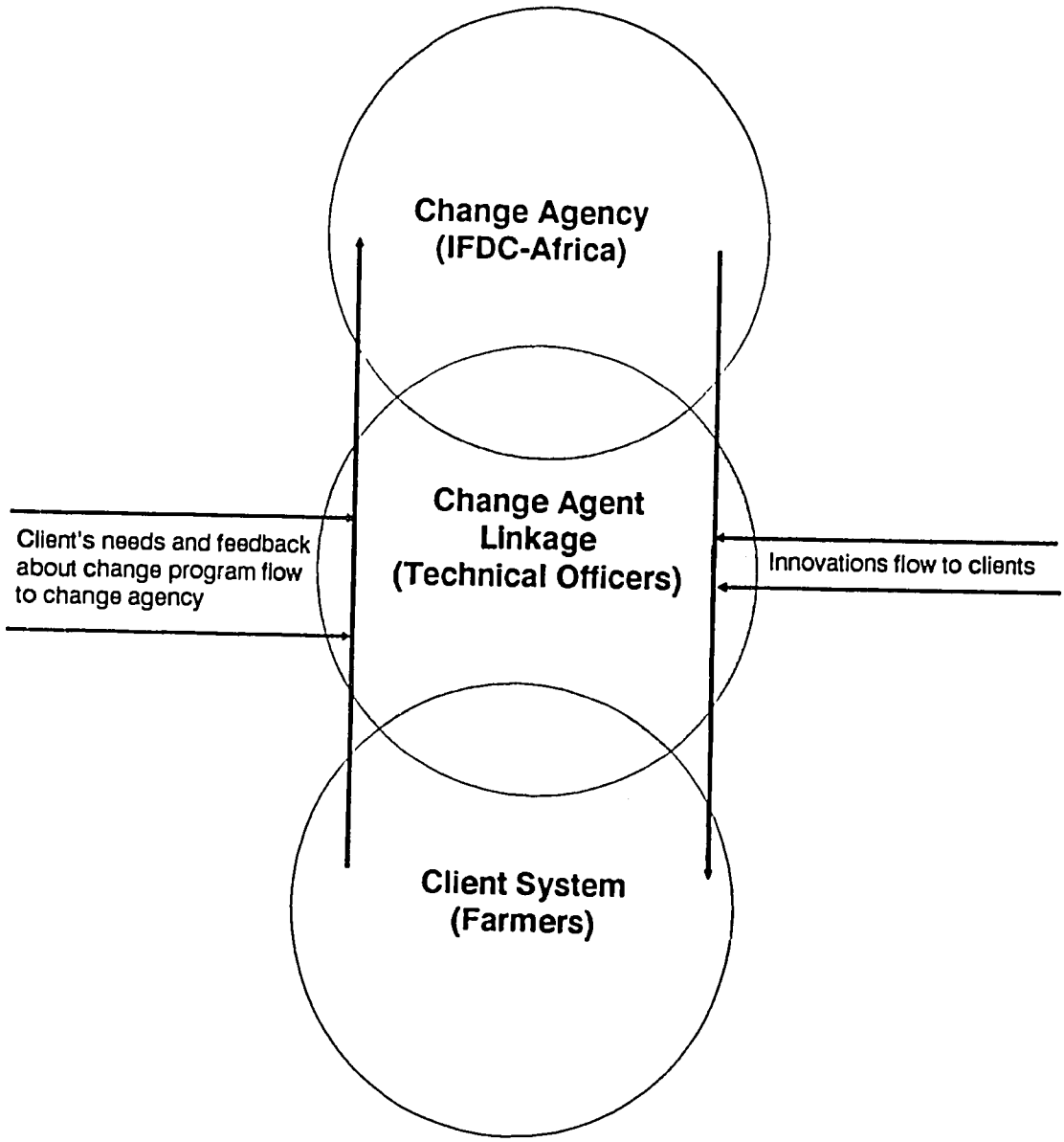
4. **Stabilize adoption, prevent discontinuance and achieve a terminal relationship:**

Once farmers have decided in favor of fertilizer use, it is incumbent on the TO to stabilize the new practice by directing reinforcing messages to farmers, thus "freezing" the new practice in farmers' minds: Drawing farmers' attention regularly to differences between crop performance (leaf color, cob size, plant height etc) on the fertilized and check plots, for example, is one of several ways to help farmers to internalize the benefits of the fertilizer-use technology.

Finally, one of the central objectives of the project is to promote fertilizer use on a sustainable basis. In other words, at some point towards the final phase of the project, farmers will be expected to assume the responsibility of procuring, distributing and applying fertilizers on their fields with little or no assistance from the technical staff. To this end, the TO will be required to assume the role of an organizer or

facilitator in creating the necessary structures/farmer associations or credit unions, that will ensure the sustainability of the new practice. Thus, the TO must seek to prepare the farmers psychologically and materially as the project progresses in order to facilitate the eventual shift from the current position of reliance on IFDC-A for fertilizer delivery and distribution, to a position of self-reliance in fertilizer and other input procurement and utilization.

Change Agents as Linkers



Adapted from E.M.Rogers (1983) "Diffusion of Innovations". Pp.314

DONNEES SUR LES CULTURES ET BUDGETS D'EXPLOITATION AU TOGO

1. IDENTIFICATION :

- Paysan : _____ Sexe : MASCULIN / FEMININ
- Croupe ethnique : _____

2. LOCALISATION :

- Pays : _____ - Village : _____

3. RESSOURCES DISPONIBLES :

31. Disponibilité en terre :

Par. N°	Distance en km	Culture	Surface en ha	Utilisation précédente	Type de * gestion
1					1 2 3 4
2					1 2 3 4
3					1 2 3 4
4					1 2 3 4
5					1 2 3 4
6					1 2 3 4
7					1 2 3 4
8					1 2 3 4
9					1 2 3 4
10					1 2 3 4

* 1 = Parcelle individuelle sous conduite d'un homme
2 = Parcelle individuelle sous conduite d'une femme
3 = Parcelle familiale sous conduite d'un homme
4 = Parcelle familiale sous conduite d'une femme

32. Disponibilité en main d'oeuvre FAMILIALE :

	Temps plein	Temps partiel
Nombre d'homme		
Nombre de femmes		
Nombre d'enfants		

4. BUDGET PARTIEL POUR LE SORGHO ET LE MIL :

41. PARCELLE DE CASE

Les renseignements suivants concernent la principale parcelle de case (une seule parcelle) cultivée en sorgho associé ou non avec du mil de 3 mois et du mil de 6 mois.

- Culture SORGHO/PETIT MIL/MIL 6 MOIS - Surface parcellaire :_____ H

- Parcelle N° : 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

A TRAVAUX CULTURAUX

TRAVAUX CULTURAUX SUR LA PARCELLE DE CASE (SORGHO+MIL 3 & 6 MOIS)	DATE		Main d'oeuvre utilisée en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Défrichement (collecte des debris + brûlis)								
Ouverture du sol pour le billonnage								
Epandage d'engrais								
Fermeture des billons								
Semis (sorgho + mils)								
Premier sarclage								
Démariage (sorgho+mils)								
1 er apport d'azote								
1 er buttage								
Second sarclage								
2nd apport d'azote								
2nd buttage								
3ième sarclage								
Autre (préciser)								

Nombre moyen d'heures de travail par jour pour la préparation du sol

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Défrichement				Buttage			
ouverture bil -lons				Autre			
Epandage des engrais							
Apport azote							
Sarclage							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

Observations sur la qualité du travail et les contraintes :

B TRAVAUX DE RECOLTE DE LA PARCELLE DE CASE

LE SORGHO

RECOLTE DU SORGHO	DATE		Utilisation de la main d'oeuvre en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Récolte des épis								
Transport des épis								
Stockage								
Coupe des tiges								
Transport des tiges								
Stockage des tiges								
Autre								

Nombre moyen d'heures de travail par jour pour le sorgho

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Récolte épis				Transport tiges			
Transport des épis				Stockage tiges			
Stockage épis				Autre			
Récolte des tiges							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

Observations sur la qualité du travail et les contraintes :

LE MIL DE TROIS MOIS

RECOLTE DU MIL 3 MOIS	DATE		Utilisation de la main d'oeuvre en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Récolte des épis								
Transport des épis								
Stockage								
Coupe des tiges								
Transport des tiges								
Stockage des tiges								
Autre								

Nombre moyen d'heures de travail par jour pour le sorgho

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Récolte épis				Transport tiges			
Transport des épis				Stockage tiges			
Stockage épis				Autre			
Récolte des tiges							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

Observations sur la qualité du travail et les contraintes :

LE MIL DE 6 MOIS

RECOLTE DU MIL 6 MOIS	DATE		Utilisation de la main d'oeuvre en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Récolte des épis								
Transport des épis								
Stockage								
Coupe des tiges								
Transport des tiges								
Stockage des tiges								
Autre								

Nombre moyen d'heures de travail par jour pour le sorgho

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Récolte épis				Transport tiges			
Transport des épis				Stockage tiges			
Stockage épis				Autre			
Récolte des tiges							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

Observations sur la qualité du travail et les contraintes :

42. PARCELLE DE BROUSSE

Les renseignements suivants concernent la principale parcelle de brousse (une seule parcelle) cultivée en sorgho associé ou non avec du mil de 3 mois et du mil de 6 mois.

- Culture SORGHO/PETIT MIL/MIL 6 MOIS - Surface parcellaire :_____ Ha
- Parcelle N° : 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

A TRAVAUX CULTURAUX

TRAVAUX CULTURAUX SUR LA PARCELLE DE CASE (SORGHO+MIL 3 & 6 MOIS)	DATE		Main d'oeuvre utilisée en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Défrichement (collecte des debris + brûlis)								
Ouverture du sol pour le billonnage								
Epandage d'engrais								
Fermeture des billons								
Semis (sorgho + mils)								
Premier sarclage								
Démariage (sorgho+mils)								
1 er apport d'azote								
1 er buttage								
Second sarclage								
2nd apport d'azote								
2nd buttage								
3ième sarclage								
Autre (préciser)								

Nombre moyen d'heures de travail par jour pour la préparation du sol

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Défrichement				Buttage			
ouverture bil-lons				Autre			
Epandage des engrais							
Apport azote							
Sarclage							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

B TRAVAUX DE RECOLTE DE LA PARCELLE DE BROUSSE

LE SORGHO

RECOLTE DU SORGHO	DATE		Utilisation de la main d'oeuvre en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Récolte des épis								
Transport des épis								
Stockage								
Coupe des tiges								
Transport des tiges								
Stockage des tiges								
Autre								

Nombre moyen d'heures de travail par jour pour le sorgho

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Récolte épis				Transport tiges			
Transport des épis				Stockage tiges			
Stockage épis				Autre			
Récolte des tiges							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

Observations sur la qualité du travail et les contraintes :

LE MIL DE TROIS MOIS

RECOLTE DU MIL 3 MOIS	DATE		Utilisation de la main d'oeuvre en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Récolte des épis								
Transport des épis								
Stockage								
Coupe des tiges								
Transport des tiges								
Stockage des tiges								
Autre								

Nombre moyen d'heures de travail par jour pour le sorgho

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Récolte épis				Transport tiges			
Transport des épis				Stockage tiges			
Stockage épis				Autre			
Récolte des tiges							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

Observations sur la qualité du travail et les contraintes :

LE MIL DE 6 MOIS

RECOLTE DU MIL 6 MOIS	DATE		Utilisation de la main d'oeuvre en jours					
			Familiale			Salariée		
	jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Récolte des épis								
Transport des épis								
Stockage								
Coupe des tiges								
Transport des tiges								
Stockage des tiges								
Autre								

Nombre moyen d'heures de travail par jour pour le sorgho

Opérations	Hommes	Femmes	Enfants	Opérations	Hommes	Femmes	Enfants
Récolte épis				Transport tiges			
Transport des épis				Stockage tiges			
Stockage épis				Autre			
Récolte des tiges							

Souligner les données vérifiées pour les distinguer des données indiquées par le paysan.

Observations sur la qualité du travail et les contraintes :

C LES TRAVAUX POST-RECOLTE

Ce chapitre concerne le sorgho et les mils quelque soit la parcelle de provenance du grain.
Les temps de battage de transport au marché et de vente doivent être indiqués en heure avec référence exacte pour chaque répétition à la quantité battue exprimée en kg de grain.
Faire 3 mesures pour chaque activité (3 répétitions).

LE SORGHO

TRAVAUX	Quantité traitée en kg de grain	DATE		Utilisation de la main d'oeuvre en heure					
				Familiale			Salariée		
		jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Battage									
Battage									
Battage									
Transport au marché									
Transport au marché									
Transport au marché									
Vente									
Vente									
Vente									

Observations :

LE MIL DE 3 MOIS

TRAVAUX	Quantité traitée en kg de grain	DATE		Utilisation de la main d'oeuvre en heure					
				Familiale			Salariée		
		jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Battage									
Battage									
Battage									
Transport au marché									
Transport au marché									
Transport au marché									
Vente									
Vente									
Vente									

Observations :

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LE MIL DE 6 MOIS

TRAVAUX	Quantité traitée en kg de grain	DATE		Utilisation de la main d'oeuvre en heure					
				Familiale			Salariée		
		jour	mois	Hommes	Femmes	Enfant	Hommes	Femmes	Enfant
Battage									
Battage									
Battage									
Transport au marché									
Transport au marché									
Transport au marché									
Vente									
Vente									
Vente									

Observations :

5. UTILISATION D'AUTRES INTRANTS (Toute culture)

Ce tableau concerne l'ensemble de l'exploitation (toute culture et toute parcelle).

INTRANTS (fumier, engrais, pesticides, matériel.....)	DATE		QUANTITE	UNITES	COUT PAR UNITE
	jour	mois			

Observations :

6. LA PRODUCTION :

61. DE LA PRINCIPALE PARCELLE DE CASE

- Variété(s) de sorgho : _____
- Variété(s) de mil 3 mois : _____
- Variété(s) de mil 6 mois : _____

Sur 2 carrés piquetés de 25 m² (5 m X 5 m) implantés dans la parcelle avec l'aide du coordonnateur, réaliser les mesures suivantes au cours du cycle :

Carré de rendement N° 1

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Carré de rendement N° 2

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Evaluation du rendement de l'ensemble de la parcelle de case :

SORGHO :

- Quantité d'épis récoltés:_____ Unité :_____ Kg/unité :_____
- Quantité d'épis stockés :_____ Unité :_____ Temps :_____

(unités selon le mode de transport : botte, bassine, charette...)

Observations :

MIL DE 3 MOIS :

- Quantité d'épis récoltés:_____ Unité :_____ Kg/unité :_____
- Quantité d'épis stockés :_____ Unité :_____ Temps :_____

(unités selon le mode de transport : botte, bassine, charette...)

Observations :

MIL DE 6 MOIS :

- Quantité d'épis récoltés:_____ Unité :_____ Kg/unité :_____
- Quantité d'épis stockés :_____ Unité :_____ Temps :_____

(unités selon le mode de transport : botte, bassine, charette...)

Observations :

62. DE LA PRINCIPALE PARCELLE DE BROUSSE

- Variété(s) de sorgho : _____
- Variété(s) de mil 3 mois : _____
- Variété(s) de mil 6 mois : _____

Sur 2 carrés piquetés de 25 m² (5 m X 5 m) implantés dans la parcelle avec l'aide du coordonnateur, réaliser les mesures suivantes au cours du cycle :

Carré de rendement N° 1

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Carré de rendement N° 2

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Evaluation du rendement de l'ensemble de la parcelle de brousse :

SORGHO :

- Quantité d'épis récoltés:_____ Unité :_____ Kg/unité :_____
- Quantité d'épis stockés :_____ Unité :_____ Temps :_____

(unités selon le mode de transport : botte, bassine, charette...)

Observations :

MIL DE 3 MOIS :

- Quantité d'épis récoltés:_____ Unité :_____ Kg/unité :_____
- Quantité d'épis stockés :_____ Unité :_____ Temps :_____

(unités selon le mode de transport : botte, bassine, charette...)

Observations :

MIL DE 6 MOIS :

- Quantité d'épis récoltés:_____ Unité :_____ Kg/unité :_____
- Quantité d'épis stockés :_____ Unité :_____ Temps :_____

(unités selon le mode de transport : botte, bassine, charette...)

Observations :

63. DES AUTRES PARCELLES (CASE OU BROUSSE) CULTIVEES EN SORGHO & MILS

- Culture SORGHO/PETIT MIL/MIL 6 MOIS - Surface parcellaire :_____

- Parcelle N° : 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

Sur 2 carrés piquetés de 25 m² (5 m X 5 m) implantés dans la parcelle avec l'aide du coordonnateur, réaliser les mesures suivantes au cours du cycle :

Carré de rendement N° 1

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Carré de rendement N° 2

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Observations :

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- Culture SORGHO/PETIT MIL/MIL 6 MOIS - Surface parcellaire :_____ Ha

- Parcelle N° : 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

Sur 2 carrés piquetés de 25 m² (5 m X 5 m) implantés dans la parcelle avec l'aide du coordonnateur, réaliser les mesures suivantes au cours du cycle :

Carré de rendement N° 1

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Carré de rendement N° 2

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

<u>Observations :</u>

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- Culture SORGHO/PETIT MIL/MIL 6 MOIS - Surface parcellaire :_____

- Parcelle N° : 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

Sur 2 carrés piquetés de 25 m² (5 m X 5 m) implantés dans la parcelle avec l'aide du coordonnateur, réaliser les mesures suivantes au cours du cycle :

Carré de rendement N° 1

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Carré de rendement N° 2

Mesures	Sorgho	Mil 3 mois	Mil 6 mois
Nombre de poquets après démariage			
Nombre de plantes après démariage			
Nombre d'épis à la récolte			
Poids total épis en kg			
Poids total de grain en kg			

Observations :

7 VENTE DU GRAIN

71 SORGHO

Lieu de vente *	Date		Quantité	Unité	Prix (fcfa/unité
	jour	mois			

* Au village, au marché (préciser quel marché...).

Observations :

72 MIL DE 3 MOIS

Lieu de vente *	Date		Quantité	Unité	Prix (fcfa/unité
	jour	mois			

* Au village, au marché (préc ser quel marché...).

bservations :

73 MIL DE 6 MOIS

Lieu de vente *	Date		Quantité	Unité	Prix (fcfa/unité
	jour	mois			

* Au village, au marché (préciser quel marché...).

Observations :

8 TRANSFORMATION ET VENTE SOUS FORME DE BOISSON

Lieu de vente *	Date		Quantité fabriqué		Travail en heure			Vente	
	jour	mois	kg grain	l bière	Homme	femme	enfant	Litres	fcfa*

Au village, au marché (préciser quel marché...)
Prix obtenu pour la quantité totale vendue.

Remarque : La différence entre la quantité de boisson fabriquée et vendue correspond à l'autoconsommation du ménage.

Observations :

APPENDIX II

A Report on the Baseline Survey of the SFRP in the Savanna Region of Togo

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Carlos A. Baanante, Economist
Konadu Acheampong, Rural Sociologist
Edward Rhodes, Agronomist
Denis Pouzet, Agricultural Economist
Koffi E. Melebou, National Project Coordinator

IFDC

International Fertilizer Development Center

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A REPORT ON THE BASELINE FARM SURVEY OF THE SOIL FERTILITY RESTORATION PROJECT (SFRP) IN THE SAVANNA REGION OF TOGO

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May 1990

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A REPORT ON THE BASELINE FARM SURVEY OF THE SOIL FERTILITY RESTORATION PROJECT (SFRP) IN THE SAVANNA REGION OF TOGO

Summary

Demographic Characteristics and Locations of Households

1. The 1988 SFRP baseline data for Togo were collected in the Savanna Region in the villages of Naki-Est and Kpembona. Of the 125 farmers interviewed, 29 were women. The survey generated data on gender; cultural groups; marital status; household location and composition; education; employment; land availability and tenure; the use of machinery; animals, equipment, and credit; sources of information about fertilizers; crop areas and management; the use and costs of fertilizers; organic manures; crop residues; the use and cost of labor; disposal and use of crop production; and finally, the perceptions of farmers about constraints to fertilizer use and agricultural production.
2. The sample households tend to be extended families with age and gender distributions that allow meaningful comparisons between men and women farmers of various ages.
3. The salient feature of schooling in the sample region is that it is minimal, although on the average men have more years of schooling than women. In Naki-Est men report an average of 1.4 years of schooling and women 0.5. The figures for Kpembona are 0.3 years for men and none for women.
4. Men farmers in both villages reported being closer to markets than women. The difference in the distance to markets between men and women is least in Naki-Est (0.3 km) and greatest in Kpembona (1.0 km).
5. The distances to fertilizer stores indicate that men in Naki-Est are the closest (1.5 km) and men in Kpembona the most distant (1.9 km).
6. Women in Kpembona reported their households as furthest from household plots (1.4 km) and women in Naki-Est the closest (0.9 km). In general, and on the average, the household plots in Kpembona are located at a greater distance from the village than in Naki-Est, 1.2 km and 1.0 km, respectively.

Off-Farm Employment

7. The off-farm employment of women farmers and household members substantially exceeds that of men. The total sample figures for 591 persons show that 26% of the men and 47% of the women were engaged in off-farm employment at the time of the survey. The greatest percentage of farmers engaged in off-farm employment was reported by women in Naki-Est (50.0) and men in this village reported the least (19.0). The percentage of off-farm employment among women in both villages is greater than that of men. Thus, Moba-Gourma women in the Savanna Region of Northern Togo are very active in off-farm employment, especially in Naki-Est, the experimental village.
8. Women reported an average of 6.1 months of off-farm employment and men 7.0 months. Thus, although a greater percentage of women than men are employed off-farm, the average duration of that employment is about 1 month less than that of men on an annual basis.
9. For months of off-farm employment, the greatest average is among men in Kpembona (7.1), followed by men in Naki-Est (6.7) and women in Kpembona (6.4). The shortest duration of off-farm employment is among women in Naki-Est (5.8 months). The total sample figures for the two villages show that the average months of off-farm employment in Kpembona (6.7) are somewhat greater than in Naki-Est (6.1).
10. The data for annual off-farm earnings for all farmers and adult household members indicate that the greatest earnings are by men in Kpembona (44,949 FCFA or about US $150), followed by men in Naki-Est (30,880 FCFA or about US $103) and women in Kpembona (22,246 FCFA or US $74). The least off-farm earnings were realized by women in Naki-Est, 13,667 FCFA or about US $46, whose average of months of off-farm employment is the least in the sample (5.8 months). Although the average of months of off-farm employment in Naki-Est (6.1) and Kpembona (6.7) is similar, average off-farm earnings among farmers are greater in Kpembona (30,444 FCFA or about US $101) compared with those in Naki-Est (18,936 FCFA or about US $63). Gender comparisons of off-farm income show that the mean of annual off-farm income of women (18,396 FCFA or about US $60) is substantially less than that of men (37,935 FCFA or about US $126).

11. Analysis of the data concerning the off-farm employment shows that about 42% of the total sample of farmers were engaged in such employment in 1988. The data by village indicate that the percentage of farmers with off-farm employment is greater in Kpembona (46.2) than in Naki-Est (36.7). Women farmers in Kpembona, the control village, have the highest percentage of off-farm employment (78.6) followed by women in Naki-Est (66.7). Men farmers in Naki-Est are the least engaged in off-farm employment (26.7). The percentage of men farmers with off-farm employment in Kpembona (37.3) exceeds that of Naki-Est. The percentage of women farmers with off-farm employment (72.4) substantially exceeds that of men farmers (32.3) in the Savanna Region of northern Togo.
12. On the average, men farmers with off-farm employment are employed 6.9 months per year off-farm and women farmers 5.9 months. The average of months of off-farm employment among farmers with off-farm employment is highest among men in Naki-Est (7.6) and lowest among women in Kpembona (5.7). Thus, the farmers of Naki-Est, the experimental village, appear to be more involved in off-farm employment than those of Kpembona.
13. The sample average of annual earnings from off-farm employment obtained by farmers with off-farm employment is 37,300 FCFA or about US $124. The average in Kpembona (43,179 FCFA or about US $144) substantially exceeds that of Naki-Est (29,818 FCFA or about US $99). The greatest average of off-farm earnings is observed among men farmers in Kpembona (51,412 FCFA or about US $171), followed by men farmers in Naki-Est (41,583 FCFA or about US $139) and women in Kpembona (30,455 FCFA or about US $101). Women farmers in Naki-Est reported the least earnings from off-farm employment (15,700 FCFA or about US $52/year).
14. For the total sample, 82% of the farmers and adult household members engaged in off-farm employment find such work within their respective villages. Men (89%) and women (100%) in Naki-Est pursue more off-farm employment in the village than in Kpembona where the figures are 68% and 72% for men and women, respectively. The favored place of off-farm employment outside their own village for men (14%) and women (22%) from Kpembona is Papri, a neighboring village.
15. The most frequent types of occupations of men in Naki-Est are small trade, dressmaking, basketmaking, construction, blacksmiths, and carpenters. These occupations account for about 80% of all occupations

pursued by men in the experimental village. Among women in Naki-Est, 15% pursue work in small trade and the great majority (84%) are involved in the work of beer brewing. Thus, the types of off-farm employment of men are much more diverse than those of women in Naki-Est. In Kpembona the occupations of small trade, agricultural labor, carpenter, basketmaking, repair work, and herdsmen account for over 85% of all off-farm employment pursued by men. Among women in Kpembona small trade, beer brewing, and food transportation account for over 90% of all occupations of women. Again, the types of off-farm employment pursued by men in Kpembona are more diverse than those of women.

Characteristics of Farms

16. The data clearly show that men and women predominantly manage their own plots; but more importantly, each gender may manage plots of the other in a cooperative exchange. The total sample figures indicate that the mean number of plots managed by men in the 96 households headed by men is 5.3 and that women manage an average of 2.6 plots among the 52 men farmers who head households and had women managing plots. Men managed an average of 4 plots among the 25 women farmers that had men managing plots and women managed an average of 2.7 plots among the 29 women farmers having women managing individual plots. The figures on the number of plots per farm show that the mean number of plots on farms of men (6.8) and women (6.1) is very similar.

17. Fifty-one men farmers in the control village of Kpembona have an average of 4.6 plots managed by men and 19 have an average of 2.5 plots managed by women. Among women farmers in the control village, 11 have an average of 4.5 plots managed by men and 14 have an average of 2.3 plots managed by women. In Kpembona the mean number of plots on farms of men (5.6) and women (5.9) is more equal than in Naki-Est.

18. Among men farmers in Naki-Est, 45 have an average of 6.1 plots managed by men and 33 have an average of 2.7 plots managed by women. Among women farmers in Naki-Est, 14 have an average of 3.5 plots managed by men and 15 have an average of 3.1 plots managed by women. The data on the number of plots per farm indicate that the mean number of plots on farms of men (8.1) is greater than that of women (6.4).

19. The total sample figures show that 96 men farmers have an average of 3.6 ha managed by men and 52 have an average 0.7 ha managed by women. Among women farmers, 25 have an average of 2.7 ha managed by men and 29 have an average of 0.7 managed by women. The total sample figures also show that the average crop area on farms of men (3.9 ha) is greater than that of women (3.0 ha).

20. Among men farmers in Naki-Est, 45 have an average of 3.6 ha managed by men and 33 have an average of 0.7 managed by women. The average crop area per farm managed by men in Naki-Est (4.1 ha) is substantially greater than that of women (2.7 ha).

21. In Kpembona, 51 men farmers have an average crop area of 3.6 ha managed by men and 19 have an average of 0.7 ha managed by women. Among women farmers in this village, 11 have an average of 3.5 ha managed by men and 14 have an average of 0.5 ha managed by women. The average crop areas of farms managed by men (3.8 ha) are somewhat larger than those managed by women (3.3).

22. It is evident that the majority of land cultivated by men is family owned but among women the majority is individually owned. A striking contrast is evident in that 66% of the area managed by men and only 10% of the area managed by women is family owned. Men also borrow a greater percentage of the land under their management for family use than women, 16% and 5%, respectively. Women are far more likely than men to own land for individual use, 58% and 15%, respectively. Land that is borrowed for individual use by women (58%) also exceeds that of men, a mere 2%. The use of rented land by men and women farmers is minimal, about 1%.

23. Men in Kpembona borrow a greater percentage of the total area under their management for family use than in Naki-Est, 20% and 12%, respectively. About 15% of the total area managed by men in both villages is individually owned. The percentage of the total area that is borrowed by individual men in Naki-Est (4%) and Kpembona (2%) is minimal, as is rented land in Kpembona (1%).

24. Women in Kpembona reported a higher percentage of the total area under their management as family owned compared with Naki-Est, 12% and 9%, respectively. The percentage of the total area managed by women that is family borrowed (13%) is much greater than in Kpembona (2%). The percentage of the total cultivated area managed by women that is

individually owned in Naki-Est (59%) is somewhat greater than in Kpembona (54%).

25. Women farmers in Naki-Est reported a far greater percentage of land under their management as individually borrowed (30%) than women in Kpembona (19%). Land rented for individual use by women in Kpembona accounts for 2% of the total area under their management and in Naki-Est women reported no land as individually rented.

26. The figures for the total sample indicate that the ownership of agricultural equipment is limited to men, specifically to men in Naki-Est. The percentage of women reporting ownership of hand tools (93%) is somewhat less than men (100%). The percentage of women reporting ownership of animals (about 90%) is also less than men (98%).

27. About 16% of the men farmers in Naki-Est reported ownership of agricultural equipment and women reported no such ownership, as did men and women in Kpembona. Men in Naki-Est and men and women in Kpembona all reported ownership of hand tools. However, about 13% of the women farmers in Naki-Est reported no ownership of hand tools.

28. Men in Naki-Est (98%) are somewhat more likely than women (93%) to own animals. The corresponding figures for Kpembona are 98% and 86%, respectively. Concerning hand tools, the data show that the average number of tools owned by men in Naki-Est (4.3) exceeds that of women (2.8); but it should be noted that women generally cultivate a smaller area than men. The same principle applies to Kpembona where men farmers own an average of 4.5 hand tools and women 2.6. The total sample figures show that on the average men farmers own 4.4 hand tools and women farmers 2.7.

29. In both villages the average ownership of animals by men significantly exceeds that of women. The average number of animals owned by men in Naki-Est, about 38, is more than three times that of women, about 11. The same principle applies to Kpembona where men own about 36 animals on the average and women about 12.

30. The total sample figures for farmers show the following summary observations: on the average, men farmers have more formal schooling (0.8 years) than women (0.2 years); the percentage of women (72%) engaged in off-farm employment greatly exceeds that of men (32%); the average crop area per farm for men (3.9 ha) is greater than that of women (3.0 ha); the percentage of men (7%) reporting ownership of

agricultural equipment is minimal but women reported no such ownership; men (100%) are more likely than women (93%) to own hand tools; women on the average own fewer hand tools than men, 2.7 and 4.4, respectively; men (98%) are also somewhat more likely than women (90%) to own animals; and the average number of animals owned by men (37) is about three times greater than the average owned by women (12).

31. The total sample area of 287.4 ha and 443 plots shows an average plot area of 0.65 ha. Women manage a sample area of 20.70 ha or 7% of the total sample area. Men manage a sample area of 266.7 ha or 93% of the total sample area. The total sample average plot area in Kpembona (0.74 ha) is greater than in Naki-Est (0.57 ha).

32. Among men farmers in Kpembona with 179 plots, the average plot area is 0.82 ha based on a sample area of 146.8 ha. Men in Naki-Est with 189 plots show an average plot area of 0.63 ha based on a sample area of 119.9 ha.

33. The 42 plots managed by women in Naki-Est represent a sample area of 11.4 ha and an average plot area of 0.27 ha. The 33 plots managed by women in Kpembona represent a sample area of 9.3 ha and an average plot area of 0.28 ha. Thus, with fewer plots in Kpembona, the total sample area and thus the average plot area are greater than in Naki-Est.

Crops and Cropping Systems

34. In Naki-Est the most frequent crops cultivated by men are cotton, peanuts, and intercropped millet-sorghum. These crops account for 44% of crops on all plots. The favored crops of women in the experimental village are cotton, peanuts, rice, and millet that account for 63% of crops on all plots.

35. The most frequent crops cultivated by men in Kpembona are sole crops of cotton and peanuts and intercrops of millet-sorghum, millet-cowpeas, and millet-sorghum-cowpeas. These account for 60% of crops on all plots. Among women in Kpembona, the favored crops are peanuts, rice, beans, and peanuts-cowpeas. These account for 51% of crops on all plots.

36. Men and women in both villages grow a wide variety of diverse crops. Millet-sorghum (16%), millet-cowpeas (11%), and millet-sorghum-cowpeas are the only crops grown on more than 10% of the total sample area cultivated by men. Other notable crops among men include cotton grown on 9% of the total area cultivated by men followed by six-month (M-6)

millet (8%), peanuts-cowpeas (9%), peanuts (8%), other millet (4%), millet-sorghum cowpea (10%), and other millet intercrops (7%).

37. Among women the crops that are grown on 10% or more of the area cultivated by women include rice (19%), beans (10%), and assorted other crops (16%). Peanuts (9%) and millet-sorghum (9%) are also notable crops among Moba-Gourma women in northern Togo.

38. An interesting contrast is that men in Naki-Est, the experimental village, allocate 51% of the total area under their management to sole crops, but this figure is only 27% for Kpembona. Conversely, men in Naki-Est allocate 49% of the total area under their management to intercrops and other crops, but this figure for men farmers in Kpembona is 73%. The dominant sole crops for men in Naki-Est are cotton (14%), M-6 millet (8%), M-3 millet (8%), and peanuts (9%). The dominant intercrops are sorghum-cowpea (10%) and millet-sorghum (13%). In Kpembona the dominant sole crops for men are cotton (5%), peanuts (7%), and M-6 millet (7%), and the dominant intercrops are millet-sorghum (20%), peanuts-cowpeas (11%), and other millet intercrops (11%).

39. Women in Naki-Est allocate 56% of the area under their management for sole crops and 44% for various intercrops and other crops. In Kpembona women allocate 57% of the area under their management for sole crops and 43% for intercrops. The dominant sole crops for women in Kpembona are peanuts (11%), beans (17%), and millet (16%). In Naki-Est the dominant sole crops cultivated by women are rice (28%), cotton (9%), peanuts (8%), and M-6 millet (7%).

40. The dominant intercrops for women in Naki-Est are millet-sorghum (16%), various other millet intercrops (3%), and millet-sorghum-cowpeas (8%). In Kpembona the favored intercrops cultivated by women are peanuts-cowpeas (10%) and millet-cowpeas (5%).

41. The percentage of the total area cultivated with sole or intercropped millet by men in Naki-Est is 52% and in Kpembona 62%. The percentage of the total cultivated area having sole or intercropped millet among women in Naki-Est (36%) is greater than in Kpembona (28%).

Use of Household and Hired Labor for All Crops

42. The use of household and hired labor for all crops in workdays per hectare in Kpembona (157.4) is very similar to that of Naki-Est (157.8). On the average, Naki-Est used fewer days of household labor than

Kpembona, 138.1 (88%) and 143.3 (91%), respectively. In Naki-Est more workdays per hectare (19.7) by hired labor were used on the average than in Kpembona (14.3). Thus, farmers in both villages rely heavily on household labor, especially for the task of weeding. On the average, farmers in Naki-Est also hire more labor for planting than those in Kpembona, 15% and 8% of the total labor used for planting, respectively.

43. For Naki-Est the data clearly show that for all crops women farmers compared with men farmers use more total labor, 187.4 days and 152.2 days, respectively. Women also use a greater percentage of hired labor (17%) than is used by men farmers (12%). Thus, women are somewhat less reliant on household labor than men, 83% and 88% of total average workdays per hectare, respectively.

44. Women in Naki-Est use a greater percentage of hired labor (55%) for land preparation for all crops than men (16%). This principle also holds for the task of planting all crops where 21% of the average workdays for planting involved hired labor by women but only 14% by men. Although men and women rely heavily on household labor, women hire substantial labor and do not perform agricultural activities alone in the Savanna Region of northern Togo.

45. Women in Kpembona also hire substantially more labor than men farmers for the task of land preparation for all crops, 46% of all average workdays per hectare compared with 18% among men farmers. This is also the case for planting where 16% of all labor days for this activity were performed by hired labor for women but only 7% for men. Men in Kpembona used hired labor for 33% of all workdays for this task, but among women this figure is 27%. The total sample figures show that on the average the proportions of household and hired labor used by men and women are very similar.

46. Moba-Gourma farmers in the Savanna Region use a greater percentage of hired labor for peanuts (24%) than cotton (16%). However, the tasks of pest control, fertilizer application, and diverse other activities were performed exclusively by household labor for both crops. Beyond these tasks, the greatest reliance on household labor for both crops is for the task of planting, 86% of all workdays for this task for peanuts and 89% for cotton.

47. Because millet is a subsistence crop, farmers use less hired labor for millet than for the cultivation of peanuts and cotton. There is heavy reliance on household labor for the production of millet. For all types of millet hired labor is most often used for the tasks of land preparation and weeding.

48. For both villages the use of hired labor for all activities is less for the millet-sorghum intercrop (13%) than for peanuts (24%) and cotton (16%).

49. Labor for land preparation for millet-sorghum is provided primarily by household members who contributed 80% of the total average workdays for this task. Hired labor for planting millet-sorghum (14%) again shows the reliance on household labor for this task. As for the task of weeding millet-sorghum, of all labor days for this task 35% was completed by hired labor. Again, land preparation and weeding for millet-sorghum are tasks for which hired labor is most likely employed.

50. The total labor data show that 30% of the average workdays per hectare of peanuts-cowpeas were performed by hired labor and for the millet-cowpeas intercrop 12% were performed by hired labor. The 30% figure for peanuts-cowpeas is the highest of any crop. Regardless of activity, the percentage of hired labor days for peanuts-cowpeas is always greater than that for the millet-cowpea intercrop. Of all labor used for millet-cowpeas, about 90% was household labor. The labor used for sole crop peanuts and intercropped peanuts-cowpeas shows the lowest percentages for household labor, 76% and 70%, respectively.

Use of Labor by Gender and Activity for All Crops

51. The task of land preparation for all crops in both villages is largely the responsibility of men who performed 91% of the workdays per hectare in Naki-Est and 88% in Kpembona. Children in Kpembona are somewhat more likely than those in Naki-Est to contribute to land preparation work, 8% and 5% of the average workdays per hectare for all crops, respectively.

52. The data for planting work for all crops show some interesting contrasts between men, women, children, and villages. In Naki-Est, the experimental village, women performed 88% of all planting workdays per hectare, men 8%, and children 4%. In contrast, the contribution of men and children in Kpembona is substantial, 22% and 11% of all workdays, respectively. Women in Kpembona are, however, responsible for about

two-thirds (67%) of all workdays for planting. Thus, planting is predominantly, but not exclusively, the responsibility of women in the Savanna Region of northern Togo.

53. Of the average workdays per hectare for weeding for all crops, 70% were performed by men in Naki-Est and 78% in Kpembona. Although weeding is predominantly a task of men, women in Naki-Est performed 24% of the average workdays and women in Kpembona 14%. Children in Naki-Est and Kpembona also contributed to the average workdays for weeding, 6% and 8%, respectively.

54. Harvesting all crops is predominantly an activity of women but with the assistance of men. Of the average workdays of harvesting per hectare, women performed 63% in Naki-Est and 59% in Kpembona. These figures for men are 35% and 30%, respectively. The labor of children for harvesting in Kpembona (11%) is greater than in Naki-Est (2%).

55. The task of fertilizer application for all crops is predominantly, but not exclusively, performed by men. In Naki-Est 51% of the average workdays for fertilizer application were performed by men, 38% by women, and 11% by children. The corresponding figures for Kpembona are 64%, 32%, and 4%, respectively. Women and children in Naki-Est are clearly more involved in fertilizer application work than their counterparts in the control village. Pest control work is done exclusively by men in both villages.

56. The tasks of storage for all crops are rather equitably shared by men and women, especially in Naki-Est where men performed 47% of the average workdays for this activity, women 45%, and children 8%. Women are more active in storage work than men in Kpembona, and men and women in Naki-Est. Specifically, women in the control village performed 52% of the average workdays for storage, men 40%, and children 8%.

57. In Naki-Est 61% of the total average workdays for all crops on plots managed by men were performed by men, 35% by women, and 4% by children. These figures for Kpembona are very similar, 62% for men, 31% for women, and 7% of the average workdays performed by children. Among women farmers in Naki-Est, 37% of the average workdays per hectare were performed by men, 45% by women and 18% by children. The corresponding figures for Kpembona are 43% for men, 54% for women, and 3% for children.

58. The addition of the average labor days of women and children for all crops on plots managed by men in Naki-Est shows that 39% of the average workdays for all crops were contributed by women and children. This figure for Kpembona is virtually identical, 38%. The figures for the labor of men and children on plots managed by women in are 55% for Naki-Est and 47% for Kpembona. Thus, women farmers appear to benefit from a greater proportional contribution of labor from men and children than men farmers from the labor of women and children. In Naki-Est men perform 61% of the average workdays on plots under their management, and women perform 45% of the average workdays on plots under their management. These figures for Kpembona are 62% for men and 54% for women.

59. The data show that land preparation work for all crops is predominantly the responsibility of men on plots under their management and on plots managed by women. A minimum of 80% of the average workdays for this task were performed by men regardless of village or gender of the plot manager. This labor pattern is reversed for the task of planting.

60. In Naki-Est women performed 92% of the average workdays for planting all crops on plots under their management, 8% were completed by children, and men contributed no days to this task. Women also performed 85% of the average workdays for planting on plots managed by men in Naki-Est, men contributed 11%, and children 4%.

61. The labor principle that Moba-Gourma women are predominantly responsible for planting work in northern Togo also holds for the control village of Kpembona, where women contributed 66% of the average workdays for planting all crops on plots managed by men, men contributed 24%, and children 10%. On plots managed by women in Kpembona women contributed 79% of the average workdays for planting, men 10%, and children 11%.

62. The data for weeding for all crops clearly show that men and women are largely responsible for weeding the plots under their respective management, but men contribute more average workdays to weeding plots managed by women than women contribute to weeding plots managed by men. In Naki-Est 81% of the average workdays for weeding plots managed by men were completed by men, 15% by women, and 4% by children. On plots managed by women in Naki-Est, women contributed 58% of the average workdays for weeding, men 29%, and children 13%. These figures may also be interpreted as showing that 42% of the average workdays for weeding

plots managed by women were completed by men (29%) and children (13%). In contrast, on plots managed by men 19% of the average workdays for weeding all crops were completed by women (15%) and children (4%). Thus, men and children contribute far more average workdays to weeding plots managed by women than women and children contribute to plots managed by men.

63. In Kpembona 86% of the average workdays for weeding all crops managed by men were contributed by men, 6% by women, and 8% by children. On plots managed by women, 70% of the average workdays for weeding were contributed by women, 22% by men, and 8% by children. Again, it is interesting to note that 30% of the average workdays for weeding plots managed by women were completed by men (22%) and children (8%). On plots managed by men in Kpembona, 76% were jointly contributed by women (66%) and children (10%).

64. Harvesting work in both villages tends to be predominantly performed by women. On plots managed by men in Naki-Est 63% of the average workdays for this task for all crops were performed by women, 35% by men, and 2% by children. However, on plots managed by women in Naki-Est women, and women alone, performed all harvesting activities.

65. On plots managed by men in Kpembona 59% of the average workdays for all crops were performed by women, 30% by men, and 11% by children. Interestingly, on plots managed by women in the control village, the average workdays for harvesting were equal among men (50%) and women (50%). Perhaps the contribution of men in harvesting plots managed by women is in exchange for the work of women in planting fields managed by men.

66. The task of fertilizer application for all crops is largely the responsibility of the plot manager. In Kpembona 69% of the average workdays for this task on plots managed by men were performed by men, 26% by women, and 5% by children. Women performed fertilizer application work for 72% of the average workdays on plots under their management, 28% were performed by men, and children did not participate in fertilizer application on plots managed by women in Kpembona.

67. On plots managed by men in Naki-Est 55% of the average workdays per hectare for fertilizer application for all crops were performed by men, 37% by women, and 8% by children. The division of labor for fertilizer application on plots managed by women in Naki-Est shows that children

performed 44% of the average workdays for this task and women performed 47%. The fact that children are responsible for 44% of the average workdays for fertilizer application on all crops managed by women and 8% on plots managed by men suggests that training children for this task in the experimental village would be appropriate.

68. On plots managed by men farmers in Naki-Est 49% of the average workdays for storage of all crops were performed by men, 46% by women, and 5% by children. On plots managed by women in the experimental village, 66% of the average workdays for storage were performed by men (33%) and children (33%). Women contribute but one-third (33%) of the average workdays for storage of production from plots under their management. Thus, men are more responsible for storing production from plots under their management than women are for plots under their management, as women receive more assistance from men and children than men receive from women and children.

69. Women and children in Kpembona perform more of the average workdays for storage (62%) of production of all crops from plots managed by men than are performed by men themselves (38%). On plots managed by women in Kpembona men (50%) and women (50%) equally share the average workdays for storage without any contribution from the labor of children. Thus, men in Kpembona contribute more average workdays for storing production grown on plots managed by women (50%) than they contribute to storing their own production (38%).

Use of Labor by Crop

70. Land preparation for sole crops of peanuts and cotton is mainly the responsibility of men who performed 92% of the average workdays for peanuts and 91% for cotton. Children contributed 7% and 9% of the average land preparation workdays for these crops, respectively.

71. Women performed the greatest percentage of average workdays for planting peanuts (74%) and cotton (71%). Men contribute slightly more of the average workdays for planting cotton (20%) than for peanuts (18%).

72. The majority (80%) of the average workdays for weeding cotton is performed by men, 12% by women, and 8% by children. Women contribute a greater percentage of the average workdays for weeding peanuts (24%) than for cotton (12%). About two-thirds (67%) of the average workdays for weeding peanuts is performed by men and 9% by children.

73. Fertilizer application for cotton is predominantly an activity of men who performed 51% of the average workdays for this task while women contributed 38% and children 11%. Other diverse activities for peanuts and cotton were completed exclusively by men.

74. Concerning the average use of labor of men, women, and children for all millet, the data show that the men performed 92% of the average workdays for land preparation and children 8%. Women performed 72% of the average workdays for planting all millet, men performed 21%, and children 7%. The weeding of all millet is predominantly a responsibility of men who performed 80% of the average workdays for this task, women contributed 14%, and children 6%.

75. The harvesting of all millet is most often done by women who performed 58% of the average workdays for this activity, men contributed 36% and children 6%. The storage of all millet is also predominantly, but not exclusively, a task of women who performed 55% of the average workdays for this activity while men contributed 42% and children 3%. Overall, men contributed 58% of the average workdays per hectare for all activities, women performed 37%, and children 5%.

76. Men contribute less of the average workdays for planting M-3 (5%) than M-6 millet (12%) and women contribute less of the average workdays for planting M-6 (80%) than M-3 millet (93%). Although women made no labor contribution to fertilizer application on M-6 millet, they contributed 25% of the average workdays for fertilizer application on M-3 millet. It may also be concluded from these descriptive data that Moba-Gourma women in northern Togo are attracted by, and thus give more attention to, M-3 millet than to M-6 millet, especially for the tasks of planting, fertilizer application, and marketing.

77. Land preparation for millet-sorghum is primarily a responsibility of men who account for 90% of the average workdays per hectare. Women and children account for 3% and 7% of the average workdays, respectively. Women contributed 87% of the average workdays for planting, 5% by men, and 8% by children. But in weeding this intercrop men accounted for 68% of the average workdays, women 20%, and children accounted for 12%. Fertilizer application work is predominantly, but not exclusively, the responsibility of men for millet-sorghum who completed 64% of the average workdays for this task. Women contributed 33% of the average workdays for fertilizer application and children 3%.

78. Women clearly dominate the harvesting of the millet-sorghum intercrop as their labor accounted for 59% of the average workdays for this task. Men accounted for 25% of the average workdays and children 16%. As for storage work for this intercrop, men accounted for 37% of the average workdays, women 48%, and children 15%.
79. For land preparation the labor of men accounts for an average of 90% of the average workdays in this activity for millet-cowpea intercrops and 99% for the intercrop of peanuts-cowpeas. As with the crops previously discussed, women account for 86% of the average workdays for planting millet-cowpeas and 78% for peanuts-cowpeas.
80. Weeding work for the millet-cowpea intercrop is predominantly a task for men who account for 82% of the average workdays for this task. Women, however, contribute more of the average workdays for weeding peanuts intercropped with cowpeas (33%) than for millet-cowpeas (12%).

Use of Fertilizers

81. In Naki-Est 93% of the men and 27% of the women farmers reported using fertilizer on at least one plot during the survey season. In Kpembona 67% of the men and 31% of the women farmers reported using fertilizer in 1988. The percentage of men and women farmers using fertilizer in Naki-Est (77%) is greater than in Kpembona (60%). It should be noted that the percentage of women farmers using fertilizer in Kpembona (31%) is slightly more than among women in Naki-Est (27%).
82. The figures describing the use of fertilizer prior to the survey year show that 98% of the men and 33% of the women farmers in Naki-Est have used fertilizer in the past. In Kpembona 85% of men farmers and 77% of the women have used fertilizer in the past. Thus, the experience of fertilizer use is most uncommon among women farmers in Naki-Est. The SFRP will provide new experiences about fertilizer use among women in the experimental village. Overall 91% of the men in the sample, 54% of the women, and 82% of the farmers in the sample used fertilizer at least once prior to the SFRP baseline survey.
83. Men (100%) in Naki-Est uniformly cited the lack of money as the reason for not using fertilizer. Women in Naki-Est (90%) are somewhat less likely than men to cite lack of money as a reason for not using fertilizer but more likely (10%) to view fertilizer as unnecessary.

84. In Kpembona, 88% of the men and 100% of the women cited lack of money as the main reason for not using fertilizer. None of the women farmers in Kpembona viewed fertilizer as not needed but 12% of the men farmers cited this reason. For the total sample women farmers (92%) are somewhat more likely to cite lack of money as a reason for not using fertilizer than men farmers (89%). But men (11%) are somewhat more likely than women (8%) to view the use of fertilizer as unnecessary. Clearly, among both men and women the lack of money is viewed as the principal reason for not using fertilizer.

85. In Naki-Est the sample of men universally cited lack of money as the reason for discontinuing the use of fertilizer. Fewer farmers in Kpembona (93%) cited this reason, but 7% indicated that fertilizer was not available. The lack of money is the main reason offered by farmers for not using or discontinuing the use of fertilizer in the sample region.

86. Considering all crops cultivated in both villages by men and women farmers, 84% of the plots in Naki-Est and 86% in Kpembona received no fertilizer.

87. Men farmers are somewhat more likely than women to use fertilizer on their plots because 84% of the plots managed by men, but 92% of those managed by women received no fertilizer. For both men and women farmers, cotton plots are most likely to receive fertilizer and plots with M-6 millet least likely.

88. The average rate of 15-15-15 application for all crops was 92 kg/ha with a 64% variation. These figures also show substantial variation in the rate of application of 15-15-15 by crop. For the millet-sorghum intercrop, an average application of 83 kg/ha with a 71% variation was observed.

89. The average rate of application for urea for cotton is 49 kg/ha with a coefficient of variation of 40%. That is the lowest variation observed in the use of urea for any crop or intercrop. Cowpeas show a similar rate of application of urea (45 kg/ha) with a coefficient of variation of 45%. The use of this fertilizer for other crops shows an average rate of 58 kg/ha with a very substantial variation of 101%. For all crops receiving urea, the average rate of application is 49 kg/ha with a coefficient of variation of 45%.

90. The use of SSP in the sample region is limited to peanuts as a sole crop and the intercrop of peanuts-cowpeas. The average rate of application of this fertilizer for peanuts is 61 kg/ha with a substantial variation of 91%. For the intercrop of peanuts-cowpeas the average rate of SSP use is 67 kg/ha with a substantially lower coefficient of variation of 50%. The average rate of use of this fertilizer for all crops is 64 kg/ha with a 52% variation in this rate.

91. The use of the complex fertilizer NPKSB is primarily on cotton and cowpeas. For cotton the average rate of application is 141 kg/ha with a variation in the rate of 33%. For cowpeas these figures are 136 kg/ha and 38%, respectively. These coefficients of variation are among the smallest of the crops in the sample.

92. The percentage of farmers using generic manure in Naki-Est (82%) is greater than in Kpembona (62%). This is also the point for the use of household refuse by 12% of the farmers in Naki-Est and 9% in Kpembona. The percentage of farmers in Kpembona using manure from sheep and goats (11%) is greater than in Naki-Est. The percentage of men and women farmers reporting the use of generic manure (3%) is about equal, 72% and 71%, respectively.

93. The percentage of women farmers using organic manure during the survey season was less than men, 25% and 80%, respectively. Stated differently 20% of the men farmers and 75% of the women farmers reported not using organic manure during the survey season.

94. Women farmers (100%) are more likely than men farmers (80%) to report the limited availability of organic manure as a constraint to use.

Credit

95. The percentage of farmers using agricultural credit is greater in Naki-Est (80%) than in Kpembona (34%). The data further show that the percentage of men using credit (64%) is about twice that of women (31%). Disregarding gender and village distinctions, 56% of the farmers in the sample used credit. Men in Naki-Est are the most frequent users of credit and women, in general, the least.

96. The figures for the sources of credit used by gender show that women (56%) are far more likely than men (10%) to borrow money from family members and friends, but again the base numbers are small. The figures also show that men (87%) are far more likely to use credit from SOTOCO

and DRDR than women (33%). Although the use of credit by women from these sources is limited, women are clearly not excluded from SOTOCO-DRDR loans.

97. The percentage of women who tried to obtain a loan but failed to receive one (30%) is greater than that of men (12%). Overall, 82% of those not using credit did not attempt to obtain a loan.

Use of Crop Output

98. More than 90% of the main crop products of all crops are grown for household consumption: 96% in Naki-Est, 97% in Kpembona, and 96% in the total sample. Less than 5% of the crops in both villages are grown for the dual purposes of household and sale.

99. The single greatest use of straw is for building material: 61% in Naki-Est, 71% in Kpembona, and 65% for the total sample. The use of straw for groundcover in Naki-Est (32%) exceeds that of Kpembona (19%) and the total sample (26%). The least use of straw is for animal feed: 7% in Naki-Est, 10% in Kpembona, and 9% for the total sample.

100. Men (98%) are somewhat more likely than women (91%) to use main crop products for household consumption. Nine women (33%) in the sample reported using crop byproducts for animal feed. No men reported such use. Men (26%) and women (26%) are equally likely to use crop byproducts for groundcover.

101. Men (74%), perhaps owing to their greater involvement in building, are more likely than women (41%) to use crop byproducts for building material. Sixty-six percent of the total sample reported the use of byproducts for this purpose.

102. The favored use of peanut straw (88%) is for animal feed. Straw from rice (71%) and millet (27%) is a crop byproduct mainly used for groundcover. The favored building materials are straw from millet (73%) and sorghum (12%).

103. Finally, in regard to the disposal of crop production, 78% of all sales were made by farmers who cultivated the particular crop and 22% by the wives of farmers. All of the crops were sold within the villages rather than at distant locations.

Sources of Agricultural Information

104. A greater percentage of farmers in Naki-Est (84%) than in Kpembona (66%) view agricultural information from cooperatives as very helpful and somewhat helpful. In contrast, farmers in Kpembona (34%) are about twice as likely as those in Naki-Est (16%) to view information from cooperatives as not helpful or report uncertainty about the value from this source. A similar pattern holds for perceptions about information from cooperatives by gender. Specifically, a greater percentage of men (79%) and of women (59%) farmers view information from cooperatives as very helpful and somewhat helpful, but women (41%) are about twice as likely as men (21%) to view information from cooperatives as not helpful or of uncertain value. Although 75% of the total sample view agricultural information from cooperatives as very or somewhat helpful, men in Kpembona and women from both villages are most likely to view information from this source as not helpful or of uncertain value.

105. Farmers in Naki-Est (90%) and Kpembona (92%) view information from extension workers as very helpful and somewhat helpful. However, women (66%) are less likely than men (95%) to view such information as very helpful. Overall, 91% of the total sample perceive information from extension workers as very helpful or somewhat helpful.

106. Farmers in Kpembona (90%) are much more likely than those in Naki-Est (57%) to view information from other farmers as very helpful. More farmers in Naki-Est (31%) than in Kpembona (5%) view such information as only somewhat helpful. There is a small gender difference about perceptions of the value of information from other farmers; 90% of men and 96% of women farmers view information from this source as very helpful or somewhat helpful. Overall 92% of the total sample view information from other farmers as very helpful or somewhat helpful.

107. Women in Naki-Est (80%) are most likely to receive no annual visits from extension workers followed in descending order by women in Kpembona (46%), men in Kpembona (19%), and men in Naki-Est (16%). Overall, about one-third (34%) of the farmers in the total sample reported no extension visits during the 1988 cropping season.

108. The numbers and percentages of farmers receiving one extension visit per year are minimal. Specifically, men (11%) in Naki-Est are most likely to report one visit followed in descending order by women in

Kpembona (8%) and men in Kpembona (4%). Overall, 7% of the sample reported receiving only one extension visit during the survey season.

