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An Economic Analysis of Rice Production
Systems and Production Organization of Rice Farmers
in The Gambia

presented by

Alimami M. Kargbo

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Warren H Vincent
Major professor

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AN ECONOMIC ANALYSIS OF RICE PRODUCTION SYSTEMS AND PRODUCTION ORGANIZATION OF RICE FARMERS IN THE GAMBIA

By

Alimami M. Kargbo

A DISSERTATION

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ABSTRACT

AN ECONOMIC ANALYSIS OF RICE PRODUCTION SYSTEMS AND PRODUCTION ORGANIZATION OF RICE FARMERS IN THE GAMBIA

By

Alimami M. Kargbo

The main objectives of this study were to identify and describe the different rice production systems, determine and compare the financial and economic costs and returns of the different rice production systems, and to estimate the total amount of resources used in rice farming and the rice incomes of rice farmers. Four different types of rice production systems were identified--upland rice, _bafaro_, mangrove, and irrigated rice. The observed yields were about 1.3, 1.8, 1.9, 2.7, and 2.4 tons of paddy with labor inputs of about 254, 361, 326, 331, and 324 workdays per hectare of upland rice, _bafaro_ rice, mangrove rice, dry and wet season irrigated rice, respectively. Family labor contributed more than 90% of the labor inputs. Women accounted for more than 87% of the total labor input in the upland, _bafaro_, and mangrove rice systems and more than 50% in the irrigated rice systems. Men contributed more than 90% of the total labor input in all upland crops.

In the financial analysis, all rice systems had positive net enterprise incomes, but only upland rice and mangrove rice had

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returns per workday to family labor and management that were higher than the enterprise wage rate. The economic analysis showed negative net economic returns for all the rice enterprises. A sensitivity analysis revealed that only upland rice and mangrove rice, and to a limited extent, bafaro rice offered any hope for optimism regarding the national goal of achieving self-sufficiency in rice production.

The financial and economic analysis of all the upland crops showed positive net enterprise incomes and net economic returns. Adopting a policy of rice self-sufficiency through an expansion of irrigated rice cultivation may lead to substantial reductions in the gross domestic product of the country.

Groundnut is by far the most important source of income utilizing about 39% of the land cultivated and 26% of the total crop labor input per household. Upland cereals and rice each accounted for 39% of the land area cultivated. They used about 18% and 55% of the crop labor input, respectively.

This study recommends that in the long run prices received by farmers be increased for all food grains; that women's cooperatives be established for rice marketing; that upland rice, mangrove rice, and bafaro rice be given equal attention as that accorded to irrigated rice; that an efficient input delivery system be established; and that women become an integral part of the planning and implementation process of all rice development programs in The Gambia.

DEDICATED

To

My parents, Sama Kargbo and Koloneh Sisay,

without whom nothing would have been possible

and To

Dr. Dunstan S. C. Spencer, with gratitude and appreciation for his support, encouragement, and confidence in me throughout my graduate studies pe

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It is impossible to acknowledge the assistance of all those people and institutions that contributed to the climax of this work, but special appreciation is due to some of them. Among these Dr. Carl K. Eicher deserves my profound gratitude and appreciation. He served as my major professor from the time I entered Michigan State University until his departure for Zimbabwe in January 1983. His directions, encouragement, and interest in a student's welfare are exemplary.

A special thanks is due to Dr. Warren Vincent, in his current capacity as my major professor and thesis supervisor. His long research experience and cordial relationship with students created a comfortable environment in the writing of this thesis. I appreciate the constructive and useful comments of other members of my guidance committee including Dr. Eric Crawford, Dr. Victor E. Smith, and Dr. Lindon Robison. They were especially helpful in the final phase of the thesis write up.

Field work in The Gambia would never have been possible without my association and generous financial support of the West Africa Rice Development Association (WARDA). Deserving my deepest gratitude are Dr. D. S. C. Spencer, who supervised the field work, Dr. R. Kagbo and the entire WARDA staff in The Gambia for providing logistical support.