109. Interestingly, women in Kpembona (46%) are most likely to receive between 2 and 4 extension visits per year followed in descending order by men in Naki-Est (44%), men in Kpembona (40%), and single women farmers in Naki-Est (7%). Overall, 38% of the sample reported receiving between 2 and 4 extension visits in 1988.

110. Men in Kpembona (29%) and men in Naki-Est (25%) reported receiving between 5 and 10 extension visits. Interestingly, 13% of the women in Naki-Est but none in Kpembona reported receiving between 5 and 10 extension visits. Overall, 22% of the total sample received between 5 and 10 extension visits during the 1988 cropping season. The number of farmers receiving 10 or more extension visits is very minimal.

111. Within the total sample 22% of the farmers reported owning a radio, but this figure obscures gender differences on this point. Men (27%) in Naki-Est reported the highest percentage of radio ownership followed by men in Kpembona (23%). Women in Kpembona (21%) are more likely to report radio ownership than women in Naki-Est (7%).

112. Overall, 10% of the sample reported having access to a television. However, women in Kpembona (21%) reported the greatest access to television followed in descending order by women in Naki-Est (13%), men in Kpembona (12%), and men in Naki-Est (4%).

Constraints to Agricultural Production and Fertilizer Use

113. Among all farmers in Naki-Est, regardless of gender, the lack of rain is perceived as the second most important constraint to agricultural production. But farmers in Kpembona perceive pests and diseases as greater constraints to production than the lack of rainfall that is ranked third in this village.

114. Farmers in Naki-Est and women in the total sample view poor field maintenance as the fourth most important constraint to agricultural production. Farmers in Kpembona view poor field maintenance as the fifth most important constraint in their village, but men in the total sample accord this constraint as least important and thus it is ranked seventh.

115. Lack of fertilizer is viewed by farmers in Naki-Est and men in the total sample as the sixth most important constraint to agricultural production. Men in Kpembona rank lack of fertilizer as the fourth most important constraint and women in the total sample rank it as fifth in importance on a scale of relative importance of constraints (SRI).

116. Other constraints, such as a lack of money for inputs, strong winds, flooding, lack of fallow, and lack of animal traction, are perceived as the least important constraints to agricultural production by farmers in Naki-Est and women in the sample. The other constraints are viewed by farmers in Kpembona as sixth in relative importance and fourth by men in both villages.

117. It is important to note that although all farmers in the sample view low soil fertility as the major constraint to crop production, the lack of fertilizer to correct this problem is not ranked highly in importance. The SFRP is designed to demonstrate to farmers the benefit and contribution of fertilizer in increasing soil fertility and thus crop production.

118. Farmers in Kpembona cite the distance to a fertilizer dealer as the third most important constraint, but farmers in Naki-Est rank this factor as fourth in importance on the SRI of constraints.

119. Farmers in Kpembona perceive a lack of rain as the fourth most important constraint to fertilizer use, but farmers in Naki-Est rank this factor as third on the SRI.

120. A lack of knowledge about fertilizer use is perceived as the fourth constraint in relative importance by women in the sample but is ranked fifth by farmers in Kpembona, sixth by farmers in Naki-Est, and least important on the SRI by men in the sample.

121. High fertilizer prices are not perceived as a constraint in Naki-Est but are ranked fourth on the SRI in Kpembona. Women, who rank high prices as fifth on the SRI, view this constraint as more than men who rank it as sixth.

122. Women and farmers in Kpembona perceive other factors such as a lack of labor, insecure land tenure, lack of seeds, and small plot sizes as sixth on the SRI of constraints to fertilizer use. Farmers in Naki-Est and men in the sample view these constraints as more important on the SRI and rank them fifth.

A REPORT ON THE BASELINE FARM SURVEY OF THE SOIL FERTILITY RESTORATION PROJECT (SFRP) IN THE SAVANNA REGION OF TOGO

Introduction

The rapidly increasing populations of sub-Saharan Africa and declining per capita food production continue to focus international attention on the region. In particular, the regions of West and Central Africa have presented some of the most complex problems in agricultural development during the latter quarter of this century.

The soils of West Africa are generally low in fertility, readily exhausted through cropping, and prone to leaching of nutrients and erosion. Farmers have traditionally coped with these problems through shifting cultivation or "bush fallow rotations" where land is left fallow for perhaps 5 or 10 years to allow natural vegetation to restore soil fertility. In the past these practices, combined with complex cropping systems, have permitted low but relatively stable food production.

In recent years, the increasing need for additional food has compelled farmers to shorten fallow periods which threatens the stability and sustainability of the shifting cultivation systems. Marginal lands are being cultivated for food crop production, and there is increasing evidence that more frequent and continuous cropping of the fragile and highly weathered soils is causing serious depletion of soil organic matter, overall fertility levels, and environmental degradation. The ecological diversity of West Africa further compounds these problems and poses a complex scientific challenge for agriculturalists, especially soil scientists, agronomists, sociologists, and economists.

International development agencies and donors are justifiably concerned about these problems and support initiatives to reverse or mitigate the problems of sub-Saharan African farmers and their natural environments. The need to manage and protect the natural resource base for agriculture in the region is imperative. Research to improve crop production through soil amendments or new alternatives must be developed to increase the productive potential of the existing resource base for food production and contribute to a sustainable agricultural base.

Basic and applied agricultural research is needed to obtain an improved understanding of the physical, chemical, biological, and socioeconomic features of agricultural systems in the region. It is especially important to identify and analyze the determinants of stability and environmental degradation of the resource bases in West Africa.

In this regard, it is necessary to identify and test methods and systems of resource management for soil fertility and cropping practices. In particular, it is necessary to design and monitor soil management systems that can at least stabilize or, ideally, increase food production. One particularly important priority for such research is to collect detailed information on the role and use of fertilizers and associated soil amendments in stabilizing, increasing, and sustaining the productive potential of West African soils. Such research should be pursued within prevailing circumstances of agricultural policies, farming systems, and socioeconomic conditions.

Considering the problems of the availability and use of fertilizers in West Africa compared with other developing regions of the world and the imperative for farmers to increase food production, the International Fertilizer Development Center (IFDC) is conducting a Soil Fertility Restoration Project (SFRP) to determine the agronomic, economic, and social benefits of fertilizer and associated soil amendments in countries and villages of West Africa. The project examines the contribution of fertilizer use in villages in Ghana, Togo, and Niger and assesses the potential of fertilizer to increase and sustain food crop production and farm incomes under contrasting agronomic, climatic, and socioeconomic conditions.

As an applied agronomic and socioeconomic research program, the SFRP evaluates various fertilizer investment options and assesses their benefits for the restoration of soil productivity, the sustainability of soil fertility, evolution of farming systems, the economies of local communities, and the implications for the reversal of environmental degradation.

Implementation of the SFRP over a 5-year period will center on pilot projects in selected villages in three agroclimatic regions in West Africa. These projects will provide baseline data on the agronomic, socioeconomic, and environmental benefits of fertilizers and associated amendments for the major soils and ecologies in the region.

Specifically, the pilot research areas are in the humid zone of Ghana, the Savanna Region of Togo, and the Sahel zone in Niger. The elimination of specific soil fertility constraints in these potentially productive areas and the availability of markets for additional produce would make fertilizer use profitable and attractive for small-scale farmers.

The SFRP research first required the selection of pilot regions in contrasting agricultural and social environments where crop production and soil fertility may be increased and maintained through soil amendments and fertilizer use, the collection of baseline ecological and socioeconomic data, and the establishment of pilot projects in selected regions. This was accomplished with the collaboration of national programs to field test soil amendments and fertilizer use strategies. Emphasis was given to the use of indigenously available resources for the soil amendments and the use of fertilizer. The products obtained through low-cost processing of indigenous raw materials as well as conventional fertilizer products were considered in designing the research.

The training of national program personnel to implement and monitor the pilot projects and collect the necessary agronomic and socioeconomic data is an important aspect of the project. The determination of economically and socially effective strategies to restore soil fertility that could be recommended for adoption in selected regions through government-sponsored programs is also of great importance and is continuing. The sharing and dissemination of information from the project and strengthening the capability of various national agricultural research organizations to conduct similar soil fertility restoration research through scientific support and consultation, material support in the execution of the pilot projects, and an annual workshop are additional benefits of the SFRP. The long-term development objective of the project is to increase the availability of food, increase rural incomes, and promote agricultural and rural development in Africa through the reclamation and conservation of croplands whose fertility is depleted.

The purpose of this report is to describe the socioeconomic characteristics, farming practices, and the role of women in agriculture that existed in the SFRP research area in the Savanna Region of Northern Togo in 1988, the initial year of the project. The data and report will provide a basis for determining the social and economic consequences of fertilizer use interventions in subsequent years of the project. The consequences of

fertilizer use will be evaluated in terms of changes in the socioeconomic environment, farming practices, use of inputs, agricultural production and productivity, monetary income of farmers, employment, and the role of women in agricultural development.

The Republic of Togo: An Overview

The Republic of Togo is an elongated and narrow francophone country that stretches about 570 km from the Bight of Bénin into the interior. Bordered on the north by Burkina Faso and the Republics of Benin and Ghana on the east and west, respectively, Togo has a total surface area of 56,785 km^2 (Figure 1).

As in neighboring Ghana and Bénin, Togo is characterized by coastal lowlands reaching for about 40 km inland. The remainder of the country consists primarily of two Savanna plains separated by a southwest-northwest range of hills, namely the Togo-Atacora mountains.

The climate of Togo is influenced principally by the interaction of two main air masses, the moist and relatively cool air mass or monsoons from the southwest across the Atlantic Ocean and the hot dry harmattan air mass from the northeast. Consequently, the climate varies northward from subtropical to Savanna. Temperatures are generally high ranging from 24° to 36°C in the relatively dry north and between 23° and 30°C in the humid southern region.

Vegetation in Togo is determined largely by climate, soils, and the extent of human activities. The southwest-northeast area of heavy annual rainfall has one or two relatively short dry seasons and is covered with evergreen forests, particularly in the wetter portions, and semi-deciduous forests in the drier zone. This area supports food crops such as maize, plantain, yam, and cash tree crops especially, cocoa, coffee, and oil palm. The rest of the country, except the coastal scrub land, is covered with Savanna vegetation. The Guinea-Savanna vegetation in the southern two-thirds of the country gradually blends into the Sudan-Savanna to the north. Crops grown in the former include cassava, maize, and cotton, while millet, groundnuts, sorghum, and cotton are grown in the latter.

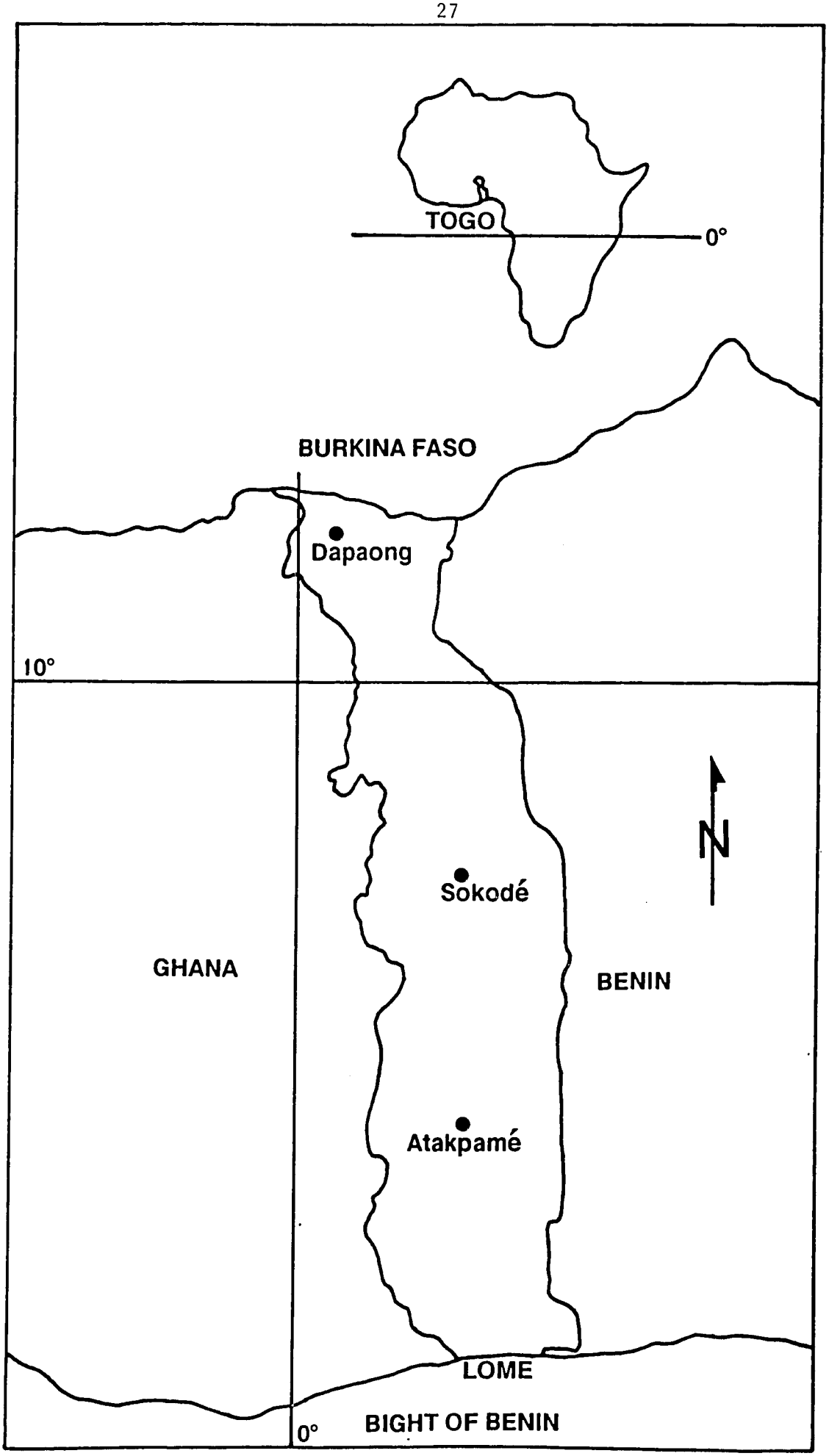

Figure 1. The Republic of Togo.

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However, as a result of prolonged farming, the original closed forest vegetation has been severely reduced. Prolonged cultivation and bush burning have caused serious degradation of vegetation and soils in the Savanna environment.

Some 75% of the estimated 3 million people live in rural areas and are engaged in agriculture and related industries. Population densities range from 24 persons per km^2 in the central zone, 42 persons per km^2 in the north, and over 165 persons per km^2 in the south. With an estimated 2.9% growth rate, the current population of Togo is projected to double in less than two decades. For purposes of administration and socioeconomic development, Togo has been divided into five regions--Maritime, Plateaux, Centrale, Kara, and Savanna. Each region is further divided into districts or prefectures.

The Data and the Sample Region

The Data

The 1988 baseline data for the SFRP were collected through the use of a questionnaire that contained open and closed ended items. The survey generated data on gender; cultural groups; marital status; household location, composition, education, and employment; land availability and tenure; the use of machinery, animals, equipment, and credit; sources of information about fertilizers; crop areas and management; the use and costs of fertilizers, organic manures, and crop residues; the use and cost of labor; disposal and use of crop production; and finally, the perceptions of farmers about constraints to fertilizer use and agricultural production. Extensive interviews were also conducted with village chiefs to provide an overview of agriculture in each village.

In the Savanna Region of Northern Togo, a random sample of farmers in two villages was stratified to include women. A total of 125 farmers were interviewed, 29 of whom were women. Thus, comparisons of gender differences in agriculture are significant contributions of the SFRP. The interviews were conducted by national collaborators in each country and supervised by IFDC staff from Headquarters and the West Africa Division.

The interviewers received tutorial instruction on field survey work and interviewing. Practice interviews were conducted and detailed discussions about the intent and nature of the questionnaire in general and

the SFRP in particular were completed with the interviewers. The interviews were conducted in village centers, households, and in the fields of farmers. The cooperation and support of the farmers that was reported by the interviewers were attributable to the support of the project by each village chief. Farm-level data are very difficult to obtain in West Africa and are found sparsely in the literature. SFRP data are thus expected to make a contribution to data base development.

The Sample Region

Covering the northernmost part of the country, the Savanna Region comprises 8,602 km^2 and exhibits most of the ecological elements characteristic of the Sudan-Guinea Savanna environment. Temperatures fluctuate between 24° and 36°C and the mean annual rainfall of about 1,200 mm is unimodal (April-October) (Figure 2). This season is followed by a relatively long dry season. The vegetation is predominantly tall grass interspersed with short trees, particularly along river courses.

About 91% of the estimated 330,000 people in the Savanna Region of Togo depend on agriculture for their livelihood. Rural population densities range from 15 persons/km^2 in the sparsely populated plains of the Oti River to 70-100 persons/km^2 in the area east of Dapaong.

Agricultural extension services in the region are provided principally by two governmental agencies: the Direction Régionale du Développement Rural (DRDR) and the Société Togolaise du Coton (SOTOCO). A third organization engaged in agricultural development in the region is the Fonds Européen de Développement (FED). The three institutions have resident extension officers in villages within their respective zones of operation.

Dapaong, the regional capital with a population of about 10,000, is the commercial center of the Savanna Region. The important all-weather, north-south road linking Lomé and Ouagadougou, in Burkina Faso, converges on the city. There are several smaller market centers including Korbongou, Naki-Est, Bogou, and Papri that are within a 40-km radius of Dapaong. Almost all the smaller towns are linked to Dapaong by second or third class roads. Thus, the bioclimatic, infrastructural, and existing institutional arrangements make the area around Dapaong, the Tône Prefecture, an ideal site for the SFRP.

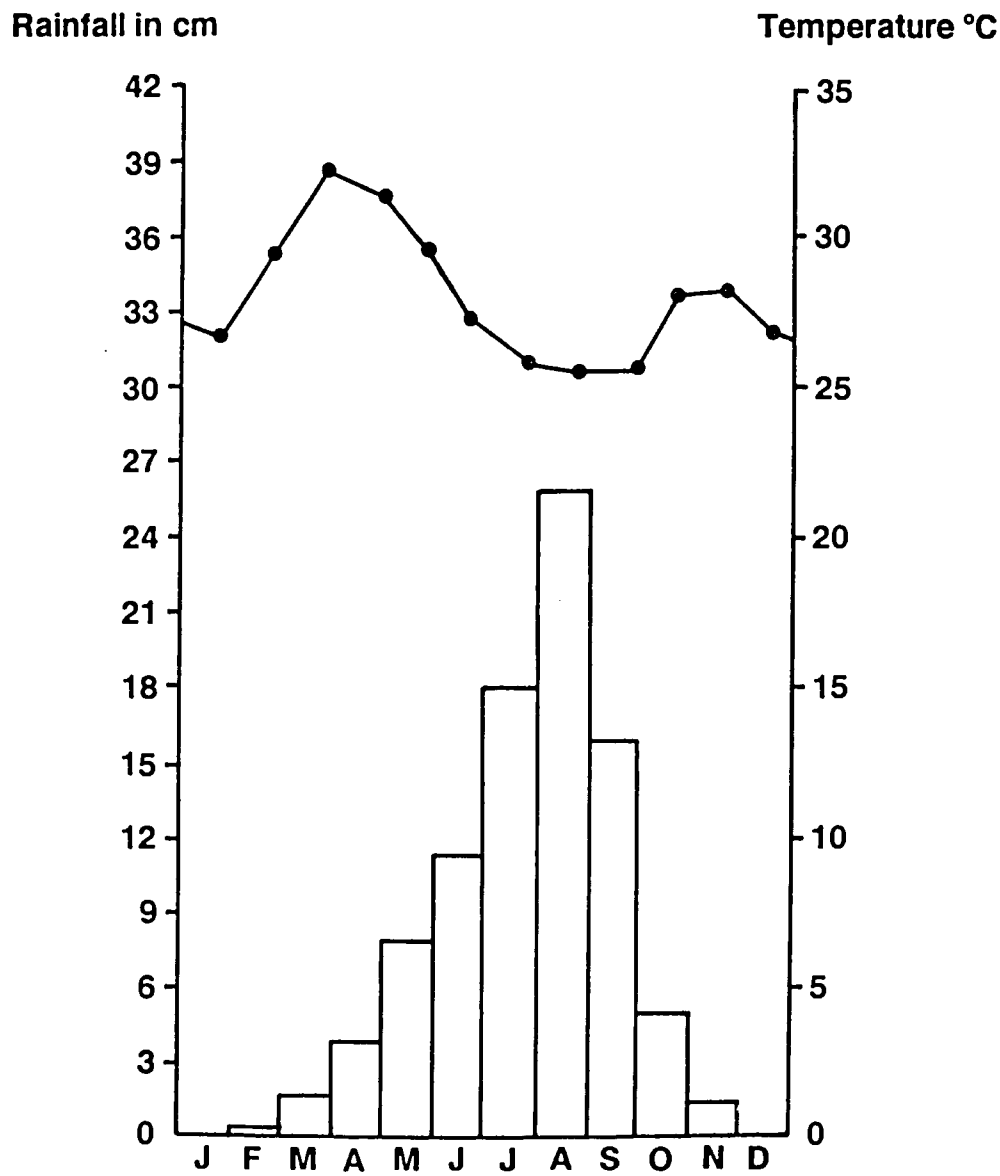


Figure 2. Dapaong - Mean Monthly Rainfall and Temperature 1980-1987.
Source: Service de la Meteorologie.
Lome 1988.

The Sample Villages

The initial phase of the village selection process involved discussions with regional agricultural extension personnel and analyses of secondary demographic data, evaluation of physical and institutional structures, review of previous studies on crop response to fertilizers, and an examination of the overall agricultural potential of the region.

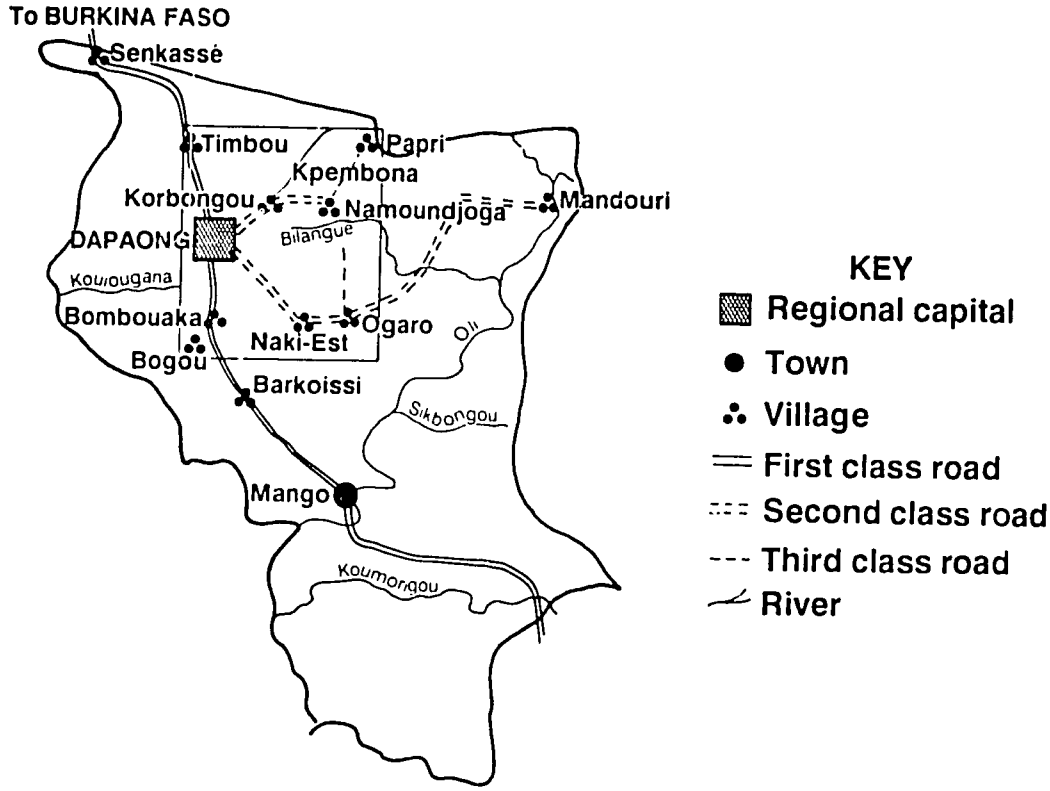
Following the discussions and an extensive review of available literature on the region, the Tône Prefecture in the Savanna Region was selected on the basis of population density, homogeneity of agroclimatic factors, and the availability of important institutional support services. From a list of several villages, compiled in collaboration with personnel from DRDR, seven villages were selected for an extensive survey on the basis of the following criteria:

- Accessibility to, and availability of, large markets and fertilizer distribution depots.
- Willingness of farmers to participate in project activities.
- Previous experience of extension workers in the village.
- Location of villages to enhance the demonstration effect of field programs.

As stated earlier, the villages of Papri, Kpembona, Kowampit-Bong, Naki-Est, Ogaro, Bombouaka, and Bogou in the Tône Prefecture of the Savanna Region, were considered as SFRP research villages. Ultimately Naki-Est, sometimes called Nakitinde-Lare, and Kpembona were chosen as the experimental and control villages, respectively (Figure 3).

In general, the villages are situated on valley bottomlands where the water table is close to the surface, thus providing farmers access to water during the long dry season. Also, the sites facilitate the use of the relatively more fertile soils that collect the topsoil washed from uphill areas. Millet, groundnuts, sorghum, and cowpeas are the main food crops and cotton is a cash crop. Some cattle, sheep, goats, pigs, and poultry are raised for domestic consumption and market sale.

Although there is a relatively good network of second and third class roads in the area, public means of transport appears to be virtually unavailable for both villages. The most frequent form of transportation for long distance travel is by bicycle. Table 1.1 provides a summary of population, road types, and distances between the experimental and control



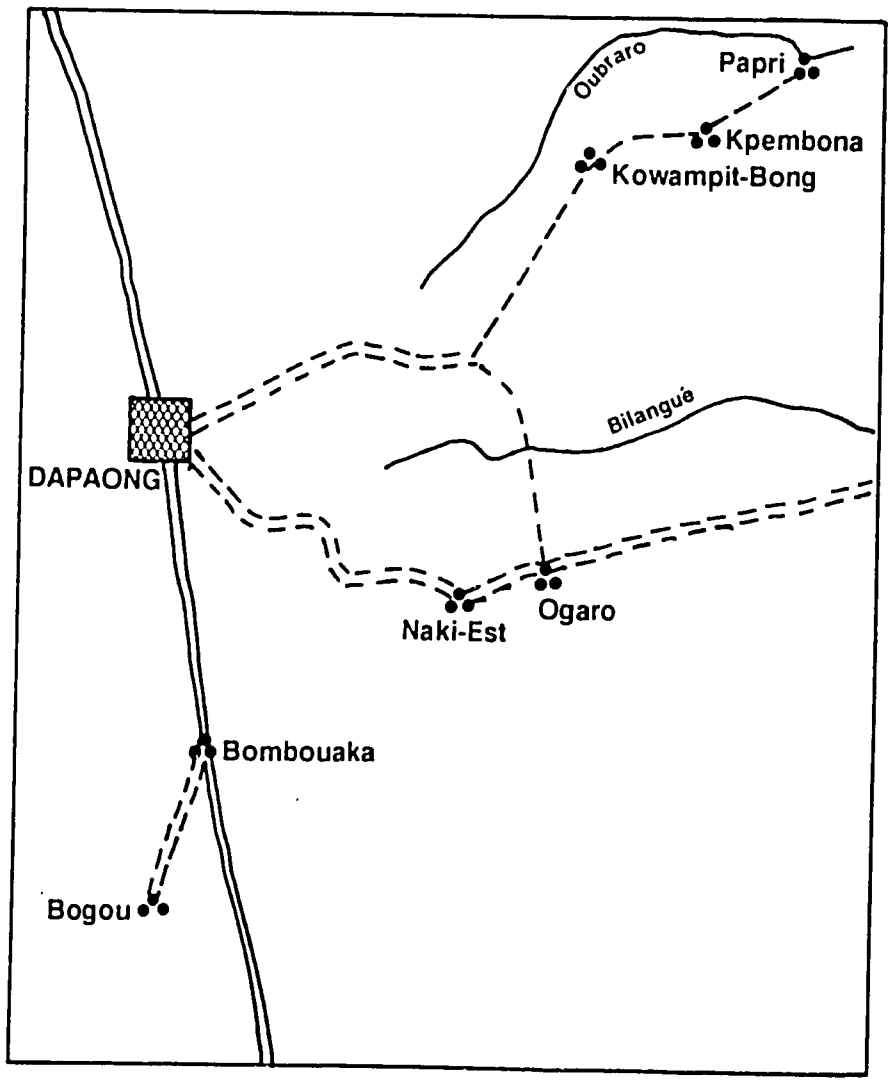


Figure 3. Location of the Research Villages.

Table 1.1. Active Population, Road Type, and Distances Between Research Villages and Essential Services

Villages	Active Population[a]	Road Type[b]	Distances to Services: Clinic	Post Primary School	Large Market[c]	Agricultural Extension/ Fertilizer Depot
			(km)			
Kpembona	828	3	3	15	36	+
Naki-Est	1,665	2	+	+	35	+

a. Persons 12 years or more.
b. (2) Second class road.
(3) Third class road.
c. Large market refers to Dapaong.
+ Indicates that service is available in the village.

Sources: Direction Régionale du Développement Rural (DRDR) and SFRP exploratory survey.

villages and the location of some essential services. Specifically, Naki-Est is the experimental village and Kpembona the control village.

As shown in Table 1.1, Naki-Est, the experimental village, has a larger population than Kpembona and is served by a second class road. Naki-Est has a clinic and post primary school within the village, unlike Kpembona. Naki-Est is also closer to the large market at Dapaong and both villages are served by agricultural extension and have a fertilizer depot.

Extensive interviews were held with the Chiefs of Naki-Est and Kpembona. The interviews are useful for understanding the character of agriculture in the villages and are provided in the form of overviews.

Village Overview: Naki-Est

Located approximately 35 km southeast of Dapaong, the regional capital, Naki-Est is comprised of a group of eight farming communities. The village has a well-maintained second-class road that provides a link with Dapaong, a large market, a resident extension officer, and a relatively large

fertilizer depot. These factors were influential in selecting Naki-Est as the experimental village.

Konkpeli Taguindame, Chief of the Naki-Est Center, agreed to an interview about agriculture in his village. The topics discussed included selectivity and pattern of migration, farm-level labor, the role of women, inputs, credit, fertilizer use, and marketing of farm produce.

The Chief estimated that over 1,500 farm families grouped into about 300 soukhalas or compound households comprise the village. He said migration, either seasonal or permanent, is very high among young men and the favored destinations are Ghana, Nigeria, and Côte d'Ivoire. Despite the rather detrimental effects of the outflow of young men on the availability of agricultural labor in the village, Chief Taguindame explained that the occasional cash remittances made by the migrants help sustain village life, particularly during the lean season.

Farm-Level Labor and the Role of Women

The Chief also discussed agricultural labor and said most farmers rely on family labor for agricultural work. A few farmers form labor pools but such groups are formed only during the periods of weeding and harvest because weather uncertainties compel farmers to concentrate on seeding individual plots with the onset of the rains. He said very few farmers can afford hired labor, as the period of peak agricultural activity usually coincides with the period when cash resources are limited. When labor is hired the daily wage does not normally exceed 300 CFA, about US $1.00.

Concerning the agricultural role and work of women, the Chief explained that, aside from traditional domestic chores, women engage in food production, livestock raising, and other economic activities. Women participate in weeding, harvesting, and marketing. Some women cultivate their own plots, but such plots tend to be small and are mostly used for food crops such as sorghum, millet, and cowpeas. Interestingly, the brewing and sale of the local beer, "Tchakpa," is the exclusive work of women.

Children also play a significant role in the socioeconomic life. The Chief explained that before age 12, children usually tend family livestock. Beyond age 12, children participate in all farming activities. Boys, for example, may be given plots of their own to cultivate and are

encouraged to form labor pools with their peers to exchang farms.

Land Tenure and Use

As in Kpembona, land is not sold in Naki-Est b from father to son. In a few cases women inherit land fro Land may also be leased to friends for a period of time, u four cropping seasons. Money is not exchanged but the use provide kola nuts or a basket of grain in return for the u

Chief Taguindame also spoke about farmers' goa He explained that the goal of every farmer in the village food for their household. Consequently, a greater part of given to the production of grain and legumes. The Chief e total land area with cotton was less than a fifth of the a in 1988.

Compound farmlands are used essentially to gro cereals and hilly areas are reserved for communal grazing. shortage of land due, in part, to population pressure. Th farmers has been generally to use multiple and continuous with fertilizers and other soil amendments if affordable.

Inputs, Credit, and Fertilizer Use

The farmers of Naki-Est prefer the local vari sorghum to the improved varieties. Consequently, crop yi appear to be lower than the potential yield. Although mo fertilizer on cotton plots, very few farms with food crop

The Chief explained that most farmers cannot fertilizers for use on food crops. He emphasized that al credit is available to some farmers, to ensure prompt rep lending agencies encourage farmers to use fertilizers and credit for cotton production.

Animal manure, according to the Chief, is use around compounds. But, in general, since it is usually t who owns the animals, it is he who uses the manure. The strategy of providing every farmer a quantity of fertiliz

Best Available Document

scale of production or type of crops as a useful approach to help those farmers who may never otherwise use fertilizers.

Agricultural Extension

Chief Taguindame also discussed the nature of agricultural extension in Naki-Est. He said the Direction Régionale du Dévéloppement Rural (DRDR) is responsible for extension services in the area. He explained that the zonal and village extension officers reside in the Naki-Est Center and organize regular village meetings. At such meetings, farmers are provided information on new technologies, possible dates for fertilizer delivery and distribution, and when to expect the first rains. In the view of the Chief, the relationship between the farmers and extension workers is very cordial and in his estimation almost all farmers accept extension advice.

Crop Yields, Storage, and Marketing

Crop yields appear to be far below the yield potential. Chief Taguindame attributed the low yields to declining soil fertility and the erratic rainfall distribution pattern. As to what farmers do to survive very bad years, he said those having livestock sell some animals and use the money to buy grain. Others borrow grain and return it after the harvest.

Concerning storage, the Chief explained that most grain is stored in lofts built mainly with local materials. A few farmers treat grain with wood ash before storage in the lofts. He described the current storage method as adequate at least for the current yields. However, he noted that if there were a 50% increase in yields some farmers may experience storage problems. He further explained that since the traditional storage facilities are built with local materials, farmers will not have much difficulty expanding storage capacities in anticipation of a bumper harvest.

On the marketing of farm produce, Chief Taguindame confidently said that with the fairly large and well patronized market in Naki-Est, he does not foresee any problems, even if farmers should double output. He explained that dealers visit the village with trucks on market days to buy farm produce, especially sorghum and millet. He said some of the women who specialize in beer-making also buy quantities of sorghum grain at harvest for brewing, storage, and use during the lean season.

Like farmers in Kpembona, those in Naki-Est are beset with several problems. Striga, screw worms, wild pigs, and guinea fowl cause substantial crop damage. The Chief explained that he and his people are working closely with extension personnel to find solutions to these problems. Currently, several farmers practice crop rotation that seems to check the menace of screw worms. The problem of striga however remains unsolved, likewise that of rodents, and other wildlife. By law all wildlife in the area are considered endangered and therefore must be protected regardless of the damage they cause to crops. Finally, Chief Taguindame expressed the support and commitment of himself and his people for the ideals of the SFRP.

Village Overview: Kpembona

The village of Kpembona is an agglomerated settlement comprised of three farming communities including Kpendjaga, Topienga, and Kpembona Center, and is headed by Chief Laboni Abdulai. As part of the Soil Fertility Restoration Project baseline survey, Chief Abdulai was interviewed about the situation of agriculture of his village.

The Chief did not know the total population of his village. In his estimation, however, there are about 800 economically active men and women all engaged in agriculture. Concerning migration, the Chief said that young men are much more mobile than older people. He mentioned the cocoa and coffee-growing areas in neighboring Ghana and Côte d'Ivoire as the favored destinations of most migrants. A few others, he said, migrate to the gold mining areas of Ghana for work. He explained that the lack of off-farm employment and, to some extent, the desire to own consumer durables such as bicycles and radio-cassette recorders are the main factors that attract young men to seek work outside the village.

Land Tenure and Use

Chief Abdulai explained that by custom village farmland cannot be sold. Land is usually passed from father to the eldest son who, in turn, may parcel some land to the younger siblings. Land may also be "leased" to friends for periods ranging from 2 to 4 years. No fee is charged for the use of the leased land. Instead, the user may make a token payment in the form of kola nuts, a chicken, or a small basket of grain at the end of the cropping

season. However, there appears to be a land shortage in the village, and some farmers, according to Chief Abdulai, travel north to Burkina Faso at the beginning of every cropping season to cultivate land provided by distant relatives.

Regarding land use, the Chief explained that the greatest proportion of the arable land is devoted to the cultivation of the main staples that include millet, sorghum, cowpeas, and groundnuts. The remainder of the land is used to grow cotton which is the main cash crop and hilly areas are usually reserved for communal grazing.

Farm-Level Labor

Agricultural labor is provided mainly by household members. Boys from age 12 work in all farming tasks. A few farmers form labor pools and take turns working on the plots owned by others in the pool. There are two main types of pooled labor, the "Kpapogre" and the "Kpounlouli" systems. Under the "Kpapogre" system, a farmer invites close friends from within and outside the village to help on his farm, usually for a day. At the end of the day the friends are treated to a large meal and a quantity of locally brewed beer called "Tchakpa." Afterwards the group disbands. By contrast, under the "Kpounlouli" system, between 8 and 12 men may band together and take turns working on the farm plots of each member. This system of rotation may last throughout the cropping season.

Hired labor is usually compensated in kind with grain or with food and drink. In a few cases when cash is paid, the wage does not usually exceed 250 CFA, about US $.80/day. The Chief mentioned that despite the different sources of labor available to farmers, a great many experience labor shortages during the period of peak agricultural activity.

Use of Fertilizers and Other Soil Amendments

Regarding fertilizer use in Kpembona, the Chief mentioned that farmers have been using fertilizers for the past two decades. In the early days, he said, a kilogram of fertilizer sold for 15 CFA compared with the current price of 65 CFA/kg. "Unfortunately for us," he continued, "there have not been any corresponding increases in prices offered for our farm produce." Consequently, several farmers cannot afford sufficient quantities of fertilizers aside from those provided by SOTOCO and DRDR on credit that are intended for the cultivation of cotton.

The Chief explained further that very small quantities of crop residue are used for soil fertility because the stalks of millet and sorghum, for example, are used as fuel and the residue from groundnuts is fed to livestock. Farmers recognize the importance of animal manure for crop production, but the main constraint for use, according to the Chief, is that it is not available in sufficient quantities. Therefore, the use of animal manure is limited to plots around dwellings.

Agricultural Extension

Regular village meetings are organized by the resident extension officer in Kpembona. The meetings, according to the Chief, are well attended by farmers. The Chief stated that at such meetings farmers are advised on "new" farming techniques, methods of fertilizer application, crop spacing, thinning, and the use of pesticides. Farmers also discuss specific problems about their farms and seek extension advice at such meetings. The Chief said most farmers follow extension advice but a few prefer the old practices.

On farmers' agricultural goals, the Chief explained that the first priority of every farmer in the village is to produce enough grain to feed his family, and if there is any surplus, sell it to buy a couple of oxen, a plow, and other inputs. The Chief said these goals can be achieved only if we have access to credit. Short of that, the only means available to those farmers who have access to large tracts of land is to expand the area under cultivation.

Crop Yields, Storage, and Marketing

Chief Abdulai also discussed yields, storage, and marketing of farm produce. He stated that yields are very low and can be improved. However, he ranked unreliable rainfall followed by declining soil fertility as the main causes of low yields. With regard to crop storage, it was explained that the greater part of sorghum and millet harvest is stored in grain lofts for household use. The remainder is usually sold in the market at Papri, 5 km north of the Kpembona center. Farmers have no problems in selling cotton because the accredited buying agency (SOTOCO) provides a ready market.

General Problems of Agriculture

Aside from declining soil fertility, unreliable rainfall, and institutional problems, such as lack of credit for inputs and equipment for the cultivation of food crops, the Chief discussed other problems of farmers. Major problems include weeds, worms, and rodents. He stated that wild pigs and guinea fowl frequently damage food crops. He also mentioned striga, a weed which survives by stifling other plants, and screw worms. He mentioned that sorghum and millet are very vulnerable to striga.

As to how farmers are dealing with the problems, the Chief explained that, with regard to the rodents, the only methods that have been effective are to keep constant surveillance of the farm and scare the pests. Concerning striga and screw worms, the Chief said "only crop rotation seems to provide a partial solution to the problem."

Demographic Characteristics of Households

The Sample Households

The distributions of sample households by age and gender are presented in Table 2.1. Of the 125 farmers interviewed, 77% are men and 23%

Table 2.1. Distribution of Sample Households by Gender and Age in Naki-Est and Kpembona

	Naki-Est						Kpembona					
	Men		Women		Total		Men		Women		Total	
Age	N	%	N	%	N	%	N	%	N	%	N	%
<24	2	4	2	13	4	7	6	12	1	7	7	11
25-29	3	6	1	7	4	7	4	8	-	-	4	6
30-34	7	16	1	7	8	13	5	10	1	7	6	9
35-39	4	9	3	20	7	12	3	6	3	22	6	9
40-44	5	11	2	13	7	12	4	8	4	29	8	12
45-49	4	9	3	20	7	12	9	17	1	7	10	16
50-54	7	16	3	20	10	16	3	6	1	7	4	6
55-59	4	9	-	-	4	7	2	4	1	7	3	5
>59	9	20	-	-	9	14	15	29	2	14	17	26
TOTAL	45	100	15	100	60	100	51	100	14	100	65	100
Percent	75		25		100		78		22		100	

Note: Percentages are rounded.

are women. The age distributions are such that the social, economic, and agronomic consequences of fertilizer use will be demonstrated among younger and older farmers of both genders. Women in both villages tend to be younger than men. Specifically, 46% of the men and 60% of the women in Naki-Est are aged 44 years or less and in Kpembona 44% of the men and 65% of the women are aged 44 years or less.

Household Composition

Table 2.2 shows the percentage distributions of the household relatives of men and women farmers by village and the total sample. A comparison of Naki-Est and Kpembona shows that wives comprise most of the household members, 40% and 42%, respectively. About one-quarter of the households of men is comprised of sons, 24% in Naki-Est and 23% in Kpembona. Daughters comprise 4% and 6% of the households of men in Naki-Est and Kpembona, respectively. Few sisters and grandchildren reside in the households of men in either village.

Table 2.2. Composition of Sample Households

Village	Gender of farmer	Wives	Husbands	Sons	Daughters	Sisters	Parents	Grandchildren	Other[a]
		(%)							
Naki-Est	Men	40	-	24	4	1	11	-	20
	Women	-	31	35	3	-	-	-	31
	Total Sample	34	19	20	3	1	6	-	17
Kpembona	Men	42	-	23	6	1	8	1	19
	Women	-	22	32	12	-	-	-	34
	Total Sample	31	20	20	5	1	5	1	17
Total Sample	Men	41	-	24	5	1	9	-	20
	Women	-	26	33	8	-	-	-	33
	Total Sample	32	19	20	4	-	7	-	18

a. Other includes cousins, uncles, nieces, nephews, grandparents, and brothers.
Note: Percentages are rounded.

The parents of men farmers in Naki-Est are somewhat more likely to live in the households of men than in Kpembona, 11% and 8%, respectively. The percentages of other relatives living in the households of men are about equal in Naki-Est and Kpembona, 20% and 19%, respectively. The figures on other relatives suggest that the households of men farmers in both villages are extended. Parents, grandchildren, and others represent 31% of household members in Naki-Est and 28% in Kpembona.

A comparison of the households of women farmers in the two villages shows that husbands comprise a greater percentage of members in Naki-Est than in Kpembona, 31% and 22%, respectively. Sons comprise 35% of the household members in Naki-Est and 32% in Kpembona. Interestingly, the percentage of daughters comprising the households of women is four times greater in Kpembona (12%) than in Naki-Est (3%).

Parents, sisters, and grandchildren are virtually unrepresented in the households of women in both villages. Compared with men, women in both villages have a greater percentage of other relatives in their households, 31% in Naki-Est and 34% in Kpembona compared with 20% and 19% among men, respectively.

Household Size

Table 2.3 describes further the sample households by the mean number of men, women, children, and mean household sizes. The mean number of men in households of men farmers is about equal in Naki-Est and Kpembona, 2.5 and 2.4, respectively. The mean number of women in households of men farmers is somewhat greater in Naki-Est than in Kpembona, 2.9 and 2.6, respectively. The mean number of children in households of men farmers in Naki-Est (6.7) is greater than in Kpembona (5.3). Thus, the mean household size among men farmers in Naki-Est (12.1) is greater than in Kpembona (10.3).

The mean number of men in the households of women farmers is greater in Kpembona (2.4) than in Naki-Est (1.9). The mean number of women in

Table 2.3. Size and Composition of Sample Households, Number of Men, Women, and Children in Households by Gender, Village, and Total Sample

Village	Gender of Farmer	Men in Household		Women in Household		Children in Household		Size of Household	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Naki-Est	Men	2.5	1.3	2.9	1.5	6.7	4.6	12.1	6.2
	Women	1.9	1.2	1.7	0.9	3.6	2.3	7.1	3.3
	Total Sample	2.4	1.3	2.6	1.5	5.9	4.3	10.8	6.0
Kpembona	Men	2.4	1.3	2.6	1.5	5.3	3.6	10.3	5.3
	Women	2.4	1.1	3.0	1.0	5.8	3.8	10.8	4.9
	Total Sample	2.4	1.3	2.7	1.4	5.4	3.6	10.4	5.2
Total Sample	Men	2.5	1.3	2.7	1.5	5.9	4.1	11.1	5.8
	Women	2.1	1.2	2.3	1.2	4.6	3.2	8.9	4.5
	Total sample	2.4	1.3	2.6	1.4	5.6	4.0	10.6	5.6

the households of women farmers in Kpembona (3.0) is greater than in Naki-Est (1.7). As shown in Table 2.2, this is attributed to a greater percentage of daughters in the households of women in Kpembona (12%) than in Naki-Est (3%).

Regarding the mean number of children in the households of women farmers, women in Kpembona reported an average of 5.8 and in Naki-Est 3.6. Thus, the mean household size among women farmers in Kpembona (10.8) is larger than in Naki-Est (7.1).

The summary figures in Table 2.3 show that, on the average, men farmers in the Savanna Region have more men in their households than women, 2.5 compared with 2.1, respectively. The average number of women in the households of men farmers (2.7) is somewhat greater than among women farmers (2.3). Men have, on the average, more children in their households (5.9) than in households of women farmers (4.6). The average household size of men farmers (11.1) is significantly greater than among women farmers (8.9).

Table 2.4 shows the frequency distributions of household sizes in Naki-Est and Kpembona by gender and indicates the predominance of large household sizes among farmers in these villages. In Naki-Est 89% of the households of men farmers and 67% of those of women have six or more persons.

Table 2.4. Frequency Distributions of Household Sizes in Naki-Est and Kpembona by Gender of Farmer

Household Size	Naki-Est						Kpembona					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
1-3	-	-	1	7	1	2	3	6	-	-	3	5
4-5	5	11	4	26	9	15	6	12	-	-	6	9
6-7	8	18	4	26	12	20	8	15	3	21	11	17
8-9	8	18	3	20	11	18	8	15	6	43	14	21
10-11	3	6	1	7	4	7	5	10	-	-	5	8
12-14	8	18	1	7	9	15	11	22	2	15	13	20
>14	13	29	1	7	14	23	10	20	3	21	13	20
TOTAL	45	100	15	100	60	100	51	100	14	100	65	100
Percent	75		25		100		78		22		100	

Note: Percentages are rounded.

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However, in Kpembona, 82% of the households of men farmers have six or more persons, but 100% of the households of women farmers in this village have six or more persons. The calculations for households having 10 or more persons in Kpembona show some interesting contrasts. Fifty-two percent of the households of men farmers have 10 or more persons, but only 36% of the households of women have 10 or more persons. Finally, in regard to Table 2.4, 29% of the men in Naki-Est and 20% of those in Kpembona have 14 or more persons in their households. In stark contrast, 7% of the women in Naki-Est compared with 21% of the women in Kpembona have more than 14 persons in their households.

Schooling

Table 2.5 shows the mean ages and years of schooling of farmers by gender, village, and total sample. In Naki-Est the average age of men farmers (45.4) is greater than that of women (37.6). Although the years of schooling is minimal in the experimental village, men report an average of 1.4 years of schooling and women 0.5 years. In Kpembona men are, on the average, somewhat older than women in the sample, 46.0 and 42.6 years, respectively. Again, the average years of schooling in Kpembona is minimal for men, 0.3 years, and women reported not completing any schooling. The total sample figures clearly show limited schooling for both men (0.8 years) and women (0.2 years).

Table 2.5. Age and Schooling of Farmers by Gender, Village, and Total Sample

		Age of Farmers (Years)			Schooling of Farmers (Years)		
Village	Gender	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Naki-Est	Men	45	45.4	13.9	45	1.4	2.5
	Women	15	37.6	10.5	15	0.5	1.1
	Total Sample	60	43.5	13.5	60	1.2	2.3
Kpembona	Men	51	46.0	16.8	51	0.3	1.2
	Women	14	42.6	11.5	14	0.0	0.0
	Total Sample	65	45.3	15.7	65	0.2	1.1
Total Sample	Men	96	45.7	15.4	96	0.8	2.0
	Women	29	40.0	11.1	29	0.2	0.8
	Total Sample	125	44.4	14.7	125	0.7	1.8

Table 2.6 shows the mean ages of the farmers and all adult household members by gender, village, and the total sample of 592 persons. On the average, men are somewhat younger than women, 33.2 years and 34.2 years, respectively. On the average men in Naki-Est completed 1.6 years of schooling compared with 0.2 for women. In Kpembona, men are on the average older than women, 35.5 years and 32.0 years, respectively. Again, men show more years of schooling than women, 1.1 years compared with 0.2 years. The summary total sample figures show that men are on the average older than women and have more formal schooling.

Table 2.6. Age and Schooling of Farmers and All Adult Household Members by Gender, Village, and Total Sample

		Age (Years)			Schooling (Years)		
Village	Gender	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Naki-Est	Men	142	33.2	16.7	142	1.6	2.7
	Women	134	34.2	14.7	133	0.2	0.9
	Total Sample	276	33.6	15.7	275	0.9	2.1
Kpembona	Men	157	35.5	19.0	157	1.1	2.3
	Women	159	32.0	14.9	160	0.2	0.8
	Total Sample	316	33.7	17.1	317	0.6	1.8
Total Sample	Men	299	34.4	18.0	299	1.3	2.5
	Women	293	33.0	14.8	293	0.2	0.8
	Total sample	592	33.7	16.5	592	0.8	2.0

Table 2.7 shows more refined and instructive descriptive data on the relationship between age and schooling by gender and for the sample of all adult household members. Men and women less than 24 years of age reported the greatest number of years of formal schooling, 2.3 and 1.1, respectively. Those men and women older than 45 years reported the least years of schooling, 0.3 and 0.1 years, respectively. This may reflect the increased access of the population to schooling in recent years. The figures clearly show that although the average years of schooling are greater among younger household members, women less than 24 years old have, on the average, 2 years less schooling than men in the same age category. Clearly the participation of women in formal schooling lags behind that of men.

Table 2.7. Schooling of Farmers and All Adult Household Members by Age, Gender, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Schooling (Years)			Schooling (Years)			Schooling (Years)		
Age (Years)	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
<24	109	2.3	2.9	98	0.3	1.1	207	1.3	2.5
25-29	30	1.8	3.2	29	0.1	0.6	59	1.0	2.5
30-34	32	1.2	2.5	41	0.1	0.5	73	0.6	1.8
35-39	18	1.2	2.2	21	0.1	0.2	39	0.6	1.6
40-45	38	0.5	1.4	51	0.2	0.8	89	0.3	1.1
>45	72	0.3	1.0	53	0.1	0.7	125	0.2	0.9
Total Sample	299	1.3	2.5	293	0.2	0.8	592	0.8	2.0

Tables 2.8 and 2.9 show descriptive data on the relationship between age and schooling of farmers and all adult household members by gender for Naki-Est and Kpembona, respectively. It is evident from these tables that both men and women in almost all age brackets have more average years of schooling in Naki-Est than in Kpembona. The availability of a post-primary school in Naki-Est probably explains this difference. These tables further show that the general relationships between age and schooling described in Table 2.6 hold for the experimental and control villages.

Table 2.8. Schooling of Farmers and All Adult Household Members by Age and Gender in Naki-Est

	Gender								
	Men			Women			Total Sample		
	Schooling (Years)			Schooling (Years)			Schooling (Years)		
Age (Years)	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
<24	55	2.3	2.8	39	0.2	1.1	94	1.5	2.5
25-29	14	2.9	3.7	13	0.2	0.8	27	1.6	3.0
30-34	14	1.7	3.2	18	0.2	0.7	32	0.8	2.3
35-39	9	1.3	2.2	11	0.1	0.3	20	0.7	1.6
40-45	18	1.0	1.9	25	0.4	1.2	43	0.7	1.5
>45	32	0.4	1.2	27	0.0	0.0	59	0.2	0.9
Total Sample	142	1.6	2.7	133	0.2	0.9	275	0.9	2.1

Table 2.9. Schooling of Farmers and All Adult Household Members by Age and Gender in Kpembona

	Gender								
	Men			Women			Total Sample		
	Schooling (Years)			Schooling (Years)			Schooling (Years)		
Age (Years)	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
<24	54	2.2	3.1	59	0.3	1.2	113	1.2	2.5
25-29	16	0.9	2.5	16	0.0	0.0	32	0.4	1.8
30-34	18	0.8	1.7	23	0.0	0.0	41	0.3	1.2
35-39	9	1.0	2.4	10	0.0	0.0	19	0.5	1.7
40-45	20	0.1	0.5	26	0.0	0.0	46	0.0	0.3
>45	40	0.2	0.8	26	0.2	1.0	66	0.2	0.9
Total Sample	157	1.1	2.3	160	0.2	0.8	317	0.6	1.8

Household Locations and Access to Markets

Table 2.10 describes the differences between men and women and between Naki-Est and Kpembona regarding distances to markets where agricultural production may be sold and purchased. Men farmers in both villages reported being closer to markets than women. The differences in the distance to markets between men and women is least in Naki-Est (0.3 km) and greatest in Kpembona (1.0 km). Disregarding gender, the farmers of Naki-Est are on the average 3.3 km closer to markets than those in the village of Kpembona. The figures in Table 2.11 for distances to stores with household goods are precisely the same as in Table 2.10.

Table 2.10. Distances From Households to Markets for Agricultural Products by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Distance			Distance			Distance		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
		- - - - (km) - - - -			- - - (km) - - - -			- - - (km) - - - -	
Naki-Est	45	1.6	1.1	15	1.9	1.3	60	1.7	1.1
Kpembona	47	4.7	2.7	14	5.7	2.3	61	5.0	2.7
Total Sample	92	3.2	2.6	29	3.7	2.7	121	3.3	2.6

Table 2.11. Distances From Households to Stores for Household Goods by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Distance to Store			Distance to Store			Distance to Store		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
		- - -(km)- - -			- - - (km)- - -			- - - -(km)- - -	
Naki-Est	45	1.6	1.1	15	1.9	1.3	60	1.7	1.1
Kpembona	47	4.7	2.7	14	5.7	2.3	61	5.0	2.7
Total Sample	92	3.2	2.6	29	3.7	2.7	121	3.3	2.6

The distances to fertilizer stores shown in Table 2.12 indicate that the households of men farmers in Naki-Est are closest (1.5 km) to fertilizer sales points and those of men in Kpembona the most distant (1.9 km). Women farmers in Kpembona reported being slightly closer to fertilizer sales points on the average than those in Naki-Est, 1.7 km and 1.8 km, respectively. Because commercial transportation is virtually unavailable for both villages, the distances reported in Tables 2.10 through 2.13 should be understood in light of the reliance of the village populations on transportation by foot and bicycle.

Table 2.12. Distance From Households to Fertilizer Stores by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Distance			Distance			Distance		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
		- - - - (km)- - -			- - - (km)- - -			- - - -(km)- - -	
Naki-Est	45	1.5	1.1	15	1.8	1.2	60	1.6	1.1
Kpembona	50	1.9	1.6	13	1.7	1.5	63	1.8	1.6
Total Sample	95	1.7	1.4	28	1.7	1.3	123	1.7	1.4

Table 2.13. Distances From Households to Household Plots by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
		- - - - (km)- - -			- - - -(km) - - -			- - - -(km)- - -	
Naki-Est	44	1.0	1.1	10	0.9	0.8	54	1.0	1.0
Kpembona	51	1.2	1.4	9	1.4	1.3	60	1.2	1.4
Total Sample	95	1.1	1.3	19	1.1	1.1	114	1.1	1.2

Distances From Households to Farm Plots

Distances to Household Plots

As shown in Table 2.13 for the total sample, the average distance from households to household plots is identical for men and women farmers (1.1 km). Women in Kpembona reported their households furthest from household plots (1.4 km) and women in Naki-Est the closest (0.9 km). On the average the household plots managed by men in Naki-Est (1.0 km) are 0.2 km closer than those of men in Kpembona (1.2 km). In general and on the average the total sample figures show that the household plots in Kpembona are located at a greater distance from the village than in Naki-Est, 1.2 km and 1.0 km, respectively.

Distances to Individual Plots

Disregarding gender, the total sample figures in Table 2.14 show that on the average the distances from households to individual plots are identical (1.1 km) in Naki-Est and Kpembona. The women farmers of Kpembona reported the least distance from their households to individual plots (0.7 km) and men in Kpembona the greatest (1.2 km). On the average individual plots cultivated by women are closer to their households than those cultivated by men, 0.9 km, and 1.2 km, respectively.

Table 2.14. Distances From Households to Individual Plots by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
		(km)			(km)			(km)	
Naki-Est	45	1.1	1.1	15	1.0	0.8	60	1.1	1.0
Kpembona	42	1.2	1.4	14	0.7	0.5	56	1.1	1.3
Total Sample	87	1.2	1.3	29	0.9	0.7	116	1.1	1.2

Off-Farm Employment of Farmers and Adult Household Members

The percentages of adult household members and farmers engaged in off-farm employment by village and gender are shown in Table 2.15. The total sample figures for 591 persons show that 26% of the men and 47% of the women were engaged in off-farm employment at the time of the survey. The greatest percentage of off-farm employment was reported by women in Naki-Est (50%) and men in this village reported the least (19%). The percentage of off-farm employment among women in both villages is greater than that of men. Thus, Moba-Gourma women in the Savanna Region of northern Togo are very active in off-farm employment, especially in Naki-Est, the experimental village.

Table 2.15. Farmers and Adult Household Members With Off-Farm Employment by Gender, Village, and Total Sample

	Gender					
	Men		Women		Total Sample	
Village	N	Percent	N	Percent	N	Percent
Naki-Est	142	19	133	50	275	34
Kpembona	156	33	160	45	316	39
Total Sample	298	26	293	47	591	37

Note: Percentages are rounded.

Table 2.16 shows the average duration of off-farm employment of farmers and adult household members who were engaged in off-farm employment by gender and village. The total sample figures show that women reported an average of 6.1 months of off-farm employment and men 7.0 months. Thus, although a greater percentage of women than men are employed off-farm (Table 2.15), the average duration of that employment is about 1 month less than that of men on an annual basis.

Table 2.16. Average Duration of Off-Farm Employment of Farmers and Adult Household Members in Months Per Year by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
		Months Per Year			Months Per Year			Months Per Year	
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Naki-Est	26	6.7	3.0	67	5.8	1.8	93	6.1	2.2
Kpembona	48	7.1	3.6	72	6.4	3.2	120	6.7	3.4
Total Sample	74	7.0	3.4	139	6.1	2.6	213	6.4	3.0

For months of off-farm employment, the greatest average is among men in Kpembona (7.1) followed by men in Naki-Est (6.7), and women in Kpembona (6.4). The shortest average duration of off-farm employment is among women in Naki-Est, 5.8 months. The total sample figures for the two villages show that the average months of off-farm employment in Kpembona (6.7) are somewhat greater than in Naki-Est (6.1).

The data for annual off-farm earnings for all farmers and adult household members shown in Table 2.17 indicate that the greatest earnings are by men in Kpembona (44,949 FCFA or about US $150), followed by men in Naki-Est (30,880 FCFA or about US $103) and women in Kpembona (22,246 FCFA or US $74). The least off-farm earnings were realized by women in Naki-Est, 13,667 FCFA or about US $46, whose average months of off-farm employment are the least in the sample, 5.8 months (Table 2.16). Although the average months of off-farm in Naki-Est (6.1) and Kpembona (6.7) are similar, average off-farm earnings among farmers in Kpembona are greater than in Naki-Est, 30,444 FCFA (US $101) compared with 18,936 FCFA (US $63), respectively. Gender comparisons of off-farm income in Table 2.17 show that the mean off-farm earnings of women (18,396 FCFA or about US $60) are substantially less than those of men (37,935 FCFA or about US $126).

Table 2.17. Annual Off-Farm Earnings of Farmers and Adult Household Members by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
		Earnings Per Year in FCFA[a]			Earnings Per Year in FCFA[a]			Earnings Per Year in FCFA[a]	
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Naki-Est	25	30,880	25,882	66	13,667	13,886	91	18,396	19,431
Kpembona	39	44,949	43,398	69	22,246	24,052	108	30,444	34,008
Total Sample	64	39,453	37,935	135	18,052	20,140	199	24,935	28,859

a. 300 FCFA = US $1.

A more detailed description of off-farm employment, age, and schooling by gender and village is shown in Table 2.18. Men uniformly show more average years of schooling (1.3), average months of off-farm employment (7.0), and greater average annual off-farm earnings (39,453 FCFA), but a smaller percentage of off-farm employment (26.2) than women in the sample.

In contrast women uniformly show fewer average years of schooling (0.2), a greater percentage of off-farm employment (47.4), fewer average months of off-farm employment (6.1), and less average off-farm earnings than men (18,052 FCFA).

Table 2.18. Average Age, Years of Schooling, and Characteristics of Off-Farm Employment of Farmers and Adult Household Members by Gender, Village, and Total Sample

Village	Gender	N	Age Mean (years)	Schooling of Farmer Mean (years)	Farmers With Off-Farm Employment (%)	Off-Farm Employment: Months Per Year Mean	Off-Farm Employment: Earnings Per Year in FCFA[a] Mean
Naki-Est	Men	142	33.1	1.6	19.0	6.7	30,880
	Women	134	34.2	0.2	50.4	5.8	13,667
Kpembona	Men	157	35.5	1.1	32.7	7.1	44,939
	Women	159	32.0	0.2	45.0	6.4	22,246
Total Sample	Men	299	34.4	1.3	26.2	7.0	39,453
	Women	293	33.0	0.2	47.4	6.1	18,052

a. 300 FCFA = US $1.

Off-Farm Employment of Farmers

Having discussed the off-farm employment patterns among all adult household members, the analysis in this section is restricted to farmers. Although the results show similar trends, sharper contrasts are also observed.

Gender differences in the percentages of farmers engaged in off-farm employment by village are shown in Table 2.19. About 42% of the total sample of farmers were engaged in off-farm employment in 1988. The figures by village indicate that the percentage of off-farm employment among farmers is greater in Kpembona (46%) than in Naki-Est (37%). Women farmers in Kpembona, the control village, have the highest percentage of off-farm employment (79%) followed by women in Naki-Est (67%). Men farmers in Naki-Est are the least engaged in off-farm employment (27%). The percentage of men farmers with off-farm employment in Kpembona (37%) exceeds that of Naki-Est. The percentage of women farmers with off-farm employment (72%) substantially exceeds that of men (32%) in the Savanna Region of northern Togo.

Table 2.19. Farmers With Off-Farm Employment by Gender, Village, and Total Sample

Village	Gender: Men N	Men Percent	Women N	Women Percent	Total Sample N	Total Sample Percent
Naki-Est	45	27	15	67	60	37
Kpembona	51	37	14	79	65	46
Total Sample	96	32	29	72	125	42

Note: Percentages are rounded.

Further instructive gender differences in off-farm employment are shown in Table 2.20. The total sample figures show that the average number of months of off-farm employment by farmers engaged in off-farm employment is somewhat higher in Naki-Est than in Kpembona, 6.9 and 6.2 months, respectively. On the average, the number of months of off-farm employment for the total sample is 6.5.

Table 2.20. Average Duration of Off-Farm Employment of Farmers in Months Per Year by Gender, Village, and Total Sample

Village	Gender: Men N	Men Months Per Year Mean	Men Months Per Year Standard Deviation	Women N	Women Months Per Year Mean	Women Months Per Year Standard Deviation	Total Sample N	Total Sample Months Per Year Mean	Total Sample Months Per Year Standard Deviation
Naki-Est	12	7.6	3.4	10	6.1	2.1	22	6.9	2.9
Kpembona	19	6.4	3.8	11	5.7	3.0	30	6.2	3.5
Total Sample	31	6.9	3.6	21	5.9	2.5	52	6.5	3.2

On the average, men farmers engaged in off-farm employment are employed 6.9 months per year off-farm and women 5.9 months. The average number of months of off-farm employment is highest among men farmers in Naki-Est (7.6) and lowest among women farmers in Kpembona (5.7). Thus, the farmers of Naki-Est, the experimental village, appear to be more involved in off-farm employment than those of Kpembona.

The average annual off-farm earnings for the total sample of farmers by village and gender are shown in Table 2.21. The average annual

Table 2.21. Annual Off-Farm Earnings of Farmers by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
		Earnings Per Year in FCFA[a]			Earnings Per Year in FCFA[a]			Earnings Per Year in FCFA[a]	
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Naki-Est	12	41,583	31,047	10	15,700	12,311	22	29,818	27,274
Kpembona	17	51,412	40,980	11	30,455	35,632	28	43,179	39,675
Total Sample	16	47,345	36,913	21	23,429	27,569	50	37,300	35,086

a. 300 FCFA = US $1.

earnings from off-farm employment for the total sample are 37,300 FCFA or about US $124. The average total sample earnings of farmers in Kpembona (43,179 FCFA or about US $144) substantially exceed that of Naki-Est (29,818 FCFA or about US $99).

The greatest average off-farm earnings are among men farmers in Kpembona (51,412 FCFA or about US $171), followed by men in Naki-Est (41,583 or about US $139) and women in Kpembona (30,455 FCFA or about US $101). Women farmers in Naki-Est reported the least earnings from off-farm employment (15,700 FCFA or about US $52 annually).

Table 2.22 summarizes age, years of schooling, and characteristics of off-farm employment of farmers by gender, village, and for the total sample. The summary figures show that men farmers are, on the average, older than women farmers and have more years of formal schooling, 0.8 and 0.2, respectively. However, the percentage of women farmers engaged in off-farm employment (72) greatly exceeds that of men (32). Women (5.9) show fewer average months of off-farm employment per year than men (6.9) and lower average earnings from off-farm employment. Men farmers in Kpembona reported the greatest off-farm earnings and women in Naki-Est the least, 51,412 FCFA or US $171 and 15,700 FCFA or about US $52, respectively.

Table 2.22. Average Age, Years of Schooling, and Characteristics of Off-Farm Employment of Farmers by Gender, Village, and Total Sample

Village	Gender	N	Age Mean (years)	Schooling of Farmer Mean (years)	Farmers With Off-Farm Employment (%)	Off-Farm Employment: Months Per Year Mean	Off-Farm Employment: Earnings Per Year in FCFA[a] Mean
Naki-Est	Men	45	45.4	1.4	26	7.6	41,583
	Women	15	37.6	0.5	66	6.1	15,700
Kpembona	Men	51	46.0	0.3	37	6.4	51,412
	Women	14	42.6	0.0	78	5.7	30,455
Total Sample	Men	96	45.7	0.8	32	6.9	47,345
	Women	29	40.0	0.2	72	5.9	23,429

a. 300 FCFA = US $1.

Locations of Off-Farm Employment for Farmers and Adult Household Members

The descriptive data shown in Table 2.23 for the total sample indicate that 82% of those engaged in off-farm employment find such work within their respective villages. Men (89%) and women (100%) in Naki-Est pursue more off-farm employment in the village than in Kpembona where the figures are 68% and 72% for men and women, respectively. The favored place of off-farm employment outside the village for men (14%) and women (22%) from Kpembona is Papri, a neighboring village. However, men and women farmers and adult household members in both villages are mainly engaged in off-farm employment in the village of residence. The figures in Table 2.23 clearly show that the locations of off-farm employment for residents of Kpembona are more dispersed than for those in Naki-Est.

Table 2.23. Frequency Distributions of Locations of Off-Farm Employment for Farmers and Adult Household Members by Gender, Village, and Total Sample

Location	Village: Naki-Est Men N	Naki-Est Men %	Naki-Est Women N	Naki-Est Women %	Naki-Est Total N	Naki-Est Total %	Kpembona Men N	Kpembona Men %	Kpembona Women N	Kpembona Women %	Kpembona Total N	Kpembona Total %	Total Sample N	Total Sample %
In village	24	89	67	100	91	97	34	68	52	72	86	71	177	82
Papri	-	-	-	-	-	-	7	14	16	22	23	19	23	11
Korbongo	-	-	-	-	-	-	-	-	4	6	4	3	4	2
Ivory Coast	1	4	-	-	1	1	2	4	-	-	2	2	3	1
Dapaong	-	-	-	-	-	-	3	6	-	-	3	2	3	1
Other	2	7	-	-	2	2	4	8	-	-	4	3	6	3
TOTAL	27	100	67	100	94	100	50	100	72	100	122	100	216	100
Percent	29		71		100		41		59		100			

Note: Percentages are rounded.

Types of Employment of Farmers and Adult Household Members

Table 2.24 shows the frequencies and percentages of types of off-farm employment of farmers and adult household members by gender, village, and total sample. The most frequent off-farm occupations of men in Naki-Est are small trade, dressmaking, basketmaking, construction, blacksmiths, and carpenters. These account for about 80% of all occupations pursued by men in the experimental village. Among women in Naki-Est, 15% of those engaged in off-farm employment pursue work in small trade and the great majority (84%) are involved in the off-farm work of beer brewing. Thus, the types of off-farm employment of men are much more diverse than those of women in Naki-Est.

Table 2.24. Frequency Distributions of Types of Off-Farm Employment of Farmers and Adult Household Members by Gender, Village, and Total Sample

	Village													
	Naki-Est						Kpembona							
	Men		Women		Total		Men		Women		Total		Total	
Type of Employment	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Small trade	6	23	10	15	16	17	19	39	21	29	40	33	56	26
Construction	2	8	-	-	2	2	1	2	-	-	1	1	3	1
Beer brewing	-	-	56	84	56	61	-	-	33	46	33	27	89	42
Dressmaker	5	19	-	-	5	6	2	4	-	-	2	2	7	3
Agricultural labor	1	4	-	-	1	1	5	10	-	-	5	4	6	3
Blacksmith	2	8	-	-	2	2	1	2	-	-	1	1	3	1
Basket making	4	15	-	-	4	4	3	6	1	1	4	3	8	4
Carpenter	2	8	-	-	2	2	8	16	-	-	8	7	10	5
Repair work	-	-	-	-	-	-	4	9	2	3	6	5	6	3
Food transport	-	-	1	1	1	1	1	2	12	17	13	11	14	7
Herdsman	-	-	-	-	-	-	3	6	2	3	5	4	5	2
Other	4	15	-	-	4	4	2	4	1	1	3	2	7	3
TOTAL	26	100	67	100	93	100	49	100	72	100	121	100	214	100
Percent	28		72		100		40		60		100			

Note: Percentages are rounded.

In Kpembona the occupations of small trade, agricultural labor, carpenter, basketmaking, repair work, and herdsmen account for 86% of all off-farm employment pursued by men. Among women in Kpembona small trade, beer brewing, and food transport account for over 90% of all occupations of women. Again, the types of off-farm employment pursued by men in Kpembona are more diverse than those of women.

Characteristics of Farms

Number of Plots

The descriptive information presented in Table 3.1 shows the average number of plots managed by men and women farmers by village and for the total sample. The total sample figures indicate that the mean number of plots managed by men in the 96 households headed by men is 5.3 and that women manage an average of 2.6 plots among the 52 men farmers who head households and had women managing plots. Men manage an average of 4 plots among the 25 women farmers that had men managing plots, and women managed an average of 2.7 plots among the 29 women farmers having women managing individual plots. The figures on the number of plots per farm for the sample show that the mean number of plots on farms of men (6.8) and women (6.1) is very similar.

Table 3.1. Number of Farm Plots Per Farmer by Gender, Village, and Total Sample

		Men Managed Plots (Number)			Women Managed Plots (Number)			Number of Plots Per Farm		
Village	Gender of Farmer	N[a]	Mean	Standard Deviation	N[b]	Mean	Standard Deviation	N[c]	Mean	Standard Deviation
Naki-Est	Men	45	6.1	2.5	33	2.7	1.9	45	8.1	3.9
	Women	14	3.5	1.4	15	3.1	1.8	15	6.4	2.2
	Total Sample	59	5.5	2.5	48	2.8	1.9	60	7.7	3.6
Kpembona	Men	51	4.6	2.1	19	2.5	1.9	51	5.6	3.0
	Women	11	4.5	2.0	14	2.3	0.7	14	5.9	2.8
	Total Sample	62	4.6	2.0	33	2.4	1.5	65	5.6	2.9
Total Sample	Men	96	5.3	2.4	52	2.6	1.9	96	6.8	3.7
	Women	25	4.0	1.7	29	2.7	1.4	29	6.1	2.5
	Total Sample	121	5.0	2.3	81	2.7	1.8	125	6.6	3.4

a. N = number of farmers having plots managed by men.
b. N = number of farmers having plots managed by women.
c. N = total number of sample farmers.

Among men farmers in Naki-Est, 45 have an average of 6.1 plots managed by men and 33 have an average of 2.7 plots managed by women. Among women farmers in Naki-Est, 14 have an average of 3.5 plots managed by men and 15 have an average of 3.1 plots managed by women. The data on the number of plots per farm in Naki-Est indicate that the mean number of plots on farms of men (8.1) is greater than that of women (6.4).

Fifty-one men in the control village of Kpembona have an average of 4.6 plots managed by men and 19 have an average of 2.5 plots managed by women. Among women farmers in the control village, 11 have an average of 4.5 plots managed by men and 14 have an average of 2.3 plots managed by women. The mean number of plots on farms of men (5.6) and women (5.9) is more equal than in Naki-Est. The data in Table 3.1 clearly show that men and women predominantly manage their own plots; but more importantly, each gender may manage plots of the other in a cooperative exchange for mutual benefit.

Area of Plots

The average crop areas per farm by village and gender are shown in Table 3.2. The total sample figures show that 96 men farmers have an average of 3.6 ha managed by men and 52 have an average 0.7 ha managed by women. Among women farmers 25 have an average of 2.7 ha managed by men and 29 have an average of 0.7 managed by women. Thus, crop areas managed by men are significantly greater than those managed by women. The total sample figures also show that the average crop area on farms of men (3.9 ha) is greater than that of women (3.0 ha).

Table 3.2. Crop Areas of Farms Managed by Men and Women by Gender of Farmer, Village, and Total Sample

Village	Gender of Farmer	Crop Area Managed by Men			Crop Area Managed by Women			Crop Area Per Farm		
		N[a]	Mean	Standard Deviation	N[b]	Mean	Standard Deviation	N[c]	Mean	Standard Deviation
		(ha per farm)			(ha per farm)			(ha)		
Naki-Est	Men	45	3.6	1.9	33	0.7	0.5	45	4.1	2.2
	Women	14	2.0	1.0	15	0.8	0.6	15	2.7	1.3
	Total Sample	59	3.2	1.8	48	0.7	0.6	60	3.7	2.1
Kpembona	Men	51	3.6	2.2	19	0.7	0.7	51	3.8	2.4
	Women	11	3.5	3.0	14	0.6	0.2	14	3.3	3.0
	Total Sample	62	3.6	2.3	33	0.6	0.6	65	3.7	2.5
Total Sample	Men	96	3.6	2.1	52	0.7	0.6	96	3.9	2.3
	Women	25	2.7	2.2	29	0.7	0.5	29	3.0	2.3
	Total Sample	121	3.4	2.1	81	0.7	0.6	125	3.7	2.3

a. N = number of farmers having plots managed by men.
b. N = number of farmers having plots managed by women.
c. N = total number of sample farmers.

Among men farmers in Naki-Est, 45 have an average of 3.6 ha managed by men and 33 have an average of 0.7 ha managed by women. The average crop area per farm of men in Naki-Est is substantially greater than that of women, 4.1 ha and 2.7 ha, respectively.

In Kpembona, 51 men farmers have an average of 3.6 ha managed by men and 19 have an average crop area of 0.7 ha managed by women. Among women farmers in this village, 11 have an average of 3.5 ha managed by men and 14 have an average of 0.5 ha managed by women. The average crop areas of farms managed by men (3.8 ha) are somewhat larger than those managed by women (3.3).

Land Tenure

The number and areas of farm plots by type of land tenure by gender for the total sample are shown in Table 3.3.

Table 3.3. Number and Areas of Farm Plots by Type of Land Tenure by Gender and Total Sample

Gender of Plot Manager	Land Tenure	Number of Plots: N	Number of Plots: Mean	Number of Plots: Standard Deviation	Number of Plots: Total in Sample	Area of Plots: Mean	Area of Plots: Standard Deviation	Area of Plots: Total in Sample
						(ha)		
Men	Family owned	104	3.6	1.8	373	2.5	1.7	264.4 (66)
	Family borrowed	41	2.3	1.2	94	1.6	1.1	65.2 (16)
	Individual owned	38	2.5	1.4	96	1.5	1.7	59.7 (15)
	Individual borrowed	9	2.1	1.3	19	1.1	1.0	10.3 (2)
	Individual rented	2	1.5	0.7	3	1.1	0.5	2.3 (1)
	Total Sample	194	3.0	1.7	585	2.1	1.6	401.8 (100)
Women	Family owned	8	2.3	1.8	18	0.7	0.6	5.7 (10)
	Family borrowed	4	1.3	0.5	5	0.8	1.0	3.1 (5)
	Individual owned	48	2.7	2.0	130	0.7	0.6	32.1 (58)
	Individual borrowed	27	2.3	1.3	61	0.5	0.4	14.4 (26)
	Individual rented	1	2.0	-	2	0.3	-	0.3 (1)
	Total Sample	88	2.5	1.7	216	0.6	0.5	55.6 (100)
Total Sample	Family owned	112	3.5	1.9	391	2.4	1.7	270.1 (59)
	Family borrowed	45	2.2	1.2	99	1.5	1.1	68.3 (15)
	Individual owned	86	2.6	1.7	226	1.1	1.3	91.8 (20)
	Individual borrowed	36	2.2	1.3	80	0.7	0.7	24.7 (5)
	Individual rented	3	1.7	0.6	5	0.9	0.6	2.6 (1)
	Total Sample	282	2.8	1.7	801	1.6	1.5	457.5 (100)

Note: Figures in parentheses are rounded percentages.

A striking contrast is evident in that 66% of the area managed by men but only 10% of the area managed by women is family owned. Men also borrow a greater percentage of the land under their management for family use than women, 16% and 5%, respectively.

Women are far more likely than men to own land for individual use, 58% and 15%, respectively. Land that is borrowed for individual use by women (26%) also exceeds that of men, a mere 2%. The use of rented land by men and women is minimal, about 1%. Based on these data it is evident that the majority of land cultivated by men is family owned but among women the majority is individually owned. This is because food for family consumption is mainly produced by men and that produced by women is primarily but not exclusively intended for sale for household revenue.

Tables 3.4 and 3.5 show the number and areas of farm plots by type of land tenure, gender, and the total sample for Naki-Est and Kpembona, respectively. Although the patterns closely followed those discussed in Table 3.3, some village contrasts are apparent.

Table 3.4. Number and Areas of Farm Plots by Type of Land Tenure, Gender, and Total Sample in Naki-Est

Gender of Plot Manager	Land Tenure	Number of Plots				Area of Plots		
		N	Mean	Standard Deviation	Total in Sample	Mean	Standard Deviation	Total in Sample
						(ha)		
Men	Family owned	49	3.9	1.9	193	2.6	1.6	127.7 (69)
	Family borrowed	20	2.1	1.2	42	1.1	0.5	22.3 (12)
	Individual owned	18	3.2	1.4	58	1.4	1.2	27.2 (15)
	Individual borrowed	7	2.0	1.2	14	0.9	0.5	6.5 (4)
	Total Sample	94	3.3	1.8	307	1.9	1.4	183.7 (100)
Women	Family owned	6	1.7	1.2	10	0.6	0.4	3.4 (9)
	Family borrowed	2	1.0	-	2	0.3	-	0.6 (2)
	Individual owned	28	2.9	2.2	80	0.8	0.6	21.4 (59)
	Individual borrowed	17	2.6	1.5	44	0.6	0.5	10.6 (30)
	Total Sample	53	2.6	1.9	136	0.7	0.5	35.9 (100)
Total Sample	Family owned	55	3.7	2.0	203	2.4	1.6	131.1 (60)
	Family borrowed	22	2.0	1.2	44	1.0	0.5	22.8 (10)
	Individual owned	46	3.0	1.9	138	1.0	0.9	48.6 (22)
	Individual borrowed	24	2.4	1.4	58	0.7	0.5	17.1 (8)
	Total Sample	147	3.0	1.9	443	1.5	1.3	219.6 (100)

Note: Figures in parentheses are rounded percentages.

Table 3.5. Number and Areas of Farm Plots by Type of Land Tenure, Gender, and Total Sample in Kpembona

Gender of Plot Manager	Land Tenure	Number of Plots				Area of Plots		
		N	Mean	Standard Deviation	Total in Sample	Mean	Standard Deviation	Total in Sample
						(ha)		
Men	Family owned	55	3.3	1.7	180	2.5	1.8	136.6 (62)
	Family borrowed	21	2.5	1.2	52	2.0	1.3	42.9 (20)
	Individual owned	20	1.9	1.2	38	1.6	2.1	32.5 (15)
	Individual borrowed	2	2.5	2.1	5	1.9	2.3	3.8 (2)
	Individual rented	2	1.5	0.7	3	1.1	0.5	2.3 (1)
	Total Sample	100	2.8	1.6	278	2.2	1.7	218.1 (100)
Women	Family owned	2	4.0	2.8	8	1.2	1.2	2.4 (12)
	Family borrowed	2	1.5	0.7	3	1.3	1.4	2.6 (13)
	Individual owned	20	2.5	1.7	50	0.5	0.5	10.7 (54)
	Individual borrowed	10	1.7	0.8	17	0.4	0.2	3.8 (19)
	Individual rented	1	2.0	-	2	0.3	-	0.3 (2)
	Total Sample	35	2.3	1.5	80	0.6	0.6	19.7 (100)
Total Sample	Family owned	57	3.3	1.7	188	2.4	1.8	139.0 (58)
	Family borrowed	23	2.4	1.2	55	2.0	1.3	45.5 (19)
	Individual owned	40	2.2	1.2	88	1.1	1.6	43.2 (18)
	Individual borrowed	12	1.8	1.	22	0.6	0.9	7.6 (4)
	Individual rented	3	1.7	0.8	5	0.9	0.6	2.6 (1)
	Total Sample	135	2.7	1.6	358	1.8	1.7	237.9 (100)

Note: Figures in parentheses are rounded percentages.

Sixty-nine percent of the total area managed by men in Naki-Est and 62% in Kpembona is family owned. Men in Kpembona borrow a greater percentage of the total area under their management for family use than in Naki-Est, 20% and 12%, respectively. About 15% of the total area managed by men in both villages is individually owned. The total area that is borrowed by individual men in Naki-Est (4%) and Kpembona (2%) is minimal, as is rented land in Kpembona (1%).

Women in Kpembona reported a higher percentage of the total area under their management as family owned compared with Naki-Est, 12% and 9%, respectively. The percentage of the total area managed by women that is family borrowed (13%) is much greater than in Kpembona (2%). The percentage of the total cultivated area managed by women that is individually owned in Naki-Est (59%) is somewhat greater than in Kpembona (54%).

The women of Naki-Est reported a far greater percentage of land under their management as individually borrowed (30%) than women in Kpembona (19%). Rented land by individual women in Kpembona accounts for 2% of the total area under their management and in Naki-Est women reported no land as individually rented. Finally, it is apparent from the data on land tenure for

both villages that the large proportion of land ownership may be conducive to capital investment among men and women farmers.

Equipment, Tools, and Animals

The percentages of farmers who own equipment, hand tools, and animals are shown in Table 3.6 by gender, village, and total sample. The figures for the total sample indicate that the ownership of agricultural equipment is limited to men, specifically to men in Naki-Est. The percentage of women reporting ownership of hand tools (93%) is somewhat less than men (100%). The percentage of women reporting ownership of animals (about 90%) is less than men (98%) in the total sample.

Table 3.6. Farmers' Ownership of Equipment, Hand Tools, and Animals by Gender, Village, and Total Sample

Village	Gender	Ownership of Equipment		Ownership of Hand Tools		Ownership of Animals	
		N	Percent	N	Percent	N	Percent
Naki-Est	Men	45	16	45	100	45	98
	Women	15	-	15	87	15	93
	Total Sample	60	12	60	97	60	97
Kpembona	Men	51	-	51	100	51	98
	Women	14	-	14	100	14	86
	Total Sample	65	-	65	100	65	95
Total Sample	Men	96	7	96	100	96	98
	Women	29	-	29	93	29	90
	Total Sample	125	5	125	98	125	96

Note: Percentages are rounded.

About 16% of the men farmers in Naki-Est reported ownership of agricultural equipment and women reported no such ownership, as did men and women in Kpembona. Men in Naki-Est and men and women in Kpembona all reported ownership of hand tools. However, about 13% of the women farmers in Naki-Est reported no ownership of hand tools. Thus, women in this village are probably obliged to borrow hand tools for their agricultural tasks.

Men in Naki-Est (98%) are somewhat more likely than women (93%) to own animals. The corresponding figures for Kpembona are 98% and 86%, respectively. Further insight into the ownership of hand tools and animals is gained from Table 3.7 that shows the average number of hand tools and animals owned by farmers by gender and village. Concerning hand tools, the data show

that the average number of tools owned by men in Naki-Est (4.3) exceeds that of women (2.8) but it should be noted that women generally cultivate a smaller area than men. The same principle applies to Kpembona where men own an average of 4.5 hand tools and women 2.6. The total sample figures show that on the average men own 4.4 hand tools and women 2.7.

Table 3.7. Number of Hand Tools and Animals Owned by Farmers, by Gender, Village, and Total Sample

		Number of Hand Tools Owned			Number of Animals Owned		
Village	Gender	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Naki-Est	Men	45	4.3	0.8	44	37.5	28.1
	Women	15	2.8	1.9	14	11.4	8.0
	Total Sample	60	3.9	1.3	58	31.2	27.1
Kpembona	Men	51	4.5	0.6	50	36.3	33.7
	Women	14	2.6	1.4	12	12.7	14.4
	Total Sample	65	4.1	1.1	62	31.8	32.2
Total Sample	Men	96	4.4	0.7	94	36.9	31.0
	Women	29	2.7	1.6	26	12.0	11.2
	Total Sample	125	4.0	1.2	120	31.5	29.7

The average number of animals owned by men in Naki-Est, about 38, is more than three times that of women, about 11. The same principle applies to Kpembona where men own about 36 animals on the average and women about 12. Thus, in both villages the average ownership of animals by men significantly exceeds that of women.

More detail about the ownership of hand tools is shown in Table 3.8 where the total sample figures show that 89% of the hand tools owned within and between villages and genders are dabas, hoes, machetes, and axes. A comparison of men and women in Naki-Est shows that of the hand tools owned by men 26% are dabas, 17% are axes, and 11% are other various tools, but the percentages of these tools among those owned by women are lower, 23%, 9%, and 7%, respectively. The ownership of hoes (34%) and machetes (27%), as a percentage of the hand tools owned by women in Naki-Est, exceeds the percentage of these hand tools among those owned by men, 26% and 20%, respectively.

Table 3.8. Frequency Distributions of Types of Hand Tools Owned by Farmers, by Gender, Village, and Total Sample

	Village									
	Naki-Est.				Kpembona				Total Sample	
	Men		Women		Men		Women			
Type of Tool	N	%	N	%	N	%	N	%	N	%
Daba	45	26	10	23	51	25	10	25	116	25
Hoe	45	26	15	34	51	25	15	38	126	28
Machette	34	20	12	27	37	19	10	25	93	21
Axe	28	17	4	9	35	17	3	7	70	15
Other	19	11	3	7	28	14	2	5	52	11
TOTAL	171	100	44	100	202	100	40	100	457	100

Note: Percentages are rounded.

In Kpembona, the percentage distributions of ownership of tools by gender show that the ownership of dabas is proportionately equal among men (25%) and women (25%), the ownership of hoes among women (38%) is proportionally higher than among men (25%) as it is the ownership of machetes; women 25% and men 19%. The ownership of axes (17%) and other hand tools (14%) is proportionally higher among men than among women, 7% and 5%, respectively. These figures show that men in the experimental village and the control village own the majority of hand tools and that women are probably obliged to borrow hand tools more often than men. The ownership of hand tools by women is restricted mainly to the most important hand tools, namely, dabas, hoes, and machettes.

The summary and descriptive data in Table 3.9 are a basis for discussing the relationships between farmers' schooling, off-farm employment, crop area per farm, ownership of equipment, ownership of hand tools, and animal ownership. The total sample figures show the following summary observations: men farmers (0.8 years) have more formal schooling than women (0.2 years); the percentage of women engaged in off-farm employment (72%) greatly exceeds that of men (32%); the average crop area per farm for men (3.9 ha) is greater than that of women (3.0 ha); the percentage of men reporting ownership of agricultural equipment is minimal (7%) but women reported no such ownership; men (100%) are more likely than women to own hand tools (93%); women on the average own fewer hand tools than men, 2.7 and 4.4, respectively; men (98%) are also somewhat more likely than women (90%) to own animals; and the average number of animals owned by men (37) is about three times greater than the average owned by women (12).

Table 3.9. Schooling, Employment, Area Cropped, and Ownership of Equipment, Tools, and Animals by Gender, Village, and Total Sample

Village	Gender	Farmers' Schooling N	Farmers' Schooling Mean (years)	Off-Farm Employment (%)	Crop Area Per Farm Mean (ha)	Ownership of Equipment (%)	Ownership of Hand Tools (%)	Number of Hand Tools Owned Mean	Ownership of Animals (%)	Number of Animals Owned Mean
Naki-Est	Men	45	1.4	26.7	4.1	15.6	100.0	4.3	97.8	37.5
	Women	15	0.5	66.7	2.7	0.0	86.7	2.8	93.3	11.4
	Total Sample	60	1.2	36.7	3.7	11.7	96.7	3.9	96.7	31.2
Kpembona	Men	51	0.3	37.3	3.8	0.0	100.0	4.5	98.0	36.3
	Women	14	0.0	78.6	3.3	0.0	100.0	2.6	85.7	12.7
	Total Sample	65	0.2	46.2	3.7	0.0	100.0	4.1	95.4	31.8
Total Sample	Men	96	0.8	32.3	3.9	7.3	100.0	4.4	97.9	36.9
	Women	29	0.2	72.4	3.0	0.0	93.1	2.7	89.7	12.0
	Total Sample	125	0.7	41.6	3.7	5.6	98.4	4.0	96.0	31.5

These principles generally hold for each village with some exceptions. For example, all agricultural equipment in the sample is owned by men in Naki-Est and the average years of schooling for both men and women in this village exceed that in Kpembona. The percentage of men and women in Kpembona engaged in off-farm employment is greater than in Naki-Est. Regarding the average crop area per farm, men in Naki-Est show a slightly greater average than in Kpembona, 4.1 ha and 3.8 ha, respectively. In contrast, women in Kpembona (3.3 ha) report a greater average crop area than women in Naki-Est (2.7 ha).

Ownership of hand tools was reported by 100% of the men farmers in both villages and also by women in Kpembona, but only 87% of the women in Naki-Est reported ownership of hand tools. The average number of hand tools owned by men and women is about equal between villages, but men clearly own more hand tools than women within the villages. The ownership of animals is substantial in both villages among men and women, but the percentage of women reporting animal ownership is least in Kpembona (86%).

Regarding the average number of animals owned, a rank ordering shows that men in Naki-Est own the greatest average number (37.5), followed by men in Kpembona (36.3) and women in Kpembona (12.7). Women in Naki-Est own the least average number of animals (11.4). Changes in these variables will be monitored as an indication of the economic consequences of the SFRP.

Crops and Cropping Systems

As shown in Table 3.10, the total sample of farms includes 443 plots with a total crop area of 287.4 ha. This results in an average plot area of 0.65 ha. Women in the sample manage an area of 20.70 ha or 7% of the total sample area while men manage an area of 266.7 ha or 93% of the total sample area. The total sample average plot area in Kpembona (0.74 ha) is greater than in Naki-Est (0.57 ha).

Table 3.10 Number and Size of Plots and Crop Area by Village, Gender, and Total Sample

	Gender								
	Men			Women			Total Sample		
Village	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
		- - - -(ha)	- - -		- - - (ha)-	- - -		- - - -(ha)-	- - -
Naki-Est	189	0.63	119.90	42	0.27	11.40	231	0.57	131.30
Kpembona	179	0.82	146.80	33	0.28	9.30	212	0.74	156.10
Total Sample	368	0.72	266.70	75	0.28	20.70	443	0.65	287.40

Note: Analysis of data collected by plot.

In Kpembona the sample shows that 179 plots, with a total area of 146.8 ha and an average plot area of 0.82 ha, are managed by men, and for the samples in Naki-Est, 189 plots with a total area of 119.9 ha and an average plot area of 0.63 ha are managed by men.

The 42 plots in the sample that are managed by women in Naki-Est show a total area of 11.4 ha and an average plot area of 0.27 ha. The 33 plots in the sample that are managed by women in Kpembona show a total area of 9.3 ha and an average plot area of 0.28 ha. Thus, the average plot area of plots managed by women is about the same in both villages.

The number and size of plots and crop areas by gender, land tenure, village, and total sample are shown in Table 3.11. The total sample figures in this table show that the average size of the 146 family owned plots managed by men in Naki-Est is 0.65 ha and that the 23 family owned plots managed by women show an average size of 0.30 ha. In Kpembona men manage 140 family owned plots with an average size of 0.80 ha and women manage 16 family owned plots with an average of 0.32 ha. Thus, family owned plots managed by women are substantially smaller than those managed by men in both villages.

Table 3.11. Number and Size of Plots and Crop Area by Gender of Manager, Land Tenure, Village, and Total Sample

Gender of Manager	Land Tenure	Crop Area: Naki-Est			Crop Area: Kpembona			Crop Area: Total Sample		
		Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
			- - - -(acres)- - - -			- - - -(acres)- - - -			- - - -(acres)	- - - -
Men	Family owned	146	0.65	94.3	140	0.80	111.7	286	0.72	206.0
	Family borrowed	19	0.59	11.3	12	1.07	12.8	31	0.78	24.1
	Family rented in	-	-	-	8	1.20	9.6	8	1.20	9.6
	Individual owned	6	0.83	5.0	10	0.60	6.0	16	0.69	11.0
	Individual borrowed	15	0.45	6.8	9	0.74	6.7	24	0.56	13.5
Women	Family owned	23	0.30	6.9	16	0.32	5.2	39	0.31	12.1
	Family borrowed	1	0.30	0.3	-	-	-	1	0.30	0.3
	Family rented in	-	-	-	1	0.10	0.1	1	0.10	0.1
	Individual owned	-	-	-	2	0.30	0.6	2	0.30	0.6
	Individual borrowed	18	0.23	4.2 (3)	14	0.24	3.4	32	0.24	7.6
TOTAL										

Note: Analysis of data collected by plot.

Interestingly, the largest average plot sizes are managed by men in Kpembona who cultivate plots that are family borrowed or family rented-in, 1.07 ha and 1.20 ha, respectively.

The percentage distributions of plots among sole crops and various intercrops are shown in Table 3.12. Throughout this section, M-3 millet refers to a 3-month variety and M-6 to a 6-month variety. The total sample figures clearly show that a wide variety of crops are grown in each village by both men and women. Cotton (15%) and peanuts (11%), cash crops, and the millet-sorghum intercrop (12%) are the only crops that are grown on more than 10% of the 443 total sample plots.

In Naki-Est the most frequent crops cultivated on plots managed by men are cotton, peanuts, and intercropped millet-sorghum that account for 44% of crops on all plots. The most frequent crops cultivated on plots managed by women in the experimental village are rice, millet-sorghum, cotton, and peanuts that account for 63% of crops on all plots. Rice is cultivated in 31% of the plots managed by women.

The favored crops cultivated by men in Kpembona are intercrops of millet-sorghum, millet-cowpeas, millet-sorghum-cowpeas, and sole crops of cotton and peanuts that account for 60% of crops on all plots. Among women in Kpembona, the favored crops are beans, peanuts, rice, and the intercrop of peanuts-cowpeas that account for 51% of crops on all plots.

The data presented in Table 3.13 allow direct comparisons between men and women farmers on crop areas and size of plots by crop and village. Clearly men and women in both villages grow a wide variety of diverse crops. Among men no crops with the exceptions of millet-sorghum (16%), millet-cowpeas (11%), and millet-sorghum-cowpeas (10%) are grown on 10% or more of the total sample area cultivated by men. Other notable crops among men include cotton grown on 9% of the total area cultivated by men followed closely by M-6 millet (8%), peanuts-cowpeas (9%), peanuts (8%), millet (4%), millet-sorghum cowpea (10%), and other millet intercrops (7%).

Among women the crops that are grown on 10% or more of the area cultivated by women include rice (19%), beans (10%), and assorted other crops (16%). Peanuts (9%) and millet-sorghum (9%) are also notable crops among Moba-Gourma women in northern Togo.

The descriptive data shown in Tables 3.14 and 3.15 provide a basis for discussing village and gender differences in crop areas and sizes of plots by crop. An interesting contrast is that men in Naki-Est, the experimental

Table 3.12. Percentage Distributions of Crops and Intercrops by Gender, Village, and Total Sample

Crop	Naki-Est						Kpembona						Total Sample	
	Men		Women		Total		Men		Women		Total			
	N Plots	%	N Plots	%	N Plots	%	N Plots	%	N Plots	%	N Plots	%	N Plots	%
Cotton	39	21	4	10	43	18	20	11	-	-	20	9	63	15
Peanuts	24	13	4	10	28	12	16	9	4	12	20	9	48	11
Sorghum	11	6	1	2	12	5	5	3	-	-	5	3	17	4
Rice	9	5	13	31	22	10	-	-	3	9	3	1	25	6
Beans	-	-	2	5	2	1	1	1	7	21	8	4	10	2
Cowpeas	-	-	-	-	-	-	5	3	-	-	5	3	5	1
Millet M-3	11	6	-	-	11	5	-	-	-	-	-	-	26	6
Millet M-6	12	6	3	7	15	6	9	5	2	6	11	5	11	2
Millet	6	3	-	-	6	3	7	4	1	3	8	4	14	3
Millet-sorghum	18	10	5	12	23	10	30	17	-	-	30	14	53	12
Millet-cowpeas	12	6	1	2	13	6	22	12	1	3	23	11	36	8
Millet-sorghum-cowpeas	12	6	2	5	14	6	20	11	2	6	22	10	36	8
Sorghum-cowpeas	13	7	-	-	13	6	3	2	1	3	4	2	17	4
Peanuts-cowpeas	14	7	1	2	15	6	17	9	3	9	20	9	35	8
Other millet intercrops	5	3	1	2	6	3	17	9	-	-	17	8	23	5
Other crops	3	1	5	12	8	3	7	4	9	28	16	8	24	5
TOTAL	189	100	42	100	231	100	179	100	33	100	212	100	443	100
Percent	82		18		100		84		16		100			

Note: Percentages are rounded.
M-3 and M-6 millet refer to 3-month and 6-month varieties, respectively. For other millet, farmers made no such distinction.

Table 3.13. Crop Area and Size of Plots by Crop, Gender, and Total Sample

Crop	Gender: Men			Gender: Women			Total Sample		
	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
		- - - -(ha)- - - - -			- - - -(ha)- - - - -			- - - - -(ha) - - - -	
Sole Crops									
Cotton	59	0.40	23.60 (9)	4	0.25	1.00 (5)	63	0.39	24.60 (9)
Peanuts	40	0.54	21.50 (8)	8	0.24	1.90 (9)	48	0.49	23.40 (8)
Sorghum	16	0.65	10.40 (4)	1	0.10	0.10 (1)	17	0.62	10.50 (4)
Rice	9	0.38	3.40 (1)	16	0.24	3.90 (19)	25	0.29	7.30 (2)
Beans	1	0.30	0.30 (-)	9	0.22	2.00 (10)	10	0.23	2.30 (.5)
Cowpeas	5	0.34	1.70 (1)	-	-	-	5	0.34	1.70 (.5)
M-3 millet	11	0.87	9.60 (4)	-	-	-	11	0.87	9.60 (3)
M-6 millet	21	0.98	20.50 (8)	5	0.26	1.30 (6)	26	0.84	21.80 (8)
Millet	13	0.88	11.50 (4)	1	1.50	1.50 (7)	14	0.93	13.00 (5)
Intercrops									
Millet-sorghum	48	0.91	43.80 (16)	5	0.36	1.80 (9)	53	0.86	45.60 (16)
Millet-cowpeas	34	0.85	28.80 (11)	2	0.40	0.80 (4)	36	0.82	29.60 (10)
Millet-sorghum-cowpeas	32	0.82	26.20 (10)	4	0.30	1.20 (6)	36	0.76	27.40 (10)
Sorghum-cowpeas	16	1.04	16.70 (6)	1	0.30	0.30 (1)	17	1.00	17.00 (6)
Peanuts-cowpeas	31	0.76	23.70 (9)	4	0.30	1.20 (6)	35	0.71	24.90 (9)
Other millet intercrops	22	0.87	19.10 (7)	1	0.30	0.30 (1)	23	0.84	19.40 (6)
Other crops	10	0.59	5.90 (2)	14	0.24	3.40 (16)	24	0.39	9.30 (3)
TOTAL	368	0.73	266.7	75	0.28	20.70	443	0.65	287.4
Percent	83		93	17		7	100		100

Note: Figures in parentheses are rounded percentages.
M-3 and M-6 millet refer to 3-month and 6-month varieties, respectively. For other millet, farmers made no such distinction.

Table 3.14. Crop Area and Size of Plots by Crop, Gender, and Total Sample for Naki-Est

Crops	Gender: Men			Gender: Women			Total Sample		
	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
		- - - -(ha)- - - - -			- - - -(ha)- - - - -			- - - - -(ha) - - - -	
Sole Crops									
Cotton	39	0.43	16.90 (14)	4	0.25	1.00 (9)	43	0.42	17.90 (14)
Peanuts	24	0.46	11.00 (9)	4	0.23	0.90 (8)	28	0.43	11.90 (9)
Sorghum	11	0.53	5.80 (5)	1	0.10	0.10 (1)	12	0.49	5.90 (4)
Rice	9	0.38	3.40 (3)	13	0.25	3.20 (28)	22	0.30	3.60 (5)
Beans	-	-	-	2	0.20	0.40 (3)	2	0.20	0.40 (1)
M-3 millet	11	0.87	9.60 (8)	-	-	-	11	0.87	9.60 (7)
M-6 millet	12	0.84	10.10 (8)	3	0.27	0.80 (7)	15	0.73	10.90 (8)
Millet	6	0.85	5.10 (4)	-	-	-	6	0.85	5.10 (4)
Intercrops									
Millet-sorghum	18	0.83	15.00 (13)	5	0.36	1.80 (16)	23	0.73	16.80 (13)
Millet-cowpeas	12	0.88	10.50 (8)	1	0.30	0.30 (2)	13	0.83	10.80 (8)
Millet-sorghum-cowpeas	12	0.86	10.30 (9)	2	0.50	1.00 (8)	14	0.81	11.30 (9)
Sorghum-cowpeas	13	0.88	11.50 (10)	-	-	-	13	0.88	11.50 (9)
Peanuts-cowpeas	14	0.52	7.30 (6)	1	0.30	0.30 (3)	15	0 51	7.60 (6)
Other millet intercrops	5	0.48	2.40 (2)	1	0.30	0.30 (3)	6	0.45	2.70 (2)
Other crops	3	0.33	1.00 (1)	5	0.26	1.30 (12)	8	0.29	2.30 (1)
TOTAL	189	0.63	119.9	42	0.27	11.4	231	.57	131.3
Percent	82		91	18		9	100		100

Note: Figures in parentheses are rounded percentages.
M-3 and M-6 millet refer to 3-month and 6-month varieties, respectively. For other millet, farmers made no such distinction.

Table 3.15. Crop Area and Size of Plots by Crop, Gender, and Total Sample for Kpembona

Crops	Gender: Men			Gender: Women			Total Sample		
	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
		- - - - (ha) - - - -			- - - - (ha) - - - -			- - - - (ha) - - - -	
Sole Crops									
Cotton	20	0.34	6.70 (5)	-	-	-	20	0.34	6.70 (4)
Peanuts	16	0.66	10.50 (7)	4	0.25	1.00 (11)	20	0.58	11.50 (7)
Sorghum	5	0.92	4.60 (3)	-	-	-	5	0.92	4.60 (3)
Rice	-	-	-	3	0.23	0.70 (8)	3	0.23	0.70 (-)
Beans	1	0.30	0.30 (-)	7	0.23	1.60 (17)	8	0.24	1.90 (1)
Cowpeas	5	0.34	1.70 (1)	-	-	-	5	0.34	1.70 (1)
Millet	7	0.91	6.40 (4)	1	1.50	1.50 (16)	8	0.99	7.90 (5)
M-6 millet	9	1.16	10.40 (7)	2	0.25	0.50 (5)	11	0.99	10.90 (7)
Intercrops									
Millet-sorghum	30	0.96	28.80 (20)	-	-	-	30	0.96	28.80 (20)
Millet-cowpeas	22	0.83	18.30 (13)	1	0.50	0.50 (5)	23	0.82	18.80 (12)
Millet-sorghum-cowpeas	20	0.80	15.90 (11)	2	0.10	0.20 (2)	22	0.73	16.10 (10)
Sorghum-cowpeas	3	1.73	5.20 (4)	1	0.30	0.30 (3)	4	1.38	5.50 (4)
Peanuts-cowpeas	17	0.96	16.40 (11)	3	0.30	0.90 (10)	20	0.87	17.30 (11)
Other millet intercrops	17	0.98	16.70 (11)	-	-	-	17	0.98	16.70 (11)
Other crops	7	0.70	4.90 (3)	9	0.23	2.10 (23)	16	0.44	7.00 (4)
TOTAL	179	0.82	146.8	33	0.28	9.3	212	0.74	156.1
Percent	84		94	16		6	100		100

Note: Figures in parentheses are rounded percentages.
M-3 and M-6 millet refer to 3-month and 6-month varieties, respectively. For other millet, farmers made no such distinction.

village, allocate 51% of the total area under their management to sole crops but this figure is only 27% for Kpembona. Conversely, men in Naki-Est allocate 49% of the total area under their management to intercrops and other crops but this figure for men farmers in Kpembona is 73%. The dominant sole crops for men in Naki-Est are cotton (14%) and M-6 millet (8%), M-3 millet (8%), and peanuts (9%). The dominant intercrops are sorghum-cowpea (10%), millet-sorghum (13%), and millet-sorghum-cowpea (9%). In Kpembona the dominant sole crops for men are cotton (5%), peanuts (7%), and M-6 millet (7%) and the dominant intercrops are millet-sorghum (20%), peanuts-cowpeas (11%), and other millet-based intercrops (11%).

Women in Naki-Est allocate 56% of the area under their management for sole crops and 44% for various intercrops and other crops. In Kpembona women allocate 57% of the area under their management for sole crops and 43% for intercrops. The dominant sole crops for women in Kpembona are peanuts (11%), beans (17%), and millet (16%). In Naki-Est the dominant sole crops cultivated by women are rice (28%), cotton (9%), peanuts (8%), and M-6 millet (7%).

The dominant intercrops for women in Naki-Est are millet-sorghum (16%), various other millet intercrops (3%), and millet-sorghum-cowpeas (8%). In Kpembona the favored intercrops cultivated by women are peanuts-cowpeas (10%) and millet-cowpeas (5%).

A final point about millet is also evident from Tables 3.15 and 3.16. The percentage of the total area cultivated with sole and intercropped millet by men in Naki-Est is 52% and 62% in Kpembona. The percentage of the total cultivated area having sole and intercropped millet among women in Naki-Est (36%) is greater than in Kpembona (28%).

Availability and Use of Variable Inputs

Use of Household and Hired Labor

Descriptive data showing the use of household and hired labor in workdays per hectare by activity and village for all crops are presented in Table 4.1. It is assumed that 2 workdays of a child equal 1 workday of an adult.

Table 4.1. Average Use of Household and Hired Labor for All Crops by Activity and Village

Activity	Village: Naki-Est, Household Labor	Naki-Est, Hired Labor	Naki-Est, Total Labor Used	Village: Kpembona, Household Labor	Kpembona, Hired Labor	Kpembona, Total Labor Used
	(workdays/hectare)					
Land Preparation	13.2	4.2	17.4	13.3	3.7	17.0
	(76)	(24)	(100)	(78)	(22)	(100)
Planting	12.1	2.1	14.2	14.3	1.3	15.6
	(85)	(15)	(100)	(92)	(8)	(100)
Weeding	24.4	12.0	36.4	18.8	9.1	27.9
	(67)	(33)	(100)	(67)	(33)	(100)
Harvesting	24.9		24.9	24.8		24.8
	(100)		(100)	(100)		(100)
Marketing	2.0		2.0			
	(100)		(100)			
TOTAL[a]	76.6	18.3	94.9	71.2	14.1	85.3
	(81)	(19)	(100)	(83)	(17)	(100)
Fertilizer application	12.1		12.1	8.5		8.5
	(100)		(100)	(100)		(100)
Pest control	14.0		14.0	16.9		16.9
	(100)		(100)	(100)		(100)
Storage	31.8	1.4	33.2	35.7		35.7
	(96)	(4)	(100)	(100)		(100)
Other activities	3.6		3.6	11.0		11.0
	(100)		(100)	(100)		(100)
TOTAL[b]	138.1	19.7	157.8	143.3	14.1	157.4
	(88)	(12)	(100)	(91)	(9)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

The average total workdays of household and hired labor in Kpembona, 157.4, is about the same as that of Naki-Est, 157.8. On the average, farmers in Naki-Est used fewer days of household labor than those in Kpembona, 138.1 (88%) and 143.3 (91%), respectively. But in Naki-Est more workdays per hectare (19.7) by hired labor were used on the average than in Kpembona (14.3). Thus, farmers in both villages rely heavily on household labor. Farmers in Naki-Est hire more labor for planting than those in Kpembona, 15% and 8% of the average workdays per hectare, respectively.

Tables 4.2 and 4.3 show figures for the average use of household and hired labor by activity and gender for Naki-Est and Kpembona, respectively. For Naki-Est the figures clearly show that women farmers use substantially more total labor than men, 187.4 days and 152.2 days, respectively. Women also use a greater percentage of hired labor (17%) than is used by men farmers (12%). Thus, women are somewhat less reliant on

Table 4.2. Average Use of Household and Hired Labor for All Crops by Activity and Gender for Naki-Est

Activity	Gender: Men			Gender: Women		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/hectare)					
Land preparation	13.5	2.5	16.0	11.6	14.0	25.6
	(84)	(16)	(100)	(45)	(55)	(100)
Planting	11.4	1.8	13.2	15.5	4.2	19.7
	(86)	(14)	(100)	(79)	(21)	(100)
Weeding	23.9	11.8	35.7	27.0	13.2	40.2
	(67)	(33)	(100)	(67)	(33)	(100)
Harvesting	25.5		25.5	16.7		16.7
	(100)		(100)	(100)		(100)
Marketing	2.0		2.0			
	(100)		(100)			
TOTAL[a]	76.3	16.1	92.4	70.8	31.4	102.2
	(83)	(17)	(100)	(69)	(31)	(100)
Fertilizer application	12.1		12.1	12.7		12.7
	(100)		(100)	(100)		(100)
Pest control	13.8		13.8	15.8		15.8
	(100)		(100)	(100)		(100)
Storage	30.4	1.5	31.9	50.0		50.0
	(95)	(5)	(100)	(100)		(100)
Other activities	2.0		2.0	6.7		6.7
	(100)		(100)	(100)		(100)
TOTAL[b]	134.6	17.6	152.2	156.0	31.4	187.4
	(88)	(12)	(100)	(83)	(17)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

household labor than men, 83% and 88% of total average workdays per hectare, respectively.

Regarding specific activities in Naki-Est by gender, the figures in Table 4.2 show that women use a greater proportion (55%) of hired labor for land preparation than men (16%). This principle also holds for the task of planting where on the average 21% of the total labor used (workdays) for planting by women was hired labor but only 14% by men. Thus for planting, 79% of the average workdays on plots managed by women were contributed by household labor, but for plots managed by men this figure is 86%. Although men and women rely heavily on household labor, women hire substantial labor and do not perform agricultural activities alone in the Savanna Region of northern Togo.