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I am also grateful to Mr. Reuben A. Thomas, Director of the Agriculture Department of The Gambia and to Mr. Tamsir Jagne, Agricultural Officer, Jenoi, for their support, understanding and interest in my field work. I will not forget the services of my enumerators --Musa Sisay, Lamin Kamara, Musa Gaye, Amat Kujabi, Elizabeth Ninson, Saihu Marenah, Foday Touray, Buba Ceesay, Mamadi Njie, Salifu Sambou, Chuku Sonko, Lang Darboe, Mariama Sangnia, Kabba Jobateh, and Yankuba Marenah for their patience and endurance during the time the data were being collected. I am also thankful to Ismail Dibba, whose knowledge of The Gambia made travelling comfortable for me.

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CHAPTER I

INTRODUCTION

The Republic of The Gambia forms a narrow band on either side of the River Gambia and has a surface area of about 11,295 square kilometers (kms). The country, which is between latitudes 13.30° and 13.50° West, penetrates over 300 kms into Senegalese territory. It forms a narrow band along the river that varies in width from 28 kms upstream to about 70 kms on the Atlantic coast on the estuary of the river. The Gambia has a flat topography, barely varied by a few undulations, which rarely exceed 30 kms. Figure 1.1 shows The Gambia's location in West Africa and the country's major administrative divisions.

The main physical feature is the river, which is one of the finest waterways in Africa. It has its source in the mountainous Fouta Djallon in the Republic of Guinea, and it meanders through Senegal before emptying into the Atlantic Ocean. The river has played a major economic role for The Gambia, serving both as an important means of transporting commodities to and from Banjul, the capital city, and as a source of irrigation water for the increasingly important rice crop.

The Gambia, one of the smallest countries in the African continent, is an independent state, a member of the Commonwealth since