As shown in Table 4.3, women in Kpembona also hire substantially more labor than men for the task of land preparation, 46% of all average workdays per hectare compared to 18% among men farmers. This is also the case

Table 4.3. Average Use of Household and Hired Labor for All Crops by Activity and Gender for Kpembona

Activity	Gender: Men			Gender: Women		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/hectare)					
Land preparation	14.1	3.2	17.3	8.5	7.2	15.7
	(82)	(18)	(100)	(54)	(46)	(100)
Planting	14.6	1.1	15.7	12.4	2.4	14.8
	(93)	(7)	(100)	(84)	(16)	(100)
Weeding	19.5	9.7	29.2	14.2	5.3	19.5
	(67)	(33)	(100)	(73)	(27)	(100)
Harvesting	24.4		24.4	26.7		26.7
	(100)		(100)	(100)		(100)
TOTAL[a]	72.6	14.0	86.6	61.8	14.9	76.7
	(84)	(16)	(100)	(81)	(19)	(100)
Fertilizer application	8.5		8.5	8.9		8.9
	(100)		(100)	(100)		(100)
Pest control	16.3		16.3			
	(100)		(100)			
Storage	36.0		36.0	46.7		46.7
	(100)		(100)	(100)		(100)
Other activities	11.0		11.0			
	(100)		(100)			
TOTAL[b]	144.4	14.0	158.4	117.4	14.9	132.3
	(91)	(9)	(100)	(89)	(11)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

for planting where 16% of all labor days for this activity were performed by hired labor for women but only 7% for men. Men in Kpembona used hired labor for 33% of all workdays for this task, but among women this figure is 27%. The total sample figures show that on the average the proportions of household and hired labor used by men and women are very similar.

The average use of household and hired labor for the cash crops of peanuts and cotton are shown by activity in Table 4.4. Moba-Gourma farmers in the Savanna Region of Togo use a greater percentage of hired labor for peanuts (24%) than cotton (16%). However, the tasks of pest control, fertilizer application, and diverse other activities such as guarding fields, bird scaring, and field inspection were performed exclusively by household labor for both crops. The greatest reliance on household labor for both crops is for the task of planting, 86% of all workdays for this task for peanuts and 89% for cotton.

Table 4.4. Average Use of Household and Hired Labor for Peanuts and Cotton by Activity

Activity	Crops: Peanuts: Household Labor	Peanuts: Hired Labor	Peanuts: Total Labor Used	Cotton: Household Labor	Cotton: Hired Labor	Cotton: Total Labor Used
	(workdays/hectare)					
Land preparation	11.7	6.3	18.0	12.0	3.8	15.8
	(65)	(35)	(100)	(76)	(24)	(100)
Planting	15.7	2.5	18.2	17.8	2.2	20.1
	(86)	(14)	(100)	(89)	(11)	(100)
Weeding	13.3	7.2	20.5	30.8	11.8	42.6
	(65)	(35)	(100)	(72)	(28)	(100)
Pest control	3.9		3.9	15.4		15.4
	(100)		(100)	(100)		(100)
Fertilizer application	4.2		4.2	16.7		16.7
	(100)		(100)	(100)		(100)
Other activities	2.0		2.0	2.0		2.0
	(100)		(100)	(100)		(100)
TOTAL[a]	50.8	16.0	66.8	94.8	17.8	112.6
	(76)	(24)	(100)	(84)	(16)	(100)

a. Harvesting not included. Figures in parentheses are rounded percentages.
Note: Peanuts--142 plots and cotton--285 plots.

The data on the average use of household and hired labor for millet by activity are shown in Table 4.5. Because millet is a subsistence crop, farmers use less hired labor than for the cultivation of peanuts and cotton. There is heavy reliance on household labor for the production of all varieties of millet. For all types of millet hired labor is most often used for the tasks of land preparation and weeding.

Descriptive data on the average use of household and hired labor for the intercrop of millet-sorghum are shown in Table 4.6. It is again evident from the total figures that the use of hired labor is less for the millet-sorghum intercrop than for peanuts and cotton. The total use of hired labor is minimal for this intercrop (13%).

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Table 4.5. Average Use of Household and Hired Labor for Sole Crop Millet by Activity

Activity	Crops: Millet			Millet M-6[a]			Millet M-3[a]		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/hectare)								
Land preparation	11.5	2.0	13.5	13.2	2.6	15.8	13.6	0.2	13.8
	(85)	(15)	(100)	(84)	(16)	(100)	(99)	(1)	(100)
Planting	10.8	0.3	11.1	11.2	0.9	12.1	10.3	0.1	10.4
	(97)	(3)	(100)	(93)	(7)	(100)	(99)	(1)	(100)
Weeding	20.5	11.0	31.5	23.0	10.1	33.1	22.7	5.3	28.0
	(65)	(35)	(100)	(69)	(31)	(100)	(81)	(19)	(100)
Fertilizer application	5.3		5.3	2.7		2.7	11.4		11.4
	(100)		(100)	(100)		(100)	(100)		(100)
Harvesting	22.6		22.6				30.7		30.7
	(100)		(100)				(100)		(100)
Storage	32.4		32.4				36.5	0.7	37.1
	(100)		(100)				(98)	(2)	(100)
Marketing							2.0		2.0
							(100)		(100)
TOTAL	103.1	13.3	116.4	50.1	13.6	63.7	127.2	6.3	133.4
	(89)	(11)	(100)	(79)	(21)	(100)	(95)	(5)	(100)

a. M-3 and M-6 varieties. Figures in parentheses are rounded percentages.
Note: Millet M-3--48 plots and Millet M-6--122 plots.

Table 4.6. Average Use of Household and Hired Labor for Intercropped Millet-Sorghum by Activity

Activity	Crops: Millet-Sorghum[a] Household Labor	Hired Labor	Total Labor Used
	(workdays/hectare)		
Land preparation	11.8	3.0	14.8
	(80)	(20)	(100)
Planting	10.0	1.6	11.6
	(86)	(14)	(100)
Weeding	20.7	11.1	31.8
	(65)	(35)	(100)
Fertilizer application	3.3		3.3
	(100)		(100)
Harvesting	22.6		22.6
	(100)		(100)
Storage	37.0		37.0
	(100)		(100)
Other activities			
TOTAL	105.4	15.7	121.1
	(87)	(13)	(100)

a. Figures in parentheses are rounded percentages.

A comparison of the average use of household and hired labor for millet-cowpeas and peanuts-cowpeas intercrops is shown in Table 4.7. The total figures show that 30% of the average workdays per hectare of peanuts-cowpeas were performed by hired labor and 12% for the millet-cowpeas intercrop. The 30% figure for peanuts-cowpeas is the highest of any crop studied. Regardless of activity, the percentage of hired labor days for peanuts-cowpeas is always greater than that for the millet-cowpea intercrop.

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Table 4.7. Average Use of Household and Hired Labor for Intercropped Millet-Cowpeas and Peanuts-Cowpeas by Activity

Activity	Crops: Millet-Cowpeas			Peanuts-Cowpeas		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/hectare)					
Land preparation	18.4	3.0	21.4	11.3	5.1	16.4
	(86)	(14)	(100)	(69)	(31)	(100)
Planting	13.9	0.8	14.7	11.9	2.9	14.8
	(95)	(5)	(100)	(80)	(20)	(100)
Weeding	22.6	12.0	34.6	9.3	7.8	17.1
	(65)	(35)	(100)	(54)	(46)	(100)
Fertilizer application	4.5		4.5	3.9		3.9
	(100)		(100)	(100)		(100)
Harvesting	25.3		25.3			
	(100)		(100)			
Storage	24.7		24.7			
	(100)		(100)			
Other Activities	6.7		6.7			
	(100)		(100)			
TOTAL	116.1	15.8	131.9	36.4	15.8	52.2
	(88)	(12)	(100)	(70)	(30)	(100)

Figures in parentheses are rounded percentages.
Note: Millet-Cowpeas--125 plots and Peanuts-Cowpeas--108 plots.

Shown in Table 4.8 are aggregate data describing the average use of household and hired labor by crop for Naki-Est and Kpembona. Of all labor used for millet, millet-sorghum, and millet-cowpeas, about 90% was household labor. The labor used for sole crop peanuts and intercropped peanuts-cowpeas shows the lowest percentages for the use of household labor, 76% and 70%, respectively. In contrast hired labor is most likely used for work on peanuts (24%), peanuts-cowpeas (30%), millet-sorghum (13%), M-6 millet (21%), and cotton (16%).

Table 4.8. Average Use of Household and Hired Labor by Crop in Naki-Est and Kpembona

Crop	Household Labor	Hired Labor	Total Labor Used
	(workdays/hectare)		
Peanuts[a]	50.8	16.0	66.8
	(76)	(24)	(100)
Cotton[a]	94.8	17.8	112.6
	(84)	(16)	(100)
Millet M-3	127.2	6.3	133.4
	(95)	(5)	(100)
Millet M-6[b]	50.1	13.6	63.7
	(79)	(21)	(100)
All millet	119.0	13.9	132.9
	(90)	(10)	(100)
Millet-sorghum[c]	105.4	15.7	121.1
	(87)	(13)	(100)
Millet-cowpeas[c]	116.1	15.8	131.9
	(88)	(12)	(100)
Peanuts-cowpeas[b]	36.4	15.8	52.2
	(70)	(30)	(100)

a. Does not include harvesting.
b. Does not include harvesting, storage, and marketing.
c. Does not include marketing.
Figures in parentheses are rounded percentages.

Use of Labor of Men, Women, and Children

The data in Table 4.9 allow comparisons of the average use of the labor of men, women, and children by activity and village. The task of land preparation in both villages is largely the responsibility of men who performed 91% of the workdays per hectare in Naki-Est and 88% in Kpembona. Children in Kpembona are somewhat more likely than those in Naki-Est to contribute to land preparation work, 8% and 5% of the average workdays per hectare, respectively.

The figures for planting work show some interesting contrasts between men, women, children, and villages. In Naki-Est, the experimental village, women performed 88% of all planting workdays per hectare, men 8%, and children, 4%. In contrast, the contribution of men and children in Kpembona is substantial, 22% and 11% of all workdays, respectively. Women in Kpembona are, however, responsible for about two-thirds (67%) of all workdays for planting. Thus, planting is predominantly but not exclusively the responsibility of women in the Savanna Region of northern Togo.

Of the average workdays per hectare for weeding, 70% were performed by men in Naki-Est and 78% in Kpembona. Although weeding is predominantly a task of men, women in Naki-Est performed 24% of the average

Table 4.9. Average Use of Labor of Men, Women, and Children for All Crops by Activity and Village

Activity	Village: Naki-Est				Village: Kpembona			
	Men	Women	Children	Total Labor Used	Men	Women	Children	Total Labor Used
	(workdays/hectare)							
Land preparation	16.1	0.7	0.8	17.6	15.2	0.7	1.4	17.3
	(91)	(4)	(5)	(100)	(88)	(4)	(8)	(100)
Planting	1.2	12.5	0.6	14.3	3.4	10.7	1.7	15.8
	(8)	(88)	(4)	(100)	(22)	(67)	(11)	(100)
Weeding	25.8	8.7	2.1	36.6	22.2	4.0	2.3	28.5
	(70)	(24)	(6)	(100)	(78)	(14)	(8)	(100)
Harvesting	8.6	15.8	0.5	24.9	7.4	14.6	2.6	24.6
	(35)	(63)	(2)	(100)	(30)	(59)	(11)	(100)
Marketing		2.0		2.0				
		(100)		(100)				
TOTAL[a]	51.7	39.7	4.0	95.4	48.2	30.0	8.0	86.2
	(54)	(42)	(4)	(100)	(56)	(35)	(9)	(100)
Fertilizer application	6.2	4.6	1.3	12.1	5.6	2.8	0.4	8.8
	(51)	(38)	(11)	(100)	(64)	(32)	(4)	(100)
Pest control	14.0			14.0	16.3			16.3
	(100)			(100)	(100)			(100)
Storage	15.5	14.8	2.8	33.1	14.6	19.2	3.0	36.8
	(47)	(45)	(8)	(100)	(40)	(52)	(8)	(100)
Other activities	2.4		1.1	3.5	11.0			11.0
	(69)		(31)	(100)	(100)			(100)
TOTAL[b]	89.8	59.1	9.2	158.1	95.7	52.0	11.4	159.1
	(57)	(37)	(6)	(100)	(60)	(33)	(7)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

workdays and women in Kpembona 14%. Children in Naki-Est and Kpembona also contributed to the average workdays for weeding, 6% and 8%, respectively.

Harvesting is predominantly an activity of women but with the assistance of men. Of the average workdays of harvesting per hectare, women performed 63% in Naki-Est and 59% in Kpembona. These figures for men are 35% and 30%, respectively. The labor of children for harvesting in Kpembona (11%) is greater than in Naki-Est (2%).

The task of fertilizer application is predominantly but not exclusively performed by men. In Naki-Est 51% of the average workdays for fertilizer application were performed by men, 38% by women, and 11% by children. The corresponding figures for Kpembona are 64%, 32%, and 4%, respectively. Women and children in Naki-Est are clearly more involved in fertilizer application work than their counterparts in the control village. Pest control work is done exclusively by men in both villages.

The tasks of storage are rather equitably shared by men and women, especially in Naki-Est where men performed 47% of the average workday for this activity, women 45%, and children 8%. Women are more active in storage work than men in Kpembona, and than men and women in Naki-Est. Specifically, women in the control village performed 52% of the average workdays for storage, men 40%, and children 8%.

In the category of other activities men performed all workdays in Kpembona and in Naki-Est 69% were performed by men and 31% by children. For example, these other activities include bird scaring, stalk gathering, field inspection, and guarding.

Tables 4.10 and 4.11 show the average use of labor of men, women, and children by activity and gender for Naki-Est and Kpembona, respectively. A comparison of the total figures from each table shows that on plots managed by men in Naki-Est 61% of the total average workdays were performed by men, 35% by women, and 4% by children. These figures for Kpembona are very similar, 62% for men, 31% for women, and 7% of the average workdays performed by children. Among plots managed by women in Naki-Est, 37% of the average workday per hectare were performed by men, 45% by women and 18% by children. The corresponding figures for Kpembona are 43% for men, 54% for women, and 3% for children. These figures show that on plots managed by men a larger proportion of the work in crop production is performed by men and on plots managed by women a larger proportion is performed by women. The gender of the plot manager appears to have a significant influence on the relative labor contribution of men and women to crop production.

Table 4.10. Average Use of Labor of Men, Women, and Children for All Crops by Activity and Gender for Naki-Est

	Gender							
	Men				Women			
Activity	Men	Women	Children	Total Labor Used	Men	Women	Children	Total Labor Used
	(workdays/hectare)							
Land preparation	15.2	0.3	0.6	16.1	20.9	3.1	2.1	26.1
	(94)	(2)	(4)	(100)	(80)	(12)	(8)	(100)
Planting	1.4	11.2	0.5	13.1		18.2	1.5	19.7
	(11)	(85)	(4)	(100)		(92)	(8)	(100)
Weeding	28.9	5.5	1.4	35.8	11.8	23.3	5.3	40.4
	(81)	(15)	(4)	(100)	(29)	(58)	(13)	(100)
Harvesting	9.2	15.7	0.6	25.5		16.7		16.7
	(36)	(62)	(2)	(100)		(100)		(100)
Marketing		2.0		2.0				
		(100)		(100)				
TOTAL[a]	54.7	34.7	3.1	92.5	32.7	61.3	8.9	102.9
	(59)	(38)	(3)	(100)	(32)	(59)	(9)	(100)
Fertilizer application	6.6	4.5	1.0	12.1	1.1	6.0	5.7	12.8
	(55)	(37)	(8)	(100)	(9)	(47)	(44)	(100)
Pest control	13.8			13.8	15.8			15.8
	(100)			(100)	(100)			(100)
Storage	15.4	14.7	1.7	31.8	16.7	16.7	16.7	50.1
	(49)	(46)	(5)	(100)	(33.3)	(33.3)	(33.3)	(100)
Other activities	2.0			2.0	3.3		3.3	6.6
	(100)			(100)	(50)		(50)	(100)
TOTAL[b]	92.5	53.9	5.8	152.2	69.6	84.0	34.6	188.2
	(61)	(35)	(4)	(100)	(37)	(45)	(18)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Table 4.11. Average Use of Labor of Men, Women, and Children for All Crops by Activity and Gender for Kpembona

Activity	Gender: Men — Men	Men — Women	Men — Children	Men — Total Labor Used	Women — Men	Women — Women	Women — Children	Women — Total Labor Used
	(workdays/hectare)							
Land preparation	15.3	0.4	1.5	17.2	14.3	2.0	0.8	17.1
	(89)	(2)	(9)	(100)	(84)	(12)	(4)	(100)
Planting	3.8	10.4	1.6	15.8	1.5	12.7	1.8	16.0
	(24)	(66)	(10)	(100)	(10)	(79)	(11)	(100)
Weeding	25.1	1.9	2.3	29.3	5.1	16.2	1.9	23.2
	(86)	(6)	(8)	(100)	(22)	(70)	(8)	(100)
Harvesting	7.0	14.7	2.8	24.5	13.3	13.3		26.6
	(29)	(60)	(11)	(100)	(50)	(50)		(100)
TOTAL[a]	51.2	27.4	8.2	86.8	34.2	44.2	4.5	82.9
	(59)	(32)	(9)	(100)	(41)	(54)	(5)	(100)
Fertilizer application	5.9	2.2	0.4	8.5	2.9	7.6		10.5
	(69)	(26)	(5)	(100)	(28)	(72)		(100)
Pest control	16.3			16.3				
	(100)			(100)				
Storage	13.8	18.9	3.3	36.0	23.3	23.3		46.6
	(38)	(53)	(9)	(100)	(50)	(50)		(100)
Other activities	11.0			11.0				
	(100)			(100)				
TOTAL[b]	98.2	48.5	11.9	158.6	60.4	75.1	4.5	140.0
	(62)	(31)	(7)	(100)	(43)	(54)	(3)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

The addition of the average labor days of women and children on plots managed by men in Naki-Est shows that 39% of the average workdays were not performed by men alone but rather by women and children. This figure for Kpembona is virtually identical, 38%. The figure for the labor of men and children on plots managed by women in Naki-Est is 55% and for Kpembona 47%. Thus, women report a greater percentage of average workdays performed by men and children than men report for women and children. Women appear to have a labor advantage in the use of men and children compared with the use of women and children by men. Stated in a different way, in Naki-Est men perform 61% of the average workdays on plots under their management, and women perform 45% of the average workdays on plots under their management. These figures for Kpembona are 62% for men and 54% for women.

Tables 4.10 and 4.11 further show that land preparation work is predominantly the responsibility of men on plots under their management and on plots managed by women. A minimum of 80% of the average workdays for this

task were performed by men regardless of village or gender of the plot manager. This labor pattern is reversed for the task of planting.

In Naki-Est women performed 92% of the average workdays for planting plots under their management, 8% were contributed by children, and men contributed no days to this task. Women also performed 85% of the average workdays for planting on plots managed by men in Naki-Est, men contributed 11%, and children 4%.

The labor principle that Moba-Gourma women are predominantly responsible for planting work in northern Togo also holds for the control village of Kpembona, where women performed 66% of the average workday for planting on plots managed by men, men performed 24%, and children 10%. On plots managed by women in Kpembona, women performed 79% of the average workdays for planting, men 10%, and children 11%.

The figures for weeding in Tables 4.10 and 4.11 clearly show that men and women are largely responsible for weeding the plots under their respective management, but that men contribute more average workdays to weeding plots managed by women than women contribute to weeding plots managed by men.

In Naki-Est 81% of the average workdays for weeding plots managed by men were contributed by men, 15% by women, and 4% by children. On plots managed by women in Naki-Est, women contributed 58% of the average workdays for weeding, men 29%, and children 13%. These figures may also be interpreted as showing that 42% of the average workdays for weeding plots managed by women were completed by men (29%) and children (13%). In contrast, on plots managed by men 19% of the average workdays for weeding were completed by women (15%) and children (4%). Thus, men and children contribute more average workdays to weeding plots managed by women than women and children contribute to plots managed by men.

In Kpembona 86% of the average workdays for weeding plots managed by men were completed by men, 6% by women, and 8% by children. On plots managed by women, 70% of the average workdays for weeding were performed by women, 22% by men, and 8% by children. Again, it is interesting to note that 30% of the average workdays for weeding plots managed by women were completed by men (22%) and children (8%). On plots managed by men in Kpembona, 14% of the average workdays for weeding were completed by women (6%) and children (8%). Thus in Kpembona, unlike Naki-Est, the demanding task of weeding plots managed by women is largely the responsibility of women but with assistance from men and children.

Harvesting work in both villages tends to be predominantly performed by women. On plots managed by men in Naki-Est 62% of the average workdays for this task were performed by women, 36% by men, and 2% by children. But on plots managed by women in Naki-Est, women and women alone performed all harvesting activities.

On plots managed by men in Kpembona 60% of the average workdays for harvesting were performed by women, 29% by men, and 11% by children. Interestingly, on plots managed by women in the control village the average workdays for harvesting were equal among men (50%) and women (50%). Perhaps the contribution of men in harvesting plots managed by women is in exchange for the work of women in planting fields managed by men.

The task of fertilizer application is largely the responsibility of the respective plot manager. In Kpembona 69% of the average workdays for this task on plots managed by men were performed by men, 26% by women, and 5% by children. Women performed fertilizer application work for 72% of the average workdays on plots under their management, 28% were performed by men, and children did not participate in fertilizer application on plots managed by women in Kpembona.

On plots managed by men in Naki-Est 55% of the average workdays per hectare for fertilizer application were performed by men, 37% by women, and 8% by children. The division of labor for fertilizer application on plots managed by women in Naki-Est shows that men and children performed 53% of the average workdays for this task and women performed 47%. The fact that children are responsible for 44% of the average workdays for fertilizer application on plots managed by women and 8% on plots managed by men suggests that training children for this task in the experimental village would be appropriate. The work of pest control is exclusively the responsibility of men in both villages who performed all of the workdays for this task on their own plots and on those managed by women.

On plots managed by men in Naki-Est 49% of the average workdays for storage were performed by men, 46% by women, and 5% by children. On plots managed by women in the experimental village, 66% of the average workdays for storage were performed by men (33%) and children (33%). Women contribute but one-third (34%) of the average workdays for storage of production from plots under their management. Thus, men are more responsible for storing production from plots under their management than women are for plots under their

management, as women receive more assistance from men and children than men receive from women and children.

Unlike Naki-Est, women and children in Kpembona perform more of the average workdays for storage (62%) of production from plots managed by men than are performed by men themselves (38%). On plots managed by women in Kpembona, men (50%) and women (50%) equally share the average workdays for storage without any contribution from the labor of children. Thus, men in Kpembona contribute more average workdays for storing production grown on plots managed by women (50%) than they contribute to storing their own production (38%). Regarding diverse other agricultural work, men performed all such tasks on plots under their management and women reported no additional and varied tasks.

Peanuts and Cotton--The use of the labor of men, women, and children varies with the sole crops and intercrops grown by farmers in the sample. A comparison of the division of labor among men, women, and children for sole crops of peanuts and cotton is based on the descriptive data shown in Table 4.12.

Table 4.12. Average Use of Labor of Men, Women, and Children for Peanuts and Cotton by Activity for Naki-Est and Kpembona

	Crops							
	Peanuts				Cotton			
Activity	Men	Women	Children	Total Labor Used	Men	Women	Children	Total Labor Used
	(workdays/hectare)							
Land preparation	16.6	0.1	1.3	18.0	14.4		1.4	15.8
	(92)	(1)	(7)	(100)	(91)		(9)	(100)
Planting	3.2	13.4	1.5	18.1	4.0	14.2	1.9	20.1
	(18)	(74)	(8)	(100)	(20)	(71)	(9)	(100)
Weeding	13.8	5.0	1.8	20.6	34.2	4.9	3.5	42.6
	(67)	(24)	(9)	(100)	(80)	(12)	(8)	(100)
Pest control	3.9			3.9	15.4			15.4
	(100)			(100)	(100)			(100)
Fertilizer application	4.2			4.2	8.5	6.4	1.8	16.7
	(100)			(100)	(51)	(38)	(11)	(100)
Other activities	2.0			2.0	2.0			2.0
	(100)			(100)	(100)			(100)
TOTAL[a]	43.7	18.5	4.6	66.8	78.5	25.5	8.6	112.6
	(65)	(28)	(7)	(100)	(70)	(23)	(7)	(100)

a. Harvesting not included. Figures in parentheses are rounded percentages.
Note:. Peanuts--143 plots and cotton--285 plots.

Land preparation for sole crops of peanuts and cotton is mainly the responsibility of men who performed 92% of the average workdays for peanuts and 91% for cotton. Children contributed 7% and 9% of the average land preparation workdays for these crops, respectively.

Women performed the greatest percentage of average workdays for planting peanuts (74%) and cotton (71%). Men contribute slightly more of the average workdays for planting cotton (20%) than for peanuts (18%).

The majority (80%) of the average workdays for weeding cotton is performed by men, 12% by women, and 8% by children. Women contribute a greater percentage of the average workdays for weeding peanuts (24%) than for cotton (12%). About two-thirds (67%) of the average workdays for weeding peanuts are performed by men and 9% by children. Pest control work is exclusively done by men for sole crop peanuts and cotton with no contribution from women or children as is fertilizer application for peanuts.

Fertilizer application for cotton is predominantly an activity of men who performed 51% of the average workdays for this task, women contributed 38%, and children 11%. Other diverse activities for peanuts and cotton were completed exclusively by men.

The total figures in Table 4.12 show that the labor contribution of men in average workdays per hectare for cotton (70%) is somewhat greater than their contribution for peanuts (65%). The total proportion of average workdays contributed by women for peanuts (28%) is somewhat greater than for cotton (23%). The percentage of total average workdays contributed by children is equal for both cash crops (7%).

Millet--Concerning the average use of labor of men, women, and children for all millet, Table 4.13 shows that the men performed 92% of the average workdays for land preparation and children 8%. Women performed 72% of the average workdays for planting all millet, men performed 21%, and children 7%. The weeding of all millet is predominantly a responsibility of men who performed 80% of the average workdays for this task, women contributed 14%, and children 6%.

Table 4.13. Average Use of Labor of Men, Women, and Children for Millet by Activity

Activity	Crops: Millet				Millet M-6				Millet M-3			
	Men	Women	Children	Total Labor Used	Men	Women	Children	Total Labor Used	Men	Women	Children	Total Labor Used
	(workdays/hectare)											
Land preparation	12.3		1.1	13.4	15.7	0.8	0.4	16.9	13.1		0.7	13.8
	(92)		(8)	(100)	(93)	(5)	(2)	(100)	(95)		(5)	(100)
Planting	2.3	8.1	0.8	11.2	1.5	10.3	0.9	12.8	0.5	9.7	0.2	10.4
	(21)	(72)	(7)	(100)	(12)	(80)	(8)	(100)	(5)	(93)	(2)	(100)
Weeding	25.3	4.3	1.9	31.5	31.9	1.8	1.5	35.2	16.6	10.1	1.2	27.9
	(80)	(14)	(6)	(100)	(91)	(5)	(4)	(100)	(59)	(36)	(5)	(100)
Fertilizer application	5.3			5.3	2.7			2.7	8.3	2.9	0.2	11.4
	(100)			(100)	(100)				(73)	(25)	(2)	(100)
Harvesting	8.2	13.2	1.3	22.7					12.7	18.1		30.7
	(36)	(58)	(6)	(100)					(41)	(59)		(100)
Storage	13.5	17.9	0.9	32.3					16.9	20.2		37.1
	(42)	(55)	(3)	(100)					(46)	(54)		(100)
Marketing										2.0		2.0
										(100)		(100)
TOTAL	66.9	43.5	6.0	116.4	51.8	12.9	2.8	67.5	68.1	61.0	2.3	131.4
	(58)	(37)	(5)	(100)	(77)	(19)	(4)	(100)	(52)	(46)	(2)	(100)

Note: Figures in parentheses are rounded percentages.
Millet M-3--48 plots and Millet M-6--122 plots.

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Eighty-one percent of the average workdays for fertilizer application on all millet was completed by men, 18% by women, and 1% by children. Thus, fertilizer application on all millet is predominantly but not exclusively a responsibility of men. The harvesting of all millet is most often done by women who performed 58% of the average workdays for this activity, men contributed 40%, and children 2%. The storage of all millet is also predominantly but not exclusively a task of women who performed 55% of the average workdays for this activity, men contributed 44%, and children 1%. The marketing of all millet is exclusively the domain of Moba-Gourma women in the sample region of northern Togo. Overall, men contributed 57% of the average workdays per hectare for all activities, women performed 40%, and children 3%.

There are also some notable differences in the use of labor for M-3 and M-6 millet. Men contribute a greater percentage of the average workdays for planting millet (21%) than for M-6 millet (12%) and M-3 millet (5%). Women contribute more of the average workdays for planting M-3 millet (93%) than for millet (72%) and M-6 millet (80%). Although women made no labor contribution to fertilizer application on millet or M-6 millet, they contributed 25% of the average workdays for fertilizer application on M-3 millet. It may also be concluded from these descriptive data that Moba-Gourma women in northern Togo give more attention to M-3 millet than to M-6 millet, especially for the tasks of planting, fertilizer application, and marketing.

Millet-Sorghum--As shown in Table 4.14, the pattern of labor use for the intercrop of millet-sorghum follows closely that of sole crop millet. Land preparation for this intercrop is primarily a responsibility of men who account for 90% of the average workdays per hectare. Women and children account for 3% and 7% of the average workdays for this task, respectively. Women contributed 87% of the average workdays for planting, 5% were completed by men, and 8% by children. But in weeding this intercrop men accounted for 68% of the average workdays, women 20%, and children accounted for 12%.

Fertilizer application work is predominantly but not exclusively the responsibility of men for millet-sorghum who completed 64% of the average workdays for this task. Women contributed 33% of the average workdays for fertilizer application and children 3%.

Table 4.14. Average Use of Labor of Men, Women, and Children for Millet-Sorghum by Activity

Activity	Millet-Sorghum			
	Men	Women	Children	Total Labor Used
	(workdays/hectare)			
Land preparation	13.3	0.4	1.1	14.8
	(90)	(3)	(7)	(100)
Planting	0.6	10.1	0.9	11.6
	(5)	(87)	(8)	(100)
Weeding	21.5	6.3	4.0	31.8
	(68)	(20)	(12)	(100)
Fertilizer application	2.1	1.1	0.1	3.3
	(64)	(33)	(3)	(100)
Harvesting	5.7	13.4	3.5	22.6
	(25)	(59)	(16)	(100)
Storage	13.6	17.9	5.4	36.9
	(37)	(48)	(15)	(100)
TOTAL	56.8	49.2	15.0	121.0
	(47)	(40)	(13)	(100)

Figures in parentheses are rounded percentages.

Women clearly dominate the harvesting of the millet-sorghum intercrop as their labor accounted for 59% of the average workdays for this task. Men accounted for 25% of the average workdays and children 16%. As for storage work for this intercrop, men accounted for 37% of the average workdays, women 48%, and children 15%.

Millet-Cowpeas and Peanuts-Cowpeas--As shown in Table 4.15, the labor of men for land preparation accounts for an average of 90% of the average workdays per hectare for millet-cowpea intercrops and 99% for the intercrop of peanuts-cowpeas. As with other crops women dominate planting and account for 86% of the average workdays for planting millet-cowpeas and 78% for peanuts-cowpeas.

Weeding work for the millet-cowpea intercrop is predominantly a task of men who account for 82% of the average workdays for this task. Women, however, contribute more labor for weeding peanuts intercropped with cowpeas, 33% of the average workdays, than for millet-cowpeas (12%).

Fertilizer application is the exclusive work of men for peanuts-cowpeas and their labor represented 82% of the average workdays for fertilizer application of the millet-cowpeas intercrop. As for harvesting

millet-cowpeas, the labor of men accounts for 32% of the average workdays, women account for 59%, and children 9%.

Storage work for millet-cowpeas is predominantly but not exclusively a responsibility of men who performed 55% of the average labor days for this task, women performed 38%, and children 7%. Men (50%) and children (50%) equally shared the average workdays for other activities for millet-cowpeas. The pattern of labor for these two intercrops is very similar, but men contribute more average workdays for all activities for peanuts-cowpeas (64%) than for millet-cowpeas (59%). Children contribute more labor to the latter (8%) than to the former (3%). The total labor contribution of women for these intercrops is identical (33%). It is important to note that for peanuts-cowpeas labor use for harvesting, storage, and other activities is not included.

Table 4.15. Average Use of Labor of Men, Women, and Children for Millet-Cowpeas and Peanuts-Cowpeas

	Crops							
	Millet-Cowpeas				Peanuts-Cowpeas			
Activity	Men	Women	Children	Total Labor Used	Men	Women	Children	Total Labor Used
	(workdays/hectare)							
Land preparation	19.3	1.1	1.0	21.4	16.3		0.2	16.5
	(90)	(5)	(5)	(100)	(99)		(1)	(100)
Planting	1.5	12.6	0.6	14.7	2.4	11.6	0.8	14.8
	(10)	(86)	(4)	(100)	(16)	(78)	(6)	(100)
Weeding	28.3	4.3	2.0	34.6	11.1	5.6	0.4	17.1
	(82)	(12)	(6)	(100)	(65)	(33)	(2)	(100)
Fertilizer application	3.7	0.8		4.5	3.9			3.9
	(82)	(18)		(100)	(100)			(100)
Harvesting	8.0	15.0	2.2	25.2				
	(32)	(59)	(9)	(100)				
Storage	13.7	9.3	1.7	24.7				
	(55)	(38)	(7)	(100)				
Other activities	3.3		3.3	6.6				
	(50)		(50)	(100)				
TOTAL	77.8	43.1	10.8	131.7	33.7	17.2	1.4	52.3
	(59)	(33)	(8)	(100)	(64)	(33)	(3)	(100)

Note: Millet-Cowpeas--125 plots and Peanuts-Cowpeas--108 plots.
Figures in parentheses are rounded percentages.

The descriptive data in Table 4.16 show a summary of the average total use of the labor of men, women, and children by crop in Naki-Est and Kpembona. For each crop men always contribute at least 47% of the average workdays per hectare. The least labor contribution of men is for millet-sorghum, 47% of total average workdays for this intercrop and at most 77% of the total average workdays for M-6 millet.

Table 4.16. Average Total Use of Labor of Men, Women, and Children by Crop in Naki-Est and Kpembona

Crop	Men	Women	Children	Total Labor Used
	(workdays/hectare)			
Peanuts[a]	43.7	18.5	4.6	66.8
	(65)	(28)	(7)	(100)
Cotton	78.5	25.5	8.6	112.6
	(70)	(23)	(7)	(100)
Millet	66.9	43.5	6.0	116.4
	(58)	(37)	(5)	(100)
Millet M-6	51.8	12.9	2.8	67.5
	(77)	(19)	(4)	(100)
Millet M-3	68.1	61.0	2.3	131.4
	(52)	(46)	(2)	(100)
Millet-sorghum	56.8	49.2	15.0	121.0
	(47)	(40)	(13)	(100)
Millet-cowpeas[b]	77.8	43.1	10.8	131.7
	(59)	(33)	(8)	(100)
Peanuts-cowpeas[c]	33.7	17.2	1.4	52.3
	(64)	(33)	(3)	(100)

a. Does not include harvesting.
b. Does not include marketing.
c. Does not include harvesting, storage, or marketing.
Figures in parentheses are rounded percentages.

Among all crops, women contribute a maximum of 46% of the total average workdays for M-3 millet and contribute least to the average workdays for M-6 millet (19%). The maximum labor input of children is for millet-sorghum, 13% of the total average workdays. Children contribute the least percentage of average workdays for the sole crop M-3 millet (2%).

Use of Fertilizer

The present and past use of fertilizer by village and gender is shown in Table 4.17. The total figures show that the percentage of men farmers using fertilizer during the survey year (79%) substantially exceeds that of women (29%). Fertilizer was used on at least one plot by 68% of the total sample during the 1988 cropping season.

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Table 4.17. Present and Past Use of Fertilizers by Gender, Village, and Total Sample

	Farmers Using Fertilizer This Season	Prior Use of Fertilizer[a]
Naki-Est		
Men	93	98
Women	27	33
TOTAL	77	82
Kpembona		
Men	67	85
Women	31	77
TOTAL	60	83
Total Sample		
Men	79	91
Women	29	54
TOTAL	68	82

a. Farmers that have used fertilizer at least once.

In Naki-Est 93% of the men and 27% of the women farmers reported using fertilizer during the survey season. In Kpembona 67% of the men and 31% of the women farmers reported using fertilizer in 1988. The total sample use of fertilizer in Naki-Est (77%) is greater than in Kpembona (60%). It should be noted that the percentage of women farmers using fertilizer in Kpembona (31%) is slightly more than among women in Naki-Est (27%). As shown later in Table 6.2, women in Kpembona reported more visits by extension workers than those in Naki-Est. This may partially explain the difference in fertilizer use.

The figures describing the use of fertilizer prior to the survey year show that 98% of the men and 33% of the women in Naki-Est have used fertilizer in the past. In Kpembona 85% of the men and 77% of the women have used fertilizer in the past. Thus, fertilizer use is most uncommon among women farmers in Naki-Est. The SFRP will provide new experiences about fertilizer use among women in both villages. Overall 91% of the men in the

sample, 54% of the women, and 82% of the total sample used fertilizer at least once prior to the initial SFRP survey.

The descriptive data in Table 4.18 show the percentages of farmers giving particular reasons for not using fertilizer. Men (100%) in Naki-Est uniformly cited the lack of money as a reason for not using fertilizer. Women (90%) are somewhat less likely than men to cite lack of money as a reason for not using fertilizer but more likely (10%) to view fertilizer as unnecessary.

Table 4.18. Percentage Distributions of Reasons Given by Farmers for Not Using Fertilizers by Gender, Village, and Total Sample

Reasons	Naki-Est			Kpembona			Total Sample		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
	- - - - (%) - - - -			- - - - (%) - - - - -			- - - - (%) - - - -		
Lack of money	100	90	91	88	100	91	89	92	91
Not needed	-	10	9	12	-	9	11	8	9
TOTAL	100	100	100	100	100	100	100	100	100

Note: Percentages are rounded.

In Kpembona, 88% of the men and 100% of the women cited lack of money as the main reason for not using fertilizer. None of the women farmers in Kpembona viewed fertilizer as not needed but 12% of the men farmers cited this reason. The total sample figures in Table 4.18 show that women (92%) are somewhat more likely to cite lack of money as a reason for not using fertilizer than men (89%). But men (11%) are somewhat more likely than women (8%) to view the use of fertilizer as unnecessary. Clearly, among both men and women the lack of money is viewed as the principal reason for not using fertilizer.

The reasons given by farmers who have discontinued but previously used fertilizer are shown in Table 4.19. In Naki-Est the sample of men universally cited lack of money as the reason for discontinuing the use of fertilizer. Fewer farmers in Kpembona (93%) cited this reason but 7% indicated that fertilizer was not available. The lack of money is the main reason offered by farmers for not using and discontinuing the use of fertilizer in the sample region.

Table 4.19. Percentage Distributions of Reasons Given by Farmers for Discontinuing the Use of Fertilizers by Village and Total Sample

Reason	Naki-Est (%)	Kpembona (%)	Total Sample (%)
Lack of money	100	93	94
Not available	-	7	6
TOTAL	100	100	100

Note: Percentages are rounded.

Table 4.20 shows that 84% of all plots and crops in Naki-Est received no fertilizer during the 1988 cropping season. Sixty-three percent of the plots with cotton received no fertilizer. Thus, 37% of the plots with cotton were fertilized, the highest percentage of all plots in the sample. For the millet-sorghum intercrop, 92% of the plots received no fertilizer, as did 88% of the plots with millet-sorghum-cowpeas, and 94% of the plots with millet-cowpeas. For plots with peanuts-cowpeas, 89% received no fertilizer. For other crops 90% or more received no fertilizer.

In Kpembona 60% of the plots with cotton received no fertilizers, as did 80% of the plots with cowpeas, and 89% of those with intercropped millet-sorghum. Of the plots with intercropped peanuts-cowpeas 86% received no fertilizers. Overall, 86% of all plots and crops received no fertilizer in 1988 in Kpembona, a figure very similar to that for Naki-Est. For all other crops 90% or more received no fertilizers during the survey year.

Regarding the use of 15-15-15 fertilizer in Naki-Est, only the intercrop millet-sorghum-cowpeas showed 10% of the plots receiving fertilizer. The plots with millet-sorghum receiving 15-15-15 in Kpembona did not exceed 10%. Seventeen percent of the plots with cotton received urea in Naki-Est and 20% in Kpembona. The only other crop for which 10% of the plots received urea was cowpeas in Kpembona.

Table 4.20. Percentages of Plots With Fertilizer by Crop for Naki-Est and Kpembona

Crops	Type of Fertilizer									
	No Fertilizer		15-15-15		Urea		SSP		NPKSB	
	Naki-Est	Kpembona	Naki-Est	Kpembona	Naki-Est	Kpembona	Naki-Est	Kpembona	Naki-Est	Kpembona
	(percentage of plots)									
Cotton	63	60	1		17	20			20	20
Millet	100	93		7						
Millet M-6	100	97		3						
Cowpeas		80				10				10
Millet-sorghum	92	89	8	10	1					
Millet M-3	92	92	6	8	2					
Millet-sorghum-cowpeas	88	94	10	6					2	
Millet-cowpeas	94	92	6	8						
Peanuts	98	94	3					6		
Peanuts-cowpeas	89	86			4		7	14		
Other crops	96	89	3	8	1	1		1		
All crops	84	86	3	5	6	4	1	1	6	3

Note: Percentages are rounded.

The use of SSP for intercropped peanuts-cowpeas was 7% of the plots in Naki-Est and 14% of the plots in Kpembona. Twenty percent of the plots with cotton in Naki-Est and Kpembona received NPKSB complex fertilizer as did 10% of the plots with cowpeas in Kpembona.

As shown in Table 4.21, plots with cotton managed by men and women show the least percentage with no fertilizer use, 61% and 65%, respectively. For all other sole crops and intercrops managed by men and women, 80% or more of the plots received no fertilizer.

Although the use of 15-15-15 fertilizer is low among both men and women farmers in the sample region, there is an interesting contrast. The only crop or intercrop managed by men where 10% or more of the plots received 15-15-15 is millet-sorghum (11%). However, on plots managed by women 20% of those with millet and 13% of those with millet-sorghum-cowpeas received this fertilizer.

Eighteen percent of the plots with cotton and 10% of those with cowpeas managed by men received applications of urea in 1988. Urea was also applied to 15% of the plots with cotton managed by women. Although the use of SSP was minimal among men and women farmers, 12% of the plots with the peanuts-cowpeas intercrop managed by men received this fertilizer. Twenty percent of the plots with cotton managed by men and women received NPKSB and 10% of the plots with cowpeas also received this fertilizer.

The descriptive data in Table 4.22 further show the use of fertilizer by summarizing the most frequently used fertilizers for the sample crops. For cotton 18% of the plots received urea and 19% received NPKSB. For cowpeas plots 10% received urea and 10% NPKSB. Eleven percent of the plots with intercropped peanuts-cowpeas received SSP. These are the only crops for which 10% or more of the plots received fertilizers.

Table 4.21. Percentages of Plots With Fertilizer by Crop and Gender In Naki-Est and Kpembona

Crops	Type of Fertilizer									
	No Fertilizer		15-15-15		Urea		SSP		NPKSB	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
	(percentage of plots)									
Cotton	61	65	1		18	15			20	20
Millet	98	80	2	20						
Millet M-6	98	100	2		1					
Cowpeas	80				10				10	
Millet-sorghum	89	100	11							
Millet M-3	92		6		2					
Millet-sorghum-cowpeas	92	87	7	13					1	
Millet-cowpeas	92	100	8							
Peanuts	95	100	2				3			
Peanuts-cowpeas	87	100			1		12			
Other crops	91	95	8	4	1	1	1			
All crops	84	92	5	3	5	2	1		5	3

Note: Percentages are rounded.

Table 4.22. Use of Fertilizer by Crop for the Total Sample

Crops	Type of Fertilizer				
	None	15-15-15	Urea	SSP	NPKSB
	- - - - - - - - - (percentage of plots) - - - - -				
Cotton	62	1	18		19
Millet	96	4			
Millet M-6	99	1			
Cowpeas	80		10		10
Millet-sorghum	90	8	2		
Millet M-3	92	6	2		
Millet-sorghum-cowpeas	91	8			1
Millet-cowpeas	93	7			
Peanuts	96	1		3	
Peanuts-cowpeas	87		2	11	
Other crops	92	6	1	1	
All crops	85	4	5	1	5

Note: Percentages are rounded.

Table 4.23 shows the mean rate and coefficients of variation of fertilizer use by crop for Naki-Est and Kpembona. Of those farmers applying 15-15-15 to crops, the intercrop of millet-cowpea, staple foods, received an average of 112 kg/ha with a 69% coefficient of variation. Thus the rate at which this fertilizer is used on millet-cowpeas varies widely among farmers. The triple intercrop of millet-sorghum-cowpeas received an average of 102 kg/ha of 15-15-15 with a 67% variation in the rate of application. The intercrop of millet-sorghum received an average rate of application of 83 kg/ha with a 71% coefficient of variation in the rate of application among all farmers.

The sole crop of millet received an average of 47 kg/ha of 15-15-15 with an 58% coefficient of variation. The average rate of application of 15-15-15 for M-6 millet was 33 kg/ha. M-3 millet received an average rate of application of only 78 kg/ha with a coefficient of variation of 25%.

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Table 4.23. Mean Rates and Coefficients of Variation (CV) of Fertilizer Use by Crop for Naki-Est and Kpembona

Crops	Type of Fertilizer							
	15-15-15		Urea		SSP		NPKSB	
	kg/ha							
	Mean	CV (%)	Mean	CV (%)	Mean	CV (%)	Mean	CV (%)
Cotton	100		49	40			141	33
Millet	47	58						
Millet M-6	33							
Cowpeas			45	45			136	38
Millet-sorghum	83	71	31					
Millet M-3	78	25	36					
Millet-sorghum-cowpeas	102	67						
Millet-cowpeas	112	69					11	
Peanuts	42				61	91		
Peanuts-cowpeas			125		67	50		
Other crops	97	55	58	101	50			
All crops	92	64	49	45	64	52	139	35

Note: Fertilizer quantities are rounded.
CV = Coefficient of variation.

The average rate of 15-15-15 application for various other crops is 97 kg/ha with a 55% coefficient of variation and the overall rate of application of 15-15-15 for all crops was 92 kg/ha with a 64% variation. These figures also show substantial variation in the rate of application for 15-15-15, especially for the millet-sorghum, an 83% variation in the average application of 71% kg/ha.

Finally, in regard to the use of 15-15-15, the favored crops for this fertilizer are staple food intercrops such as millet-sorghum-cowpeas, millet-cowpeas, and M-6 millet-sorghum. It is also apparent that M-6 millet sole crops and bases for intercrops receive more average kilograms per hectare of 15-15-15 than M-3 millet crops with a lower coefficient of variation.

The average rate of application of urea for cotton is 49 kg/ha with a coefficient of variation of 40%. That is lower than any variation in the use of urea for any crop or intercrop. Cowpeas show a similar rate of application of urea (45 kg/ha) with a coefficient of variation of 45%. The use of urea for other crops shows an average rate of 58 kg/ha with a very

substantial variation of 101%. For all crops receiving urea, the average rate of application is 49 kg/ha with a coefficient of variation of 45%.

The use of SSP in the sample region is limited to peanuts as a sole crop and the intercrop of peanuts-cowpeas. The average rate of application of this fertilizer for peanuts is 61 kg/ha with a substantial variation of 91%. For the intercrop of peanuts-cowpea the average rate of SSP use is 67 kg/ha with a substantially lower coefficient of variation of 50%. The average rate of use of this fertilizer for all crops is 64 kg/ha with a 52% variation in this rate.

The use of the complex fertilizer NPKSB is limited to cotton and cowpeas. For cotton the average rate of application is 141 kg/ha with a coefficient of variation of 33%. For cowpeas these figures are 136 kg/ha and 38%, respectively. For all crops fertilized with NPKSB the average rate of application is 139 kg/ha with a coefficient of variation of 35%. Small coefficients of variation may indicate that most farmers know about and are using this fertilizer at rates at which it is recommended.

Regarding the use of fertilizers as discussed in this section, the perceptions of farmers about the types of fertilizers used are not in accordance with that of the extension service. However, the data were not changed to agree with the views of extension personnel in the sample region. This will be clarified as the SFRP continues.

Use of Organic Manure

Table 4.24 shows the types of manures used by village, gender, and for the total sample. The data show that farmers do not make detailed distinctions between types of manure but tend to view "manure as manure." Thus the category of "generic manure" is used.

The percentage of farmers using generic manure in Naki-Est (82%) is greater than in Kpembona (62%). For household refuse, these figures are 12% in Naki-Est and 9% in Kpembona, however, the number of farmers using household refuse for fertilization is rather small as is the case with the use of manure from sheep and goats.

On a percentage basis, men (72%) and women (71%) are about equal users of generic manure, although in absolute terms far fewer women (7) than men (78) report the use of all organic manures. No women but 12% of the men reported the use of household refuse for fertilization.

Table 4.24. Types of Organic Manures Used by Village, Gender, and Total Sample

	Generic Manure	Sheep and Goats	Fowl and Goats	Household Refuse	Crop Residue	Other
Village						
Naki-Est	33	1	1	5		
	(82)	(3)	(3)	(12)		
Kpembona	28	5	3	4	1	4
	(62)	(11)	(7)	(9)	(2)	(9)
Gender						
Men	56	5	3	9	1	4
	(72)	(6)	(4)	(12)	(1)	(5)
Women	5	1	1			
	(71)	(14)	(14)			
Total Sample	61	6	4	9	1	4
	(72)	(7)	(5)	(10)	(1)	(5)

Note: Figures in parentheses are rounded percentages.

The present and past use of organic manures is shown in Table 4.25 by village, gender, and total sample. On a percentage basis, men in Kpembona (83%) are the greatest users of organic manure compared with men in Naki-Est (78%), women in Naki-Est (33%), and least likely to use organic manure are women in Kpembona (15%). The total sample figures show that men (68%) compared with women (32%) are more than twice as likely to use organic manure.

The pattern of manure use prior to 1988 in Naki-Est shows an interesting contrast between men and women. More men (91%) report using manures in the past than in the 1988 season (78%). However, among women farmers equal percentages report not using manure for the present season and not having used manure in the past (67%). Thus, the use of manure fluctuates more among men than women, probably owing to availability and preference.

Table 4.25. Percentage Distributions of Farmers Using Organic Manures by Gender, Village, and Total Sample

	Use of Organic Manure This Season		Manure Used in the Past[a]	
	Yes	No	Yes	No
Naki-Est				
Men	35	10	41	4
	(78)	(22)	(91)	(9)
Women	5	10	5	10
	(33)	(67)	(33)	(67)
Total Sample	40	20	46	14
	(67)	(33)	(77)	(23)
Kpembona				
Men	43	9	46	6
	(83)	(17)	(88)	(12)
Women	2	11	2	11
	(15)	(85)	(15)	(85)
Total Sample	45	20	48	17
	(69)	(31)	(74)	(26)
Total				
Men	78	19	87	10
	(80)	(20)	(90)	(10)
Women	7	21	7	21
	(25)	(75)	(25)	(75)
Total Sample	85	40	94	31
	(68)	(32)	(75)	(25)

a. Farmers who have used organic manure for at least one season prior to 1988.

Note: Figures in parentheses are rounded percentages.

The same pattern holds among men and women farmers in Kpembona where a greater percentage of men have used manures in the past (88%) than for the survey season (83%). But the fluctuation is not as great as among men in Naki-Est. As in Naki-Est, the percentages of women reporting no use of manure during the survey season and not having used manure in the past are equal (75%).

Finally, in regard to not using organic manure, Table 4.26 clearly shows that in Naki-Est (93%) and Kpembona (94%) the most frequently cited reason is that manure is not available. The figures by gender show that all women (100%) reported that manure is not used because it is not available, but

Table 4.26. Reasons Given by Farmers for Not Using Organic Manures

	Reasons		
	No Means of Transportation	Not Available	Other
Village			
Naki-Est	1	13	
	(7)	(93)	
Kpembona		16	1
		(94)	(6)
Gender			
Men	1	8	1
	(10)	(80)	(10)
Women		21	
		(100)	
Total Sample	1	29	1
	(3)	(94)	(3)

Note: Figures in parentheses are rounded percentages.

80% of men reported this reason. Of the farmers not using manures, 94% cited nonavailability as the major reason.

Use of Agricultural Credit

Table 4.27 shows the percentages of farmers who used agricultural credit during the 1988 cropping season by gender, village, and total sample. The percentage of farmers using agricultural credit is greater in Naki-Est (80%) than in Kpembona (34%). The figures further show that the percentage of men using credit (64%) is about twice that of women (31%). Disregarding gender and village distinctions, 56% of the farmers used credit and 44% did not. Clearly, men in Naki-Est are the greatest users of credit and women in general the least.

Table 4.27. Percentages of Farmers Who Used Agricultural Credit by Gender, Village, and Total Sample

	Use of Credit	
	Yes	No
Village		
Naki-Est	48 (80)	12 (20)
Kpembona	22 (34)	43 (66)
Gender		
Men	61 (64)	35 (36)
Women	9 (31)	20 (69)
Total Sample	70 (56)	55 (44)

Note: Figures in parentheses are rounded percentages.

A further understanding of the use of credit in the sample region of Togo is offered in Table 4.28 that shows the sources of credit among farmers who obtained a loan. That farmers in Naki-Est are more commercially oriented than in Kpembona is evident in that 90% of those in the experimental village used credit from the Société Togolaise du Coton (SOTOCO) or the Direction Régionale du Développement Rural (DRDR) compared with 57% in Kpembona. Farmers in Kpembona (24%) are more likely than those in Naki-Est (6%) to borrow money from family members for agricultural purposes. Although the actual number is small, 9% of the farmers in Kpembona borrowed money from a cooperative bank, but no such loans were reported by farmers in Naki-Est.

The figures for the sources of credit used by gender show that women (56%) are far more likely than men (10%) to borrow money from family members and friends, but again the base numbers are small. The figures also show that men (87%) are far more likely to use credit from SOTOCO and DRDR than women (33%). Although the use of credit by women from these sources is limited, women are not excluded from SOTOCO-DRDR loans.

Table 4.28. Sources of Credit Among Farmers by Village, Gender, and Total Sample

	Source				
	Money Lender	Family Member	Friend	Cooperative Bank	SOTOCO-DRDR[a]
Village					
Naki-Est		3	2		43
		(6)	(4)		(90)
Kpembona	1	5	1	2	12
	(5)	(24)	(5)	(9)	(57)
Gender					
Men		4	2	2	52
		(7)	(3)	(3)	(87)
Women	1	4	1		3
	(11)	(45)	(11)		(33)
Total Sample	1	8	3	2	55
	(1)	(12)	(4)	(3)	(80)

a. Credit from these sources is given in-kind as fertilizer, seed, and chemicals.
Note: Figures in parentheses are rounded percentages.

Further insight into the use of credit in the sample region is shown in Table 4.29. The percentage of farmers in Naki-Est (50%) who tried and received a loan and those who tried but failed (50%) is equal. But the percentage of farmers in Kpembona who did not obtain a loan but tried (90%) is substantial. The percentage of women who tried to obtain a loan but failed to receive one (30%) is greater than that of men (12%). Men (88%) are somewhat more likely than women (70%) not to have tried to obtain a loan. Overall, 82% of those not using credit did not attempt to obtain a loan.

Finally, in regard to credit, among 11 farmers who tried but failed to obtain a loan, 6 failed from a family member, 4 from a friend, and only 1 failed to obtain a loan from SOTOCO or DRDR. Among the 10 farmers who could site a reason for not obtaining a loan, 9 stated that money was not available and 1 received an unfavorable decision.

Table 4.29. Percentages of Farmers Who Tried But Failed to Obtain a Loan by Village and Gender

	Tried to Obtain a Loan	
	Yes	No
Village		
Naki-Est	6 (50)	6 (50)
Kpembona	38 (90)	4 (10)
Gender		
Men	4 (12)	30 (88)
Women	6 (30)	14 (70)
Total Sample	10 (18)	44 (82)

Note: Figures in parentheses are rounded percentages.

Disposal and Use of Crop Production

The descriptive data shown in Table 5.1 indicate that in excess of 90% of the main crop products of all crops are grown for household consumption: 96% in Naki-Est, 97% in Kpembona, and 96% in the total sample. Less than 5% of the crops in both villages are grown for the dual purposes of household consumption and sale.

The single greatest use of straw is for building material: 61% in Naki-Est, 71% in Kpembona, and 65% for the total sample. The use of straw for groundcover in Naki-Est (32%) exceeds that of Kpembona (19%) and the total sample (26%). The least use of straw is for animal feed: 7% in Naki-Est, 10% in Kpembona, and 9% for the total sample.

Table 5.1. Percentage Distribution of Uses and Disposal of Crop Products for All Crops by Village

Product	Disposal Use	Village: Naki-Est	Village: Kpembona	Total Sample
Main product	Household Consumption	110 (96)	99 (97)	209 (96)
	Household Consumption and sale	5 (4)	3 (3)	8 (4)
Straw	Animal feed	4 (7)	5 (10)	9 (9)
	Ground cover	18 (32)	9 (19)	27 (26)
	Building material	35 (61)	34 (71)	69 (65)

Note: Figures in parentheses are rounded percentages.

Table 5.2 describes the use and disposal of crop products for all crops by gender. Men (98%) are somewhat more likely than women (91%) to use main crop products for household consumption. Nine women (33%) in the sample reported using crop byproducts for animal feed. No men reported such use. Men (26%) and women (26%) are equally likely to use crop byproducts for groundcover. Men (74%), perhaps owing to their greater involvement in building, are more likely than women (41%) to use crop byproducts for building material. Sixty-six percent of the total sample reported the use of byproducts for this purpose.

Table 5.2. Percentage Distribution of Uses and Disposal of Crop Products for All Crops by Gender and Total Sample

Product	Disposal Use	Gender: Men	Gender: Women	Total Sample
Main product	Household Consumption	158 (98)	51 (91)	209 (96)
	Household Consumption and sale	3 (2)	5 (9)	8 (4)
Straw	Animal feed		9 (33)	9 (8)
	Ground cover	20 (26)	7 (26)	27 (26)
	Building material	58 (74)	11 (41)	69 (66)

Note: Figures in parentheses are rounded percentages.

The uses and disposal of crop products for six crops for the total sample are shown in Table 5.3. For each crop, with the exception of rice, more than 90% of the main products are used for household food consumption. Rice (30%) is grown for the dual purpose of household consumption and sale. Less than 10% of all other crops are grown for these purposes.

The favored use of peanut straw (88%) is animal feed. Straw from rice (71%) and millet (27%) is a crop byproduct mainly used for groundcover. The favored building materials are straw from millet (73%) and sorghum (12%).

Finally, in regard to the disposal of crop production, 78% of all sales were made by the farmers who cultivated the particular crop and 22% by the wives of farmers. All of the crops were sold within the villages rather than at distant locations.

Table 5.3. Percentage Distribution of Uses and Disposal of Crop Products by Crop and Total Sample

Product	Disposal Use	Crop: Millet	Sorghum	Peanuts	Beans	Rice	Bambara Groundnuts	Total Sample
Main product	Household Consumption	121 (98)	47 (98)	19 (91)	9 (100)	7 (70)	6 (100)	209 (96)
	Household Consumption and sale	2 (2)	1 (2)	2 (9)		3 (30)		8 (4)
Straw	Animal feed			7 (88)		1 (14)	1 (100)	9 (9)
	Ground cover	21 (27)		1 (12)		5 (71)		27 (26)
	Building material	56 (73)	12 (100)			1 (14)		69 (65)

Note: Figures in parentheses are rounded percentages.

Sources of Agricultural Information

Cooperatives

Table 6.1 provides descriptive data on the perceptions of farmers in the Savanna Region of Togo about the value of agricultural information received from various sources. A greater percentage of farmers in Naki-Est (84%) than in Kpembona (66%) view agricultural information from cooperatives as very helpful and somewhat helpful. In contrast, farmers in Kpembona (34%) are about twice as likely as those in Naki-Est (16%) to view information from cooperatives as not helpful or report uncertainty about the value from this source. A similar pattern holds for perceptions about information from cooperatives by gender. Specifically, a greater percentage of men (79%) and of women (59%) farmers view information from cooperatives as very helpful and somewhat helpful, but women (41%) are about twice as likely as men (21%) to view information from cooperatives as not helpful or of uncertain value. Although 75% of the total sample view agricultural information from cooperatives as very or somewhat helpful, men in Kpembona and women from both villages are most likely to view information from this source as not helpful or of uncertain value.

Table 6.1. Perceptions About the Value of Agricultural Information From Various Sources by Village and Gender

Source	Village		Gender		Total Sample
	Naki-Est	Kpembona	Men	Women	
Cooperatives					
Very helpful	34 (60)	35 (59)	59 (64)	10 (42)	69 (60)
Somewhat helpful	14 (24)	4 (7)	14 (15)	4 (17)	18 (15)
Not helpful	9 (16)	18 (31)	19 (21)	8 (33)	27 (23)
Uncertain		2 (3)		2 (8)	2 (2)
Extension Workers					
Very helpful	52 (88)	57 (87)	90 (95)	19 (66)	109 (88)
Somewhat helpful	1 (2)	3 (5)	1 (1)	3 (10)	4 (3)
Not helpful	6 (10)	3 (5)	3 (3)	6 (21)	9 (7)
Uncertain		2 (3)	1 (1)	1 (3)	2 (2)
Other Farmers					
Very helpful	32 (57)	59 (90)	68 (74)	23 (79)	91 (75)
Somewhat helpful	17 (31)	3 (5)	15 (16)	5 (17)	20 (17)
Not helpful	6 (11)	3 (5)	8 (9)	1 (4)	9 (7)
Uncertain	1 (1)		1 (1)		1 (1)

Note: Figures in parentheses are rounded percentages.

Extension Workers

Farmers in Naki-Est (90%) and Kpembona (92%) view information from extension workers as very helpful and somewhat helpful. However, women (66%) are less likely than men (95%) to view such information as very helpful. Overall, 91% of the total sample perceive information from extension workers as very helpful or somewhat helpful.

Other Farmers

Farmers in Kpembona (90%) are much more likely than those in Naki-Est (57%) to view information from other farmers as very helpful. More farmers in Naki-Est (31%) than in Kpembona (5%) view such information as only somewhat helpful. There is a small gender difference about perceptions of the value of information from other farmers; 90% of men and 96% of women farmers view information from this source as very helpful or somewhat helpful. Overall 92% of the total sample view information from other farmers as very helpful or somewhat helpful.

Table 6.2 shows the number of annual visits by extension workers received by farmers by village, gender, and total sample. Women in Naki-Est (80%) are most likely to receive no annual visits from extension workers followed in descending order by women in Kpembona (46%), men in Kpembona (19%), and men in Naki-Est (16%). Overall about one-quarter (28%) of the farmers in the total sample reported no extension visits during the 1988 cropping season.

Table 6.2 Number of Annual Visits by Extension Workers to Farmers by Gender and Village

	Village						
	Naki-Est			Kpembona			
Number of Visits	Men	Women	Total	Men	Women	Total	Total Sample
None	7	12	19	9	6	15	34
	(16)	(80)	(32)	(19)	(46)	(25)	(28)
1	5		5	2	1	3	8
	(11)		(8)	(4)	(8)	(5)	(7)
2-4	20	1	21	19	6	25	46
	(44)	(7)	(35)	(40)	(46)	(41)	(38)
5-10	11	2	13	14		14	27
	(25)	(13)	(22)	(29)		(23)	(22)
>10	2		2	4		4	6
	(4)		(3)	(8)		(6)	(5)
TOTAL	45	15	60	48	13	61	121
Percent	100	100	100	100	100	100	100

Note: Figures in parentheses are rounded percentages.

The numbers and percentages of farmers receiving one extension visit per year are minimal. Specifically, men (11%) in Naki-Est are most likely to report one visit followed in descending order by women in Kpembona (8%) and men in Kpembona (4%). Overall, 7% of the sample reported receiving only one extension visit during the survey season.

Interestingly, women in Kpembona (46%) are most likely to receive between 2 and 4 extension visits per year followed in descending order by men in Naki-Est (44%), men in Kpembona (40%), and single women farmers in Naki-Est (7%). Overall, 38% of the sample reported receiving between 2 and 4 extension visits in 1988.

Men in Kpembona (29%) and men in Naki-Est (25%) reported receiving between 5 and 10 extension visits. Interestingly, 13% of the women in Naki-Est but none in Kpembona reported receiving between 5 and 10 extension visits. Overall, 22% of the total sample received between 5 and 10 extension visits during the 1988 cropping season. The number of farmers receiving 10 or more extension visits is very minimal.

Radio and television are of course useful media for the dissemination of agricultural information. As shown in Table 6.3, farmers were asked about their radio ownership and access to television. Within the total sample 22% of the farmers reported owning a radio, but this figure obscures gender differences on this point. Men in Naki-Est (27%) reported the highest percentage of radio ownership followed by men (23%) and women (21%) in Kpembona. Women in Naki-Est (7%) are least likely to own radios. Overall, 10% of the sample reported having access to a television. The greatest access to television is among women farmers in Kpembona (21%), followed by women in Naki-Est (13%) and men in Kpembona (12%).

Table 6.3. Radio Ownership and Access to Television by Village and Gender

	Village						
	Naki-Est			Kpembona			
	Men	Women	Total	Men	Women	Total	Total Sample
Owns a Radio							
Yes	12	1	13	12	3	15	28
	(27)	(7)	(22)	(23)	(21)	(23)	(22)
No	33	14	47	39	11	50	97
	(73)	(93)	(78)	(77)	(79)	(77)	(78)
Has Access to Television							
Yes	2	2	4	6	3	9	13
	(4)	(13)	(7)	(12)	(21)	(14)	(10)
No	43	13	56	45	11	56	112
	(96)	(87)	(93)	(88)	(79)	(86)	(90)

Note: Figures in parentheses are rounded percentages.

Perceptions of Farmers About Constraints to Agricultural Production and Fertilizer Use

Assumptions for Calculating Scores for Constraints

In calculating the scores and ranks for perceived constraints to agricultural production and fertilizer use, it is assumed that the relative importance of the first constraint is equal to three times the importance of the third most important constraint. Thus, a constraint that is mentioned three times in the third order of importance is as important as a constraint mentioned once in the first order of importance.

It is further assumed that the importance of the second constraint is equal to 1.5 times the importance of the third most important constraint. Thus, a constraint that is mentioned two times in the second order is as important as a constraint mentioned once in the first order of importance.

These assumptions serve as a basis for calculating the scores for the relative importance of constraints (SRI) to agricultural production and fertilizer use where:

$$SRI_i = \sum_{j=1}^{3} (W_j f_j)_i$$

where w_j = weights and f_j = frequencies for a given i constraint and j orders or ranking.

Constraints to Agricultural Production

The scores and ranks for perceived constraints to agricultural production by village and gender are shown in Table 7.1. This table clearly shows that low soil fertility is perceived as the most important constraint to agricultural production in both villages and among both men and women farmers. This uniform perception demonstrates that the goals of the SFRP clearly address the most important constraint to agricultural production as understood by farmers in the Savanna Region of northern Togo.

Among farmers in Naki-Est and men and women the lack of rain is perceived as the second most important constraint to agricultural production. But farmers in Kpembona perceive pests and diseases as a greater constraint to

Table 7.1. Ranked Scores of the Relative Importance of Constraints to Agricultural Production as Perceived by Farmers by Village and Gender

Constraint	Village				Gender				Total Sample	
	Naki-Est		Kpembona		Men		Women			
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Low soil fertility	230	1	212	1	220	1	222	1	442	1
Lack of rain	149	2	111	3	132	2	128	2	260	2
Pests--diseases	97	3	116	2	118	3	94	3	212	3
Poor field maintenance	27	4	22	5	13	7	36	4	49	4
Lack of fertilizer	18	6	29	4	17	6	29	5	47	5
Weeds	26	5	11	7	19	5	18	6	37	6
Other[a]	14	7	16	6	21	4	9	7	30	7

a. Includes lack of money for inputs, strong winds, flooding, lack of fallow, and lack of animal traction.

Note: Scores are rounded and adjusted by sample size for comparisons between men and women and villages.

production than the lack of rainfall that is ranked third in this village. With the exception of farmers in Kpembona, pests and diseases are uniformly perceived as the third most important by farmers in Naki-Est and by men and women farmers.

Farmers in Naki-Est and women in the total sample view poor field maintenance as the fourth most important constraint to agricultural production. However, farmers in Kpembona view poor field maintenance as the fifth most important constraint in their village, but men in the total sample rank this constraint as least important and thus it is ranked seventh.

Lack of fertilizer is viewed by farmers in Naki-Est and men in the total sample as the sixth most important constraint to agricultural production. Men in Kpembona rank lack of fertilizer as the fourth most important constraint and women in the total sample rank it as fifth in importance.

Weeds are viewed by farmers in Kpembona as the least important constraint to agricultural production and are ranked relatively low as a constraint by farmers in Naki-Est and men and women in both villages.

Other constraints such as a lack of money for inputs, strong winds, flooding, lack of fallow, and lack of animal traction are perceived as the least important constraints to agricultural production by farmers in Naki-Est and women in the sample. The other constraints are viewed by farmers in Kpembona as sixth in relative importance and fourth by men in both villages.

It is important to note that although all farmers in the sample view low soil fertility as the major constraint to crop production, the lack of fertilizer to correct this problem is not ranked highly in importance. The SFRP is designed to demonstrate to farmers the benefit and contribution of fertilizer in increasing soil fertility, and thus crop production.

Constraints to Fertilizer Use

As shown in Table 7.2, the lack of money or credit is uniformly perceived as the most important factor for the SRI constraints to fertilizer use in both villages by men and women. There is also a uniform perception that the lack of fertilizer supplies is the second most important constraint to using this input.

Table 7.2. Ranked Scores of the Relative Importance of Constraints to Fertilizer Use as Perceived by Farmers by Village and Gender

	Village				Gender					
	Naki-Est		Kpembona		Men		Women		Total Sample	
Constraint	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
No money or credit	307	1	270	1	293	1	284	1	577	1
Fertilizer not available	113	2	117	2	125	2	105	2	230	2
Distance to dealer	15	4	26	3	22	3	19	3	41	3
Lack of rain	18	3	16	4	17	4	17	4	34	4
No knowledge	9	6	11	5	3	7	17	4	20	5
High prices	-	-	16	4	6	6	10	5	16	7
Other[a]	13	5	5	6	9	5	9	6	18	6

a. Includes lack of labor, insecure land tenure, lack of seeds, and small size of plots.

Note: Scores are rounded and adjusted by sample size for comparisons between men and women and villages.

Farmers in Kpembona and men and women in the sample cite the distance to a fertilizer dealer as the third most important constraint, but farmers in Naki-Est rank this factor as fourth in importance on the SRI of constraints.

Farmers in Kpembona and men and women farmers perceive a lack of rain as the fourth most important constraint to fertilizer use, but farmers in Naki-Est rank this factor as third on the SRI.

A lack of knowledge about fertilizer use is perceived as the fourth constraint in relative importance by women in the sample but is ranked fifth by farmers in Kpembona, sixth by farmers in Naki-Est, and least important on the SRI by men in the sample.

High fertilizer prices are not perceived as a constraint in Naki-Est but is ranked fourth on the SRI in Kpembona. Women, who rank high prices as fifth on the SRI, view this constraint as more important than men who rank it as sixth.

Women and farmers in Kpembona perceive other factors such as a lack of labor, insecure land tenure, lack of seeds, and small plot sizes as sixth on the SRI of constraints to fertilizer use. Farmers in Naki-Est and men in the sample view these constraints as more important on the SRI and rank them fifth.

Econometric Analyses

Statistical procedures were used to estimate functions that could help explain crop production, farmers' income, and the demand for farm labor. However, because of data limitations, estimates of crop production and labor use functions were not satisfactory in explaining variations in crop production and labor use, nor suitable to make reliable inferences about the influence of various factors, such as gender and schooling of the farmers and fertilizer use, on crop production, labor productivity, and use. Future surveys should provide data appropriate for the estimation of reliable functions and relationships.

A Report on the Baseline Survey of the SFRP in the Maradi Region of Niger

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A REPORT ON THE BASELINE SURVEY OF THE SOIL FERTILITY RESTORATION PROJECT IN THE MARADI REGION OF NIGER

Summary

Demographic Characteristics and Locations of Households

1. A stratified random sample of 129 farmers, including 37 women from the villages of Tchizon and Maiguero in the Maradi Department of Niger, was interviewed in 1988, the initial year of the Soil Fertility Restoration Project (SFRP). The survey generated data on gender; cultural groups; household location and composition, education, and employment; land availability and tenure; the use of machinery, animals, equipment, and credit; crop areas and management; sources of information about fertilizers; the use and cost of fertilizers, organic manures, and crop residue; the use and cost of labor; disposal and use of crop production; and finally, the perceptions of farmers about constraints concerning fertilizer use in particular and agricultural production in general.
2. The households of sample farmers are generally comprised of nuclear families. But households in Tchizon, the experimental village, tend to be larger and are more likely to have extended family members than households in Maiguero, the control village.
3. Among farmers and their adult household members the number of women exceeds men, and women are generally younger than men; but men have twice as many years of formal schooling. This suggests that, as in the past, opportunities for formal schooling for rural Hausa women have not improved in recent years.
4. Regardless of gender, farmers buy household goods and agricultural inputs from the nearest market centers where farm produce is sold. Due to lack of public or commercial transportation, farmers rely on transportation by foot and sometimes farm animals. Farmers in Maiguero and Tchizon are about equal distances from a large market center, 35 km and 36 km, respectively.

5. There are no significant differences between men and women with regard to distances from households to household or individual plots. However, women who manage plots in Tchizon are likely to be more distant from their plots than their counterparts in Maiguero.

Off-Farm Employment

6. No women farmers in the sample reported are engaged in off-farm employment. Apparently household chores, such as food preparation, tending children, and watering animals preclude women from engaging in off-farm work. Seclusion is also a factor in minimal off-farm employment of women. A significant proportion of men farmers (35%) engage in off-farm employment for periods ranging from 2 to 9 months/year. Men in Maiguero, the control village, are more likely to be engaged in off-farm employment but are employed for a shorter duration and consequently earn less than men in Tchizon. In Tchizon, the majority (54%) of off-farm employment is in the village of residence. In contrast, 84% of off-farm employment in Maiguero is outside the national territory, specifically in northern Nigeria.
7. The ability of men farmers in Tchizon to realize off-farm earnings is evident in that although twice as many men farmers in Maiguero engage in off-farm employment compared to Tchizon, men farmers in Tchizon earn over twice as much (48,222 FCFA or US $163) as their counterparts in Maiguero (21,700 FCFA or US $73).

Characteristics of Farms

8. Aside from the household plots that are predominantly managed by men, each gender may manage plots of the other.
9. There are significant differences in the number of plots and the crop area per farm managed by each gender. On the average, men manage three times (7.5) as many plots as women (2.5). The average crop area on farms managed by men (9.9 ha) is about five times greater than that of farms managed by women (2.1 ha).
10. Unlike several societies in West Africa, where custom prohibits the sale of farmland, a significant 13% (38.5 ha) of the total sample area in Tchizon managed by men was acquired through direct purchase.

11. Very few plots are borrowed or rented. Ninety-eight percent of a total of 280 plots (987 ha) is family-owned (75%) or owned by the individual plot manager (23%).
12. The average area cultivated by men farmers exceeds that of women farmers. The largest average crop area is observed among men in Tchizon (12.0 ha), followed by men farmers in Maiguero (7.3 ha), women farmers in Tchizon (2.9 ha), and women farmers in Maiguero (1.5 ha).
13. The data indicate clearly that family-owned plots comprise the largest portion (90%) of the area managed by men farmers. The area managed by women farmers is somewhat equally divided between family-owned (52%) and individually-owned plots (47%) but men reported only 8% of the area under their management as individually owned.

Equipment, Tools, and Animals

14. The ownership of agricultural equipment such as seeders and mist-blowers is limited to a few men farmers in Maiguero. Farmers generally use locally made hand tools, and the distribution of tools between men and women is such that women are at no particular disadvantage in access to the most important tools such as hilaires and dabas.
15. Men (85%) and women (87%) farmers in the two villages own animals, but on the average men own about twice as many animals (7.1) as women (3.3).
16. Virtually all farmers, regardless of gender, own hand tools with men farmers somewhat more likely than women farmers to report ownership. All men and women in Tchizon reported hand tool ownership, but men in Maiguero (97.5%) are somewhat more likely than women (95%) to own hand tools.
17. The percentage of farmers owning animals varies by gender and village. In Tchizon, a greater percentage of men farmers (92%) than women farmers (82%) own animals. But in Maiguero these figures are 75% and 90%, respectively.

Crops and Cropping Systems

18. The sole crop of millet (46%) and other millet-based intercrops (37%) account for 83% of the cropping systems on 309 plots sampled. The most important food crop after millet is sorghum. In the experimental village of Tchizon, millet and sorghum as sole crops or a basis for other

intercrops account for 92% of the crops on 153 sample plots. The corresponding figures for Maiguero are 99% on 157 plots.

19. An interesting contrast is that men and women farmers in Tchizon allocate 7% of all plots in the village for the cultivation of cowpeas, but this crop is hardly grown in Maiguero. Instead, farmers in Maiguero grow mainly peanuts as a legume that is grown only by a few men farmers in Tchizon.
20. The total sample figures show that the average size of 309 plots included in the sample is 1.56 ha. The average plot area for men is 1.77 ha and 0.81 ha for women.
21. Millet is a very important grain for farmers in Hausaland. Approximately one-half (49%) of the total sample area or 235.1 ha was allocated to the sole crop of millet. Men farmers allocated a greater percentage of their total crop area to the sole crop of millet (51% or 213 ha) than women (39% or 21.9 ha).
22. Women allocate a higher percentage of their total crop area for sorghum (14%) than men (10%). Although the difference may not appear significant, it should be noted that the average plot area for sorghum among men (1.48 ha) is greater than that of women (0.80 ha).
23. Women in Maiguero allocate 43% of the total area under their management to the millet-sorghum intercrop, but this intercrop is not cultivated by women in Tchizon.

Use of Household and Hired Labor for All Crops

24. Farmers in both villages rely heavily on household labor for farming activities. Specifically, on the average 99% of all workdays per hectare are performed by household labor in Tchizon. The corresponding figure for Maiguero is 96%. Thus, farmers in Maiguero are slightly more likely to use hired labor than those in Tchizon.
25. There are striking differences between men and women farmers about total labor used in workdays per hectare between the two villages. In Tchizon, women use twice as many average workdays per hectare for all crops (41.2) as men (20.2). By contrast, in Maiguero, the total labor use in workdays per hectare for women (22.5) is slightly less than that of men (27.9). For the more demanding task of weeding, for example, on the average, women in Maiguero use 8.5 workdays/ha compared with 14.0 workdays for men.

26. There are significant differences between the two villages in the average total labor used per hectare by farmers for all crops and intercrops. For the sole crops of millet and sorghum and the millet-sorghum intercrop farmers in Tchizon, on the average, use 26.3, 33.7, and 11.9 workdays/ha for all activities, respectively. The corresponding figures for the three cropping systems in Maiguero are 29.2, 26.3, and 27.0 workdays/ha. Thus, farmers in Tchizon use fewer workdays per hectare for the sole crop of millet and the millet-sorghum intercrop but more workdays per hectare for the sole crop of sorghum than farmers in Maiguero.

Use of Labor by Gender for All Crops

27. Regardless of village, crop, or gender of plot manager, farmers in the sample depend mainly on household labor for all agricultural activities. The maximum contribution of hired labor for all activities and all crops is 6% of the average workdays in Maiguero.
28. A comparison of th labor contributions of men and women for all crops by village shows that work is more equally shared by men and women in Maiguero who contributed 48% and 46% of the average workdays for all crops, respectively. For Tchizon this labor contribution for men is 60% and 32% for women.
29. In Tchizon the percentages of average workdays contributed by men (47%) and women (44%) for all activities on plots managed by women are more equal than on plots managed by men, 65% and 28%, respectively.
30. In Maiguero the men and women are the main contributors of labor for all activities for all crops on plots under their respective management. On plots managed by women 27% of the average workdays were contibuted by men and 72% by women. On plots managed by men these percentages are 64% and 28%, respectively.
31. The labor contributions of children were largely for the activities of planting, weeding, and harvesting. On the average, children are more likely to labor on plots managed by men than on plots managed by women. Between 5% and 10% of all workdays for all activities, regardless of crop-mix or cropping system, were performed by children.

Use of Fertilizers

32. Approximately one-third (32%) of the farmers in the sample used fertilizer during the survey year. Slightly more than one-half (52%) of

the sample farmers in Tchizon used fertilizers, compared with only 10% in Maiguero.

33. Although men are more likely than women to use fertilizers, there was a remarkable 12% increase between women who used fertilizer in the past (7%) and those who used it during the survey season (19%). Women farmers in Tchizon (41%) are more likely to use fertilizers than their counterparts in Maiguero (nil).

34. Limited financial resources are one of the main constraints to fertilizer use in the study area. Eighty-four percent of farmers who have not adopted fertilizers cited lack of money as the main constraint. Farmers in Tchizon (96%) are more likely than farmers in Maiguero (64%) to cite lack of money as a reason for not using fertilizer.

35. In Maiguero, 29% of the farmers cited weeds as the main reason for discontinuing fertilizer use. Fewer farmers in Tchizon cited this reason (4%).

36. Fertilizer use is more elaborate in the experimental village than in the control village. Approximately 13% of all sampled plots in Tchizon received fertilizers during the survey year. Only 1.6% of the plots in Maiguero were fertilized.

37. The average rate of SSP applications for various sole crops and intercrops in Tchizon was 75.1 kg/ha compared with 41.4 kg/ha in Maiguero. Urea was applied at the average rates of 31.6 kg/ha and 27.5 kg/ha in Tchizon and Maiguero, respectively.

38. The use of ground Tahoua phosphate rock is limited to the sole crop of millet in Maiguero, and the sole crops of millet and sorghum and other millet intercrops in Tchizon. The average rate of application of this fertilizer is 100 kg/ha in Maiguero and 18.5 kg/ha in Tchizon.

39. The use of 15-15-15 and TSP is limited to Tchizon where the average rates of application were 45.8 and 32.0 kg/ha, respectively.

40. The most popular method of fertilizer application used by farmers in the study area is broadcasting (64.3%) followed by point placement (15.1%), and sidedressing (11.9%). Banding is the least used method of fertilizer application.

41. In the two villages 86% of the farmers used organic manure during the survey cropping season. The percentage of farmers who used manure was slightly higher in Maiguero (88.3%) than in Tchizon (83.1%).

42. Among the few farmers who did not use manure, lack of transportation and nonavailability of manures were the two main reasons cited.

Use of Credit

43. Regardless of gender, the use of agricultural credit is very minimal in the study area. Only 5% of sample farmers used agricultural credit and virtually all farmers borrowed from a friend or a family member. It is worthy to note that 97% of farmers who did not use credit made no attempt to obtain a loan during the survey cropping season.

Use of Crop Output

44. The greater proportion of agricultural production is reserved for household consumption. In Tchizon, 85% of the millet production and 80% of sorghum were exclusively designated for household use. The corresponding figures for the two crops in Maiguero are 72% and 97%, respectively. However, a remarkable 80% of the peanut crop and 12% of all crops' output in Maiguero were exclusively for market sale. In Tchizon, only 8% of the cowpea production or 4% of all crops were sold. Thus, farmers in Maiguero are somewhat more market-oriented than those in Tchizon.

45. The responsibility for crop sales mostly rests with farmers. This is the case for 90% of the total sample--88% for farmers in Maiguero and all of the farmers (100%) in Tchizon. The favored places for the sale of crops are the nearest small market towns. In Tchizon, 83% of farm produce marked for sale was sold in nearby Tchadua (4 km); the remainder (17%) was sold in the village. Farmers in Maiguero sold 87% of their produce destined for the market in Gabi (3 km).

Sources of Agricultural Information

46. Farmers in the two villages generally have a positive perception of agricultural cooperatives. However, farmers in Tchizon (97%) are more likely than those in Maiguero (67%) to view agricultural information from cooperatives as very helpful. A similar pattern holds for perceptions about information from extension workers. Specifically, virtually all farmers in Tchizon (97%) and 91% of those in Maiguero perceive information from extension workers as very helpful. But farmers in

Maiguero (5%) are more likely than those in Tchizon to be uncertain about the value of agricultural information from extension workers.

47. In excess of 90% of farmers in the two villages view agricultural information from other farmers as very helpful or somewhat helpful, but again 8% of farmers in Maiguero, mostly women, are uncertain about the value of agricultural information from this source.

48. The pattern is somewhat the same with regard to agricultural information from fertilizer dealers. Farmers in Tchizon (3%) are more likely than those in Maiguero to view information from this source as not helpful.

49. A significant proportion of farmers in the study area have access to extension services. Only 9% of farmers in the sample did not receive extension service visits. However, farmers in Tchizon are better served by extension service workers. In Tchizon 7 out of 10 farmers, compared with one-half of farmers in Maiguero, received more than four extension service visits during the survey year. The visits were more frequent among men than women farmers.

50. Overall, men and women in each of the two sample villages have about equal access to agricultural information through radio and television, but farmers in Tchizon (84%) are more likely to have seen television programs about fertilizers than those in Maiguero (41%). The greatest ownership of radios is among women in Tchizon (41%), followed by men in Tchizon (23%), and finally, men (8%) and women (5%) in Maiguero.

Constraints to Agricultural Production

51. The data clearly show that regardless of gender, farmers perceive lack of rain as the most important constraint to agricultural production in the study area.

52. Low soil fertility is perceived by men in Tchizon, the experimental village, as the second most important constraint to crop production. Among women in Tchizon and all farmers in Maiguero, regardless of gender, pests and diseases are perceived as the second most important constraint to agricultural production.

53. Other constraints, such as weeds, strong winds, and lack of money to purchase inputs, are perceived by women farmers in Tchizon and Maiguero as the third most important constraint to crop production, but these

factors are viewed by men farmers in Tchizon as fourth in relative importance.

54. Finally, women in the study sample cite low soil fertility as the least in relative importance of all constraints identified.

Constraints to Fertilizer Use

55. Regarding constraints to fertilizer use, farmers in Tchizon perceive inadequate rainfall as the second most important constraint after lack of money to purchase fertilizers, but this factor is ranked third in Maiguero. However, farmers in both villages are unanimous about their inadequate knowledge about fertilizers as the fourth most important constraint to fertilizer use.

56. Lack of fertilizer is viewed by farmers in Tchizon as the third most important constraint to fertilizer use. But it seems this does not pose any problem for farmers in Maiguero who apparently have access to supplies from nearby Nigeria, however irregular.

Econometric Analyses

57. Parameter estimates of millet production functions indicate the following: overall productivity was not significantly different between villages. Thus, "holding constant" other factors included in the models, millet yields in Tchizon were not significantly different from the yields in Maiguero.

58. Regarding gender, a somewhat higher level of productivity is evident for men farmers. However, the coefficients are not statistically significant. Therefore, the hypothesis that men and women farmers have the same level of overall productivity cannot be rejected.

59. The use of fertilizer had a positive and statistically significant effect on millet yields. The coefficients of fertilizer use variables were statistically significant at the 0.01 level of significance.

    The coefficient of the linear model shows that, "holding constant" other factors included in the model, millet yields of farmers using fertilizer were 564 kg/ha higher than the yields of farmers not using fertilizer.

60. Coefficients of the labor use variable in the linear and logarithmic models are estimates of the average productivity of labor and of the elasticity of crop yields with respect to labor use, respectively. These

coefficients are statistically significant at the 0.01 level of significance and show that the average productivity of a workday of labor is equivalent to about 18 kg of millet or approximately FCFA 600. The estimated elasticity of millet yields with respect to labor (0.6) indicates the percentage change in yields associated with a 1% change in the use of labor; i.e., on the average a 10% increase in labor use is associated with about a 6% increase in millet yields.

61. The low magnitude and lack of significance of the coefficients for the variable crop area per farm show that millet yields are not significantly affected by farm size. That is, there is no indication of economies or diseconomies of scale in millet production.

Estimates of the functions of farmers' income indicate the following.

62. Gross income of farmers from millet production and total household income were somewhat higher in Maiguero than in Tchizon. Differences between villages were statistically significant in levels of gross income from millet but not in total household income.

63. Men have higher levels of income than women farmers; however, holding constant other factors (use of labor and fertilizer, and crop area per farm) the gender of the farmer does not have a significant effect on household income.

64. Fertilizer use, intensity of labor use (workdays per hectare), and crop area per farm are the most important determinants of household income. The coefficients of these variables are statistically significant at the 0.01 level of significance in all models.

65. The coefficient of the dummy 0-1 variable for fertilizer use shows that the use of fertilizer increased the gross annual income of farmers by about FCFA 127,000-144,000/household.

66. Coefficients of the intensity of labor use variable (workdays per hectare) show that on the average a workday per hectare of cultivated land increased the annual income per household by about FCFA 7,000, and that the elasticity of household income with respect to labor use is about 0.6.

67. Coefficients of the variable for crop area per farm in the linear models show that the gross annual income of farmers per household increases by about FCFA 29,000/ha of cultivated land. That is, holding other factors constant, an additional hectare of millet increased gross household

income of farmers by FCFA 29,000/year. The coefficients for this variable in the logarithmic models show elasticities of income with respect to crop area. Because these coefficients are not significantly different from 1, household income increases in the same proportion as the crop area per farm, thereby, no significant economies or diseconomies of scale are evident.

Estimates of the labor use models for Maiguero and Tchizon indicate the following.

68. Gender had a statistically significant impact on labor use in the village of Maiguero where men farmers are apparently using more labor per hectare on millet than women. Differences in labor use were not significant in Tchizon.

69. In both villages the use of fertilizer and the off-farm employment of farmers did not have significant effects on the levels of labor use per hectare of millet.

70. Coefficients estimating the effect of the variable area cultivated per farm on the intensity of labor use were negative and statistically significant in both villages. Use of labor per hectare decreases with the area cultivated per farm. Thus, there is an inverse relationship between the intensity of labor use (workdays per hectare) and the total area cultivated by farm. In Maiguero the elasticity of labor use per hectare with respect to the area cultivated per farm was -0.45. These results may be explained by the presence of constraints in the availability of family labor and for the hiring of labor during periods of high labor demand.

A REPORT ON THE BASELINE SURVEY OF THE SOIL FERTILITY RESTORATION PROJECT (SFRP) IN THE MARADI REGION OF NIGER

Introduction

In recent years West Africa has been the focus of intensive agricultural research, as it is one of the few regions in the world that has consistently experienced difficulty in feeding its people. Rapid population growth, inadequate infrascructure, economic stagnation, poverty, and declining soil productivity have combined in various ways to stifle food production in the region.

Although soil fertility varies considerably, extensive weathering, leaching, and erosion often make West African soils infertile. Farmers have traditionally coped with the problem of declining soil productivity through "bush fallow rotation" whereby land is rested after 2 or 3 years of cropping to permit natural regeneration of the soil.

But over the last two decades or more, this system of soil fertility restoration has come under severe pressure and is increasingly less viable because of rapid population growth and the attendant increase in the demand for food. In response, farmers have shortened fallow periods and are increasingly expanding cultivation on land of marginal fertility. Indeed, there is increasing evidence that in several areas of the West African Savanna and the Sahel continuous cropping has replaced the bush fallow system. The result is that much farmland is now showing signs of widespread environmental degradation and declining soil fertility.

Reversing the decline in West Africa food production and environmental degradation requires the identification and testing of sustainable systems of soil management that enhance food production while maintaining the natural resource base. In this regard it is imperative, as a first step, to conduct basic and applied agricultural research to obtain a better understanding of the biophysical, chemical, economic, and sociocultural environments of West African farmers.

In particular, it is important to collect detailed information on farmers' resource endowments and utilization. It is equally important to field test fertilizers and soil amendments and assess their role in

stabilizing, increasing, and sustaining crop production in West Africa. Such research should be pursued within prevailing circumstances of farming systems, the socioeconomic conditions of the intended beneficiaries, as well as governmental agricultural policies and programs.

It is against this background that the International Fertilizer Development Center (IFDC) embarked on a Soil Fertility Restoration Project (SFRP) to field test the agronomic, economic, and sociocultural benefits of using fertilizer and soil amendments in three countries and six villages of West Africa.

As an applied agronomic and socioeconomic research program, the SFRP is examining, in collaboration with national counterparts, the benefits of fertilizer use in soil fertility restoration, evolution of farming systems, the economies of local communities, and the implications for the reversal of environmental degradation in West Africa. Specifically, the 5-year project is being implemented in three contrasting agroecological and socioeconomic zones in Ghana (humid), Togo (Savanna), and Niger (Sahel), where the elimination of specific soil fertility constraints in potentially productive areas and the availability of markets for additional produce would make fertilizer use profitable and attractive for small-scale farmers.

The SFRP research first required the selection of pilot regions and then villages where crop production and soil fertility may be increased and maintained through soil amendments and fertilizer use, the collection of baseline ecological and socioeconomic data, and the establishment of pilot projects in the selected regions. In the continuing activity of field testing amendments and fertilizer use strategies, equal emphasis has been given to the use of available local resources, some of which are obtained through low-cost processing of indigenous raw materials.

Another aspect of the SFRP is regular formal and informal training of counterpart staff to implement and monitor the pilot projects and collect the necessary agronomic and socioeconomic data. Sharing and disseminating information from the project, strengthening the capability of national agricultural research organizations to conduct similar research in soil fertility restoration through scientific support and consultation, material support for the execution of pilot projects, and regular workshops are integral parts and benefits of the SFRP. The ultimate development goals of the project are to increase the availability of food, increase rural incomes, and promote agriculture and rural development in sub-Saharan Africa through

the reclamation and conservation of farmlands whose fertility is depleted or low.

The purpose of this report is to describe the socioeconomic characteristics and farming practices that existed in the SFRP research area in Niger in 1988, the initial year of the project. The baseline data reported here are intended to provide a basis for determining the social and economic consequences of fertilizer use interventions in subsequent years of the project. Thus, the consequences of fertilizer use will be evaluated with regard to changes in the socioeconomic environment, farming practices, use of inputs, agricultural production and productivity, off-farm employment, monetary incomes of farmers, and the role of women in agricultural development.

The Republic of Niger: An Overview

The Republic of Niger covers a total area of approximately 1.3 million km^2 and is the largest country in West Africa. Niger is landlocked and about two-thirds of the area is in the vast Sahara Desert.

About 80% of the estimated 7 million people in Niger (1986) are classified as rural dwellers. More than one-half of the Nigerien population is below 20 years of age, and at the estimated growth rate of 3% annually, about 10 million people are expected to inhabit Niger by the year 2000.

An estimated one-third of the Nigerien Gross Domestic Product is derived from traditional farming and livestock-rearing. The main food crops are millet, sorghum, cowpeas, rice, and peanuts. In the past, with the exception of the drought periods, expansion in the production of these crops has kept pace with population growth. But in recent years, Niger has experienced periodic grain deficits due largely to declining soil productivity, growing food demand, and food distribution problems. Thus, improvement of the natural resource base as envisaged in the SFRP is crucial to ensure stability in food crop production, enhancing the well-being of the vast rural population, and ensuring a predictable supply of food.

The Data and the Sample Region

The Data

The data for the baseline survey were collected in September 1988 through the use of a questionnaire that contained open and close ended items. The survey generated data on gender; cultural groups; household location, composition, education, and employment; land availability and tenure; the use of machinery, animals, equipment, and credit; crop areas and management; sources of information about fertilizers; the use and costs of fertilizers, organic manures, and crop residues; the use and cost of labor; disposal and use of crop production; and finally the perceptions of farmers about constraints to fertilizer use in particular and agricultural production in general. In addition, extensive interviews were conducted with village chiefs to provide an overview of agriculture in each village.

In the Maradi Region of Niger, a sample of 129 farmers, including 37 women, was selected from the villages of Tchizon and Maiguero for intensive interviews that were conducted by national collaborators under the supervision of IFDC Staff. The interviewers received instructions on field survey work and interviewing techniques. The training included practice interviews, detailed discussions about the intent and nature of the questionnaire, and the objectives of the SFRP. The interviews were conducted in farmer's homes, village centers, and in the fields of farmers.

The Sample Region

The Maradi Region is located in south-central Niger and has a land area of about 38,500 km^2 representing about 3% of the national territory of Niger (Figure 1), but the area potentially available for cultivation is considerably less than the above figure might suggest.

The climate of the region is largely Sahelian with three seasons; a warm and dry season from October to February, a hot and dry season from March through May, and a fairly hot and wet season from May through September. Temperatures are high throughout the year with the highest absolute temperature (45°C) occurring in April-May.

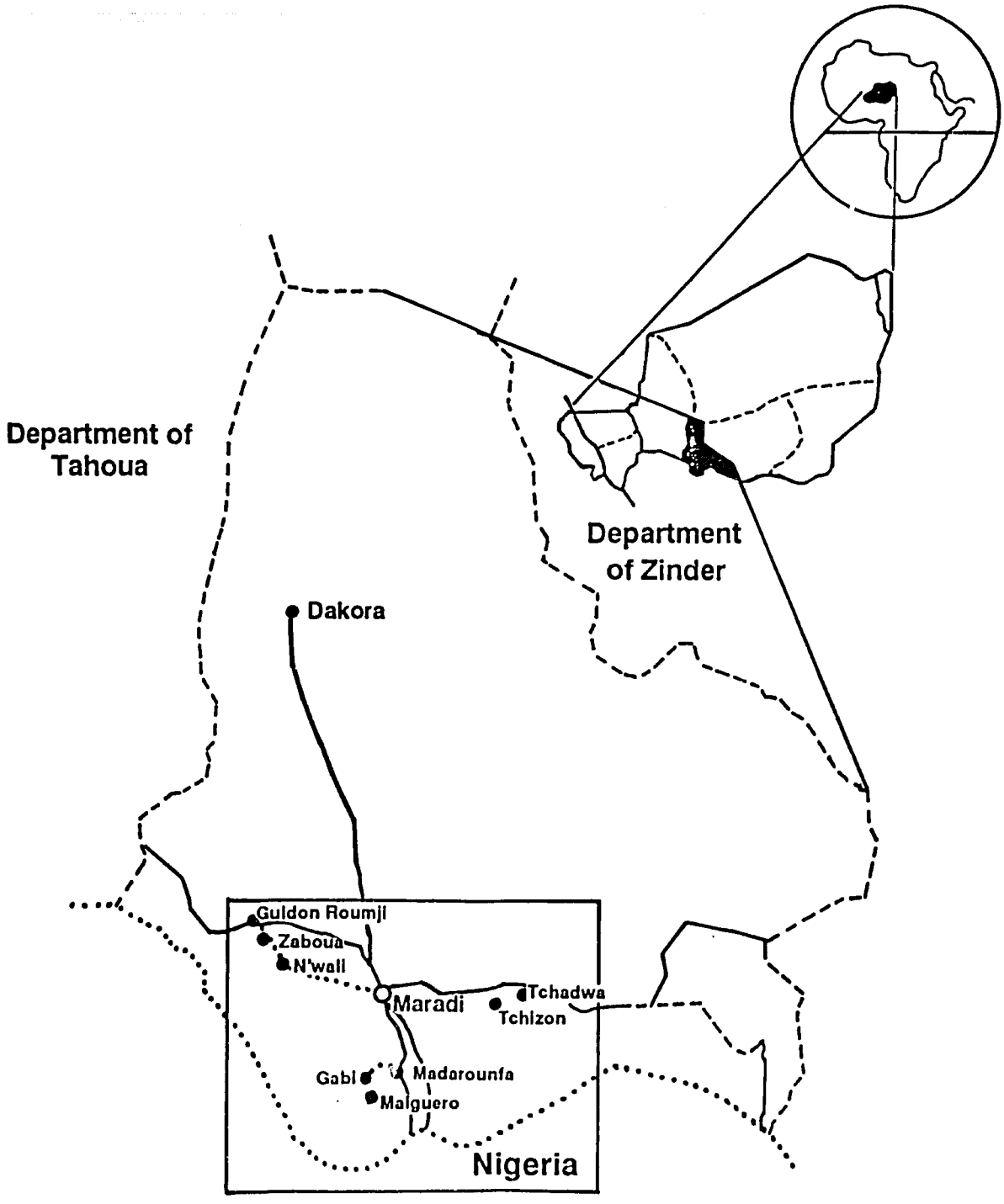


Figure 1. Republic of Niger, Department of Maradi.

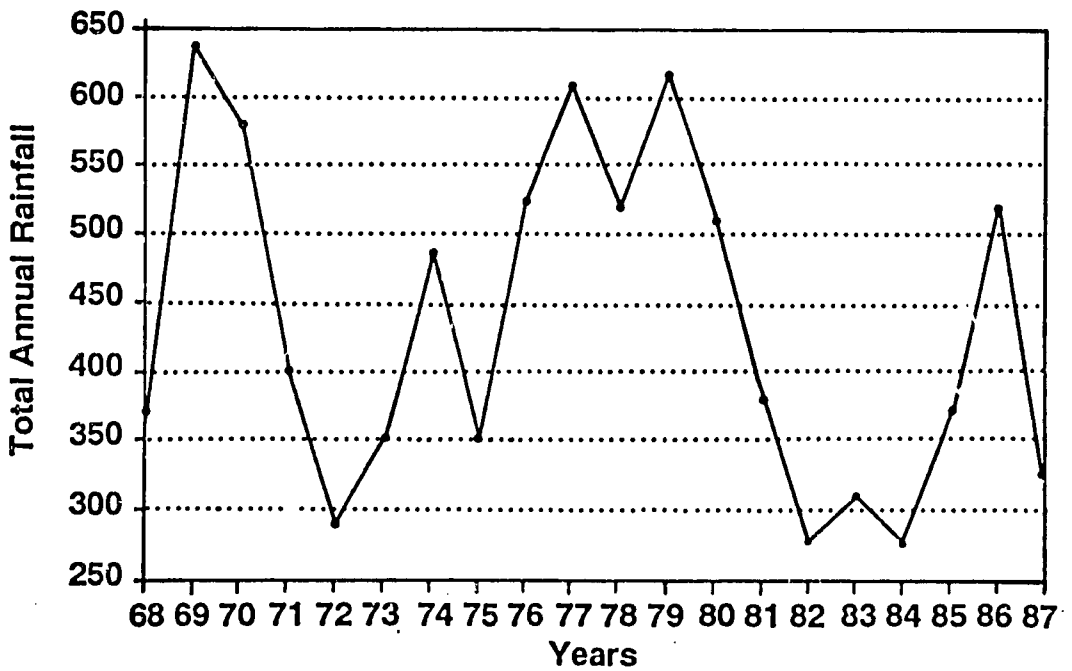
Although precipitation varies with latitude and local conditions (400 mm in the north to 600 mm in the south), it is generally unimodal and restricted to a period of 4-5 months. The beginning of the unimodal and convective-type rainfall is highly variable, unreliable, and unpredictable (Figure 2). Thus, drought and desertification are real concerns.

About 90% of the estimated 1.2 million people in the region live in rural areas. Population densities range from about 10 persons per km^2 in the relatively arid and predominantly pastoral north to about 60 persons per km^2 in the south. Environmental and economic challenges such as declining soil productivity, constant threats of drought, and restricted internal market notwithstanding, the Maradi region has assets and potential for agricultural development. The region's assets include a network of paved and improved dirt roads, abundant human resources, an inexpensive labor force, and proximity to large markets in relatively more prosperous Nigeria. Thus, the geographical location and the infrastructural and other cultural arrangements in the Maradi Region provide the ideal Sahelian environment for the SFRP.

The Sample Villages

Seven villages within 45-km radius of Maradi were considered as research villages. Three were excluded after a preliminary survey because of their relatively small agricultural population base and difficult accessibility. Based on exploratory surveys of the four remaining villages, two villages, Tchizon and Maiguero, were chosen for intensive study (Figure 3).

Tchizon and Maiguero were chosen on the basis of the following criteria: (1) agricultural population base, (2) proximity and accessibility to large markets, (3) organization and availability of extension services, and (4) centrality of location to enhance the adoption and diffusion of information about fertilizer and other related activities of SFRP. Farmers in the experimental village of Tchizon will receive fertilizer, and their counterparts in the control village, Maiguero, without fertilizer, will serve as a control village to compare the changes that occur as a result of SFRP intervention.



Source: Association pour la Securite de la Navigation Aerienne (ASECNA), Exploitation Meteorologique No. 213-1

Figure 2. Interannual Rainfall Variability Maradi, 1968-1987.

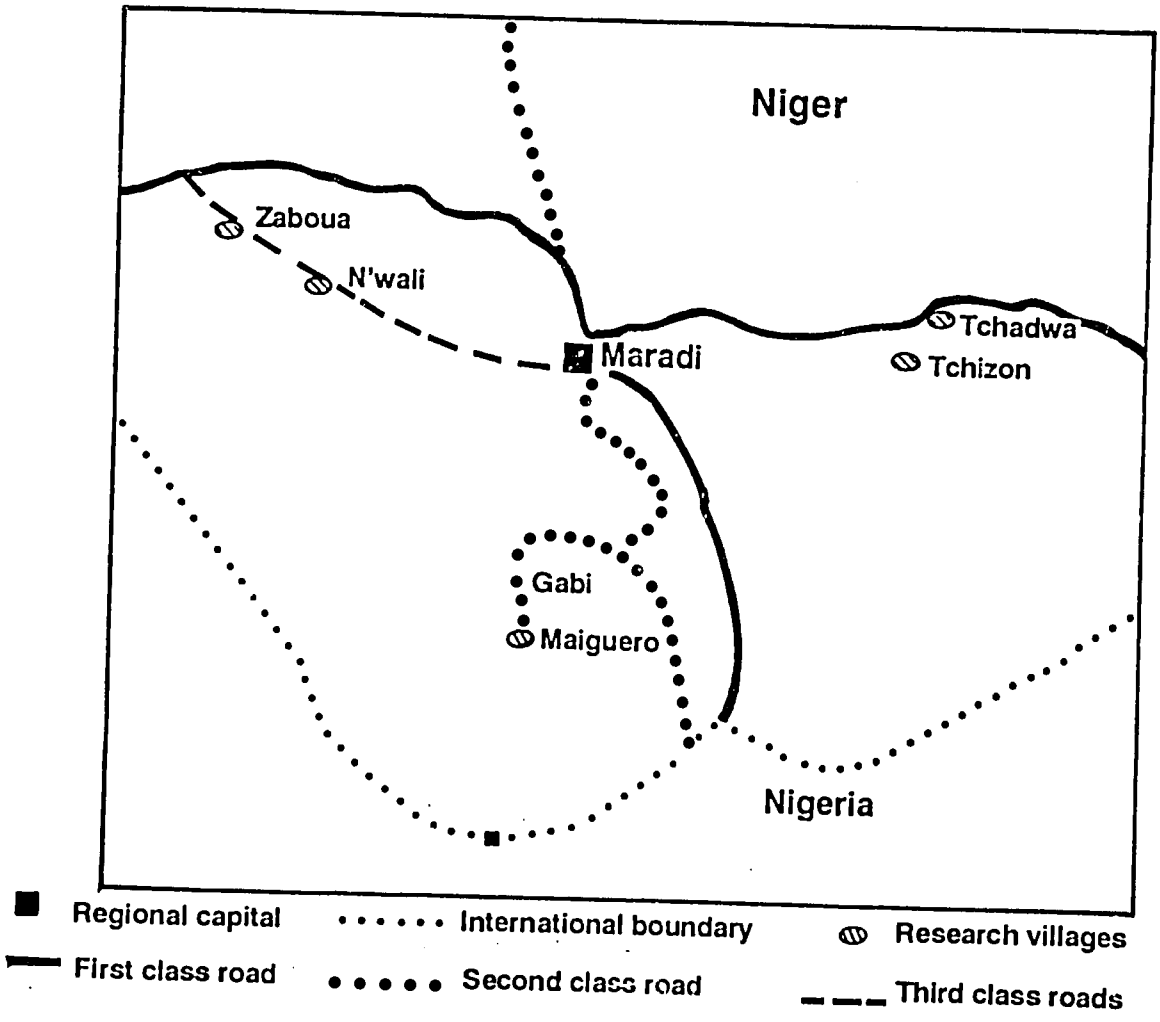


Figure 3. Location of the Research villages

As shown in Table 1.1, unlike Maiguero, the experimental village of Tchizon has an agricultural cooperative and a fertilizer depot. Farmers in Tchizon may also have easier access to the large market in Maradi because the village is located near a paved road. Interviews granted by the chiefs of the two villages provide additional instructive background information on agriculture in the two research villages and are provided in the form of overviews.

Table 1.1. Active Population, Road Types, and Distances Between Research Villages and Essential Services

Village	Estimated Active Population[a]	Farmers' Cooperatives	Road Type	Distance to Extension Service	Distance to Large[b] Market	Distance to Fertilizer Depot
				(km)	(km)	(km)
Tchizon	982	+	Paved	4	36	+
Maiguero	946		Unpaved	3	35	3

a. Persons aged 13 years or more.
b. Large market refers to Maradi, the regional capital (population 40,000).
+ Indicates that service is available within the village.

Village Overview: Maiguero

It was generally agreed that the village of Maiguero is comprised of 44 extended families that are further divided into 200 nuclear families. Migration from the village, whether permanent or temporary, is to northern Nigeria with favored destinations being Kano and Sokoto. In drought years a number of families always leave Maiguero permanently and settle in northern Nigeria. Chief Dango estimated that during the drought year of 1987 some 40 families permanently left the village.

The nearest market is the village of Gabi that is about 3.0 km from Maiguero. Although the farmers in this village were introduced to fertilizer about 20 years ago, in some years there is money to purchase fertilizers and supplies are short, and in other years when supplies are available money is scarce. In the 1987 cropping season for example, the Nigerian border was described as "tight" and consequently those who brought fertilizer to Niger

from Nigeria were unable to move adequate supplies through the "parallel market."

Land

There appears to be a land shortage in Maiguero. That shortage is the result of population growth and land use policy from the forestry authorities. The latter have defined the outward limits of agricultural expansion and that policy has the intended consequence of land conservation and the unintended one of protecting elephants which are understood by village residents as common pests. The elephants enter the village at night and eat the millet in storage houses rather than in the field. As Chief Dango stated, "we are defenseless with our slingshots, so the elephants eat until satisfied." Such an incident occurred on the night of September 6, 1988, when several elephants ate or otherwise destroyed five storehouses of millet.

Thus, the land shortage and pests explain the annual migration of village families to northern Nigeria in search of land. The north-south migration is further evident in that, according to the village chief, about 35 family heads from the area north of Maradi requested borrowed land around the village. Their requests were denied by the chief and that decision was supported by the forestry and land conservation authorities. Those families, the chief supposed, moved further south into northern Nigeria.

Crops and Prices

The chief mentioned that sale prices of agricultural produce fluctuate significantly between "good and bad years" and also at particular periods during the growing season. The principal crops of Maiguero and the seasonal high and low prices quoted by the chief are shown in Table 1.2.

Table 1.2. High and Low Prices for Crops in Maiguero, 1988

Crop		Sale Price High	Sale Price Low	Difference FCFA	Difference US $
		- - -(FCFA/kg)	- -		
Millet		83	25	58	0.20
Sorghum		50	17	33	0.11
Peanuts:	Shelled	117	83	34	0.11
	Unshelled	50	17	33	0.11
Cowpeas		183	50	133	0.45
Cotton		120	110	10	0.03
Tobacco[a]		510	200	310	1.05

FCFA 295 = US $1

a. In bundles of 5 leaves.

Note: Grains are usually measured in units of "Tias" (3 kg).

Labor and Wages

Chief Dango reported that there is no labor shortage in the village and that many men seeking day labor are turned away from Maiguero. The wage scheme in Maiguero is rather complex in that it depends upon the crop and task.

Land preparation is contracted by hectare and wages depend on whether the field is understood as easy or difficult to clear. An easy field with minimal clearing is generally contracted for 520 FCFA (US $1.75)/day and 100 FCFA food (US $0.34). Usually 3 days are required to prepare one easy hectare. Thus the cost, assuming 3 days of work, is 1,860 FCFA or US $6.30. By contrast, a difficult field costs 1,000 FCFA/day to clear and again 100 FCFA for food is customary. Such a field generally requires 5 days of labor. Therefore, the total cost is 5,500 FCFA (US $18.65).

The tasks of planting and weeding are paid at the same rate of between 400 and 500 FCFA/day or between US $1.35 and $1.70. About 150 FCFA is customary for food. Thus, assuming that planting and weeding require 2 days of labor per hectare and assuming 450 FCFA, the total cost for these two tasks per hectare is 1,200 FCFA or US $4.06.

The weeding of cotton and tobacco fields is at the same wage rate as planting and weeding, but 1 ha of either crop requires 5 days. Therefore, 3,000 FCFA or US $10.17 is a typical cost per hectare.

Wage rates for harvesting maize, millet, sorghum, and cowpeas show two different patterns in Maiguero. Harvesting work from sunup to sundown costs 1,500 FCFA or about US $5.08 plus 100 CFA for food or US $0.34. The second pattern is work from sunup until high noon where the wage is 250 FCFA or US $0.85 plus 100 FCFA for food. But again, the time required to harvest 1 ha depends on the relative abundance. In a good year 5 days are required to harvest 1 ha of maize, millet, sorghum, or cowpeas while in a poor and less abundant year only 2 days are required. Thus the total cost of harvesting these crops ranges from about 3,200 FCFA to 8,000 FCFA or US $10.85 to US $27.12.

The Agricultural Work of Women

Among the tasks of land preparation, planting, weeding, and harvesting collective household fields, the work of women in Maiguero in particular and in Hausa culture in general is limited to the tasks of planting, weeding, and harvesting. The most demanding and arduous tasks of land preparation are the sole responsibility of men. Furthermore, women are customarily prohibited from selling their labor for any agricultural task. The pounding of grain is the sole responsibility and domain of Hausa women.

Agricultural Work on Individual Plots Managed by Women

It is customary throughout Hausa culture that men clear and otherwise prepare the individual fields for women. The division of labor in planting is that men perform the demanding task of making holes and women drop seeds into the hole. That the seeds fall from fertile hands is a matter of importance in Hausa agriculture. Women weed and harvest their own individual fields. Men are also required to build storage houses for their wives, but men are not entitled to any grain produced on the individual fields of women.