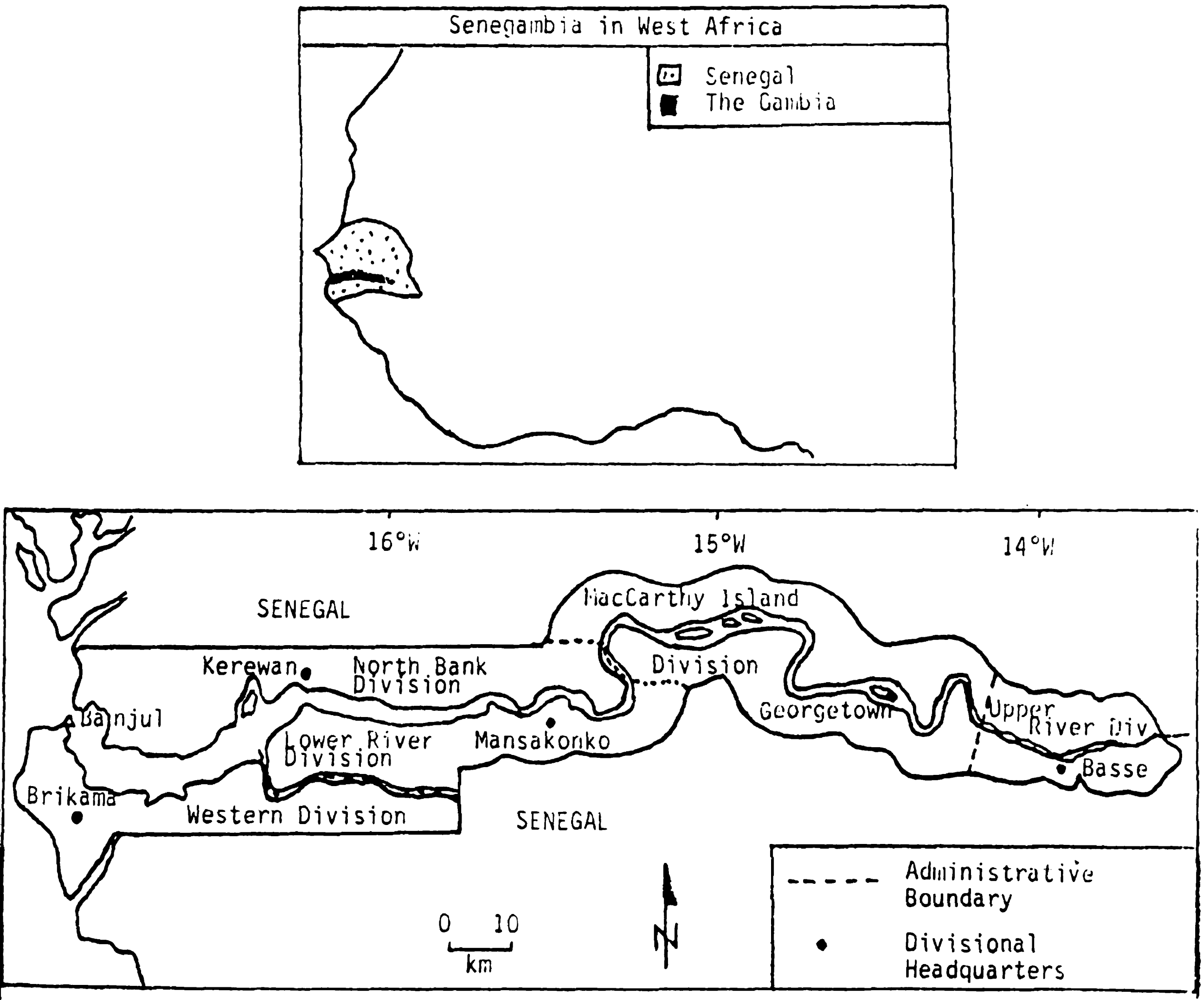

Figure 1.1--Location of The Gambia.

1965 and a Republic since 1970. The boundaries are political and do not correspond to any physical or ethnic reality, but originate from colonial times. Early in 1982 the country signed an agreement with Senegal which established the Confederation of Senegambia.

Background

The Gambian Economy

The Gambian economic structure has not changed much in recent years. There are still no known economically exploitable minerals, and the only sectors of the economy with any potential for development are agriculture and tourism. In fact agriculture assumes first priority not only because a large percentage of the population derives its living from it, but also because the development of agriculture appears to be the safest and most stable avenue for increasing rural income and employment and improving the shortage of foreign exhange. As can be seen in Table 1.1, agriculture accounts, on the average, for about 28% of the Gross Domestic Product (GDP) at market prices. Trade and government services have provided about 12% each.

In recent years, efforts have been made to diversify the country's economic base by increasing rice and cotton production, livestock and fishing, as well as the tourist sector. To the present, however, the outcome of such efforts has been very modest. Within the period 1974-75 to 1979-80, the GDP at market prices rose at an annual average rate of 2.9%. Since population increased at almost the same rate, GDP per capita has remained almost constant. This slow growth rate is believed to have resulted from the decline in agricultural

1974/75 to 1980/81 (million dalasis)[a]

	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	Annual Growth Rate	Average	
									Amount	% of Total[b]
Agriculture	107.0	102.4	103.8	90.0	112.5	70.6	76.9	(8.0)[c]	94.7	28.2
Industry	8.0	14.3	14.3	12.4	16.2	12.9	13.7	10.0	13.1	3.9
Electricity and Water	1.3	1.4	1.8	1.8	1.3	2.0	0.1	9.0	1.4	0.4
Construction, mining, quarrying	16.4	16.1	17.2	24.9	26.8	28.8	0.5	11.9	18.7	5.6
Hotels and restaurants	7.4	7.6	7.1	5.5	10.4	8.2	0.1	2.1	6.6	2.0
Transport, storage, and communication	15.3	18.3	19.8	24.4	26.8	29.8	8.3	14.3	20.4	6.1
Trade	36.8	44.8	48.5	45.6	53.6	59.0	0.5	9.9	41.2	12.3
Banking and Insurance	7.2	10.9	9.7	10.5	11.1	12.5	12.3	11.7	10.6	3.2
Real estate, business, services	13.7	13.9	14.2	15.5	14.8	15.0	15.3	1.8	14.5	4.3
Other services	5.9	6.3	6.5	7.1	7.5	7.9	8.3	6.0	7.1	2.1
Government services	25.8	29.7	37.1	42.9	44.4	48.5	5.6	13.5	40.6	12.1
Imputed bank charges	(5.2)	(6.4)	(6.2)	(6.4)	(7.9)	(8.9)	(8.7)	11.4	(7.1)	(2.1)
GDP at factor cost	239.6	259.5	273.8	273.2	317.6	286.3	287.9	3.6	276.8	
Indirect taxes minus subsidies	57.0	72.4	73.8	56.4	61.4	65.6	39.9	(0.5)	59.5	17.7
GDP at market prices	296.6	331.9	347.6	329.6	379.0	341.9	327.8	2.9	336.3	100.0

SOURCE: Derived from Republic of The Gambia, "Five Year Plan for Economic and Social Development 1981/82 to 1985/86," Banjul, 1981.

[a]\$1.00 = 2.20 dalasis in May 1982

[b]Total may not equal 100 because of rounding errors.

[c]Figures in parenthesis are negative.

...Producers Value by Broad Industrial Origin in Constant 1976/77 Prices, 1974/75 to 1980/81 (million dalasis)[a]

	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	Annual Growth Rate	Average Amount	Average % of Total[b]
Agriculture	107.0	102.4	103.8	90.0	112.5	70.6	76.9	(8.0)[c]	94.7	28.2
Industry	8.0	14.3	14.3	12.4	16.2	12.9	13.7	10.0	13.1	3.9
Electricity and Water	1.3	1.4	1.8	1.8	1.3	2.0	0.1	9.0	1.4	0.4
Construction, mining, quarrying	16.4	16.1	17.2	24.9	26.8	28.8	0.5	11.9	18.7	5.6
Hotels and restaurants	7.4	7.6	7.1	5.5	10.4	8.2	0.1	2.1	6.6	2.0
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Trade	36.8	44.8	48.5	45.6	53.6	59.0	0.5	9.9	41.2	12.3
Banking and Insurance	7.2	10.9	9.7	10.5	11.1	12.5	12.3	11.7	10.6	3.2
Real estate, business, services	13.7	13.9	14.2	15.5	14.8	15.0	15.3	1.8	14.5	4.3
Other services	5.9	6.3	6.5	7.1	7.5	7.9	8.3	6.0	7.1	2.1
Government services	25.8	29.7	37.1	42.9	44.4	48.5	5.6	13.5	40.6	12.1
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output which averaged a negative growth rate of 8.0% per annum for the same period.

Because of the decline in agricultural output and the rapid growth in most nonagricultural sectors, the share of agriculture in the total GDP decreased from more than 40% in 1974-75 to less than 30% in 1979-80. The value of exports also declined from D83.8 million in 1974-75 to D64.8m in 1979-80. Imports, meanwhile, increased from D88.3m to D290.4m for the same period (Gambia, 1981).

Agriculture in The Gambia

Agriculture and its related activities--fisheries and livestock--form the heart of the Gambian economy. It provides a livelihood for more than 85% of the active population, contributes on the average nearly 90% of the domestic export earnings, and forms the basis for the principal processing industries. Table 1.2, which shows export earnings by commodity for the period of 1974-75 to 1980-81, indicates that groundnut is by far the most important single cash crop in the country. In addition to being the major source of rural income, it accounts for more than 75% of the total export earnings, averaging about 90% in the past seven years. Because of this heavy dependence on one crop, the country's economic prospects are highly unpredictable and tend to fluctuate in sympathy with fluctuations in groundnut income. A fall in groundnut production resulted in a decline in export earnings of about 60% from D104.8m in 1976-77 to a low of D40.9m in 1980-81.

TABLE 1.2.--Exports of Principal Commodities (million dalasis)[a]

	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	Averages
Groundnut shelled/unshelled	47.0	43.7	52.6	26.6	40.1	35.8	12.6	36.9
Groundnut oil unrefined	26.1	21.8	31.0	27.6	16.7	14.7	14.9	21.8
Groundnut meal and cake	7.7	5.8	14.5	9.2	5.9	5.1	3.4	7.4
Total Groundnut Products	80.8	71.3	98.1	63.0	62.7	55.6	30.9	66.1
Palm Kernals and nuts	0.7	0.4	0.8	1.6	0.8	0.8	0.9	0.9
Fish and fish preparations	1.7	2.6	4.8	7.6	3.7	6.6	6.4	4.8
Other products	0.5	0.7	1.1	2.2	2.1	1.8	2.7	1.6
Total Domestic Exports	83.7	75.0	104.8	74.4	69.3	64.8	40.9	73.3
Re-exports	1.5	2.3	4.6	13.6	25.0	18.2	15.0	11.5
TOTAL EXPORTS (F.O.B.)	85.2	77.3	109.4	88.0	94.3	83.0	55.9	84.8
% Groundnut Export to Total Domestic Exports	96.5	95.1	93.6	84.7	90.5	85.8	75.6	90.2