The millet produced by women is for market sale, ceremonies, or for other friends in need. Children have rights to the grain produced by women and often sell it for cash to purchase clothes. Women who are divorced, widowed, or otherwise alone are responsible for all agricultural tasks but may hire labor. It is well known that wages offered by women are lower than wages offered by men.

Agricultural Work of Children

Boys generally begin working in the fields at age 7 but "tag along" and learn to do small tasks at age 6. Girls begin work at age 9 at such tasks as gathering firewood and fetching water from village wells or carrying lunch to men and boys in collective fields. Children rarely assist in the tasks of planting and weeding.

Animals and Manure

The animals of Hausa villages are cows, goats, sheep, horses, chickens, donkeys, and camels. Men are responsible for maintaining work animals such as cows, horses, donkeys, and camels. Women are responsible for small animals and sheep belonging to men are cared for by women, but men must provide forage for their sheep. Goats and their forage and care are the responsibility of women.

The rights to manure from village animals are such that manure is never sold but may be given as a gift. Manure inside the walls or fences of family compounds is considered family and private property. However, upon request, permission may be granted to another to gather that manure for use elsewhere. By contrast, manure outside the household compound on public paths and walkaways is available to anyone who wishes to gather it.

Extension and Fertilizer Prices

On extension service, the chief said that regular visits are made to Maiguero by extension officers of the National Institute of Agricultural Research in Niger (INRAN). The chief stated that farmers are advised to use fertilizers, but either farmers are without money or supplies are not available.

The loss of the "parallel market" in 1987/88 disappointed the farmers of Maiguero. Table 1.3 shows the difference in prices for urea and SSP in Niger contrasted by prices for those products from Nigeria.

Table 1.3. Prices for Urea and SSP in Niger and From the "Parallel Markets" in Nigeria

Fertilizer	Sale Price		Difference	
	Niger	Nigeria	FCFA	US $
	- - - (FCFA/50 kg) - - -			
Urea	2,500	1,250	1,250	4.23
SSP	1,750	700	1,050	3.56

Harvest and Storage

The village chief was asked to describe the harvests for the years 1984-88. He responded as follows:

1984	Very poor
1985	Excellent
1986	Very poor
1987	Poor
1988	Excellent

Using 1987 as a baseline poor year, the chief estimated that 10 sacks of 100 kg millet was the total village storage. However, in 1988, an excellent year, the chief expects the total village storage to be 500 sacks of 100 kg or 50,000 kg.

The chief stated that in a poor year women sell their sheep, men sell their cows, and able-bodied men migrate to northern Nigeria for work. Although land is not sold during a poor season, it is often used as collateral for loans. The chief described village land holdings to be 66% collective fields and 33% individual fields and that these proportions remain constant over time.

Credit

First and foremost there is no agricultural credit for fertilizer for food crops in Niger. There is credit, however, for the purchase of farm animals and equipment. Prices and implied interest of items for which agricultural credit are available are shown in Table 1.4.

Table 1.4. Cash and Credit Prices for Farm Animals and Equipment at the Gabi Cooperative, Niger 1988

Item	Price		Difference	
	Cash	Credit[a]	FCFA	US $
Plow	15,000	27,000	12,000	40.68
Two cows	90,000	100,000	10,000	33.90
Cart-bullock	75,000	94,000	19,000	64.40
Cart-donkey	55,000	70,000	15,000	50.85

FCFA 295 = US $1.
a. Payment is over 4 years and is due in October of each year.

Village Overview: Tchizon

The village chief of Tchizon, Hassane Tchetche, provided an excellent interview about agriculture and fertilizer use in his village. The chief estimated the population of the village to be 1,416 persons in 337 households. The number of births was estimated to be about 120/year. As in the village of Maiguero, the favored destinations for temporary or permanent migration are the cities of Kano and Sokoto in northern Nigeria.

Regarding the fertilizer situation, the chief explained that because 1987 was such a poor year there is no money to purchase fertilizers, but then again with increased surveillance along the Nigerian border, there is no fertilizer available. He further explained that fertilizers were introduced in Tchizon about 18 years ago and that, at least over the past 5 years, all farmers use fertilizers if possible.

The chief explained that there is a land shortage around the village. Some families have migrated permanently to northern Nigeria and others have purchased land from neighboring villages.

One hectare of land near Tchizon generally costs about 17,000 FCFA or US $57.60 and 1 ha at greater distances from the village costs about 11,000 FCFA or US $37.00. There is also an abundance of labor such that those seeking to sell their labor are turned away and daily wages have decreased.

Labor Costs

The costs of land preparation for an easy field are 750 FCFA plus 250 FCFA/ha or US $3.40. For the preparation of a difficult field, costs are 1,000 FCFA and 250 FCFA for food or a total of US $4.25/ha. According to the chief, an easy field takes about 3 days to prepare, thus the total cost per hectare is about US $10.00. The preparation of a difficult field generally requires about 5 days of work. Thus, the total cost of preparing a difficult field of 1 ha is about US $21.00. Labor is rarely hired for planting as this task is completed by family members in the village of Tchizon.

Weeding has two rates of wages. Those who work from sunup until noon receive 250 FCFA for labor and 250 FCFA for food or a total of FCFA 500 or about US $1.70. Those who labor from sunup until sundown receive 400 FCFA for labor and 250 FCFA for food or a total cost of FCFA 650 or US $2.20. Those who are hired for the work of harvesting receive 600 FCFA/day plus 250 FCFA for food or a total of US $2.88/day.

Wages Paid for Labor on Plots Managed by Women

The wages paid by women for hired labor are lower than chose offered by men. Men who work for women appear to accept the different wages. This may well be related to the surplus of labor that is available to the farmers of Tchizon.

The head of the household is responsible for the preparation of fields managed by women. A man may perform the work himself or hire men and only men to do the work. The planting of the fields managed by women is a family task and no labor is hired for this purpose.

Women are responsible for weeding their fields, but labor may be hired for that work. For weeding work, men and only men are hired at wages of 250 FCFA and 250 FCFA for work from sunup until noon. This amounts to about US $1.70/day.

The difference in wages offered by men and women is evident in compensation to labor for weeding. Women offer 300 FCFA and 250 FCFA for sunup to sundown work. This amounts to US $1.86/day while men offer about US $2.20/day. Women offer payment in kind for harvesting labor. Specifically 2 TIAS or about 6 kg of millet is customary for a day of labor. All production from the fields of women is sole property of the women, but the man must build storage for his wife (wives).

A male child, usually at age 9, receives his own individual field that is cultivated with his mother. Proceeds from the sale of grain are used to purchase clothing for the child and otherwise cover "children's expenses" such as school fees.

The rules for using village manure and animal ownership are identical to those described in Maiguero. Furthermore, these patterns appear to be valid for all of Hausa culture.

Crops and Prices

As in Maiguero, sale prices of agricultural produce in Tchizon fluctuate considerably throughout the growing season and between good and bad years. The principal crops and high and low prices for Tchizon are shown in Table 1.5. Prices for millet vary monthly and according to supply. A low dollar value of 6 kg of millet is about US $0.50 and a high value is about US $3.05.

Table 1.5. High and Low Prices for Crops in Tchizon, 1988

Crop	Sale Price		Difference	
	High	Low	FCFA	US $
	- - -(FCFA/kg) - -			
Cowpeas	173	50	123	0.42
Peanuts: Unshelled	140	50	90	0.31
Millet	150	25	125	0.42
Sorghum	133	17	116	0.39
Souchet	133	33	100	0.34

FCFA 295 = US $1.
Note: Grains are usually measured in units of "Tias" (3 kg).

Extension

Chief Tchetche stated that extension agents visit his village once every 2-3 weeks during the cropping season. He also offered examples of advice given to farmers by extension agents that are rejected and not followed and he offered the following explanation.

First, agents advise the farmers to prepare their fields by animal traction, but farmers continue to use the "daba", a short-handled hoe, to make holes. The farmers believe that complete traction preparation exposes the soil to wind erosion and runoff. Therefore, extension advice is not followed.

Second, the farmers are advised to increase the density of the crops. The farmers agree that it is a good idea if fertilizers are available, but if the density is increased without fertilizer, total output decreases. Also mentioned was that increased density often rules out intercropping which is a common risk-reduction strategy.

Third, farmers are advised to plant trees around their fields for protection against wind erosion, but young trees cannot survive the dry season without watering. To maintain such trees water would have to be transported as far as 3 or 4 km with a return walk of equal distance. This is a problem of transportation and time so the advice is not followed.

Chief Tchetche also discussed the goals of village farmers. First and foremost, the outstanding goal is to eat well. Second, farmers seek to produce and store surplus for market sale at peak prices and that goal is a central component of SFRP. Third, storage for poor cropping years is a goal, as is the purchase of animals which the chief described as a "savings account."

Agricultural Problems

In describing the agricultural problems of Tchizon, the chief stated that erratic and unpredictable fertilizer supplies is a serious and disturbing problem. As a second problem, he stated that as a result of the poor harvest of 1987, nearly all farmers sold their cows and, therefore, work is more difficult in 1988 because animal work is virtually nil. As a third problem the chief cited the closing of a fertilizer credit bank in 1987 because farmers were unable to pay their loans because of the massive crop failures of that year.

Regarding these problems, in general, he cited the two most important strategies are to maximize storage and purchase cows. Depending on supply, a cow is worth about US $135-$237. Asked to describe the quality of the cropping years, 1984-88, the following was offered:

1984	Very bad
1985	Good
1986	Average
1987	Very bad
1988	Excellent

According to the chief, a good farmer is ready for the rainy season in terms of tools, seeds, and land preparation. A good farmer does not search to borrow tools or seed. Furthermore, a good farmer sells grain but does not purchase it, and a good farmer has grain even in a poor year. A poor farmer the chief said "is one who begs others for food."

The chief of Tchizon is now 58 years old and recalled that the rainy season was longer when he was a child. Nobody stored grain then, because crop output was very consistent. Now, storage is a necessity. But the chief stated that when he was a child, farmers did not weed their fields. The extension agent advised that weeding 2-3 times each season is good... "Production is better now when it rains."

Estimated Village Storage Capacity

In a good year the chief estimated that 571,428 kg of millet could be stored in the village. Women, he estimated, could store 142,857 kg in a good year while the estimated collective household storage would be 428,571 kg.

By contrast, the chief estimated that in a bad year collective household storage would be 21,500 kg and women could collectively store 7,000 kg. These figures describe the harvest of 1987 (a poor year). During the hungry season or in a bad year the farmers sell their animals and, if necessary, migrate to northern Nigeria for work and send money home with a trusted envoy.

Demographic Characteristics of Households

The Sample Households

Table 2.1 shows the distribution of households by gender and age in Tchizon, the experimental village, and Maiguero, the control village. Approximately 29% of the total sample of 129 farmers are women, but women are more represented in the sample for Maiguero (33%) than in the sample for Tchizon (25%). By contrast, three-fourths (75%) of sampled farmers in Tchizon are men compared to two-thirds (67%) in Maiguero.

Table 2.1. Distribution of Sample Households by Gender and Age in Tchizon and Maiguero

	Tchizon						Maiguero					
	Men		Women		Total		Men		Women		Total	
Age	N	%	N	%	N	%	N	%	N	%	N	%
<24	-	-	1	6	1	1	3	7	6	30	9	15
25-29	4	8	1	6	5	7	5	13	3	15	8	13
30-34	1	2	1	6	2	3	6	15	1	5	7	12
35-39	8	15	4	23	12	17	9	22	1	5	10	17
40-44	7	14	-	-	7	10	5	13	-	-	5	8
45-49	8	15	2	12	10	15	4	10	2	10	6	10
50-54	11	21	2	12	13	19	6	15	2	10	8	13
55-59	5	10	1	6	6	9	-	-	2	10	2	4
>59	8	15	5	29	13	19	2	5	3	15	5	8
TOTAL	52	100	17	100	69	100	40	100	20	100	60	100
Percent	75		25		100		67		33		100	

It is also evident from the data that sample farmers in the control village of Maiguero are relatively younger than those in Tchizon. Specifically, 65% of the sample farmers in Maiguero are less than 44 years old, but for Tchizon this figure is 38%. In contrast, 62% of men and women farmers in Tchizon, compared with 35% of those in Maiguero, are 45 years old or more. It is evident from the figures in Table 2.1 that the sample will allow meaningful comparisons between men and women farmers of varying ages to be made.

Household Composition

The percentage distribution of household relatives of men and women farmers by village and the total sample is presented in Table 2.2.

Table 2.2. Composition of Sample Households

Village	Gender of Farmer	Wives	Husbands	Sons	Daughters	Sisters	Parents	Grandchildren	Other[a]
		(%)							
Tchizon	Men	43	-	39	11	-	1	-	6
	Women	-	-	45	41	-	-	-	14
	Total sample	41	-	53	15	-	-	-	7
Maiguero	Men	77	-	12	4	-	4	-	2
	Women	-	-	-	100	-	-	-	-
	Total sample	82	-	9	4	-	3	-	2
Total Sample	Men	50	-	34	10	-	1	-	5
	Women	-	-	45	42	-	-	-	13
	Total sample	50	-	30	13	-	1	-	6

a. Other includes cousins, uncles, nieces, nephews, grandparents, and brothers.

In Tchizon, sons and daughters comprise about 86% of the households of sampled women farmers but for men farmers this figure is 50%. Women farmers in Tchizon are also more likely than men to have other relatives residing in their households, 14% and 6%, respectively. By contrast, in the control village of Maiguero, households of women farmers are comprised exclusively of daughters. The absence of husbands in the households of women farmers is a result of intentionally interviewing those divorced and widowed women actively engaged in farming.

The total sample figures in Table 2.2 further show that regardless of gender, about 90% of households in the two sample villages are comprised of spouses, sons, and daughters; an indication that the traditional extended family system in Hausaland has indeed changed to nuclear family units in the sample villages.

Household Size

The mean number of men, women, children, and mean household size by village and gender are presented in Table 2.3.

Table 2.3. Size and Composition of Sample Households and Number of Men, Women, and Children in Households by Gender, Village, and Total Sample

Village	Gender of Farmer	Men in Household Mean	Men in Household Standard Deviation	Women in Household Mean	Women in Household Standard Deviation	Children in Household[a] Mean	Children in Household[a] Standard Deviation	Size of Household Mean	Size of Household Standard Deviation
Tchizon	Men	2.9	1.6	2.7	1.4	4.7	2.5	10.3	4.3
	Women	1.7	1.0	2.4	1.2	1.5	1.5	5.3	2.3
	Total sample	2.6	1.6	2.6	1.3	3.9	2.6	9.1	4.5
Maiguero	Men	1.5	0.8	1.6	0.9	4.1	4.0	7.1	4.9
	Women	-	-	1.6	0.5	1.8	1.9	3.4	2.2
	Total sample	1.4	0.8	1.6	0.8	3.3	3.6	5.8	4.5
Total sample	Men	2.3	1.5	2.2	1.3	4.4	3.2	8.9	4.8
	Women	1.6	1.1	1.9	[illegible]	1.6	1.7	4.2	2.4
	Total sample	2.2	1.5	2.1	[illegible]	3.6	3.1	7.6	4.8

a. Children are defined as those aged less than 13 years.

The mean number of men in households of men farmers in Tchizon (2.9) is greater than in Maiguero (1.5). On the average, households of men farmers in Tchizon also have more women (2.7) than those in Maiguero (1.6) and more average children, 4.7 and 4.1, respectively. The mean household size of men farmers in Tchizon (10.3) substantially exceeds that of men farmers in Maiguero (7.1).

In households of women farmers in Tchizon the mean number of men (1.7) exceeds that in Maiguero (nil).[1] Compared to Tchizon, the mean number of women in households of women farmers exceeds that in Maiguero, 2.4 and 1.6, respectively. The average number of children in households of women farmers in Tchizon and Maiguero are rather similar, 1.5 and 1.8, respectively.

Concerning average household sizes, the largest households are found among men farmers in Tchizon (10.3) followed by men farmers in Maiguero (7.1), women farmers in Tchizon (5.3), and women farmers in Maiguero (3.4).

More instructive data on distribution of household size by gender in the two villages are shown in Table 2.4. Regardless of gender, household

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1. Where special attention was given to interviewing single, widowed, and divorced women farmers.

sizes are generally larger in Tchizon, the experimental village, than in the control village of Maiguero.

Table 2.4. Frequency Distributions of Household Sizes in Tchizon and Maiguero by Gender of Farmer

House-hold Size	Tchizon						Maiguero					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
1-3	1	2	3	18	4	6	9	22	12	60	21	35
4-5	6	12	7	41	13	19	9	22	4	20	13	22
6-7	8	15	4	23	12	17	8	20	4	20	12	20
8-9	8	15	3	18	11	16	5	13	-	-	5	8
10-11	13	25	-	-	13	19	3	8	-	-	3	5
>11	16	31	-	-	16	23	6	15	-	-	6	10
TOTAL	52	100	17	100	69	100	40	100	20	100	60	100
Percent	75		25		100		67		33		100	

In Tchizon, 71% of households of men farmers have eight or more persons. In a sharp contrast, only 18% of the households of women farmers in Tchizon have eight or more persons. Figures for the total sample also show that more than one-half (58%) of the households in Tchizon have eight or more persons. There is a higher concentration of larger households among men farmers than women. This pattern is better illustrated in the data for Maiguero that show 36% of households of men farmers have eight or more persons, but virtually no household headed by a woman has that many persons.

It is also clear from Table 2.4 that the modal size of households of women farmers in Maiguero is 1-3, compared to 4-5 for women farmers in Tchizon. Thus, households of women farmers in Tchizon are more likely to have labor available for farmwork than women farmers in Maiguero. Overall, the largest household size is among men farmers in Tchizon, followed by men in Maiguero, and then women farmers in Tchizon. Households of women farmers in Maiguero have the least number of people.

Schooling

Table 2.5 describes the age and schooling of the sample farmers by gender, village, and total sample. On the average, men farmers in Tchizon are older and have more average years (2.7) of schooling than women farmers (nil),

but the variation in age is higher among women than men. In the control village of Maiguero, on the average, men and women farmers are about the same age but again, men have more years of formal schooling than women, 1 4 and nil, respectively. Indeed, the total sample figures show that none of the 37 women interviewed had any formal schooling. This suggests that women in the two villages have had virtually no opportunity for formal education.

Table 2.5. Age and Schooling of Farmers by Gender, Village, and Total Sample

		Age of Farmers (Years)			Schooling of Farmers (Years)		
Village	Gender	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Tchizon	Men	52	47.5	11.9	42	2.7	7.4
	Women	17	45.9	17.9	11	-	-
Maiguero	Men	39	38.2	10.2	38	1.4	3.5
	Women	20	38.7	19.3	20	-	-
Total sample	Men	91	43.5	12.1	80	2.1	5.9
	Women	37	42.0	18.8	31	-	-

Table 2.6 describes the age and schooling of farmers and all adult household members in sample households. Again, it is clear that generally men are older than women and have about 3 years more formal schooling than women. However, the variation in the number of years of formal schooling is higher among men than women as evidenced in the total sample standard deviations for men (5.1) and women (1.4).

Table 2.6. Age and Schooling of Farmers and All Adult Household Members by Gender, Village, and Total Sample

Village	Gender	Age (Years) N	Age (Years) Mean	Age (Years) Standard Deviation	Schooling (Years) N	Schooling (Years) Mean	Schooling (Years) Standard Deviation
Tchizon	Men	153	30.8	14.8	113	3.4	5.7
	Women	155	29.7	12.2	133	0.4	1.7
	Total sample	308	30.3	13.5	246	1.8	4.3
Maiguero	Men	55	35.2	12.1	54	1.6	3.3
	Women	82	29.7	12.9	77	-	-
	Total sample	137	31.9	12.8	131	0.6	2.3
Total sample	Men	208	32.0	14.2	167	2.8	5.1
	Women	237	29.7	12.4	210	0.3	1.4
	Total sample	445	30.8	13.3	377	1.4	3.7

More detailed data on the relationship between age and years of formal schooling for farmers and all adult household members by age group and gender of household head are provided in Table 2.7. It is evident from the total sample figures that, on the average, men have attained substantially more years of formal schooling (2.8 years) compared to women (0.3 years). The greatest disparity is between adult young men and women. On the average men who are less than 24 years have had about 4 years of formal schooling compared to one-half year for women in the same age group.

Table 2.7. Schooling of Farmers and All Adult Household Members by Age, Gender, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Schooling (Years)			Schooling (Years)			Schooling (Years)		
Age (Years)	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
<24	54	4.0	4.1	76	0.5	1.8	130	2.0	3.4
25-29	28	2.4	4.3	37	0.2	0.9	65	1.1	3.1
30-34	15	2.5	3.6	31	0.4	1.8	46	1.1	2.7
35-39	21	1.8	3.6	24	-	-	45	0.8	2.6
40-45	13	0.2	0.6	20	-	-	35	-	-
>45	36	3.0	8.1	20	-	-	56	1.9	6.6
Total sample	67	2.8	5.1	210	0.3	1.4	377	1.4	3.7

This principle also holds for persons under 24 years old in Tchizon (Table 2.8) and also in Maiguero (Table 2.9) except that the difference in the number of years schooling between young men and women is not as great as in Maiguero. That young adult women in the two villages have had virtually no formal schooling suggests that, as in the past, educational opportunities for rural Hausa women have not improved significantly in recent years.

Table 2.8. Schooling of Farmers and All Adult Household Members by Age and Gender in Tchizon

	Gender								
	Men			Women			Total Sample		
	Schooling (Years)			Schooling (Years)			Schooling (Years)		
Age (Years)	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
<24	43	4.4	4.3	46	0.9	2.3	89	2.6	3.8
25-29	21	2.3	4.3	24	0.3	1.1	45	1.3	3.1
30-34	7	4.0	4.4	21	0.4	2.1	28	1.3	3.2
35-39	11	2.0	4.4	15	-	-	26	0.8	3.0
40-45	7	0.2	4.7	15	-	-	22	-	0.4
>45	24	3.6	9.3	12	-	-	36	2.4	7.8
Total sample	113	3.4	5.7	133	0.4	1.7	246	1.8	4.3

Table 2.9. Schooling of Farmers and All Adult Household Members by Age and Gender in Maiguero

	Gender								
	Men			Women			Total Sample		
	Schooling (Years)			Schooling (Years)			Schooling (Years)		
Age (Years)	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
<24	11	2.1	2.7	30	-	-	41	0.5	1.6
25-29	7	2.5	4.7	13	-	-	20	0.9	2.9
30-34	8	1.2	2.4	10	0.3	0.9	18	0.7	1.7
35-39	10	1.5	2.7	9	-	-	19	0.7	2.1
40-45	6	0.1	0.4	7	-	-	13	-	0.2
>45	12	1.6	4.8	8	-	-	20	1.0	3.8
Total sample	54	1.6	3.3	77	-	0.3	131	0.6	2.3

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Household Locations and Access to Markets

The differences between men and women and between Tchizon and Maiguero about distances to markets where agricultural production may be sold are shown in Table 2.10. On the average, there is little difference by gender concerning distance to markets where farmers sell agricultural products. However, the total sample figures show that farmers in Maiguero are much closer to markets than those in Tchizon, 2.5 km and 7.2 km, respectively. It is important to note that "markets" in this context refer to the nearest small market towns where farmers dispose of surplus production. In this regard, any significant increases in yields will require farmers to seek larger markets. The location of Tchizon on a paved road and its relative proximity to Maradi, the regional capital, will be very beneficial to farmers in this respect.

Table 2.10. Distances From Households to Markets for Agricultural Products by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Distance			Distance			Distance		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
		- - - (km) - - -			- - - (km) - - -			- - - (km) - - -	
Tchizon	52	7.3	0.7	17	6.8	0.1	69	7.2	0.8
Maiguero	40	2.5	-	18	2.5	0.1	58	2.5	0.1
Total sample	92	5.2	2.4	35	4.6	2.3	127	5.1	2.4

Distances from households to stores where household goods are purchased are presented in Table 2.11. It is very clear from the data that, regardless of gender, farmers in the two villages probably buy household goods from the same markets where agricultural produce is sold. The total sample figures show that on the average, farmers in Tchizon must travel about three times the distance of farmers in Maiguero to stores where household goods are purchased.

Table 2.11. Distances From Households to Stores for Household Goods by Gender, Village, and Total Sample

Village	Gender: Men N	Men Distance Mean (km)	Men Distance Standard Deviation (km)	Women N	Women Distance Mean (km)	Women Distance Standard Deviation (km)	Total Sample N	Total Sample Distance Mean (km)	Total Sample Distance Standard Deviation (km)
Tchizon	52	7.3	0.7	17	7.0	-	69	7.2	0.6
Maiguero	40	2.5	-	18	2.5	0.1	58	2.5	0.1
Total sample	92	5.2	2.4	35	4.7	2.3	127	5.1	2.4

The reverse is true for farmers in the two villages with regard to distances to stores where fertilizers are purchased except perhaps women farmers in Maiguero. As shown in Table 2.12, regardless of gender, on the average, farmers in Tchizon are closer (8.2 km) to fertilizer stores than those in Maiguero (11.0 km). In Maiguero men travel about five times (14.6 km) the distance traveled by women (3.0 km) to purchase fertilizers. The distance traveled by men from Tchizon to purchase fertilizers (8.0) is somewhat less than that reported by women (9.0).

Table 2.12. Distance From Households to Fertilizer Stores by Gender, Village, and Total Sample

Village	Gender: Men N	Men Distance Mean (km)	Men Distance Standard Deviation (km)	Women N	Women Distance Mean (km)	Women Distance Standard Deviation (km)	Total Sample N	Total Sample Distance Mean (km)	Total Sample Distance Standard Deviation (km)
Tchizor	51	8.0	2.6	17	9.0	8.1	68	8.2	4.5
Maiguero	40	14.6	13.7	18	3.0	2.3	58	11.0	12.6
Total sample	91	10.9	9.8	35	5.9	6.5	126	9.5	9.2

It is important to note that whatever advantage a group of farmers in one village may have over the other in regard to proximity to markets

and/or fertilizer stores depends largely on the farmers' access to or willingness to use commercial transportation. But as shown in Table 2.13, regardless of gender, no farmers in Tchizon and only 5% of the women farmers in Maiguero report "access" to commercial transportation. The implication here is that farmers expend significant time and energy to transport purchased fertilizers from the source of purchase to farms and this poses a real constraint to fertilizer use. Men farmers in Maiguero are most likely to report "access" to commercial transportation. Although there is no commercial transportation entering and departing Tchizon, village residents have "access" to such a service after walking 3-4 km to the main paved highway to Maradi where bus service is available. But this is not convenient "access." Fares may also be prohibitive for nonessential travel.

Table 2.13. Farmers With Access to Commercial Transportation to Markets by Gender, Village, and Total Sample

	Gender of Farmer					
	Men		Women		Total Sample	
Village	N	Percent of Farmers	N	Percent of Farmers	N	Percent of Farmers
Tchizon	52	-	16	-	68	-
Maiguero	40	67.5	20	5.0	60	46.6
Total sample	92	29.3	36	2.7	128	21.8

Distances From Households to Farm Plots

Distances to Household Plots

The data in Table 2.14 show that for the total sample the average distance from the households to household plots is 1.6 km. However, the average distance to household plots in Maiguero (2.1 km) is nearly twice that of Tchizon (1.2 km). The greater dispersion of population in Tchizon, compared to Maiguero, may account for this difference.

Table 2.14. Distances from Households to Household Plots by Gender, Village, and Total Sample

Village	Gender of Farmer: Men N	Men Mean (km)	Men Standard Deviation (km)	Women N	Women Mean (km)	Women Standard Deviation (km)	Total Sample N	Total Sample Mean (km)	Total Sample Standard Deviation (km)
Tchizon	50	1.1	1.6	12	2.0	2.6	62	1.2	1.8
Maiguero	40	2.3	1.3	20	1.6	1.4	60	2.1	1.4
Total Sample	90	1.6	1.6	32	1.7	1.9	122	1.6	1.6

The data suggest further, that on the average, men are slightly closer (1.6 km) to household plots than women (1.7 km). Men farmers in Maiguero report the least average distance to household plots (1.1 km), followed by women in Maiguero (1.6 km), women in Tchizon (2.0 km), and men in Maiguero (2.3 km) reported the greatest average distance to household plots.

Distances to Individual Plots

Additional data on the relationship between gender and distance to individual plots are shown in Table 2.15. The data show that in Tchizon the average distance to individual plots managed by women (2.0 km) is somewhat greater than the distance to individual plots managed by men (1.7 km). This observation is reversed for Maiguero where the individual fields managed by women are, on the average, closer to the households (1.1 km) than individual plots managed by men (2.1 km). Overall, on the average individual plots are located 1.8 km from households.

Table 2.15. Distances from Households to Individual Plots by Gender, Village, and Total Sample

Village	Gender of Farmer: Men N	Men Mean (km)	Men Standard Deviation (km)	Women N	Women Mean (km)	Women Standard Deviation (km)	Total Sample N	Total Sample Mean (km)	Total Sample Standard Deviation (km)
Tchizon	9	1.7	2.0	10	2.0	1.2	19	1.9	1.6
Maiguero	28	2.1	1.8	20	1.1	1.3	48	1.8	1.6
Total sample	37	1.9	1.8	30	1.6	1.3	67	1.8	1.6

The foregoing does not support the generalization, women compared to men in sub-Saharan Africa cultivate plots more distant from households. However, it is evident from the data on various distances that farmers must travel significant distances to purchase fertilizers and that public transportation is easily accessible in the study area. Hence, any program that seeks to promote fertilizer use should first strive to make fertilizers available to farmers at more accessible locations.

Off-Farm Employment of Farmers and Adult Household Members

Table 2.16 shows the percentages of farmers and adult household members engaged in off-farm employment during the survey year by gender, village, and total sample. The total sample figures show that, regardless of gender, about 13% of all adult household members and farmers were engaged in off-farm employment during the baseline survey year. Furthermore, the percentage of farmers and adult household members with off-farm employment in Maiguero (22.7%) greatly exceeds that of Tchizon (8.0%).

Table 2.16. Farmers and Adult Household Members With Off-Farm Employment by Gender, Village, and Total Sample

	Gender					
	Men		Women		Total Sample	
Village	N	%	N	%	N	%
Tchizon	145	11.7	144	4.2	289	8.0
Maiguero	56	53.6	76	-	132	22.7
Total sample	201	23.4	220	2.7	421	12.6

It is significant to note, however, that on the average men (23.4%) are more likely than women (2.7%) to be engaged in off-farm employment. That rural Hausa women, compared with men, seldom engage in off-farm employment is further illustrated by the data, particularly in the control village of Maiguero, where more than one-half (53.6%) of the men were engaged in off-farm employment, but no women reported being engaged in such employment. In

Tchizon the percentage of women with off-farm employment (4.2%) is greater than that in Maiguero (nil) but less than that of men (11.7%).

The average durations of off-farm employment of farmers and adult household members are shown in Table 2.17. Regardless of gender, farmers and adult household members in Tchizon, on the average, are employed off-farm more months per year than their counterparts in Maiguero, 8.6 and 2.5 months, respectively. It is also evident from the data that adult women in Tchizon are on average engaged in off-farm work over twice as many months per year (6.5 months) as adult men in Maiguero (2.5 months). The greatest average of months of off-farm employment is among adult men in Tchizon (9.5).

Table 2.17. Average Duration of Off-Farm Employment of Farmers and Adult Household Members in Months Per Year by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Months Per Year			Months Per Year			Months Per Year		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Tchizon	15	9.5	3.8	6	6.5	4.0	21	8.6	4.0
Maiguero	27	2.5	2.0	0	-	-	27	2.5	2.0
Total sample	42	5.0	4.4	6	6.5	4.0	48	5.2	4.3

Table 2.18 shows the average annual off-farm earnings of adult household members including farmers. On the average, men in Tchizon earn about twice as much as men in Maiguero from off-farm employment, 45,267 FCFA (US $153) and 21,586 (US $73), respectively. The total sample data on average annual off-farm earnings by gender show that men earn 29,659 FCFA and women 18,000 FCFA. Considering the total sample and disregarding gender, the average off-farm earnings in Tchizon (39,526 FCFA) are substantially greater than in Maiguero (21,586 FCFA). The total sample average of off-farm earnings of 28,688 FCFA represents about US $97.

Table 2.18. Annual Off-Farm Earnings of Farmers and Adult Household Members by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
	Earnings/Year (FCFA)			Earnings/Year (FCFA)			Earnings/Year (FCFA)		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Tchizon	15	45,267	37,209	4	18,000	24,097	19	39,526	36,112
Maiguero	29	21,586	27,987	0	0	0	29	21,586	27,987
Total sample	44	29,659	33,011	4	18,000	24,097	48	28,688	32,321

a. FCFA 295 = US $1.

Summary data on the relationship between the duration of off-farm employment, annual off-farm earnings, and sociodemographic characteristics of farmers and all adult household members are shown in Table 2.19. These data for the total sample show that, on the average, men are slightly older, have more years of schooling, and work relatively fewer months per year off the farm compared with women. It is also evident from the data that the higher off-farm earnings of men in Tchizon compared to their counterparts in Maiguero are associated with more years of schooling and more months of off-farm employment.

Table 2.19. Average Age, Years of Schooling, and Characteristics of Off-Farm Employment of Farmers and Adult Household Members by Gender, Village, and Total Sample

						Off-Farm Employment	
		Age		Schooling of Farmer	Farmers With Off-Farm Employment	Months Per Year	Earnings per Year in FCFA[a]
Village	Gender	N	Mean (years)	(Mean) (years)	(%)	(Mean)	(Mean)
Tchizon	Men	153	30.9	3.4	11.7	9.5	45,266
	Women	155	29.8	0.5	4.2	6.5	18,000
Maiguero	Men	55	35.3	1.6	53.6	2.5	21,586
	Women	82	29.7	-	-	-	-
Total sample	Men	208	32.0	2.8	23.4	5.0	29,659
	Women	237	29.8	0.3	2.7	6.5	18,000

a. FCFA 295 = US $1.

Off-Farm Employment of Farmers

Unlike the preceding section that dealt with farmers and all adult members of the households, the analysis of off-farm employment in this section is limited to farmers. Although the pattern is similar, the data provide insight on the domination of men farmers in non-farm economic activities in Hausaland.

As shown in Table 2.20, about one-quarter (25.6%) of the sample farmers engage in off-farm employment but none are women. This is explained by the fact that, aside from farmwork, women farmers are usually preoccupied with household chores such as food preparation and tending children and small animals, and thus have virtually no extra time to engage in off-farm economic activities. The seclusion of women is also a factor in this observation. The percentage of men farmers from Maiguero reporting off-farm employment (52.5%) greatly exceeds that of Tchizon (19.6%). Overall about 35% of the men farmers in the baseline sample are engaged in off-farm employment.

Table 2.20. Farmers With Off-Farm Employment by Gender, Village, and Total Sample

	Gender					
	Men		Women		Total Sample	
Village	N	%	N	%	N	%
Tchizon	46	19.6	11	-	57	15.8
Maiguero	40	52.5	20	-	60	35.0
Total sample	86	34.9	31	-	117	25.6

The average duration of off-farm employment of farmers in months per year by village, gender, and total sample is shown in Table 2.21. Because women farmers report no off-farm employment the total sample figures, showing an average off-farm employment duration of 4.7 months, pertain only to men farmers from both villages. The average duration of off-farm employment among men farmers in Tchizon, 9.6 months, substantially exceeds that of men farmers in Maiguero, 2.2 months. This may be attributable in part to the paved highway between Tchizon and Maradi City that makes work locations more accessible and provides a commercial link to the village.

Table 2.21. Average Duration of Off-Farm Employment of Farmers in Months Per Year by Gender, Village, and Total Sample

	Gender								
	Men			Women			Total Sample		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Tchizon	9	9.6	3.7	-	-	-	9	9.6	3.7
Maiguero	18	2.2	1.9	-	-	-	18	2.2	1.9
Total sample	27	4.7	4.4	-	-	-	27	4.7	4.4

The average annual earning from off-farm employment of farmers by gender village and the total sample is shown in Table 2.22. The total sample figures show that on the average farmers earn 29,931 FCFA or US $100 annually from off-farm employment. The ability of men farmers in Tchizon to realize off-farm earnings is again evident from the data, in that although twice as many men farmers in Maiguero compared to Tchizon engage in off-farm employment, men farmers in Tchizon earn over twice as much (48,222 FCFA or US $163) as their counterparts in Maiguero (21,700 FCFA or US $73) on the average.

Table 2.22. Annual Off-Farm Earnings of Farmers by Gender, Village, and Total Sample

	Gender of Farmer								
	Men			Women			Total Sample		
	Earnings/Year (FCFA)			Earnings/Year (FCFA)			Earnings/Year (FCFA)		
Village	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Tchizon	9	48,222	42,133	-	-	-	9	48,222	42,133
Maiguero	20	21,700	32,454	-	-	-	20	21,700	32,454
Total sample	29	29,931	37,119	-	-	-	29	29,931	37,119

a. FCFA 295 = US $1.

A summary of the age, years of schooling, and characteristics of off-farm employment for farmers by village, gender, and total sample is provided in Table 2.23. The figures show that farmers in Tchizon reported

being generally older than their counterparts in Maiguero, but there is significant variation in age between men, women, and villages.

Table 2.23. Average Age, Years of Schooling, and Characteristics of Off-Farm Employment of Farmers by Gender, Village, and Total Sample

Village	Gender	Age N	Age Mean (years)	Schooling of Farmer (Mean) (years)	Farmers With Off-Farm Employment (%)	Off-Farm Employment: Months Per Year (Mean)	Off-Farm Employment: Earnings Per Year in FCFA[a] (Mean)
Tchizon	Men	52	47.5	2.8	9.6	9.6	48,222.2
	Women	17	45.9	-	-	-	-
Maiguero	Men	39	38.2	1.4	52.5	2.2	21,700.0
	Women	20	38.8	-	-	-	-
Total Sample	Men	91	43.5	2.2	34.9	4.7	29,931.0
	Women	37	42.1	-	-	-	-

a. FCFA 295 = US $1.

On the average, men farmers in Tchizon are the oldest (47.5 years) followed closely by women farmers also in Tchizon (45.9 years) and then women (38.8 years) and finally men (38.2 years) farmers in Maiguero.

Table 2.23 also shows that 52.5% of men farmers in Maiguero engage in off-farm employment compared to 9.6% in Tchizon. The ability of men farmers in Tchizon to realize higher annual average off-farm earnings than in Maiguero is probably due to the fact that, on the average, men farmers in Tchizon have twice as many years of schooling and work about four times as many months per year in off-farm employment than those in Maiguero.

Locations of Off-Farm Employment of Farmers and Adult Household Members

Percentage distributions of the locations of off-farm employment of farmers and adult household members by gender, village, and total sample are presented in Table 2.24. Slightly more than one-half (54%) of farmers and adult household members engage in off-farm employment in Nigeria. The percentage of those who engage in off-farm employment in the village of residence (24%) is about equal to those who work in other locations in Niger

(21%). The few (6) women in Tchizon who engage in off-farm employment exclusively find work in the village.

Table 2.24. Percentage Distributions of Locations of Off-Farm Employment of Farmers and Adult Household Members by Gender, Village, and Total Sample

	Village													
	Tchizon						Maiguero						Total Sample	
	Men		Women		Total		Men		Women		Total			
Location	N	%	N	%	N	%	N	%	N	%	N	%	N	%
In Village	6	38	6	100	12	54	1	3	-	-	1	3	13	25
Nigeria	3	19	-	-	3	13	25	84	-	-	25	84	28	54
Maradi	3	19	-	-	3	13	1	3	-	-	1	3	4	8
Tchadua	2	12	-	-	2	10	-	-	-	-	-	-	2	4
Other places In Niger	2	12	-	-	2	10	3	10	-	-	3	10	5	9
TOTAL	16	100	6	100	22	100	30	100	-	-	30	100	52	100
Percent	73		27		100		100		-		100			

About one in five men (19%) in Tchizon engaged in off-farm employment in Nigeria, 38% were employed in their village of residence and 43% worked in the regional capital of Maradi or elsewhere in Niger. By contrast, 84% of men in Maiguero engaged in off-farm employment in Nigeria, only 3% worked in their village of residence, and 13% in other locations within Niger. That men in Maiguero are about four times more likely than those in Tchizon to seek off-farm employment in Nigeria is puzzling because the difference in the proximity of Maiguero to the Nigerian frontier (21 km) compared to Tchizon (38 km) is minimal. One may speculate that kinship contacts in Nigeria play a role in attracting Maiguero residents to work there and an informal support network has developed among friends and relatives.

Types of Employment of Farmers and Adult Household Members

The descriptive data presented in Table 2.25 show that about one-half of the total sample (48%) was engaged in service occupations as off-farm employment during the survey year. Small trade (24%), agricultural

labor (22%), and construction (4%) account for 50% of off-farm employment among residents of the two sample villages.

Table 2.25. Percentage Distribution of Types of Off-Farm Employment of Farmers and Adult Household Members by Gender, Village, and Total Sample

	Village													
	Tchizon						Maiguero						Total Sample	
	Men		Women		Total		Men		Women		Total			
Location	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Government service	1	6	-	-	1	5	-	-	-	-	-	-	1	2
Agricultural labor	1	6	2	33	3	14	8	29	-	-	8	29	11	22
Small trade	8	50	2	33	10	45	2	7	-	-	2	7	12	24
Construction	-	-	-	-	-	-	2	7	-	-	2	7	2	4
Service occupations	6	38	2	33	8	36	16	57	-	-	16	57	24	48
TOTAL	16	100	6	99	22	100	28	100	-	-	28	100	50	100
Percent	73	27			100		100				100			

In Maiguero, service occupations (57%) and agricultural labor (29%) account for over 80% of off-farm employment. By contrast, these types of employment account for about 50% of off-farm employment among adult residents of Tchizon. Small trade, the most frequent type of work among men in Tchizon (50%), is among the least pursued in Maiguero (7%).

Characteristics of Farms

Number of Plots

The descriptive data presented in Table 3.1 show the average number of plots managed by men and women farmers by village and for the total sample. The total sample figures indicate that the mean number of plots managed by men among 92 men farmers is 4.0 and that 7 women farmers have an average of 2.3 plots managed by men. Concerning the numbers of men farmers having plots managed by women, 86 have an average of 3.6 plots and 36 have an average of 2.1 plots managed by women.

Table 3.1. Number of Farm Plots Per Farmer by Gender, Village, and Total Sample

Village	Gender of Farmer	Men Managed Plots (Number) N[a]	Mean	Standard Deviation	Women Managed Plots (Number) N[b]	Mean	Standard Deviation	Number of Plots Per Farm N[c]	Mean	Standard Deviation
Tchizon	Men	52	3.6	2.0	48	4.3	2.9	52	7.6	4.2
	Women	6	2.0	0.6	16	1.9	1.0	17	2.5	1.2
	Total sample	58	3.4	1.9	64	3.7	2.8	69	6.3	4.3
Maiguero	Men	40	4.6	2.7	38	2.9	1.8	40	7.4	4.1
	Women	1	4.0	-	20	2.3	1.8	20	2.5	1.9
	Total sample	41	4.6	2.7	58	2.7	1.8	60	5.7	4.2
Total sample	Men	92	4.0	2.4	86	3.7	2.6	92	7.5	4.1
	Women	7	2.3	1.0	36	2.1	1.5	37	2.5	1.6
	Total sample	99	3.9	2.3	122	3.2	2.4	129	6.0	4.2

a. N = number of farmers having plots managed by men.
b. N = number of farmers having plots managed by women.
c. N = total number of sample farmers.

Gender differences are further illustrated by the total sample figures that show on the average there are three times as many plots managed by men (7.5) as managed by women (2.5). However, the variation of the number of plots per farm among men is greater than that of women as shown in the total sample standard deviations.

Among men farmers in Tchizon, 52 have an average of 3.6 plots managed by men and 48 have an average of 4.3 plots managed by women. Among 6 women farmers in Tchizon, men manage an average of 2.0 plots and 16 women farmers have an average of 1.9 plots managed by women. The total sample figures for Tchizon show that on the average, there are nearly three times as many plots managed by men as there are managed by women, an average of 7.6 and 2.5 plots, respectively.

The total sample figures for Maiguero show trends similar to Tchizon, but there are striking differences between men and women farmers. Among men farmers, 40 have an average of 4.6 plots managed by men and 38 have an average of 2.9 plots managed by women. But unlike in Tchizon, 20 women farmers in Maiguero have an average of 2.3 plots managed by women and only 1 woman farmer reported 4 plots managed by men. However, as in Tchizon, the

mean number of plots managed by men in Maiguero (7.4) is about three times that of women (2.5).

Area of Plots

The descriptive data presented in Table 3.2 show the average crop areas managed by men and women by gender, village, and total sample. The total sample figures show that among 92 men farmers, an average of 6.2 ha is managed by men and 3.9 ha by women. Among the six women farmers, men and women, on the average, manage 2.5 and 1.8 ha, respectively. It is also evident from Table 3.2 that, for the total sample, the crop area managed by men is, on the average, about five times larger than the crop area managed by women, 9.9 ha and 2.1 ha, respectively.

Table 3.2. Crop Areas of Farms Managed by Men and Women by Gender of Farmer, Village, and Total Sample

Village	Gender of Farmer	Crop Area Managed by Men			Crop Area Managed by Women			Crop Area Per Farm		
		N[a]	Mean	Standard Deviation	N[b]	Mean	Standard Deviation	N[c]	Mean	Standard Deviation
			- - -(ha/farm)- -			- - (ha/farm) - -			- - (ha/farm)- -	
Tchizon	Men	52	7.1	3.8	50	5.1	4.2	52	12.0	6.7
	Women	6	2.5	0.8	16	2.1	0.8	17	2.9	1.3
	Total sample	58	6.6	3.9	66	4.4	3.9	69	9.7	7.1
Maiguero	Men	40	5.1	3.6	38	2.3	1.7	40	7.3	4.8
	Women	-	-	-	20	1.5	1.3	20	1.5	1.3
	Total sample	40	5.1	3.6	38	2.3	1.7	40	5.4	4.8
Total Sample	Men	92	6.2	3.8	88	3.9	3.6	92	9.9	6.4
	Women	6	2.5	0.8	36	1.8	1.1	37	2.1	1.5
	Total sample	98	6.0	3.8	124	3.3	3.3	129	7.7	6.5

a. N = number of farmers having plots managed by men.
b. N = number of farmers having plots managed by women.
c. N = total number of sample farmers.

In the village of Tchizon, 52 men farmers reported averages of 7.1 ha managed by men and 5.1 ha by women with an average total crop area of 12.0 ha. In a sharp contrast, women farmers in Tchizon reported an average of 2.5 ha managed by men and 2.1 ha managed by women with an average crop area per farm of 2.9 ha.

In Maiguero, the total sample figures show that the average crop area per farm is 5.4 ha. Among men farmers, the average crop area managed by men is over twice that managed by women, 5.1 ha and 2.3 ha, respectively. Farmers in Tchizon, on the average, manage much larger areas per farm (9.7 ha) than farmers in Maiguero (5.4 ha). The largest average crop area is observed among men farmers in Tchizon (12.0 ha), followed by men farmers in Maiguero (7.3 ha) and women farmers in Tchizon (2.9 ha). The smallest average crop area per farm is observed among women farmers in Maiguero (1.5 ha).

Land Tenure

More instructive data on the relationship between gender and the number and areas of farm plots are shown in Table 3.3, where various types of land tenure are used in combination with gender for descriptive analysis and discussion.

Table 3.3. Number and Areas of Farm Plots by Type of Land Tenure, Gender, and Total Sample

Gender of Plot Manager	Land Tenure	Number of Plots: N	Number of Plots: Mean	Number of Plots: Standard Deviation	Number of Plots: Total in Sample	Area of Plots: Mean	Area of Plots: Standard Deviation	Area of Plots: Total in Sample
						(ha)		
Men	Family owned	97	3.4	1.7	331	5.5	3.1	526.2 (90)
	Family borrowed	5	1.6	0.9	8	1.5	1.0	7.5 (1)
	Family rented	6	1.3	0.5	8	1.0	0.4	6.0 (1)
	Individual owned	16	1.9	1.2	31	2.6	2.2	41.3 (8)
	Individual borrowed	1	1.0	-	1	0.5	-	0.5 (0)
	Total sample	125	3.0	1.7	379	4.7	3.2	581.5 (100)
Women	Family owned	93	2.4	1.4	219	2.3	1.9	211.5 (52)
	Family borrowed	1	3.0	-	3	3.5	-	3.5 (1)
	Individual owned	59	2.9	2.1	169	3.1	3.2	189.0 (47)
	Individual borrowed	1	1.0	-	1	1.0	-	1.0 (0)
	Individual rented	1	1.0	-	1	1.0	-	1.0 (0)
	Total sample	155	2.5	1.7	393	2.6	2.5	405.9 (100)
Total sample	Family owned	190	2.9	1.6	550	3.9	3.0	737.7 (75)
	Family borrowed	6	1.8	1.0	11	1.8	1.2	11.0 (1)
	Family rented	6	1.3	0.5	8	1.0	0.4	6.0 (1)
	Individual owned	75	2.7	1.9	200	3.0	3.0	230.2 (23)
	Individual borrowed	2	1.0	-	2	0.8	0.4	1.2 (0)
	Individual rented	1	1.0	-	1	1.0	-	1.0 (0)
	Total sample	280	2.8	1.7	772	3.5	3.0	987.4 (100)

Figures in parentheses are rounded percentages.

The total sample figures show that 98% of 987.4 ha in the two sample villages are either family owned (75%) or individually owned (23%). The data further show that there is a small difference between the average number of plots that are family owned (2.9) and individually owned (2.7). Nevertheless, plot sizes are, on the average, larger on family owned plots (3.9 ha) than on individually owned plots (3.0 ha). The data also indicate clearly that family owned plots comprise 90% of the total area managed by men. In contrast, the areas managed by women are somewhat equally divided between the family owned (52%) and individually owned (47%) categories of land tenure. These differences notwithstanding, it is clear from the data that family owned and individually owned plots are the dominant system of land tenure in the Maradi region of Niger.

Further information on the number and area of farm plots by type of land tenure by gender and the total sample is presented separately for Tchizon (Table 3.4) and Maiguero (Table 3.5).

Table 3.4. Number and Areas of Farm Plots by Type of Land Tenure, Gender, and Total Sample in Tchizon

Gender of Plot Manager	Land Tenure	Number of Plots				Area of Plots		
		N	Mean	Standard Deviation	Total in Sample	Mean	Standard Deviation	Total in Sample
						(ha)		
Men	Family owned	56	2.9	1.4	164	6.0	3.1	338.6 (89)
	Family borrowed	5	1.6	0.9	8	1.5	1.0	7.5 (2)
	Individual owned	11	2.3	1.3	25	3.1	2.3	34.5 (9)
	Total sample	72	2.7	1.4	197	5.3	3.2	380.6 (100)
Women	Family owned	51	2.4	1.4	122	2.8	2.2	144.5 (50)
	Family borrowed	1	3.0	-	3	3.5	-	3.5 (1)
	Individual owned	39	2.9	2.2	112	3.4	3.7	140.0 (49)
	Total sample	91	2.6	1.8	237	3.1	2.9	288.0 (100)
Total sample	Family owned	107	2.7	1.4	286	4.5	3.1	483.1 (72)
	Family borrowed	6	1.8	1.0	11	1.8	1.2	11.0 (2)
	Individual owned	50	2.7	2.0	137	3.4	3.4	174.5 (26)
	Total sample	163	2.7	1.6	434	4.1	3.2	668.6 (100)

Figures in parentheses are rounded percentages.

Table 3.5. Number and Areas of Farm Plots by Type of Land Tenure, Gender, and Total Sample in Maiguero

Gender of Plot Manager	Land Tenure	Number of Plots: N	Number of Plots: Mean	Number of Plots: Standard Deviation	Number of Plots: Total in Sample	Area of Plots: Mean	Area of Plots: Standard Deviation	Area of Plots: Total in Sample
						(ha)		
Men	Family owned	41	4.1	1.8	167	4.7	2.9	187.7 (94)
	Family rented	6	1.3	0.5	8	1.0	0.4	6.0 (3)
	Individual owned	5	1.2	0.4	6	1.4	1.0	6.8 (3)
	Individual borrowed	1	1.0	-	1	0.5	-	0.5 (0)
	Total sample	53	3.4	2.0	182	3.9	2.9	200.9 (100)
Women	Family owned	42	2.3	1.4	97	1.6	1.0	67.0 (57)
	Individual owned	20	2.9	1.8	57	2.4	1.9	49.0 (41)
	Individual borrowed	1	1.0	-	1	1.0	-	1.0 (1)
	Individual rented	1	1.0	-	1	1.0	-	1.0 (1)
	Total sample	64	2.4	1.6	156	1.8	1.4	117.9 (100)
Total sample	Family owned	83	3.2	1.8	264	3.1	2.6	254.6 (80)
	Family rented	6	1.3	0.5	8	1.0	0.4	6.0 (2)
	Individual owned	25	2.5	1.8	63	2.2	1.8	55.7 (18)
	Individual borrowed	2	1.0	-	2	0.8	0.4	1.5 (0)
	Individual rented	1	1.0	-	1	1.0	-	1.0 (0)
	Total sample	117	2.9	1.8	338	2.7	2.4	318.8 (100)

Figures in parentheses are rounded percentages.

The figures for Tchizon and Maiguero show trends very similar to the total sample figures in Table 3.3. Although family-owned and individually-owned plots in both villages comprise about 98% of the total area managed by men and women, the percentage of individually-owned plots is higher in Tchizon (26%) than in Maiguero (18%). It is noteworthy that women in both villages own a significant proportion of the plots under their management, 49% in Tchizon, and 41% in Maiguero. Women rarely manage rented or borrowed land (1%).

Overall, it is clear from the data that the system of land ownership in the sample villages is such that the great majority of land is owned by the household or by an individual household member, regardless of gender. That 98% of the total sample area is owned by farmers and that women are more likely than men to manage individually-owned plots is conducive to the SFRP that seeks both medium- and long-term investments in soil fertility restoration and maintenance.

Equipment, Tools, and Animals

Table 3.6 shows the percentages of farmers who own equipment, hand tools, and animals by gender, village, and total sample. Regardless of gender, ownership of agricultural equipment and machinery such as seeders, tractors, and mist-blowers is minimal in the study area. Of the 129 farmers interviewed, less than 15% reported owning such equipment, and ownership is limited exclusively to men farmers in Maiguero. Thus, farmers generally rely on hand tools and animals for agricultural operations.

Table 3.6. Ownership of Equipment, Hand Tools, and Animals by Gender, Village, and Total Sample

Village	Gender	Ownership of Equipment		Ownership of Hand Tools		Ownership of Animals	
		N	%	N	%	N	%
Tchizon	Men	52	-	52	100.0	52	92.3
	Women	17	-	17	100.0	17	82.4
	Total sample	69	-	69	100.0	69	89.9
Maiguero	Men	40	15.0	40	97.5	40	75.0
	Women	20	-	20	95.0	20	90.0
	Total sample	60	10.0	60	96.7	60	80.0
Total sample	Men	92	6.5	92	98.9	92	84.8
	Women	37	-	37	97.3	37	86.5
	Total sample	129	4.7	127	98.4	129	85.3

Virtually all farmers, regardless of gender, own hand tools. But in Maiguero men (98%) are slightly more likely than women (95%) to own hand tools. Thus, women farmers in the area are not likely to be dependent on men for hand tools. But some borrowing of tools by women and men probably occurs.

Regarding the ownership of animals, the data show trends similar to those pertaining to ownership of hand tools. Approximately 85% of men in the total sample own animals, but there are significant differences between gender and villages. In Tchizon, men (92%) are more likely than women (82.4%) to own animals. By contrast, 75% of men farmers in Maiguero own animals, compared with 90% of women farmers. Thus, the highest percentage of farmers owning animals is among men in Tchizon (92%), followed by women in Maiguero (90%), women in Tchizon (82%), and finally men in Maiguero (75%). That higher percentages of men and women in Tchizon own animals may be explained by the

relatively large population base of the village, greater land area and probably a larger grazing area, and proximity to the relatively large livestock market at Tchadoua for sales.

More instructive data are presented in Table 3.7 that shows the mean number of hand tools and animals owned by farmers by village and gender.

Table 3.7. Number of Hand Tools and Animals Owned by Farmers by Gender, Village, and Total Sample

		Number of Hand Tools Owned			Number of Animals Owned		
Village	Gender	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Tchizon	Men	52	1.4	0.6	48	7.9	5.9
	Women	17	2.1	0.9	14	4.1	2.5
	Total sample	69	1.6	0.7	62	7.1	5.5
Maiguero	Men	40	2.5	0.7	30	5.9	8.9
	Women	20	1.6	0.6	18	2.7	1.2
	Total sample	60	2.2	0.8	48	4.7	7.2
Total sample	Men	92	1.9	0.8	78	7.1	7.2
	Women	37	1.8	0.8	32	3.3	2.0
	Total sample	129	1.9	0.8	110	6.0	6.4

The total sample figures show an average of about two hand tools per farmer, regardless of gender. The total sample figures by village show that farmers in Maiguero have, on the average, more hand tools (2.2) than farmers in Tchizon (1.6). The greatest average number of hand tools owned is among men farmers in Maiguero (2.5), followed by women in Tchizon (2.1), women in Maiguero (1.6), and the least average number of hand tools owned is among men farmers in Tchizon (1.4). Thus, whereas women farmers in the control village of Maiguero may be compelled to borrow tools, the reverse may be true between men and women farmers in the experimental village of Tchizon.

Table 3.7 further shows that the average number of animals owned by men (7.1) is over twice that owned by women (3.3). Men in Tchizon own the greatest average number of animals (7.9), followed by men in Maiguero (5.9), women in Tchizon (4.1), and the least average number of animals owned is by women in Maiguero (1.2).

Further insight into the ownership of hand tools is presented in Table 3.8 that shows specific types of tools and ownership by gender and village. The total sample figures show that about one-third (34%) of all hand tools are dabas, one of the three most important hand tools for weeding. Hoes and hilaires constitute 27% and 29% of all hand tools owned within the total sample, respectively.

Table 3.8. Frequency Distributions of Types of Hand Tools Owned by Farmers, by Gender, Village, and Total Sample

	Village									
	Tchizon				Maiguero				Total Sample	
	Men		Women		Men		Women			
Type of Tool	N	%	N	%	N	%	N	%	N	%
Daba	17	24	11	31	39	39	16	46	83	34
Hilaire	52	72	17	47	3	3	-	-	72	29
Hoe	3	4	8	22	36	35	18	51	65	27
Axe	-	-	-	-	21	21	-	-	21	9
Machete	-	-	-	-	2	2	-	-	2	1
Other	-	-	-	-	-	1	3	1	1	-
TOTAL	72	100	36	100	101	100	35	100	244	100
Percent	67		33		7[illegible]		26			

The data show that hoes are very common, particularly among women farmers in Maiguero and to a lesser extent in Tchizon. Hilaires appear not to be a popular tool among men and women farmers in Maiguero, as this tool represents only 3% of all hand tools owned. By contrast hilaire ownership among men (72%) and women (47%) in Tchizon is quite substantial. It is significant to note that while the hoe can be used to weed on all types of soils, the hilaire is well suited for work on lighter soils. Thus, the relatively heavy soils in Maiguero explain the prevalence of the hoe and daba among farmers in the village. The data show further that perhaps with the exception of axes among women farmers in Maiguero, women in the two villages are at no particular disadvantage in access to important hand tools such as dabas, hilaires, and hoes. The limited utility of axes and machetes in the Sahelian environment is evident from these data.

Table 3.9 provides a summary of the relationships between schooling, off-farm employment, crop area per farm, and the percentages of farmers owning equipment, hand tools, and animals by village, gender, and the total sample. The total sample figures show that women farmers have no formal schooling, do not own farm equipment such as tractors, mist blowers, or seeders, and do not engage in off-farm employment. On the average, women farmers cultivate a much smaller area per farm (2.1 ha) than men farmers (9.9 ha). It is important to note, however, that the percentages of women farmers who own hand tools and animals are very similar to that of men farmers. But in terms of absolute numbers, compared with women farmers, men farmers on the average own over twice as many animals.

In the experimental village of Tchizon, about 20% of men farmers engage in off-farm employment. By contrast, more than one-half (52.5%) of men farmers in Maiguero engage in off-farm employment. Limited off-farm employment of men in Tchizon probably explains the higher mean crop area per farm (12.0 ha) and the relatively high mean number of animals (7.9). In Maiguero, the mean crop area among men is 7.3 ha and the average number of animals owned by men is 5.9.

Crops and Cropping Systems

Farmers were asked questions about specific crops under their management at the time of the survey. In this regard, the information provided in Tables 3.10 through 3.15 was obtained from an analysis of data collected by plot and shows the cropping systems and cropped area observed during the survey year.

Table 3.10 shows the percentage distributions of sole crops and various intercrops on the total of 310 sample plots by village and gender. The total sample figures show that the sole crop of millet (46%) and other millet-based intercrops (40%) account for 86% of all crops in the two villages. The remaining crops are accounted for by the sole cropped sorghum (10%), other crops (2%), and the sole cropped cowpeas (2%). There are however differences in crops between villages and gender.

In the experimental village of Tchizon, millet and sorghum as sole crops and bases for other intercrops account for 92% of the crops on 153 sampled plots, compared with 99% on 157 plots in Maiguero. It is worth noting that cowpeas as a sole crop or intercrop are more prevalent on plots in Tchizon (20%) than in Maiguero (6%). A possible explanation is that cowpeas

Table 3.9. Schooling, Employment, Area Cropped, and Ownership of Equipment, Tools, and Animals by Gender, Village, and Total Sample

Village	Gender	Farmer Schooling N	Farmer Schooling Mean (years)	Off-Farm Employment (%)	Crop Area Per Farm (Mean) (ha)	Ownership of Equipment (%)	Ownership of Hand Tools (%)	Number of Hand Tools Owned (Mean)	Ownership of Animals (%)	Number of Animals Owned (Mean)
Tchizon	Men	42.0	2.8	19.6	12.0	-	100.0	1.4	92.3	7.9
	Women	11.0	-	-	2.9	-	100.0	2.1	82.4	4.1
	Total sample	53.0	2.2	15.8	9.7	-	100.0	1.6	89.9	7.1
Maiguero	Men	38.0	1.4	52.5	7.3	15.0	97.5	2.5	75.0	5.9
	Women	20.0	-	-	1.5	-	95.0	1.6	90.0	2.7
	Total sample	58.0	0.6	35.0	5.4	10.0	96.7	2.2	80.0	4.7
	Men	80.0	2.2	34.9	9.9	6.5	98.9	1.2	84.8	7.1
	Women	31.0	-	-	2.1	-	97.3	1.8	86.5	3.3
	Total sample	111.0	1.5	25.6	7.7	4.7	98.4	1.9	85.3	6.0

Table 3.10. Percentage Distributions of Crops and Intercrops by Gender, Village, and Total Sample

Crop	Tchizon						Maiguero						Total Sample	
	Men		Women		Total		Men		Women		Total			
	N Plots	%	N Plots	%	N Plots	%	N Plots	%	N Plots	%	N Plots	%	N Plots	%
Millet	65	51	16	61	81	53	57	49	6	15	63	40	144	46
Millet-sorghum	8	6	7	27	15	10	24	21	18	44	42	26	57	18
Sorghum	14	11	-	-	14	9	14	12	3	7	17	11	31	10
Millet-sorghum-cowpeas	14	11	-	-	14	9	4	3	-	-	4	3	18	6
Millet-cowpeas	10	8	-	-	10	6	3	3	1	2	4	3	14	5
Other millet intercrops	2	2	-	-	2	1	6	5	6	15	12	8	14	5
Millet sorghum intercrop	4	3	-	-	4	3	3	3	3	7	6	4	10	3
Millet-peanuts	2	2	-	-	2	1	4	3	3	7	7	4	9	3
Cowpeas	4	3	3	12	7	5	-	-	-	-	-	-	7	2
Other crops[a]	4	3	-	-	4	3	1	1	1	2	2	1	6	2
TOTAL	127	100	26	100	153	100	116	100	41	99	157	100	310	100
Percent	83		17		100		74		26		100			

a. Other crops include souchet, tobacco, okra, and other vegetables that are sole crops or intercropped with millet or sorghum.

Note: Analysis of data collected by plot.

were introduced in Maiguero less than a decade ago. Thus, the potential of cowpeas as a supplementary cash crop is greater in the experimental village than in the control village.

Regarding gender differences in crop choices by village, substantial and notable differences are observed. Women farmers in Tchizon allocate 61% of plots under their management for sole crop millet but that percentage for men farmers in Tchizon is less (51%). Women farmers in Tchizon allocate 27% of their plots for millet-sorghum but men farmers only 6%. Men allocate 11%, 11%, and 8% of their plots for sorghum, millet-sorghum-cowpeas, and millet-cowpeas in Tchizon but women in Tchizon did not cultivate these crops during the survey year. Finally, in Tchizon women allocate a greater percentage of their plots for cowpeas (12%) than men (3%). Thus, cowpeas appear to be a "women's crop" in the experimental village.

In Maiguero, men allocate a substantially greater percentage (49%) of their plots for millet compared to women (15%). But women in Maiguero allocate a substantially greater percentage (44%) of their plots for intercropped millet-sorghum compared to men (21%). But men compared to women allocate a greater percentage of their plots for sorghum, 12% and 7% of their respective plots. Finally, it is observed that women compared to men in Maiguero favor diverse other millet based intercrops.

Additional data in Table 3.11 show the number and average size of plots by gender, village, and the total sample. The total sample figures show that the average size of the 305 sampled plots with data on area in the two villages is 1.56 ha. In Tchizon, the experimental village, the average plot area of 153 plots is 1.96 ha, and the total sample area is 299.2 ha. By contrast, in the control village of Maiguero, the average plot area is 1.17 ha for 152 plots with a total area of 178.0 ha. The average plot size cultivated by men farmers in Tchizon (2.14 ha) is larger than that of men farmers in Maiguero (1.34 ha), women farmers in Tchizon (1.04 ha), and women farmers in Maiguero (0.71 ha). For the total sample, the average area of plots cultivated by men farmers (1.77 ha) is much larger than that of women (0.84 ha).

Table 3.11. Number and Size of Plots and Plot Area by Village, Gender, and Total Sample

	Gender								
	Men			Women			Total Sample		
Village	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Tota Sampl Are
		- - - -(ha)- - - -			- - - -(ha)- - -			- - - -(ha)- - -	
Tchizon	127	2.14	272.2	26	1.04	27.0	153	1.96	299.2
Maiguero	111	1.34	148.7	41	0.71	29.3	152	1.17	178.0
Total sample	238	1.77	420.9	67	0.84	56.3	305	1.56	477.2

Note: Analysis of data collected by plot.

Table 3.12 provides further insight into the numbers and sizes of plots in the sample villages by gender and type of land tenure. The average plot area owned by families among men farmers in Tchizon is 2.1 ha and the total sample area is about 226 ha. The corresponding figures for Maiguero are 1.35 and 85.4 ha, respectively. The average size of family-owned plots managed by women farmers in Tchizon is 1.17 ha and the total sample area is 14 ha. By contrast, in Maiguero the average size of family-owned plots managed by women farmers is 0.86 ha, with a total sample area of 6.9 ha.

Table 3.12. Number and Size of Plots and Plot Area by Gender of Manager, Land Tenure, Village, and Total Sample

		Crop Area								
		Tchizon			Maiguero			Total Sample		
Manager	Land Tenure	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
			- - - (ha) - - -			- - - (ha) - - -			- - - (ha) - - -	
Men	Family owned	107	2.10	225.7	63	1.35	85.4	170	1.83	311.1
	Family borrowed	4	1.25	5.0	1	0.50	0.5	5	1.10	5.5
	Family rented	-	-	-	1	0.50	1.0	1	0.50	0.5
	Individual owned	2	1.50	3.0	-	-	-	2	1.50	0.5
	Purchased	14	2.75	38.5	-	-	-	14	2.75	38.5
Women	Family owned	12	1.17	14.0	8	0.86	6.9	20	1.04	20.9
	Family rented	-	-	-	1	0.80	0.8	1	0.80	0.8
	Individual owned	14	0.73	13.0	10	0.76	7.6	24	0.86	20.6

Note: Analysis of data collected by plot.

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A point of interest is that, unlike some areas of West Africa where land is acquired mostly by inheritance or borrowing, some land in the study area has been acquired through direct purchase. As shown in Table 3.12, 38.5 ha of the total sample area managed by men in Tchizon is reported to have been acquired by purchase. Further changes in this form of land acquisition in terms of the size and number of plots as a result of the use of fertilizers will be one indicator of the socioeconomic consequences of SFRP.

The descriptive data in Table 3.13 show gender differences in the allocation of land for particular crops. The importance of millet in the study area is clearly evident from these data. The total sample figures show that men and women farmers allocate 103 of 305 (34%) plots for the cultivation of millet-based intercrops. Furthermore, in the total sample, men and women farmers allocate about one-half (47%) or 142 of 305 plots for sole crop millet with an average area of 1.66 ha. Thus, 80% of the total area managed by men and women farmers is planted with sole crop and intercropped millet.

The sole crop of sorghum is observed on a total of 37 plots or 12% of all plots with an average area of 1.29 ha or 10% of the total sample area. The least important crop in terms of plot allocation is the sole crop of cowpeas which was observed on only 7 of 305 plots (2%) with an average area of 1.0 ha or about 1% of the total sample area.

There are significant similarities and differences between men and women and between villages in the allocation of plots for particular crops. For the dominant and most important sole crop of millet, men farmers have 120 plots with an average area of 1.78 ha or 51% of the total area (421 ha) under their management. The corresponding figures for women were 22 plots with an average area of 1 ha. This represents 39% (22 ha) of the total sample area (56.3 ha) managed by women farmers in the sample.

The millet-sorghum intercrop is second in importance for both men and women who allocate 12% and 23% of the total area under their respective management.

The sole crop of sorghum is the third most important crop for both men and women farmers. Men and women allocate 10% and 14% of the total area under their respective management for this crop. However, the average plot area with sorghum among men is about twice as large (1.48 ha) as that among women (0.8 ha).

Table 3.13. Crop Area and Size of Plots by Crop, Gender, and Total Sample

Crop	Gender: Men			Gender: Women			Total Sample		
	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
		- - - -	(ha) - - - -		- - - -	(ha)- - - -		- - - -	(ha) - - - -
Millet	120	1.78	213.20 (51)	22	1.00	21.90 (39)	142	1.66	235.10 (49)
Sorghum	27	1.48	39.90 (10)	10	0.80	8.00 (14)	37	1.29	47.90 (10)
Cowpeas	4	1.00	4.00 (1)	3	1.00	3.00 (5)	7	1.00	7.00 (1)
Millet-sorghum	30	1.66	49.80 (12)	18	0.71	12.70 (23)	48	1.30	62.50 (13)
Millet-sorghum-cowpeas	18	2.07	37.30 (9)	-	-	- -	18	2.07	37.30 (8)
Millet-peanuts	6	3.33	20.00 (5)	3	0.77	2.30 (4)	9	2.48	22.30 (5)
Millet-cowpeas	13	1.72	22.40 (5)	3	0.30	0.30 (1)	14	1.62	22.70 (5)
Other Millet intercrops	8	2.13	17.00 (4)	6	1.00	6.00 (10)	14	1.64	23.00 (5)
Other Sorghum intercrops	7	1.47	10.30 (2)	3	0.60	1.80 (3)	10	1.21	12.10 (3)
Other Crops[a]	5	1.40	7.00 (1)	1	0.30	0.30 (1)	6	1.22	7.30 (2)
TOTAL	238	1.77	420.9	67	0.84	56.30	305	1.56	477.2
Percent	78		88	22		12	100		100

a. Other crops include such crops as souchet, tobacco, and vegetables that are sole crops or intercrops with millet or sorghum.

Note: Figures in parentheses are rounded percentages.

Gender differences in the allocation of plots for specific crops and intercrops are further illustrated in the sole crop of cowpeas and the millet-based peanut and cowpea intercrops. Concerning the sole crop of cowpeas, men allocate a mere 1% of the total sample area under their management for this crop. By contrast, women have 5% of their total sample with this crop. But the average crop area (1.0 ha) is the same regardless of gender.

The figures for the millet-sorghum-cowpea intercrop show that men have 9% of all plots under their management with this intercrop with an average plot area of 2.07 ha. Women farmers do not cultivate this intercrop.

Women allocate a greater proportion of the total area under their management for the millet-sorghum intercrop (23%); but men farmers only allocate 12% of the total area under their management for this intercrop. Women allocate 4% of the total area under their management for millet-peanuts and about 1% for millet-cowpeas, whereas men allocate 5% of the total area under their management for each of these intercrops. Changes in the number of plots, plot sizes, and the total areas allocated for particular crops will be monitored during the SFRP project and serve as indicators of the agro-socioeconomic consequences of extensive fertilizer use.

Tables 3.14 and 3.15 show crop areas, size of plots by crops, and gender of farmers for Tchizon and Maiguero, respectively.

The total sample figures for Tchizon in Table 3.14 show that sole crop millet is cultivated on 52% of the total area managed by all farmers regardless of gender. Sole crop sorghum and the millet-sorghum-cowpeas intercrop are each cultivated on 11% of the total sample area. Two other important intercrops in Tchizon are millet-sorghum cultivated on 8% of the total area and millet-cowpea cultivated on 7%. Together these sole crops and intercrops are cultivated on 89% of the total sampled area in Tchizon.

Among the sample farmers in Tchizon who are men, the following sole crops and intercrops account for 90% of the total area for all crops under their management: millet (51%), millet-sorghum-cowpeas (13%), sorghum (10%), millet-sorghum (9%), and millet cowpeas (7%). The remaining sole crops including sole cowpea (1%), millet-peanuts (2%), other millet intercrops (2%), other sorghum intercrops (3%), and other crops (2%) account for 10% of the total area for all crops. Among the sample farmers in Tchizon who are women, three sole crops are found on the total area under their management; millet

Table 3.14. Crop Area and Size of Plots by Crop, Gender, and Total Sample for Tchizon

Crop	Gender: Men			Gender: Women			Total Sample		
	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
		- - - - -(ha)- - - - -			- - - - -(ha) - - - - -			- - - - -(ha) - - - - -	
Millet	65	2.14	139.3 (51)	16	1.09	17.5 (65)	81	1.94	156.8 (52)
Sorghum	14	1.96	27.5 (10)	7	0.93	6.5 (24)	21	1.62	34.0 (11)
Cowpeas	4	1.00	4.0 (1)	3	1.00	3.0 (11)	7	1.00	7.0 (2)
Millet-sorghum	8	3.06	24.5 (9)	.	.	.	8	3.06	24.5 (8)
Millet-sorghum-cowpeas	14	2.38	33.3 (13)	.	.	.	14	2.38	33.3 (11)
Millet-peanuts	2	3.00	6.0 (2)	.	.	.	2	3.00	6.0 (2)
Millet-cowpeas	10	2.01	20.1 (7)	.	.	.	10	2.01	20.1 (7)
Other millet intercrops	2	2.50	5.0 (2)	.	.	.	2	2.50	5.0 (2)
Other sorghum intercrops	4	1.63	6.5 (3)	.	.	.	4	1.63	6.5 (3)
Other crops[a]	4	1.50	6.0 (2)	.	.	.	4	1.50	6.0 (2)
TOTAL	127	2.13	271.7	26	1.04	27.0	153	1.95	298.7
Percent	83		91	17		9	100		100

a. Other crops include souchet, okra, and other vegetables that are sole crops or intercrops with millet.

Note: Figures in parentheses are rounded percentages.

Table 3.15. Crop Area and Size of Plots by Crop, Gender, and Total Sample for Maiguero

Crop	Gender: Men			Gender: Women			Total Sample		
	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area	Number of Plots	Average Plot Area	Total Sample Area
		- - - - -(ha)- - - - -			- - - - -(ha) - - - - -			- - - - -(ha) - - - - -	
Millet	55	1.34	73.9 (49)	6	0.73	4.4 (15)	61	1.28	78.3 (44)
Sorghum	13	0.95	12.4 (8)	3	0.50	1.5 (5)	16	0.87	13.9 (8)
Millet-sorghum	22	1.15	25.3 (17)	18	0.71	12.7 (43)	40	0.95	38.0 (21)
Millet-sorghum-cowpea	4	1.00	4.0 (3)	-	-	-	4	1.00	4.0 (2)
Millet-peanuts	4	3.50	14.0 (9)	3	0.77	2.3 (8)	7	2.33	16.3 (9)
Millet-cowpea	3	0.77	2.3 (2)	1	0.30	0.3 (1)	4	0.65	2.6 (2)
Other millet intercrops	6	2.00	12.0 (8)	6	1.00	6.0 (21)	12	1.50	18.0 (10)
Other sorghum intercrops	3	1.27	3.8 (3)	3	0.60	1.8 (6)	6	0.93	5.6 (3)
Other crops[a]	1	1.00	1.0 (1)	1	0.3	0.3 (1)	2	0.65	1.3 (1)
TOTAL	111	1.34	148.7	41	0.71	29.3	152	1.17	178.0
Percent	73		84	27		16	100		100

a. Other crops include such crops as souchet, tobacco, and vegetables that are sole crops or intercrops with millet or sorghum.

Note: Figures in parentheses are rounded percentages.

(65%), sorghum (24%), and cowpeas (11%). Women farmers in Tchizon reported no cultivation of intercrops.

The total sample figures for Maiguero in Table 3.15 show that sole crop millet is cultivated on 44% of the total area managed by all farmers regardless of gender. Other notable crops include sorghum cultivated on 8% of the total sample, millet-sorghum (21%), millet-peanuts (9%), and other millet intercrops (10%). Together these crops account for 92% of all crops cultivated in the total sample area.

The favored crops among farmers who are men in Maiguero are sole crop millet cultivated on 49% of the total area under the management of men, followed by millet-sorghum (17%), millet-peanuts (9%), sorghum (8%), and other millet intercrops (8%). These sole crops and intercrops account for 91% of all crops on the total sample area managed by men farmers in Maiguero.

The favored crop among farmers who are women in Maiguero is the intercrop of millet-sorghum cultivated on 43% of the total area managed by women, followed by other millet intercrops (21%), sole crop millet (15%), intercropped millet-peanut (8%), other sorghum intercrops (6%), and sole crop sorghum (5%). Taken together, these sole crops and intercrops account for 98% of all crops on the total area managed by women in Tchizon. The percentages of the total area cultivated with millet-cowpea (1%) and other crops (1%) are negligible.

Availability and Use of Variable Inputs

Use of Household and Hired Labor

Table 4.1 shows descriptive data on the use of household and hired labor in average workdays per hectare by activity and village for all crops.

The total sample figures show that virtually all labor for all crops is provided by household members in Tchizon (99%) and Maiguero (96%). Farmers in Maiguero, however, reported that 4% of the average workdays per hectare for land preparation and 2% for weeding were contributed by hired labor.

Table 4.1. Average Use of Household and Hired Labor by Activity and Village for All Crops

Activity	Village: Tchizon			Village: Maiguero		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/ha)					
Land preparation	2.8 (100)	-	2.8 (100)	2.7 (96)	0.1 (4)	2.8 (100)
Planting	2.0 (100)	-	2.0 (100)	2.4 (100)	-	2.4 (100)
Weeding	12.0 (99)	0.1 (1)	12.1 (100)	12.0 (98)	0.3 (2)	12.3 (100)
Harvesting	3.2 (100)	-	3.2 (100)	4.1 (100)	-	4.1 (100)
Marketing	-	-	-	0.6 (100)	-	0.6 (100)
TOTAL[a]	20.0 (99)	0.1 (1)	20.1 (100)	21.8 (98)	0.4 (2)	22.2 (100)
Fertilizer application	1.6 (100)	-	1.6 (100)	2.9 (100)	-	2.9 (100)
Pest control	2.0 (100)	-	2.0 (100)	-	-	-
Storage	1.6 (100)	-	1.6 (100)	1.8 (100)	-	1.8 (100)
Other activities	0.6 (86)	0.1 (14)	0.7 (100)	0.9 (60)	0.6 (40)	1.5 (100)
TOTAL[b]	25.8 (99)	0.3 (1)	26.0 (100)	27.4 (96)	1.0 (4)	28.4 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Tables 4.2 and 4.3 show the average use of household and hired labor by gender of farmers for all crops in Tchizon and Maiguero, respectively. There are virtually no differences between men and women farmers in Tchizon as to their use of household and hired labor, as both show a virtually universal

Table 4.2. Average Use of Household and Hired Labor for All Crops by Activity and Gender for Tchizon

Activity	Gender: Men			Gender: Women		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/ha)					
Land preparation	2.3 (100)	-	2.3 (100)	4.8 (100)	-	4.8 (100)
Planting	1.8 (100)	-	1.8 (100)	2.5 (100)	-	2.5 (100)
Weeding	9.3 (99)	0.1 (1)	9.4 (100)	25.9 (100)	-	25.9 (100)
Harvesting	3.2 (100)	-	3.2 (100)	2.9 (100)	-	2.9 (100)
TOTAL[a]	16.6 (99)	0.1 (1)	16.7 (100)	36.1 (100)	-	36.1 (100)
Fertilizer application	1.4 (100)	-	1.4 (100)	2.8 (100)	-	2.8 (100)
Storage	1.4 (100)	-	1.4 (100)	2.3 (100)	-	2.3 (100)
Other Activities	0.6 (86)	0.1 (14)	0.7 (100)	-	-	-
TOTAL[b]	20.0 (99)	0.2 (1)	20.2 (100)	41.2 (100)	-	41.2 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Table 4.3. Average Use of Household and Hired Labor for All Crops by Activity and Gender for Maiguero

Activity	Gender: Men			Gender: Women		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/ha)					
Land preparation	2.8 (100)	-	2.8 (100)	2.4 (100)	-	2.4 (100)
Planting	2.3 (100)	-	2.3 (100)	2.4 (100)	-	2.4 (100)
Weeding	13.6 (97)	0.4 (3)	14.0 (100)	8.2 (97)	0.3 (3)	8.5 (100)
Harvesting	4.1 (98)	0.1 (2)	4.2 (100)	3.5 (100)	-	3.5 (100)
Marketing	0.6 (100)	-	0.6 (100)	-	-	-
TOTAL[a]	23.4 (98)	0.5 (2)	23.9 (100)	16.5 (98)	0.3 (2)	16.8 (100)
Fertilizer application	1.0 (100)	-	1.0 (100)	3.2 (100)	-	3.2 (100)
Storage	1.6 (100)	-	1.6 (100)	2.5 (100)	-	2.5 (100)
Other activities	0.8 (57)	0.6 (43)	1.4 (100)	-	-	-
TOTAL[b]	26.8 (96)	1.1 (4)	27.9 (100)	22.2 (99)	0.3 (1)	22.5 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

reliance on household labor for all activities, 99% and 100%, respectively. This pattern of dependence on household labor regardless of the gender of farmers is also observed in Maiguero where household labor accounts for 96% of the total average workdays per hectare among men farmers and 99% among women farmers.

Sole Crop Millet--The data in Table 4.4 on the average use of household and hired labor for sole crop millet again show a virtually universal reliance on household labor for all activities. In Tchizon household labor contributed 99% of the total average workdays for sole crop millet. This figure for Maiguero is 94%.

In Tchizon, hired labor contributed 5% of the average workdays for planting; the greatest percentage of any activity is the experimental village. In Maiguero, 4% of the average workdays for land preparation were contributed by hired labor; the greatest percentage of any activity in the control village.

Sole Crop Sorghum--Table 4.5 shows the average use of household and hired labor for sole crop sorghum by activity and village. The figures again show the near universal reliance on household labor for this crop in the Sahelian region of South Central Maradi in Niger. In Tchizon household labor contributed 99% of the total average workdays for all activities for this crop. The corresponding percentage for Maiguero is 98%. Farmers in Tchizon (3%) and Maiguero (6%) do, however, hire minimal labor for land preparation.

Intercropped Millet-Sorghum--Table 4.6 shows the average use of household and hired labor for intercropped millet-sorghum by activity and village. The percentages for the average use of household and hired labor in Tchizon and Maiguero for intercropped millet-sorghum again show a virtual universal reliance on household labor for all activities. In Tchizon, 100% of the workdays for all activities were contributed by hired labor and for Maiguero that figure is 99%.

Table 4.7 provides a summary of the average use of household and hired labor by crop and village. Regardless of crop, men and women farmers in both village depend almost exclusively on household labor for the cultivation of all crops. The percentages of the total average workdays contributed by household labor for all crops in Tchizon (99%) and Maiguero (98%) demonstrate this point.

Table 4.4. Average Use of Household and Hired Labor for Sole Crop Millet by Activity and Village

Activity	Village					
	Tchizon			Maiguero		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/ha)					
Land preparation	2.9 (100)	-	2.9 (100)	2.7 (96)	0.1 (4)	2.8 (100)
Planting	2.0 (95)	0.1 (5)	2.1 (100)	2.3 (100)	-	2.3 (100)
Weeding	12.9 (99)	0.1 (1)	13.0 (100)	12.9 (98)	0.3 (2)	13.2 (100)
Harvesting	3.1 (100)	-	3.1 (100)	4.0 (98)	0.1 (2)	4.1 (100)
Marketing	-	-	-	0.7 (100)	-	0.7 (100)
TOTAL[a]	20.9 (99)	0.2 (1)	21.1 (100)	22.6 (98)	0.5 (2)	23.1 (100)
Fertilizer application	1.6 (100)	-	1.6 (100)	3.2 (100)	-	3.2 (100)
Pest control	2.1 (100)	-	2.1 (100)	-	-	-
Storage	1.5 (100)	-	1.5 (100)	1.7 (100)	-	1.7 (100)
Other Activities	-	-	-	-	1.2 (100)	1.2 (100)
TOTAL[b]	26.1 (99)	0.2 (1)	26.3 (100)	27.5 (94)	1.7 (6)	29.2 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Table 4.5. Average Use of Household and Hired Labor for Sole Crop Sorghum by Activity and Village

Activity	Village					
	Tchizon			Maiguero		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/ha)					
Land preparation	3.8 (97)	0.1 (3)	3.9 (100)	1.7 (94)	0.1 (6)	1.8 (100)
Planting	2.1 (100)	-	2.1 (100)	2.2 (100)	-	2.2 (100)
Weeding	18.1 (100)	-	18.1 (100)	9.2 (97)	0.3 (3)	9.5 (100)
Harvesting	2.8 (100)	-	2.8 (100)	3.7 (100)	-	3.7 (100)
Marketing	-	-	-	0.3 (100)	-	0.3 (100)
TOTAL[a]	26.8 (99)	0.1 (1)	26.9 (100)	17.1 (98)	0.4 (2)	17.5 (100)
Fertilizer application	1.8 (100)	-	1.8 (100)	5.3 (100)	-	5.3 (100)
Pest control	2.3 (100)	-	2.3 (100)	-	-	-
Storage	2.3 (100)	-	2.3 (100)	1.5 (100)	-	1.5 (100)
Other activities	0.4 (100)	-	0.4 (100)	2.0 (100)	-	2.0 (100)
TOTAL[b]	33.6 (99)	0.1 (1)	33.7 (100)	25.9 (98)	0.4 (2)	26.3 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Table 4.6. Average Use of Household and Hired Labor for Intercropped Millet-Sorghum by Activity and Village

Activity	Village					
	Tchizon			Maiguero		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/ha)					
Land preparation	1.6 (100)	-	1.6 (100)	3.0 (100)	-	3.0 (100)
Planting	1.1 (100)	-	1.1 (100)	2.4 (100)	-	2.4 (100)
Weeding	4.7 (100)	-	4.7 (100)	11.7 (99)	0.1 (1)	11.8 (100)
Harvesting	1.4 (100)	-	1.4 (100)	4.1 (100)	-	4.1 (100)
Marketing	-	-	-	0.9 (100)	-	0.9 (100)
TOTAL[a]	8.8 (100)	-	8.8 (100)	22.1 (99)	0.1 (1)	22.2 (100)
Fertilizer application	0.7 (100)	-	0.7 (100)	2.9 (100)	-	2.9 (100)
Pest control	0.9 (100)	-	0.9 (100)	-	-	-
Storage	1.1 (100)	-	1.1 (100)	1.9 (100)	-	1.9 (100)
Other activities	0.4 (100)	-	0.4 (100)	-	-	-
TOTAL[b]	11.9 (100)	-	11.9 (100)	26.9 (99)	0.1 (1)	27.0 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Table 4.7. Average Use of Household and Hired Labor by Crop in Tchizon and Maiguero

Activity	Village					
	Tchizon			Maiguero		
	Household Labor	Hired Labor	Total Labor Used	Household Labor	Hired Labor	Total Labor Used
	(workdays/ha)					
Cowpeas	29.7 (100)	-	29.7 (100)	-	-	-
Millet-sorghum-cowpeas	20.5 (100)	-	20.5 (100)	26.6 (100)	-	26.6 (100)
Millet-peanut	13.3 (100)	-	13.3 (100)	14.9 (96)	0.6 (4)	15.5 (100)
Millet-cowpeas	14.2 (97)	0.4 (3)	14.6 (100)	39.5 (100)	-	39.5 (100)
Other millet intercrops	8.0 (100)	-	8.0 (100)	19.5 (96)	0.8 (4)	20.3 (100)
Other sorghum intercrops	22.3 (99)	0.1 (1)	22.4 (100)	26.1 (96)	1.0 (4)	27.1 (100)
Other crops	26.8 (100)	-	26.8 (100)	30.5 (98)	0.6 (2)	31.1 (100)
TOTAL Percent	134.8 (99)	0.5 (1)	135.3 (100)	157.1 (98)	3.0 (2)	160.1 (100)

Note: Figures in parentheses are rounded percentages.

Use of Labor of Men, Women, and Children by Activity and Village

Table 4.8 shows the average use of labor of men, women, and children by activity and village for all crops. For the experimental village of Tchizon, the total sample figures show that 60% of the total average workdays per hectare were contributed by men, 32% by women, and 8% by children.

Table 4.8. Average Use of Labor of Men, Women, and Children for All Crops by Activity and Village

Activity	Tchizon				Maiguero			
	Men	Women	Children	Total	Men	Women	Children	Total
	(workdays/ha)							
Land preparation	2.2 (85)	0.3 (12)	0.1 (3)	2.6 (100)	1.6 (62)	0.7 (27)	0.3 (11)	2.6 (100)
Planting	0.9 (47)	0.8 (42)	0.2 (11)	1.9 (100)	0.9 (41)	1.2 (55)	0.1 (4)	2.3 (100)
Weeding	6.0 (50)	4.8 (40)	1.1 (10)	11.9 (100)	6.1 (50)	5.5 (45)	0.7 (5)	12.3 (100)
Harvesting	1.7 (55)	1.2 (39)	0.2 (6)	3.1 (100)	1.5 (39)	2.2 (56)	0.2 (5)	3.9 (100)
Marketing	-	-	-	-	0.4 (80)	-	0.1 (20)	0.5 (100)
TOTAL[a]	10.8 (56)	7.1 (36)	1.6 (8)	19.5 (100)	10.5 (49)	9.6 (45)	1.4 (6)	21.5 (100)
Fertilizer application	1.0 (67)	0.4 (27)	0.1 (6)	1.5 (100)	0.1 (4)	2.7 (96)	-	2.8 (100)
Pest control	1.7 (89)	0.2 (11)	-	1.9 (100)	-	-	-	-
Storage	0.9 (64)	0.4 (29)	0.1 (7)	1.4 (100)	1.2 (74)	0.2 (13)	0.2 (13)	1.6 (100)
Other activities	0.7 (100)	-	-	0.7 (100)	1.3 (100)	-	-	1.3 (100)
TOTAL[b]	15.1 (60)	8.1 (32)	1.8 (8)	25.0 (100)	13.1 (48)	12.5 (46)	1.6 (6)	27.2 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

The percentages of labor contributed by men, women, and children for land preparation in Tchizon show that men contributed 85% of the total average workdays per hectare, women 12%, and children 3%. Thus, land preparation is predominately a task of men.

Of the total average workdays per hectare for planting, men contributed 47%, women 42%, and children 11%. The labor contribution of children for this activity is greater than for all other activities in Tchizon. Planting is also the activity that is most equitably shared by men and women in Tchizon.

The percentage of the total average workdays per hectare for weeding contributed by men (50%) and women (40%) shows that labor for this activity is also rather equitably shared. Children contributed 10% of the total average workdays per hectare for weeding in Tchizon; a substantial contribution.

In Tchizon, the greatest percentage of the total average workdays for harvesting is contributed by men (55%) with substantial contributions from women (39%) and children (6%). Concerning fertilizer application, men contributed 67% of the total average workdays for this task, women 27%, and children 6%. Pest control in Tchizon is primarily a responsibility of men who contributed 89% of the total average workdays for this task; women contributed 11% and children made no contribution to pest control. Other activities such as guarding and inspecting fields were exclusively performed by men.

The labor contributions of men, women, and children in Maiguero often show a different pattern than in Tchizon. The percentage of the total average workdays for land preparation in Maiguero contributed by women (27%) and children (11%) exceeds that of Tchizon; although men make the dominant contribution, 62% of the total average workdays for this task.

As for the task of planting in Maiguero, men contributed 41% of the total average workdays for this activity, women 55%, and children 4%. Thus, women are more active in planting in Maiguero than in Tchizon but men and children are less active. The percentages of the total average workdays contributed by men (50%) and women (45%) for weeding in Maiguero show that labor for this task is rather equitably shared. Children in Maiguero contributed 5% of the total average workdays for weeding; a lesser contribution than that of children in Tchizon.

Unlike Tchizon, women in Maiguero contribute the greatest percentage of the total average workdays per hectare for harvesting (56%), followed by men (39%) and children (5%). As for the tasks of marketing, no activity was

reported by farmers in Tchizon and only minimal activity in Maiguero where men contributed 80% of the total average workdays for this task and children 20%. The minimal marketing activity in both villages demonstrate the subsistence orientation of agriculture in the Sahel.

A comparison of the labor contributions of men and women for fertilizer application in the two villages shows an interesting contrast and variability in the division of labor within the Hausa ethnic group. Recall that in Tchizon men contributed 67% of the total average workdays for fertilizer application and women 27%. But in Maiguero, women contributed 96% of the total average workdays for this task and men about 4%. The implication here is that instruction for fertilizer application and related tasks should be directed to both men and women but the division of labor for this task should be determined on a village-by-village basis.

No pest control activity was reported by the sampled farmers in Maiguero. The labor for storage work in Maiguero is primarily performed by men who contributed 74% of the total average workdays for this task; women contributed 13% (compared to 29% in Tchizon) and children 13% (compared to 7% in Tchizon). Men contributed 100% of the total average workdays for other activities such as guarding and inspecting fields in Maiguero.

Use of Labor of Men, Women, and Children by Activity and Gender of Plot Manager

Tables 4.9 and 4.10 show the percentages of the total average workdays contributed by men, women, and children for all crops by activity and gender of the plot managers in Tchizon and Maiguero, respectively.

The percentages for the total average workdays per hectare for all activities for Tchizon in Table 4.9 show interesting contrasts in the average use of labor on plots managed by men and women farmers. On plots managed by men, 65% of the total average workdays were contributed by men, 28% by women, and 7% by children. Thus, overall men are predominately but not exclusively responsible for labor on plots under their management. It should be noted here that women and children jointly contribute 35% of the total average workdays for all activities on plots managed by men.

Table 4.9. Average Use of Labor of Men, Women, and Children for All Crops by Activity and Gender for Tchizon

Activity	Gender: Men — Men	Men — Women	Men — Children	Men — Total	Women — Men	Women — Women	Women — Children	Women — Total
	(workdays/ha)							
Land preparation	2.1	0.1	0.1	2.3	2.8	1.5	0.4	4.7
	(92)	(4)	(4)	(100)	(60)	(32)	(8)	(100)
Planting	0.8	0.7	0.2	1.7	0.9	1.2	0.3	2.4
	(47)	(41)	(12)	(100)	(38)	(50)	(12)	(100)
Weeding	4.9	3.5	0.8	9.2	11.3	11.7	2.8	25.8
	(53)	(38)	(9)	(100)	(44)	(45)	(11)	(100)
Harvesting	1.8	1.1	0.2	3.1	1.2	1.3	0.3	2.8
	(58)	(35)	(7)	(100)	(43)	(46)	(11)	(100)
TOTAL[a]	9.6	5.4	1.3	16.3	16.2	15.7	3.8	35.7
	(59)	(33)	(8)	(100)	(45)	(44)	(11)	(100)
Fertilizer application	1.0	0.3	0.1	1.4	1.7	1.1	-	2.8
	(72)	(21)	(7)	(100)	(61)	(39)		(100)
Pest control	1.7	0.1	-	1.8	1.9	0.7	-	2.6
	(94)	(6)		(100)	(73)	(27)		(100)
Storage	0.9	0.3	0.1	1.3	1.1	1.8	0.3	3.2
	(69)	(23)	(8)	(100)	(35)	(56)	(9)	(100)
Other activities	0.7	-	-	0.7	-	-	-	-
	(100)			(100)				
TOTAL[b]	13.9	6.1	1.5	21.5	20.9	19.3	4.1	44.3
	(65)	(28)	(7)	(100)	(47)	(44)	(9)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Table 4.10. Average Use of Labor of Men, Women, and Children for All Crops by Activity and Gender for Maiguero

Activity	Gender							
	Men				Women			
	Men	Women	Children	Total	Men	Women	Children	Total
	(workdays/ha)							
Land preparation	2.1 (78)	0.1 (3)	0.5 (19)	2.7 (100)	0.4 (17)	1.9 (83)	-	2.3 (100)
Planting	1.1 (50)	0.9 (41)	0.2 (9)	2.2 (100)	0.3 (13)	2.0 (87)	-	2.3 (100)
Weeding	7.9 (57)	5.0 (36)	1.0 (7)	13.9 (100)	1.5 (18)	6.8 (81)	0.1 (1)	8.4 (100)
Harvesting	1.9 (48)	1.8 (45)	0.3 (7)	4.0 (100)	0.5 (15)	2.9 (85)	-	3.4 (100)
Marketing	0.4 (80)	-	0.1 (20)	0.5 (100)	-	-	-	-
TOTAL[a]	13.4 (58)	7.8 (33)	2.1 (9)	23.3 (100)	2.7 (16)	13.6 (83)	0.1 (1)	16.4 (100)
Fertilizer application	0.8 (89)	-	0.1 (11)	0.9 (100)	-	3.1 (100)	-	3.1 (100)
Pest control	1.7 (94)	0.1 (6)	-	1.8 (100)	1.9 (73)	0.7 (27)	-	2.6 (100)
Storage	1.2 (80)	0.1 (7)	0.2 (13)	1.5 (100)	2.0 (83)	0.3 (13)	0.1 (4)	2.4 (100)
Other activities	1.3 (100)	-	-	1.3 (100)	-	-	-	-
TOTAL[b]	18.4 (64)	8.0 (28)	2.4 (8)	28.8 (100)	6.6 (27)	17.7 (72)	0.2 (1)	24.5 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

On plots managed by women in Tchizon, 47% of the total average workdays for all tasks were contributed by men, 44% by women, and 9% by children. Thus, men contribute a greater percentage of the total average workdays per hectare on plots managed by women than women contribute to plots managed by men. Furthermore, men and children jointly contribute 56% of the total average workdays for all tasks on plots managed by women.

The activity of land preparation on plots managed by men and women in Tchizon is predominately, but not exclusively, performed by men who contributed 92% of the total average workdays per hectare on plots managed by men, 60% on plots managed by women. In contrast, women contributed 4% of the total average workdays for land preparation on plots managed by men and 32% on plots managed by women. Children contribute a greater percentage of the total average workdays for land preparation on plots managed by women than on plots managed by men, 8% and 4%, respectively. These percentages also show that women and children jointly contribute 8% of the total average workdays for land preparation on plots managed by men in Tchizon. In stark contrast, men and children jointly contribute 68% of the total average workdays for this task on plots managed by women.

The percentages of the total average workdays for planting activities contributed by men and women on plots managed by men and women are more equal than for land preparation. On plots managed by men, 47% of the total average workdays were contributed by men, 41% by women, and 12% by children. Thus, 53% of the total average workdays for planting on plots managed by men in Tchizon were contributed by women and children.

On plots managed by women in Tchizon, men contributed 38% of the total average workdays for planting, women 50%, and children 12%. Thus, men and children jointly contribute 50% of the total average workdays per hectare on plots managed by women.

Weeding on plots managed by men in Tchizon is predominately, but not exclusively, a task performed by men who contributed 53% of the total average workdays for this task, women contributed 38%, and children 9%. Thus, 47% of the total average workdays per hectare for weeding plots managed by men were jointly contributed by women and children.

On plots managed by women in Tchizon, men contributed 44% of the total average workday per hectare for weeding, women 45%, and children 11%. These figures show that 55% of the total average workdays for weeding plots

managed by women in Tchizon were contributed by men and children, a substantial labor contribution.

For the activity of harvesting crops from plots managed by men in Tchizon, men contributed 58% of the total average workdays per hectare, women 35%, and children 7%. Thus, women and children jointly contributed 42% of the total average workdays per hectare for harvesting crops from plots managed by men. On plots managed by women in Tchizon, men contributed 43% of the total average workdays per hectare for harvesting, women contributed 46%, and children 11%. Thus, 54% of the total average workdays per hectare for harvesting crops from plots managed by women were not contributed by women but by men and children.

In summarizing the labor contributions of men, women, and children in Tchizon for the major agricultural activities of land preparation, planting, weeding, and harvesting, it is evident that men and children jointly contribute a greater percentage of the total average workdays per hectare for these activities (56%) on plots managed by women than women and children jointly contribute for work on plots managed by men (41%). It is further evident that men contribute a greater percentage of the total average workdays per hectare for these tasks on plots managed by women (45%) than women contribute on plots managed by men (33%).

Regardless of gender of the plot manager, men contribute a greater percentage of the total average workdays per hectare for fertilizer application than women. Specifically, on plots managed by men in Tchizon 72% of the average workdays per hectare for this activity were contributed by men, 21% by women, and 7% by children. Although women contribute more to work for fertilizer application on plots managed by women than on those managed by men, men contributed 61% of the total average workdays per hectare for this activity on plots managed by women and women contributed 39%.

Regardless of the gender of the plot manager, compared to women, men also contribute a greater percentage of the total average workdays per hectare for pest control. On plots managed by men, men performed 94% of such workdays and women 6%. On plots managed by women, women contribute more of the average workdays for pest control (27%) than on plots managed by men (6%), but men contributed 73% on such workdays. Thus, pest control is an activity that is predominately, but not exclusively, performed by men in Tchizon.

The percentages for the labor contributions of men and women for storage show that men contribute a greater percentage (35%) of the total

average workdays per hectare for storage on production from plots managed by women than women contribute for production from plots managed by men (23%). The percentages in Table 4.9 for storage also show that women and children jointly contribute 31% of the total average workdays per hectare for storage of production from plots managed by men. This percentage for the labor contribution of men and children on plots managed by women is 44%. Considering the unique labor contributions of men and women on plots under their respective management, 69% of the total average workdays per hectare for storage of production from plots managed by men were performed by men. The labor contribution of women for storage of production from plots managed by women is 56% of the total average workdays per hectare. Other activities on plots managed by men and women were negligible during the baseline survey year.

The average use of labor of men, women, and children for all crops by activity and gender in Maiguero is shown in Table 4.10. On plots managed by men in Maiguero, 64% of the total average workdays per hectare for all activities were performed by men, 28% by women, and 8% by children. Thus, women and children jointly contributed 36% of the total average workdays per hectare for all activities on plots managed by men in the control village.

On plots managed by women in Maiguero, 27% of the total average workdays per hectare for all activities were performed by men, 72% by women, and a mere 1% by children. Men and children jointly contributed 28% of the total average workdays per hectare on plots managed by women. Considering the labor contributions of men and women to plots under their respective management, women contribute a greater percentage of the total average workdays for all tasks (72%) on plots under their management than men contribute to plots under their management (64%).

For the activity of land preparation on plots managed by men in Maiguero, men contributed 78% of the total average workdays per hectare for this task, women 3%, and children 19%. Thus, 22% of the total average workdays per hectare for land preparation on plots managed by men were not contributed by men but jointly by women and children. On plots managed by women in Maiguero, 17% of the total average workdays per hectare for land preparation were contributed by men, 83% by women, and nil by children. The substantial labor contribution by women in Maiguero for this task shows that women are not excluded from or physically unable to perform this arduous and demanding agricultural task.

For the activity of planting on plots managed by men in Maiguero, Table 4.10 shows that 50% of the total average workdays per hectare were contributed by men, 41% by women, and 9% by children. Thus, 50% of the total average workdays per hectare for this activity on plots managed by men were performed by women and children.

In stark contrast, 87% of the total average workdays per hectare for planting on plots managed by women were performed by women, 13% by men, and nil by children. Thus, women contribute a far greater percentage of the average workdays per hectare for planting on plots managed by men (41%) than men contribute on plots managed by women (13%).

Of the total average workdays per hectare for weeding on plots managed by men, 57% were contributed by men, 36% by women, and 7% by children. Thus, 43% of the average workdays per hectare for this task on plots managed by men were not contributed by men but rather by women and children. On plots managed by women in Maiguero, 81% of the total average workdays per hectare were contributed by women, 18% by men, and 1% by children. Thus, 19% of the average workdays per hectare for weeding plots managed by women were contributed by men and children. These figures show that women contribute a greater percentage of average workdays per hectare for weeding plots managed by men (36%) than men contribute to weeding plots managed by women (18%). Thus, women in Maiguero are more singularly responsible for weeding their plots than men are for weeding plots under their management.

The activity of harvesting crops from plots managed by men in Maiguero is rather equitably shared between men and women. Of the total average workdays per hectare for this activity, men contributed 48%, women 45%, and children 7%. In understanding the labor on plots managed by men that is not contributed by men, the percentages show that over one-half (52%) of the average workdays per hectare for harvesting were jointly contributed by women (45%) and children (7%). This is in contrast to the labor for harvesting plots managed by women. That women contribute 85% of the total average workdays per hectare for this task on plots under their management and men contribute but 15% shows that, as with planting and weeding, men contribute less labor to women than women contribute to men. This is in contrast to the general pattern of labor observed in Maiguero. These points show that researchers should be prudent in formulating generalizations about the roles and contributions of men and women in West African agriculture.

Marketing activity is minimal among both men and women farmers in Maiguero. This again demonstrates the subsistence nature of agriculture in the Sahel.

The total average workdays per hectare for land preparation, planting, weeding, harvesting, and marketing on plots managed by men in Maiguero show that, in the aggregate, 58% of the average labor (workdays per hectare) was contributed by men, 33% by women, and 9% by children. Thus, 42% of the average workdays per hectare for these tasks on plots managed by men were contributed not by men but jointly by women and children. The labor contribution of women on plots managed by women for these tasks is 83% of the average workdays per hectare, men contributed 16%, and children a mere 1%. Thus, for the major agricultural activities of land preparation, planting, weeding, harvesting, and marketing, women contribute a greater percentage of the average workdays per hectare on plots managed by men (33%) than men contribute on plots managed by women (16%).

Men and women farmers in Maiguero do not assist each other in activity of fertilizer application and men but not women receive a labor contribution from children for this task. On plots managed by men, men contributed 89% of the total average workdays per hectare for application and children contributed 11%. On plots managed by women, the labor of women and only women was used for fertilizer application.

Pest control on plots managed by men and women is an activity that is predominately performed by men. On plots managed by men, men contributed 94% of the total average workdays per hectare and women 6%. On plots managed by women, women contributed 27% of the total average workdays per hectare for pest control and men 73%. Because men contribute a far greater percentage of the average workdays for this task on plots managed by women (73%) than women contribute to plots managed by men (6%), pest control appears to be a task specialization of men in Maiguero. Children do not contribute labor to men or women for pest control in Maiguero.

Storage work also appears to be a task specialization of men. The data in Table 4.10 show that on plots managed by men, 80% of the total average workdays per hectare were contributed by men, 7% by women, and 13% by children. On plots managed by women, these figures are 83%, 13%, and 4%, respectively. As evident, men contribute a far greater percentage of the total average workday per hectare for storage of production from plots managed by women (83%) than women contribute for plots managed by men (7%).

As for other diverse activities such as field guarding and inspection, men contributed all labor for such tasks on plots under their management and women farmers in Maiguero reported no such activity.

Use of Labor of Men, Women, and Children by Crop

Millet--As shown in Table 4.11, the total average of all workdays per hectare for all tasks for millet production indicate that the patterns of the average use of labor of men, women, and children in Tchizon and Maiguero are very similar. For all tasks for millet production in Tchizon, men contributed 57% of the average workdays per hectare, women 35%, and children 8%. For Maiguero, these percentages are 53%, 40%, and 7%, respectively.

The data for land preparation for millet in Tchizon, the staple food crop of the Maradi region, show that 85% of the total average workdays per hectare for this activity were contributed by men, 11% by women, and 4% by children. The corresponding figures for Maiguero are 70%, 15%, and 15%, respectively. In terms of average workdays per hectare, children in Maiguero make a greater labor contribution (15%) for this activity than those in Tchizon (4%). Also interesting is a village comparison of the joint contribution of women and children for land preparation for millet. Women (15%) and children (15%) jointly contribute 30% of the total average workdays per hectare for this task in Maiguero, but in Tchizon the joint contribution of women (11%) and children (4%) is only 15%.

The data on the average use of labor of men, women, and children for planting millet in Tchizon show that men contributed 47% of the total average workdays per hectare for this activity, women 42%, and children 11%. Thus, the joint labor contribution of women and children (53%) for this activity in Tchizon exceeds that of men (47%). Planting work for millet in Maiguero is also rather equally shared between men who contributed 43% of the total average workdays per hectare and women who contributed 48%. But again the joint labor contribution of women and children for this task (57%) exceeds that of men (43%).

Weeding work for millet is also rather equitably shared between men and women in both villages. In Tchizon, men contributed 50% of the total average workdays per hectare for this task. This percentage for Maiguero is 52%. Women in Tchizon and Maiguero made an equal contribution to weeding millet in their respective villages, 40% of the average workdays. Children in

Table 4.11. Average Use of Labor of Men, Women, and Children for Millet by Activity and Village

Activity	Village							
	Tchizon				Maiguero			
	Men	Women	Children	Total	Men	Women	Children	Total
	(workdays/ha)							
Land preparation	2.3	0.3	0.1	2.7	1.9	0.4	0.4	2.7
	(85)	(11)	(4)	(100)	(70)	(15)	(15)	(100)
Planting	0.9	0.8	0.2	1.9	1.0	1.1	0.2	2.3
	(47)	(42)	(11)	(100)	(43)	(48)	(9)	(100)
Weeding	6.5	5.3	1.3	13.1	6.8	5.3	1.0	13.1
	(50)	(40)	(10)	(100)	(52)	(40)	(8)	(100)
Harvesting	1.4	1.3	0.3	3.0	2.0	1.8	0.2	4.0
	(47)	(43)	(10)	(100)	(50)	(45)	(5)	(100)
Marketing	-	-	-	-	0.6	-	-	0.6
					(100)			(100)
TOTAL[a]	11.1	7.7	1.9	20.7	12.3	8.6	1.8	22.7
	(54)	(37)	(9)	(100)	(54)	(39)	(7)	(100)
Fertilizer application	1.0	0.4	0.1	1.5	0.2	2.8	-	3.0
	(67)	(27)	(6)	(100)	(7)	(93)		(100)
Pest control	1.7	0.2	-	1.9	-	-	-	-
	(89)	(11)		(100)				
Storage	0.8	0.5	0.1	1.4	1.3	0.1	0.2	1.6
	(57)	(36)	(7)	(100)	(81)	(6)	(13)	(100)
Other activities	-	-	-	-	1.2	-	-	1.2
					(100)			(100)
TOTAL[b]	14.6	8.8	2.1	25.5	15.0	11.5	2.0	28.5
	(57)	(35)	(8)	(100)	(53)	(40)	(7)	(100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Tchizon contribute slightly greater percentage of the average workdays for weeding millet (10%) than those in Maiguero (8%).

Harvesting work for millet is also rather equitably shared between men and women in the experimental and control villages. In Tchizon, men contributed 47% of the total average workdays per hectare for this task and for Maiguero this figure is 50%. Women in Tchizon contributed 43% of the average workdays for this task and women in Maiguero 45%. The labor contribution of children for this activity in Tchizon in average workdays (10%) exceeds that of children in Maiguero (5%). No marketing activity was reported in Tchizon and men exclusively performed this activity in Maiguero.

For the dominant labor activities of land preparation, planting, weeding, harvesting, and marketing of millet, the aggregate percentages in Table 4.11 show that the labor for these activities is predominately but not exclusively contributed by men. Men in Tchizon and Maiguero both contribute 54% of the total average workdays per hectare for these activities in their respective villages. These percentages for women in Tchizon (37%) and Maiguero (39%) are also remarkably similar. The labor contributions of children in Tchizon (9%) and Maiguero (7%) for the dominate activities are less than 10% of aggregate total average workdays.

The proportional labor contributions of men, women, and children for fertilizer application on plots with millet show some interesting variation. In Tchizon men contribute 67% of the total average workday per hectare for this task, women 27%, and children 6%. In Maiguero women contribute 93% of the total average workdays per hectare for this task and men a mere 7%. These percentages again show the risks of generalizations about gender and the division of agricultural labor in West Africa.

In Tchizon the control of millet pests is predominately an activity of men who contributed 89% of the total average workdays per hectare for this task. Women contributed 11% of such days and children in Tchizon made no labor contributions for this task. No pest control work in Maiguero was reported.

In both villages the storage of millet is an activity where the labor of men is predominant. In Tchizon men contributed 57% of the total average workdays per hectare for this task, women contributed 36%, and children 7%. Compared to Tchizon, the labor contribution of men in Maiguero for storage is far more pronounced where men contributed 81% of the total average workdays per hectare for this task, women 6%, and children 13%.

Other agricultural activities such as field guarding and inspection were not observed in Tchizon and were performed exclusively by men in Maiguero.

Sole Crop Sorghum--The total figures for the average workdays per hectare of men, women, and children for sorghum in Tchizon shown in Table 4.12 indicate that men contributed 54% of the total average workdays for all activities, women 36%, and children 10%. Thus, sorghum in Tchizon is predominately but not exclusively tended by men. These figures for sorghum in Maiguero suggest that work for this crop is more equally shared between men and women than in Tchizon. In contrast, these percentages for Maiguero are 46%, 51%, and 3%, respectively.

The proportional labor contributions of men, women, and children for land preparation for sorghum in Tchizon show that this activity is performed primarily by men who contributed 76% of the total average workdays per hectare. The percentages for the labor contribution of women and children are 16% and 8% for this task, respectively.

In Maiguero children made no labor contribution to land preparation for sorghum. Like Tchizon, men in Maiguero contributed more of the total average workdays per hectare for this activity (71%) than women (29%).

Planting sorghum is an activity that is rather equitably shared between men and women in both villages, especially in Tchizon where the contributions of men and women to the total average workdays per hectare are equal (43%). Children in Tchizon contributed 14% of the average workdays per hectare for planting sorghum, but children in Maiguero made no labor contribution for this activity. Women in Maiguero contribute a somewhat greater percentage of the average workdays per hectare for planting sorghum (52%) than men (48%).

Men in Tchizon and Maiguero contribute a greater proportion of the total average workdays for weeding sorghum than women, 46% and 53% of the average workdays, respectively. But, for the labor contribution of women in Maiguero for this activity, 45% of the total average workdays per hectare slightly exceeds that of women in Tchizon, 42%. Children in Tchizon made a substantial labor contribution for weeding sorghum; 12% of the total average workdays per hectare for this activity, compared to that of children in Maiguero (2%).

Table 4.12. Average Use of Labor of Men, Women, and Children for Sole Crop Sorghum by Activity and Village

Activity	Village							
	Tchizon				Maiguero			
	Men	Women	Children	Total	Men	Women	Children	Total
	(workdays/ha)							
Land preparation	2.8 (76)	0.6 (16)	0.3 (8)	3.7 (100)	1.2 (71)	0.5 (29)	-	1.7 (100)
Planting	0.9 (43)	0.9 (43)	0.3 (14)	2.1 (100)	1.0 (48)	1.1 (52)	-	2.1 (100)
Weeding	8.3 (46)	7.5 (42)	2.2 (12)	18.0 (100)	5.0 (53)	4.3 (45)	0.2 (2)	9.5 (100)
Harvesting	1.3 (48)	1.1 (41)	0.3 (11)	2.7 (100)	1.4 (39)	2.0 (56)	0.2 (5)	3.6 (100)
Marketing	-	-	-	-	-	-	0.3 (100)	0.3 (100)
TOTAL[a]	13.3 (50)	10.1 (38)	3.1 (12)	26.5 (100)	8.6 (50)	7.9 (46)	0.7 (4)	17.2 (100)
Fertilizer application	1.2 (67)	0.5 (28)	0.1 (5)	1.8 (100)	-	5.3 (100)	-	5.3 (100)
Pest control	1.8 (78)	0.5 (22)	-	2.3 (100)	-	-	-	-
Storage	1.2 (55)	0.7 (32)	0.3 (13)	2.2 (100)	1.3 (93)	-	0.1 (7)	1.4 (100)
Other activities	0.4 (100)	-	-	0.4 (100)	2.0 (100)	-	-	2.0 (100)
TOTAL[b]	17.9 (54)	11.8 (36)	3.5 (10)	33.2 (100)	11.9 (46)	13.2 (51)	0.8 (3)	25.9 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

The proportions of the average workdays contributed by men and women in Tchizon for harvesting sorghum are similar, 48% and 41%, respectively. Children in Tchizon contributed 11% of the average workdays for this activity. However, the pattern of labor in Maiguero for harvesting sorghum is different in that women contributed 56% of the average workdays for this activity, men 39%, and children 5%. These differences again show that generalizations about the agricultural division of labor in West Africa are tenuous at best.

Fertilizer application for sorghum is primarily an activity of men in Tchizon who contributed 67% of the total average workdays per hectare for this activity, women contributed 28%, and children 5%. Interestingly, women contributed 100% of the workdays for this activity in Maiguero. This figure again shows the risks of generalizations about gender and agricultural labor in West Africa.

Pest control for sorghum in Tchizon is again an activity that is conducted primarily by men who contributed 78% of the total average workdays per hectare, women 22%, and children in Tchizon made no labor contribution for this task. No pest control work was reported by the sample in Maiguero.

The labor for storing sorghum is provided primarily by men in Tchizon and almost exclusively by men in Maiguero. In Tchizon men contributed 55% of the total average workdays per hectare for this activity, women 32%, and children 13%. In Maiguero men contributed 93% of the average workdays and children 7%. Women in Maiguero made no labor contribution to harvesting sorghum. The labor for other activities such as field guarding and inspection for sorghum was contributed exclusively by men in both villages.

Intercropped Millet-Sorghum--Table 4.13 shows data on the labor contributions of men, women, and children for intercropped millet-sorghum. The total figures for all activities show differences in the division of labor for this intercrop by village and gender. For all activities in Tchizon, men contributed 70% of the total average workdays per hectare, women 26%, and children 4%. Thus, men are the predominant source of labor for millet-sorghum in Tchizon.

A distinctly different pattern of labor for millet-sorghum was observed in Maiguero where the proportional labor contributions of men and women for this intercrop are more equal. Of the total average workdays per hectare for millet-sorghum in Maiguero, men contributed 43%, women 51%, and children 6%. Thus, women in Maiguero contribute a greater percentage of the

total average workdays per hectare for millet-sorghum (51%) than those in Tchizon (26%).

Table 4.13. Average Use of Labor of Men, Women, and Children for Intercropped Millet-Sorghum by Activity and Village

Activity	Village							
	Tchizon				Maiguero			
	Men	Women	Children	Total	Men	Women	Children	Total
	(workdays/ha)							
Land preparation	1.5 (94)	-	0.1 (6)	1.6 (100)	1.8 (62)	0.7 (24)	0.4 (14)	2.9 (100)
Planting	0.5 (45)	0.5 (45)	0.1 (10)	1.1 (100)	0.8 (35)	1.4 (61)	0.1 (4)	2.3 (100)
Weeding	2.6 (57)	1.7 (37)	0.3 (6)	4.6 (100)	5.1 (44)	5.9 (50)	0.7 (6)	11.7 (100)
Harvesting	0.9 (64)	0.5 (36)	-	1.4 (100)	1.4 (35)	2.4 (60)	0.2 (5)	4.0 (100)
Marketing	-	-	-	-	0.9 (100)	-	-	0.9 (100)
TOTAL[a]	5.5 (63)	2.7 (31)	0.5 (6)	8.7 (100)	10.0 (46)	10.4 (48)	1.4 (6)	21.8 (100)
Fertilizer application	0.5 (71)	0.2 (29)	-	0.7 (100)	-	2.9 (100)	-	2.9 (100)
Pest control	0.9 (100)	-	-	0.9 (100)	-	-	-	-
Storage	0.9 (82)	0.2 (18)	-	1.1 (100)	1.4 (74)	0.4 (21)	0.1 (5)	1.9 (100)
Other activities	0.4 (100)	-	-	0.4 (100)	-	-	-	-
TOTAL[b]	8.2 (70)	3.1 (26)	0.5 (4)	11.8 (100)	11.4 (43)	13.7 (51)	1.5 (6)	26.6 (100)

a. Includes dominant labor activities (80%-90%) for the sampled plots.
b. Includes all activities present (10%-20%) for the sampled plots. Figures in parentheses are rounded percentages.

Land preparation for millet-sorghum is an activity where men make the predominant labor contribution in both villages. Women in Tchizon made no labor contribution for preparing land for millet-sorghum, but men contributed 94% of the total average workdays per hectare, and children 6%. Men in Maiguero also make the dominant labor contribution for land preparation for this intercrop but not as dominant as Tchizon. The figures for Maiguero show that men contributed 62% of the total average workdays per hectare for this activity, women 24%, and children 14%. Two points of comparison are noteworthy here. First, women do contribute labor for land preparation in West Africa and one may speculate the soil type may be a contributing factor. The soil of Tchizon is light, sandy, and easily worked, but the soil in Maiguero is heavy and thus requires more labor. Therefore, women and children in Maiguero contribute more of the average workdays per hectare for land preparation than those in Tchizon.

The division of labor for planting the millet-sorghum intercrop also shows variation by gender and village. In Tchizon the proportional labor contributions of men and women are equal; 45% of the total average workdays per hectare for this activity. Children contributed 10% of such workdays. The pattern of labor in Maiguero is different where men contributed 35% of the total average workdays per hectare for this activity, women 61%, and children 4%.

Labor for weeding work for intercropped millet-sorghum in Tchizon is predominately, but not exclusively, contributed by men who performed 57% of the total average workdays per hectare for weeding, women contributed 37%, and children 6%. The proportional labor contributions of women in Maiguero for weeding millet-sorghum are far more than in Tchizon, 50% of the average workdays. Children in Maiguero contributed 6% of the total average workdays per hectare for this task, a proportion equal to that of children in Tchizon.

The proportional labor contributions of men and women for harvesting millet-sorghum show substantial contrasts between villages. In Tchizon men contributed 64% of the total average workdays per hectare for this activity, women 36%, and children made no labor contribution. The proportional labor contributions of men and women for harvesting millet-sorghum are reversed in Maiguero where men contributed 35% of the average workdays, women 60%, and children 5%.

The predominance of subsistence agriculture in the Sahel is evident in that marketing activity for millet and sorghum is virtually nil in Maiguero, 0.9 average workdays, and nil in Tchizon.

The total figures for the average workdays per hectare for the major activities of land preparation, planting, weeding, and harvesting in Tchizon show that men contributed 63% of the average workdays for millet-sorghum, women 31%, and children 6%. But these figures for Maiguero show that overall these tasks are remarkably shared between men who contributed 46% of the average workdays and women who contributed 48%. These figures again show the risk of generalizations about the roles of men and women in sub-Saharan agriculture.

In Tchizon fertilizer application on plots of millet-sorghum is predominately, but not exclusively, a labor activity of men who contributed 71% of the average workdays for this task, women contributed 29%, and children in Tchizon made no labor contribution. Interestingly, in Maiguero women contributed 100% of the workdays for this task.

No pest control work was reported by the sample in Maiguero and this activity was minimal in Tchizon (0.9 average workdays per hectare) where men contributed 100% of the labor.

Labor for storage work for intercropped millet-sorghum is predominately, but not exclusively, contributed by men in both villages. In Tchizon 82% of the total average workdays per hectare for this activity were contributed by men and women contributed 18%; children in Tchizon made no contribution to this activity. In Maiguero the labor contributions of women and children, 21% and 5% of the average workdays per hectare, exceed that of women and children in Tchizon. But men in Maiguero also contribute the majority of the average workdays per hectare for this activity (74%).

No other diverse activities for millet-sorghum were reported in Maiguero and such activities were minimal in Tchizon (0.4 average workdays per hectare) and performed exclusively by men.

All Crops--A summary of the average total use of labor of men, women, and children per hectare by crop for Tchizon and Maiguero is provided in Table 4.14. It is clear from the total figures that, with the exception of sole cropped cowpeas in Tchizon, more than two-thirds of all workdavs for the various crops and intercrops were contributed by men.

Total 4.14. Average Total Use of Labor of Men, Women, and Children by Crop and Village

Crop	Village							
	Tchizon				Maiguero			
	Men	Women	Children	Total	Men	Women	Children	Total
	(workdays/ha)							
Cowpeas	13.9	11.7	4.2	29.8	-	-	-	-
	(47)	(39)	(14)	(100)				
Millet-sorghum-cowpeas	14.2	5.7	0.6	20.5	21.2	3.0	2.5	26.7
	(69)	(29)	(2)	(100)	(79)	(11)	(10)	(100)
Millet-peanuts	9.4	3.1	0.9	13.4	4.8	9.0	1.9	15.7
	(70)	(23)	(7)	(100)	(31)	(57)	(12)	(100)
Millet-cowpeas	11.2	3.4	0.1	14.7	22.2	17.3	-	39.5
	(76)	(23)	(1)	(100)	(56)	(44)		(100)
Other millet intercrops	6.4	1.3	0.4	8.1	9.1	9.8	1.5	20.4
	(79)	(16)	(5)	(100)	(45)	(48)	(7)	(100)
Other sorghum intercrops	16.7	5.3	1.2	23.2	17.1	9.4	0.6	27.1
	(72)	(23)	(5)	(100)	(63)	(35)	(2)	(100)
Other crops	19.7	7.2	-	26.9	8.8	20.4	1.9	31.1
	(73)	(27)		(100)	(28)	(66)	(6)	(100)
TOTAL	91.5	37.7	7.4	136.6	83.2	68.9	8.4	160.5
	(67)	(28)	(5)	(100)	(52)	(43)	(5)	(100)

Figures in parentheses are rounded percentages.

It is also evident that the labor of men in Tchizon is most dominant in the production of various millet intercrops, in that 79% of the average workdays per hectare were contributed by men and 16% by women. The difference in the labor contribution by gender in Tchizon narrows somewhat for the sole crop of cowpeas where men and women, respectively, contribute 47% and 39% of the average workdays per hectare. Notably, 14% of the average workdays for this crop is accounted for by children.

In Maiguero, three patterns emerge from the data on the use of labor of men, women, and children for all crops. The labor of women is dominant in the production of the millet-peanut intercrop, as they account for more than one-half (57%) of the average workdays for the production of this intercrop.

Men and children, respectively, accounted for 31% and 12% of the average workdays for this intercrop.

The production of the millet-sorghum-cowpeas, millet-cowpeas, and other sorghum intercrops is dominated by the labor of men. Men performed 79%, 56%, and 63% of the average workdays for these intercrops, respectively. The labor of men and women for other millet intercrops is somewhat shared equally by men (45%) and women (48%) in Maiguero. Finally, unlike in Tchizon, the labor of children in Maiguero is primarily for millet-sorghum intercrop (9%), millet-peanuts (12%), and other millet intercrops (7%).

Use of Fertilizer

Table 4.15 shows present and past use of fertilizer by village and gender. The total sample figures show that approximately one-third (32%) of farmers in both villages used fertilizers during the survey year. It is also evident from the total sample figures that men (34%) are more likely than women (19%) to have used fertilizers during the 1988 cropping season.

Table 4.15. Present and Past Use of Fertilizers by Gender, Village, and Total Sample

	Farmers Using Fertilizer This Season (%)	Prior Use of Fertilizer[a] (%)
Tchizon		
Men	56	95
Women	41	20
TOTAL	52	71
Maiguero		
Men	15	29
Women	0	0
TOTAL	10	19
Total sample		
Men	34	54
Women	19	7
TOTAL	32	39

a. Farmers that have used fertilizer at least once prior to the survey year.

In the experimental village of Tchizon, about one-half (52%) of farmers interviewed reported using fertilizer during the survey year. But in Maiguero, the control village, only 10% of the sample farmers reported using fertilizers. Fertilizer use during the survey year was highest among men in Tchizon (56%), followed by women in Tchizon (41%), and men in Maiguero (15%). Women farmers in Maiguero did not report using fertilizers during the survey year.

Also shown in Table 4.15 are figures describing the use of fertilizer prior to the survey cropping season. The total sample figures show that the percentage of men farmers who used fertilizers at least once in the past (54%) is much greater than women (7%). In Tchizon, 95% of the men farmers in the sample used fertilizers at least once in the past compared with 20% of women farmers. The pattern of fertilizer use for Maiguero shows that 29% of the men farmers used fertilizers at least once prior to the survey year, but no women reported ever using fertilizer. Women in Maiguero who reported workdays for fertilizer application (Tables 4.8 and 4.13) probably performed the activity on household plots not on individual plots. Overall, the percentage of farmers in the two villages having used fertilizers at least once prior to the survey year (39%) was higher than the percentage who used fertilizers during the survey year (32%). But among women, there was an increase from 7% past users to 19% current users of fertilizers.

Farmers also were asked to explain why the use of fertilizers was discontinued. As shown in Table 4.16, 84% of the total sample reported a lack of money as a reason for discontinued use, 13% cited excessive weeds, and 3% mentioned risks such as bad weather and crop failure, situations where an investment in fertilizer would be lost.

Table 4.16. Percentage Distributions of Reasons Given by Farmers for Discontinuing the Use of Fertilizers by Village and Total Sample

Reasons	Village		
	Tchizon	Maiguero	Total Sample
	(%)		
Lack of money	96	64	84
Excessive weeds	4	29	13
Risks/other	-	7	3
TOTAL	100	100	100

In Tchizon, 96% of sampled farmers cited lack of money and the remaining 4% cited excess weeds as the main reasons for discontinuing the use of fertilizers. Compared with Tchizon, fewer farmers who discontinued the use of fertilizers cited lack of money as a reason (64%), 29% cited excessive weeds, and 7% mentioned various risks.

The descriptive data in Table 4.17 show the percentage of plots receiving fertilizer by crop, village, and total sample. It is clear from the data that fertilizer use in both villages is minimal in that only 2% of all sampled plots in Maiguero received fertilizers during the survey season and only 13% of all sampled plots in Tchizon.

Table 4.17. Percentages of Plots with Fertilizer by Crop, Village, and Total Sample

Crop	Village		Total Sample
	Tchizon	Maiguero	
	(% of plots)		
Millet	12	2	8
Sorghum	11	1	7
Cowpeas	5	-	5
Millet-sorghum	14	2	4
Cowpeas-millet-sorghum	17	-	14
Millet-peanuts	-	-	-
Millet-cowpeas	15	-	11
Other millet intercrops	27	3	11
Other sorghum intercrops	20	3	11
Other crops[a]	20	-	14
Total sample	13	2	8

a. Other crops include souchet (tiger nuts), tobacco, cotton, and assorted vegetables.

A striking contrast in choices of crops to fertilize is also evident from Table 4.17. In Tchizon, fertilizers were used on 17% and 15% of all plots with the cowpea-millet-sorghum and millet-cowpea intercrops, respectively, but none of the plots with these intercrops were fertilized in Maiguero. Overall, with the exception of the millet-peanut intercrop, the percentages of plots on which fertilizers were used for all crops and intercrops were consistently higher in Tchizon than in Maiguero. The

importance of various millet-based intercrops in Tchizon is evident in that 27% of such plots were fertilized.

Additional data on fertilizer use in the sample villages with regard to the type of fertilizer and quantity used in kilograms per hectare for sole intercrops is shown in Table 4.18 for Tchizon and Table 4.19 for Maiguero.

Table 4.18. Average Rate of Fertilizer Use by Type and Crop in Tchizon

Crop	Type of Fertilizer					Total All Fertilizers
	Urea	SSP	15-15-15	TSP	Tahoua PR	
	- - - - - - - - - - (kg/ha) - - - - - - - -					(kg/ha)
Millet	32	60	44	26	28	43
Sorghum	43	64	15	100	7	47
Cowpeas	100	-	-	9	-	55
Millet-sorghum	12	58	25	-	-	27
Cowpeas-millet-sorghum	23	108	48	-	-	50
Millet-cowpeas	36	47	67	-	-	44
Other millet intercrops	25	100	33	17	13	43
Other sorghum intercrops	25	71	75	-	-	63
Other crops[a]	-	167	67	-	-	127
Total sample	32	75	46	32	19	48

a. Other crops include souchet and vegetables.

Table 4.19. Average Rates of Fertilizer Use by Type and Crop in Maiguero

Crop	Type of Fertilizer			Total All Fertilizers
	Urea	SSP	Tahoua PR	
	- - - - - (kg/ha) - - - - -			(kg/ha)
Millet	-	53	100	62
Sorghum	-	50	-	50
Millet-sorghum	50	29	-	34
Other millet intercrops	-	33	-	33
Other sorghum intercrops	5	-	-	5
Total sample	28	41	100	44

Farmers in Tchizon reported using five types of fertilizers, namely urea, SSP, NPK as 15-15-15, TSP, and indigenous Tahoua ground phosphate rock (GPR). The total figures show that the average rate of fertilizer use for all fertilizers in Tchizon was 48 kg/ha for all crops. It is also evident from these data that on the average, SSP (75 kg/ha) and 15-15-15 (46 kg/ha) were the most widely used and popular fertilizers in terms of the quantity used per hectare and the range of crops and intercrops fertilized. The ground Tahoua phosphate rock (19 kg/ha) was least used and was limited to the sole crops of millet and sorghum and other millet intercrops.

Virtually all the various crops and intercrops received some urea applications at rates ranging from 12 kg/ha on the millet-sorghum intercrop to 100 kg/ha on the sole crop of cowpeas, a cash crop.

Table 4.19 shows that urea, SSP, and Tahoua PR were the three main types of fertilizers used by farmers in Maiguero during the survey year. SSP and Tahoua PR, the two principal sources of P, were applied by farmers at average rates of 41 kg/ha and 100 kg/ha, respectively. But the Tahoua PR was only used by farmers on plots with the sole crop of millet.

Thus, compared with Tchizon, the average level of fertilizer use in Maiguero during the survey year was low regardless of the type of fertilizer. Also, farmers in Tchizon used twice as many sources of P as farmers in Maiguero.

A final observation about fertilizer use in the two sample villages concerns methods of fertilizer application. As shown in Table 4.20, approximately two-thirds (64%) of the 126 sampled farmers used the broadcast method, 15% applied fertilizers by the method of point placement, and 12% by sidedressing. Banding (9%) was the least used method of fertilizer application in the two sample villages.

Table 4.20. Frequency Distribution of Methods of Fertilizer Application Used by Farmers in Tchizon and Maiguero

Method of Application	N	%
Broadcast	81	64
Point placement	19	15
Sidedressing	15	12
Banding	11	9
TOTAL	126	100

Use of Organic Manure

Farmers in the two sample villages use organic manure from two principal sources, namely, animal manure and plant residue. Approximately 86% of the total sample used organic manure during the survey year. The percentage of farmers using organic manure was slightly higher in Maiguero (88%) than in Tchizon (83%).

Regarding past use of organic manure, in Tchizon approximately 36% of sample farmers used organic manure at least once prior to the survey year. The corresponding percentage for Maiguero is 57%. Sixty-three percent of the farmers never used organic manure and reported lack of transportation as the main constraint. Two farmers cited limited availability and one farmer mentioned risk as the main constraints to the use of organic manure. Overall, a significant proportion of farmers in Tchizon and Maiguero use organic manure, but the main constraint to more extensive use is limited availability.

Use of Agricultural Credit

The use of agricultural credit, regardless of gender, was very minimal in the two sample villages as 95% of the total sample did not use agricultural credit of any sort during the survey year. Of the seven farmers (5%) who used agricultural credit, four borrowed money from a friend, one from a family member, and one borrowed money from an individual lender. It is significant to note that approximately 97% of the total sample of farmers who did not use credit made no attempt to obtain a loan.

As shown in Table 4.21, more than one-half (59%) of the total sample reported not being able to find a lender as a reason for not using agricultural credit. Other reasons were: loan not needed (15%), expected disapproval (10%), fear of debt (11%), and high interest rates (5%). There were remarkable differences between farmers in the two villages with regard to the reasons cited.

In Tchizon, 19% of the farmers said credit was not needed because assistance from family members was available, reliance on their own resources was preferable to debt, and 16% did not expect loan approval regardless of potential source. Only one farmer in each case cited fear of debt due to crop failure and high interest rates as reasons for not seeking an agricultural loan.

Table 4.21. Percentage Distribution of Reasons Given by Farmers for Not Trying to Borrow Money by Village

Reasons	Village: Tchizon N	Tchizon %	Maiguero N	Maiguero %	Total Sample N	Total Sample %
Did not find lender	39	61	30	56	69	59
Loan not needed	12	19	5	9	17	15
Expected disapproval	10	16	2	4	12	10
Fear of debt	1	2	12	22	13	11
High interest rates	1	2	5	9	6	5
Total sample	63	100	54	100	117	100

By contrast, in Maiguero only 9% said a loan was not needed, approximately one-quarter (22%) cited fear of debt, about 4% did not expect a loan request to be approved, and 9% cited high interest rates as a reason for not attempting to obtain a loan.

Thus, although farmers in Tchizon compared with their counterparts in Maiguero appear more skeptical about obtaining agricultural credit, they seem to have a more favorable attitude toward credit as evidenced by the fact that only about 2% of the farmers did not try to borrow money for fear of being indebted.

Disposal and Use of Crop Production

Table 5.1 shows the disposal and use of all crops including the two main cereals (millet and sorghum) and the principal legumes in Tchizon (cowpeas) and Maiguero (peanuts). In Tchizon, 80% of the total output from all crops was designated for household use, 4% exclusively for market sale, 2% for the dual purposes of consumption and sale, and 13% was reported lost to pests. Only 1% of all crops was designated for storage.

Unlike in Tchizon, farmers in Maiguero reported losing only 1% of all crops to pests, 74% was used exclusively for household consumption, 13% for the dual purpose of household consumption and sale, and a significant 12% intended exclusively for the market sale. Thus, although farmers in both

villages are clearly subsistence oriented, those in Maiguero appear more interested in market sales.

Table 5.1. Percentage Distribution of Uses and Disposal of Crop Products by Village

Use	Tchizon				Maiguero			
	Millet	Sorghum	Cowpeas	All Crops	Millet	Sorghum	Peanuts	All Crops
	(%)							
Household consumption and sale	2	-	-	2	21	-	-	13
Sale	2	-	8	4	7	-	80	12
Household consumption	85	80	92	80	72	97	10	74
Storage	1	-	-	1	-	-	-	-
Lost to pests	10	20	-	13	-	3	10	1
TOTAL	100	100	100	100	100	100	100	100

Table 5.1 further shows that in both villages sorghum is a crop used for household consumption, 85% in Tchizon and 97% in Maiguero. In Maiguero, 80% of the peanut production and 7% of millet were intended exclusively for market sale compared to only 8% of cowpeas and only 2% of millet in Tchizon. The higher incidence of pests in Tchizon compared to Maiguero probably explains why farmers in Tchizon sell smaller quantities of crop production.

Place of Sale for All Crops

Table 5.2 provides descriptive information on the locations where farmers sold produce by village and the total sample. The total sample figures show that 13% of all crop sales were made in the village of residence, but farmers in Tchizon (17%) were somewhat more likely to sell produce in their village than farmers in Maiguero (13%).

Table 5.2. Percentage Distribution of Places of Sale for All Crops by Village and Total Sample

Place of Sale	Village: Tchizon (%)	Village: Maiguero (%)	Total Sample (%)
In village	17	13	13
Tchadoua	83	-	17
Gabi	-	87	70
TOTAL	100	100	100

It is also clear from Table 5.2 that farmers in both villages rely heavily on small market centers for crop sales that are close to the villages rather than larger and more distant markets at Maradi (approximately 30 km). Farmers in Tchizon sold 83% of all production that was sold in the neighboring village of Tchadoua (4 km). Farmers in Maiguero sold 87% of all their crops intended for sale in nearby Gabi (3 km). Inadequate means of public transportation and near universal reliance on transportation by foot and farm animals probably explain why farmers make sales at market centers close to their respective villages.

Household Responsibility for Crop Sales

Table 5.3 shows the percentage distribution of the persons responsible for the sale of crops by village and the total sample.

Table 5.3. Percentage Distribution of Persons Responsible for Crop Sales by Village and Total Sample

Person Making Sales	Village: Tchizon (%)	Village: Maiguero (%)	Total Sample (%)
Farmer	100	88	90
Farmer's daughter	-	8	7
Farmer's son	-	4	3
TOTAL	100	100	100

Figures for the total sample show that 90% of the farmers were responsible for selling their own crops and 10% was sold by their sons (3%) and daughters (7%). In Tchizon farmers themselves are responsible for selling production. This is also the case in Maiguero, but unlike Tchizon, daughters and sons of farmers assist in selling crops.

Sources of Agricultural Information

Farmers in the study area receive agricultural information from a variety of sources. Table 6.1 provides descriptive data on the perceptions of farmers about the value of agricultural information received from four sources.

Table 6.1. Perceptions About the Value of Agricultural Information From Various Sources by Village

Sources of Information	Very Helpful		Somewhat Helpful		Not Helpful		Uncertain	
	Tchizon	Maiguero	Tchizon	Maiguero	Tchizon	Maiguero	Tchizon	Maiguero
	(%)							
Cooperatives	95	67	3	33	2	-	-	-
Extension workers	97	91	3	4	0	-	-	5
Other farmers	83	91	16	5	1	0	-	4
Fertilizer dealers	80	97	17	3	3	0	-	-

Table 6.1 shows that 95% of farmers in Tchizon describe agricultural information from cooperatives as very helpful, 3% view it as somewhat helpful, and 2% perceive the value of such information as not helpful. Among farmers in Maiguero, 67% view information from cooperatives as very helpful and 33% describe such information as somewhat helpful.

Concerning the value of information from extension workers, 97% of the farmers in Tchizon perceive information from this source as very helpful and 3% describe such information as somewhat helpful. A similar evaluation of information from extension workers was reported by farmers in Maiguero where 95% of respondents characterize the value of information from extension workers as very helpful (91%) or somewhat helpful (4%).

Farmers in Maiguero (91%) perceive information from other farmers as very helpful, 5% view information from this source as somewhat helpful, and 4% are uncertain about the value of information from other farmers. The corresponding figures on information from other farmers in Tchizon are very helpful (83%), somewhat helpful (16%), and not helpful (1%). Regarding fertilizer dealers, 3% of farmers in Tchizon perceive agricultural information from this source as not helpful, but 80% perceive information from this source as very helpful. Farmers in Maiguero view information from fertilizer dealers as very helpful (97%) or somewhat helpful (3%).

Further insights into farmers' perceptions about the value of agricultural information from various sources are provided in Table 6.2 for Tchizon and Table 6.3 for Maiguero.

Table 6.2. Perceptions About the Value of Agricultural Information From Various Sources in Tchizon by Gender

Sources of Information	Perceptions of Farmers			
	Very Helpful	Somewhat Helpful	Not Helpful	Uncertain
	(%)			
Gender				
Men				
Cooperatives	90	6	4	-
Extension workers	94	6	-	-
Other farmers	66	32	2	-
Fertilizer dealers	59	35	6	-
Women				
Cooperatives	100	-	-	-
Extension workers	100	-	-	-
Other farmers	100	-	-	-
Fertilizer dealers	100	-	-	-

Table 6.3. Perceptions About the Value of Agricultural Information From Various Sources in Maiguero by Gender

Sources of Information	Perceptions of Farmers			
	Very Helpful	Somewhat Helpful	Not Helpful	Uncertain
	(%)			
Gender				
Men				
Cooperatives	67	33	-	-
Extension workers	82	7	-	11
Other farmers	90	10	-	-
Fertilizers dealers	94	6	-	-
Women				
Cooperatives	-	-	-	-
Extension workers	100	-	-	-
Other farmers	92	-	-	8
Fertilizers dealers	100	-	-	-

Table 6.2 shows that in Tchizon 90% of the men farmers find information from agricultural cooperatives very helpful, 6% characterize such information somewhat helpful, and only 4% view such information not helpful. The perceptions of men farmers about the value of agricultural information from extension workers are about the same as that from agricultural cooperatives except that, unlike the latter source, information from extension workers is perceived as very helpful (94%) or somewhat helpful (6%).

Regarding the value of agricultural information from other farmers, two-thirds (66%) of men farmers in Tchizon perceive the value of such information as very helpful; the remainder view it as somewhat helpful (32%) or not helpful (2%).

Among men farmers in Tchizon 6% describe agricultural information from fertilizer dealers as not helpful, 35% perceive information from this source as somewhat helpful, and 59% perceive information as very helpful. Recent isolated incidents of adulteration by a few fertilizer dealers in Tchizon probably explain why farmers appear skeptical about the value of agricultural information this source.

The figures describing the perceptions of women farmers in Tchizon about the value of agricultural information from the various sources show a universal positive evaluation of all four sources. Hausa women rarely, if

ever, participate in the activities of agricultural cooperatives and contact with fertilizer dealers and extension workers is limited. Thus, the responses of women in Table 6.2 show a reluctance to be critical and an interest in giving polite answers.

Table 6.3 provides descriptive information on the perceptions of men and women farmers in Maiguero about the value of agricultural information from various sources.

Approximately two-thirds (67%) of men farmers in Maiguero perceive agricultural information from agricultural cooperatives very helpful and 33% view such information as somewhat helpful. That women in Maiguero are generally excluded from participation in cooperatives is evident in that they evidently have no basis to gauge the value of agricultural information from cooperatives.

All sampled women (100%) and 82% of sampled men in Maiguero perceive agricultural information from extension workers to be very helpful. But 11% of the men farmers are uncertain about the value of such information, 7% describe such information from extension workers as somewhat helpful. In Maiguero 90% of men and 92% of women farmers characterize information from other farmers as very helpful. Only a small minority of women (8%) in Maiguero are uncertain about the value of agricultural information from other farmers.

But as in Tchizon, 100% of all women farmers in Maiguero perceive the value of agricultural information from fertilizer dealers to be very helpful. Again, this observation suggests that Hausa women are reluctant to be critical. However, unlike in Tchizon, men in Maiguero find agricultural information from fertilizer dealers very helpful (94%) or somewhat helpful (6%).

Overall, farmers in Tchizon, the experimental village, are more likely to perceive agricultural information from cooperative and extension workers positively than farmers in Maiguero, the control village. The rather high confidence farmers in Tchizon have in extension workers suggests that continued involvement of extension service workers in SFRP activities in the village will be very useful in the transfer of fertilizer use technology. But this will depend largely on the frequency of interactions between farmers and workers of the extension service. The responses of women farmers in Table 6.2 and 6.3 show their reluctance to be critical and their interest in politeness.

Extension Service Visits

Table 6.4 provides descriptive data on the number of extension service visits per year received by farmers, by village, and total sample.

Table 6.4. Percentage Distribution of Number of Extension Service Visits Per Year by Village, Gender, and Total Sample

Number of Visits Per Year	Village												Total Sample	
	Tchizon						Maiguero							
	Men		Women		Total		Men		Women		Total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
0									10	56	10	19	10	9
1	2	5			2	4	2	6	3	17	5	10	7	7
2-4	3	8	10	59	13	23	8	24	3	17	11	21	24	22
5-10	25	64	7	41	32	57	12	35	2	11	14	27	46	43
More than 10	9	23			9	16	12	35			12	23	21	19
TOTAL	39	100	17	100	56	100	34	100	18	100	52	100	108	100

The total sample figures show that 9% of farmers received no extension service visits during the survey year, 7% received 1 visit, 22% received between 2 and 4 visits, 43% received between 5 and 10 visits, and 19% of the total sample reported receiving more than 10 extension service visits during the survey year.

Every farmer in the Tchizon sample received at least one extension visit during the survey year. Approximately one-fourth (23%) received between 2 and 4 visits, more than one-half (57%) received between 5 and 10 visits, and 16% of the total sample in Tchizon reported receiving more than 10 extension visits during the survey year.

By contrast, 19% of the farmers in Maiguero received no extension visits during the survey year and those farmers in Maiguero are women. Of all farmers in Maiguero, 10% received 1 extension visit, 21% received between 2 and 4 visits, and 27% reported receiving between 5 and 10 extension visits during the survey year. Again, of the 23% of farmers in Maiguero who received more than 10 extension visits, none is a woman farmer.

That farmers in Tchizon are better served by the extension service is evident, in that overall 73% of the sample farmers in Tchizon received 5 or more extension visits during the survey year, compared with 50% of farmers in

Maiguero. It is also clear from Table 6.4 that men farmers are better served by the extension service than women farmers. Among men farmers in Tchizon, 83% received 5 or more visits but only 41% of the women farmers in Tchizon received that number of visits. In Maiguero, 70% of men farmers received 5 or more visits from extension workers compared with only 11% of women farmers.

Radio Ownership and Televised Fertilizer Information

Radio and television are becoming important sources of agricultural information for farmers in West Africa. Farmers in this study were asked about ownership of radios and exposure to fertilizer information on television.

Table 6.5 shows radio ownership and access to television by village and gender. In Tchizon, 28% of all sample farmers reported owning radios. The ownership of a radio in Tchizon is such that 41% of the women and 23% of men farmers in the sample own radios. In contrast, only 7% of all sample farmers in Maiguero reported radio ownership. The percentages by gender show that 5% of women and approximately 8% of men farmers in Maiguero own radios. Thus, radio ownership is greatest among women farmers in Tchizon (41%), followed by men in Tchizon (23%), and men in Maiguero (8%). Women in Maiguero are the least likely to own radios (5%).

Table 6.5. Radio Ownership and Access to Television by Village, Gender, and Total Sample

	Village						
	Tchizon			Maiguero			
	Men	Women	Total	Men	Women	Total	Total Sample
Owns a Radio							
Yes	12 (23)	7 (41)	19 (28)	3 (8)	1 (5)	4 (7)	23 (18)
No	39 (77)	10 (59)	49 (72)	36 (92)	18 (95)	54 (93)	103 (82)
Has Seen Fertilizer Information on Television							
Yes[a]	46 (89)	12 (71)	58 (84)	16 (41)	8 (42)	24 (41)	82 (65)
No	6 (11)	5 (29)	11 (16)	23 (59)	11 (58)	34 (59)	45 (35)

a. Farmers who have seen at least one program or commercial about fertilizer.

Note: Figures in parentheses are rounded percentages.

Concerning agricultural information from television, 41% of all sample farmers in Maiguero and 84% of those in Tchizon reported having seen at least one television program or commercial about fertilizers during the survey year. In Tchizon, the percentages by gender show that 89% of the men farmers and 71% of the women farmers reported having seen at least one program that concerned fertilizer products during the survey year. The corresponding figures for Maiguero are 41% for men and 42% for women.

Overall, it appears that men and women farmers in Tchizon have greater potential to hear media messages about fertilizer from radio and television than those in Maiguero. The higher propensity among farmers in Tchizon to own radios is likely a consequence of the relative prosperity of farmers in Tchizon compared with those in Maiguero. The village television in Tchizon was supplied by the national authorities and viewing is an important village event.

Perceptions of Farmers About Constraints to Agricultural Production and Fertilizer Use

Assumptions for Calculating Scores for Constraints

Farmers in the study were asked to explain their perceptions of constraints to agricultural production and fertilizer use. The calculations of scores and ranks for the perceived constraints are based on two assumptions.

First, it is assumed that the relative importance of the first constraint mentioned is equal to three times the importance of the third most important constraint mentioned. Thus, a constraint that is mentioned three times in the third order of importance is as important as a constraint mentioned once in the first order of importance.

Second, it is assumed that the importance of the second constraint is equal to one and one-half (1.5) times the importance of the third most important constraint mentioned by respondents. Thus, a constraint that is mentioned two times in the second order of importance is as important as a constraint mentioned once in the first order of importance.

These two assumptions provide a basis for calculating the scores for relative importance of constraints (SRI) to agricultural production and fertilizer use, where:

$$SRI = \sum_{j=1}^{3} (W_j f_j)i$$

where

W_j = weights.

f_j = frequencies for a given i constraint and j orders or ranking.

Constraints to Agricultural Production

Table 7.1 shows the scores and ranks for perceived constraints to agricultural production by village and gender. It is evident from the data that regardless of gender, farmers in both villages perceive lack of rain as the most important constraint to agricultural production. This is not surprising, because in the Sahelien environment the images of drought and the attendant food shortages are real concerns.

Table 7.1. Ranked Scores of the Relative Importance of Constraints to Agricultural Production as Perceived by Farmers by Village and Gender

	Village											
	Tchizon						Maiguero					
	Men		Women		Total Village		Men		Women		Total Village	
Constraint	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Lack of rain	45.5	1	16.0	1	61.5	1	35.5	1	15.5	1	51.0	1
Low soil fertility	18.5	2	4.0	4	22.5	2	8.1	3	0.8	4	1.8	4
Pests/diseases	10.5	3	6.5	2	17.0	3	14.0	2	6.0	2	20.0	2
Other[a]	5.8	4	5.0	3	10.8	4	-	-	2.0	3	2.0	3

a. Includes weeds, strong winds, and lack of money to purchase inputs.

Concerning other constraints, low soil fertility is perceived as the second most important constraint to crop production among men in the experimental village of Tchizon. Women in Tchizon, as well as men and women in Maiguero, uniformly perceive pests and diseases as the second most important constraint.

However, in a society where most agricultural investment decisions are taken by men, the fact that men farmers in the experimental village recognize low soil fertility as an important constraint to agricultural production suggests that the long-term goals of the SFRP address one of the most serious but amenable problems of agricultural production as perceived by farmers. But lack of fertilizers to address the problem was not specifically cited by farmers. The SFRP shall demonstrate the relationship between soil fertility and fertilizer use in the experimental village.

Women farmers in both Tchizon and Maiguero cite other factors such as weeds, strong winds, and lack of money to buy inputs as the third most important constraint to crop production. Again, among men, these factors are ranked fourth in Tchizon but are not perceived as problems by men farmers in Maiguero.

Surprisingly, women in both villages rank low soil fertility as the least important of all the constraints to agricultural production cited. One possible explanation is that because women, particularly in Maiguero, on the average, cultivate less distant plots which generally receive the bulk of organic manure available, fertility levels of their plots may be relatively higher than those of men. This observation, however, is not consistent with the general literature that women often cultivate the least fertile soils.

Nevertheless, changes in the perceptions of women, particularly those in the experimental village, about soil fertility as a result of the use of fertilizers will be one indicator of the consequences of the SFRP.

Constraints to Fertilizer Use

The scores and ranks for perceived constraints to fertilizer use by village are provided in Table 7.2 and show that farmers in Tchizon identified seven constraints to fertilizer use compared with four in Maiguero. However, farmers in both villages rank a lack of money as the most important constraint to fertilizer use.

Table 7.2. Ranked Scores of the Relative Importance of Constraints to Fertilizer Use as Perceived by Farmers by Village

Constraint	Village			
	Tchizon		Maiguero	
	Score	Rank	Score	Rank
Lack of money	36.5	1	54.0	1
Inadequate rainfall	26.2	2	3.0	3
Fertilizer not available	10.3	3	-	-
Inadequate knowledge	2.3	4	11.0	4
Lack of credit	1.5	6	6.0	2
High fertilizer prices	1.7	5	-	-
Excessive weed growth	1.5	6	-	-

The second most important constraint to fertilizer use among farmers in Tchizon is inadequate and unreliable rainfall. In contrast, farmers in Maiguero cite lack of credit programs as the second most important constraint to fertilizer use.

Farmers in Tchizon view the unavailability of fertilizers as the third most important constraint to fertilizer use. In Maiguero this was not mentioned. One may speculate that some arrangements for the transportation and sale of fertilizers from Nigeria are present in Maiguero.

Inadequate knowledge about the use fertilizer products is cited by farmers in both Tchizon and Maiguero as the fourth most important constraint to fertilizer use. By lack of knowledge, farmers implied knowledge about the types, correct doses, and combinations of fertilizers that could provide maximum yields at minimum costs.

The fifth most important constraint to fertilizer use cited by farmers in Tchizon is high prices of fertilizer. This constraint is not cited by farmers in Maiguero and may be explained by the relatively lower prices of fertilizer obtainable from the "parallel markets" from Nigeria.

Lack of credit was ranked the second most important constraint by farmers in Maiguero and is cited as the sixth most important constraint to fertilizer use by farmers in Tchizon.

It is important to note that in the experimental village of Tchizon unavailability of fertilizer, inadequate rainfall, and lack of money are ranked as the three most important constraints to fertilizer use. The SFRP

clearly addresses two of the three most important constraints to fertilizer use as perceived by farmers in the experimental village.

Econometric Analyses

Descriptive statistics of variables that characterize agriculture production and the socioeconomic environment in the SFRP area of the Maradi region have been presented and discussed in the previous sections of this report. Frequency distributions and means of variables are useful for descriptive purposes and for comparisons but are inadequate to study relationships among variables. In the following sections statistical procedures are used to estimate and evaluate relationships that can help explain crop production, farmers' income, and the demand for farm labor.

Production economics theory is used as a basis to specify models of functions for crop production, farmer's income, and the demand for farm labor. Regression analysis and ordinary least square procedures are used to estimate these functions using cross-sectional data from a subsample of farmers. Observations used for the estimations were those having information on the variables included in the models.

In the context of this baseline survey report of SFRP in the Maradi region of Niger, the estimates of functions of production, farmers' income, and farm labor demands that are presented here should be viewed as representative of relationships that characterize agricultural production in the project area before fertilizers are extensively introduced in the experimental village. These functions will be useful for comparisons with similar relationships that will be estimated using survey data to be collected in subsequent years after fertilizers are more extensively used by farmers. This should allow the identification and assessment of changes in levels of production, productivity, income, and labor demand, among others.

Crop Production Functions

Crop production occurs as a result of the combination and management of a set of variable inputs such as seeds, labor, water, fertilizer, and pesticides under given agroclimatic and soil conditions. Concepts of production economics theory are used to establish the relationships among crop production and a set of variable inputs and agroclimatic and soil factors in

the form of a production function. Estimates of properly specified production function models provide valuable information about the input-output relationships that characterize crop production in diverse agroclimatic and socioeconomic environments.

In this study, cross-sectional data from a subsample of farmers in the Maradi region of Niger are used to estimate production function models for millet, the dominant crop in the region. Given the objectives of SFRP and the data collected in the survey, the following linear and logarithmic models were estimated:

Linear Model:

$$Y = \alpha + \gamma_1 V + \gamma_2 G + \gamma_3 F + \beta_1 TL + \Theta A$$

Logarithmic Model:

$$\ln Y = \alpha + \gamma_1 V + \gamma_2 G + \gamma_3 F + \beta_1 \ln TL + \Theta \ln A$$

where: Y = Yield of millet in kilograms per hectare.

V = Dummy 0-1 variable for village, 1 for Tchizon and 0 for Maiguero.

G = Dummy 0-1 variable about the gender of the farmer, 1 for a man and 0 for a woman.

F = Dummy 0-1 variable for the use of fertilizer, 1 for user and 0 for nonuser.

TL = Total labor used in workdays per hectare.

A = Total area cultivated per farm in hectares, and α, γ's, β's, and Θ are parameters of the production function.

Natural logarithms of the continuous variables described above are included in the specification of the logarithmic models.

Estimates of the production function models are shown in Table 8.1. For SFRP these estimates are useful to (1) determine the most important input-output relationships that characterize crop production in the pilot area before fertilizers are extensively introduced and (2) test hypotheses about the impact of various factors on crop production.

Parameter estimates of millet production functions shown in Table 8.1 indicate the following:

1. Coefficients of the dummy 0-1 variable for village show that overall productivity was not significantly different between villages. Thus,

"holding constant" other factors included in the models, millet yields in Tchizon were not significantly different from the yields in Maiguero.

2. The positive coefficient of the dummy 0-1 variable for gender shows a somewhat higher level of productivity for men farmers. However, these coefficients were not statistically significant. Therefore, the hypothesis that men and women farmers have the same level of overall productivity cannot be rejected.
3. The use of fertilizer had a positive and statistically significant effect on millet yields. The coefficients of the dummy 0-1 variable for fertilizer use were statistically significant at the 0.01 level of significance in both models. The coefficient of the linear model shows that, "holding constant" other factors included in the model, millet yields of farmers using fertilizer were 564 kg/ha higher than the yields of farmers not using fertilizer.
4. Coefficients of the labor use variable in the linear and logarithmic models are estimates of the average productivity of labor and of the elasticity of crop yields with respect to labor use, respectively. These coefficients are statistically significant at the 0.01 level of significance and show that the average productivity of a workday of labor is equivalent to about 18 kg of millet or approximately FCFA 600. The estimated elasticity of millet yields with respect to labor (0.6) indicates the percentage change in yields associated with a 1% change in the use of labor; i.e., on the average a 10% increase in labor use is associated with about a 6% increase in millet yields.
5. The low magnitude and lack of significance of the coefficients for the variable crop area per farm show that millet yields are not significantly affected by farm size. That is, there is no indication of economies or diseconomies of scale in millet production.

Table 8.1. Parameter Estimates of Production Functions for Millet in Niger

Independent Variables	Linear Model[a]	Logarithmic Model[b]
Intercept	59.7 (162.7)	4.17 (0.55)
Dummy 0-1 variables		
Villages (V)	-15.6 (135.1)	0.07 (0.18)
Gender of farmer (G)	115.7 144.9	0.21 (0.22)
Fertilizer use (F)	564.3** (152.5)	0.65** (0.20)
Continuous variables[c]		
Total labor (workdays/ha) (TL)	18.2** (3.8)	0.60**
Crop area per farm (ha) (A)	0.3 (9.4)	-0.05 (0.15)
F value	9.47	7.14
R square	0.40	0.34
Number of observations	78	78

a. The dependent variable in the linear model is the yield of millet in kilograms/hectare.
b. Dependent variable in the logarithmic model is the logarithm of the yield of millet.
c. In the form of logarithms in the logarithmic models. Standard errors of parameter estimates are in parentheses.

* Significant at 0.10 level of significance.
** Significant at 0.05 level of significance.

Farmers' Income

Estimates of the present level of farmers' income are important to determine the impact of fertilizer use interventions of the SFRP, on the income of farmers in subsequent years. The main sources of income for farmers in the Maradi region are off-farm employment and crop production. Data on income from off-farm employment were collected in the survey. However, income from crop production can be estimated only on the basis of reliable data on the revenues and costs associated with all the crops grown by farmers.

Because of the diversity in crops and intercropping practices of farmers in the area, it is very difficult to obtain accurate estimates of the farmers' incomes from crop production. Therefore, estimates of total revenue

associated with the production of millet, the dominant crop in the area, were used as estimates of gross income from crop production.

Annual average incomes of farmers by village and gender are presented in Table 8.2. Results for both villages clearly show that crop production is the main source of household income in both villages. About 94% of household income is derived from crop production and only 6% from off-farm employment. However, for women farmers, crop production provides 99% of household income. Because of lower yields and smaller farms, the household income of women farmers is substantially smaller than that of men.

Table 8.2. Average Annual Household Income by Village and Gender

Village	Gender	Millet Yield (Mean) (kg/ha)	Crop Area Per Farm (Mean) (ha)	Annual Income Per Household: Millet Income (Mean)	Off-Farm Earnings (Mean)	Total Household Income: Mean	Total Household Income: Standard Deviation
				(FCFA/household)			
Tchizon	Men	854	11	294,226 (94)	19,793 (6)	314,019 (100)	281,058
	Women	721	7	123,310 (99)	882 (1)	124,192 (100)	103,289
Total village		805	9	231,062 (95)	12,804 (5)	243,866 (100)	248,046
Maiguero	Men	616	8	189,354 (94)	13,125 (6)	202,479 (100)	274,212
	Women	374	2	27,485 (100)	0	27,485 (100)	33,535
Total village		584	7	168,241 (94)	11,413 (6)	179,654 (100)	262,378
Total Sample by Gender of Farmer							
	Men	716	9	233,431 (94)	15,928 (6)	249,359	280,584
	Women	630	6	98,312 (99)	652 (1)	98,694 (100)	99,498
Total sample		695	8	199,651 (94)	12,109 (6)	211,760 (100)	255,950

Figures in parentheses are percentages.
295 FCFA = US $1.

Estimates of Farmer's Income Functions

Linear and logarithmic models of functions of farmers' income were estimated to determine the influence of inputs and factors of production on the gross income of farmers. Estimating equation models were similar to those used previously for the estimation of production functions. In these models the dependent variables were alternatively the gross income from millet and the total household income in FCFA.

Estimates of the functions of farmers' income shown in Table 8.3 indicate the following.

1. Holding other factors "constant," gross income of farmers from millet production and total household income were somewhat higher in Maiguero than in Tchizon. Differences between villages were statistically significant in levels of gross income from millet but not in total household income.
2. Men have higher levels of income than women farmers, however, holding constant other factors (use of labor and fertilizer and crop area per farm) gender does not have a significant effect on household income.
3. Fertilizer use, intensity of labor use (workdays/hectare), and crop area per farm are the most important determinants of household income. The coefficients of these variables are statistically significant at the 0.01 level of significance in all models.
4. The coefficient of the dummy 0-1 variable for fertilizer use shows that the use of fertilizer increased the gross annual income of farmers by about FCFA 127,000-144,000/household.
5. Coefficients of the intensity of labor use variable (workdays per hectare) show that on the average a workday per hectare of cultivated land increased the annual income per household by about FCFA 7,000 and that the elasticity of household income with respect to labor use is about 0.6.
6. Coefficients of the crop area per farm variable in the linear models show that the gross annual income of farmers per household increases by about FCFA 29,000/ha of cultivated land, i.e, holding other factors constant, an additional hectare of millet increased gross household income of farmers by FCFA 29,000/year. The coefficients of this variable in the logarithmic models show elasticities of income with respect to crop area. Because these coefficients are not significantly different from one, household income increases in the same proportion as the crop area per

farm, thereby, no significant economies or diseconomies of scale are evident.

Table 8.3. Parameter Estimates of Gross Income Functions Based on Millet Production

Independent Variables	Gross Crop Income Models[a]		Gross Household Income Models[b]	
	Linear Model	Logarithmic Model	Linear Model	Logarithmic Model
Intercept	-212,882**	27.11**	-215,179**	27.35**
	(50,151)	(0.55)	(54,067)	(0.57)
Dummy 0-1 variables:				
Village (V)	-70,688*	0.09	-65,772	0.11
	(41,612)	(0.19)	(44,862)	(0.19)
Gender of farmer (G)	17,407	0.31	31,020	0.43**
	(44,655)	(0.22)	(48,142)	(0.22)
Fertilizer use (F)	127,759**	0.67**	144,894**	0.72**
	(46,998)	(0.20)	(50,668)	(0.21)
Continuous variables[c]				
Total labor	7,085**	0.59**	6,747**	0.54**
(workdays/ha) (TL)	(1,193)	(0.14)	(1,286)	(0.15)
Crop area per	28,810**	1.11**	29,558**	1.05**
farm (ha) (A)	(2,923)	(0.14)	(3,151)	(0.15)
F value	29.57	26.12	27.19	24.40
R square	0.67	0.65	0.65	0.63
Number of observations	78	78	78	78

a. Dependent variables in the models are the total income from millet in FCFA per farm and in the logarithmic models the logarithm of that income.
b. Dependent variables in the models are the total household gross income in FCFA per farm and in the logarithmic models the logarithm of that income.
c. In the form of logarithms in the logarithmic models.

Standard error of parameter estimates are in parentheses.

* Significant at 0.10 level of significance.
** Significant at 0.05 level of significance.

Labor Use Functions

Labor productivity and demand are important aspects of agricultural development. In general, the use of fertilizers increases labor productivity and demand. Estimates of labor demand functions are useful to determine the influence of fertilizer and other factors on the demand for farm labor. Data on wage rates of farm labor are required to estimate properly specified models of labor demand. However, in this study functions of intensity of labor use in millet production (workdays/hectare), rather than labor demand functions, were estimated because of the lack of adequate data on wage rates.

Because of important differences between villages regarding the influence of some variables on labor use, the following models of labor use functions were estimated by village.

Linear Model:

$$TL = \alpha + \gamma_1 G + \gamma_2 F + \gamma_3 EM + \Theta A$$

Logarithmic Model:

$$\ln TL = \alpha + \gamma_1 G + \gamma_2 F + \gamma_3 EM + \Theta \ln A$$

where EM is a dummy 0-1 variable for off-farm employment, 1 for yes and 0 for no. All other variables are used as previously defined. Estimates of these models for Maiguero and Tchizon are shown in Table 8.4 and indicate the following:

1. Gender had a statistically significant impact on labor use in the village of Maiguero where men farmers are apparently using more labor per hectare of millet than women. Differences in intensity of labor use (workdays/ha) by gender were not significant in Tchizon.
2. In both villages the use of fertilizer and the off-farm employment of farmers did not have significant effects on the levels of labor use per hectare of millet.
3. Coefficients estimating the effect of the variable area cultivated per farm on the intensity of labor use were negative and statistically significant in both villages. Use of labor per hectare decreases with the area cultivated per farm. There is an inverse relationship between the intensity of labor use (workdays per hectare) and the total area cultivated by farm. In Maiguero, the elasticity of labor use per hectare with respect to the area cultivated per farm was -0.45. These results

may be explained by the presence of constraints in the availability of family labor and for the hiring of labor during periods of high labor demand.

Table 8.4. Parameter Estimates of Labor Use Functions for Millet In Maiguero and Tchizon

Independent Variables	Maiguero Linear Model	Maiguero Logarithmic Model	Tchizon Logarithmic Model
Intercept	20.73**	3.32**	3.61**
	(4.37)	(0.23)	(0.34)
Dummy 0-1 variables			
Gender of farmer	5.21	0.62**	0.15
	(5.68)	(0.26)	(0.27)
Fertilizer use	-4.06	-0.30	0.21
	(6.68)	(0.28)	(0.25)
Off-farm employment	-0.60	-0.12	-0.27
	(3.86)	(0.16)	(0.28)
Continuous variables[a]			
Crop area per farm (ha)	-0.67**	-0.45**	-0.29**
	(0.31)	(0.15)	(0.18)
F value	1.35	2.98	1.10
R square	0.13	0.25	0.11
Number of Observations	42	42	38

a. In the form of logarithms in the logarithmic models.

Dependent variables in the linear are the total labor used in workdays/hectare and in the logarithmic models the logarithm of the total labor used.

Standard error of parameter estimates are in parenthesis.

* Significant at 0.10 level of significance.
** Significant at 0.05 level of significance.

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