SOURCE: Derived from Republic of The Gambia, "Five Year Plan for Economic and Social Development 1981/82 to 1985/86," Banjul, 1981.

[a]$1.00 = D2.20 in May 1982.

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Groundnut meal and cake	7.7	5.8	14.5	9.2	5.9	5.1	3.4	7.4
Total Groundnut Products	80.8	71.3	98.1	63.0	62.7	55.6	30.9	66.1
Palm Kernals and nuts	0.7	0.4	0.8	1.6	0.8	0.8	0.9	0.9
Fish and fish preparations	1.7	2.6	4.8	7.6	3.7	6.6	6.4	4.8
Other products	0.5	0.7	1.1	2.2	2.1	1.8	2.7	1.6
Total Domestic Exports	83.7	75.0	104.8	74.4	69.3	64.8	40.9	73.3
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SOURCE: Derived from Republic of The Gambia, "Five Year Plan for Economic and Social Development 1981/82 to 1985/86," Banjul, 1981.

[a]$1.00 = D2.20 in May 1982.

In terms of the overall economy, this means that resources that are available for consumption, investment, and recurrent government expenditure can vary substantially from year to year. Although the country has in the past adjusted relatively well to this situation, there is little doubt that the economic costs associated with the uncertainties involved in the dependence on one cash crop can be substantial. Foreign exchange reserves and price stabilization funds in the marketing board need to be built up in good years to minimize resource short-falls in bad years. Any inadequate reserve build ups can seriously disrupt imports and investments in bad years. On the other hand, excessive reserve accumulation can take resources away from consumption and investment in good years (AID, 1979). The obvious solution to this dilemma is crop diversification. But the potential for this in The Gambia is very limited.

The only other significant export commodity in The Gambia is fish and fish preparations which, on the average, have accounted for a little more than 6% of the total domestic export earnings in the last seven years. Palm kernels, which once formed a significant part of export earnings, are decreasing in importance with an average export value of less than D1 million. Some efforts are being made to develop a lime juice industry, but so far only a small hectarage has been planted for commercial production. Cotton production has also been encouraged, but the results are disappointing.

Subsistence crops include rice, sorghum, millet, maize, and cassava. Traditionally, sorghum and millet formed the major food crops, but in recent years rice has become the most important staple

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Subsistence crops include rice, sorghum, millet, maize, and cassava. Traditionally, sorghum and millet formed the major food crops, but in recent years rice has become the most important staple

crop. A study by CRED (1977) shows that for the period of 1973-74 to 1976-77, the actual tonnage of domestically produced cereals declined and that increases in total land cultivated were mainly used for groundnut production. Also, consistent with the decline in local production, there was an increasing dependence on the exterior to meet local demands. As will be seen in the next section, it is doubtful whether more recent statistics will indicate otherwise. For example, the value of total food imports has increased from D17.7m in 1974-75 (about 19.4% of total imports) to D63.7m in 1980-81 (about 23.1% of total imports) (Gambia, 1981). And in a study of 57 compounds in eight villages, which compared the 1977-78 and 1978-79 cropping seasons for farmers participating in a rural development project, The Gambia (1979) found a decrease of 21% for rice, 15% for millet, and 59% for maize in the 1978-79 season as compared to the 1977-78 season in terms of area cultivated. Groundnut hectarage remained virtually unchanged for the two seasons. It is noteworthy to indicate that similar shifts away from cereals to groundnuts have also been recorded in Senegal by Craven and Tuluy (1981). They show that from 1959-60 to 1976-77, the percentage of total area cultivated to groundnut increased from 48% to 52% while cereals hectarage percentage decreased from 43.6% to 41.4% for the same period.

Problem Setting

Records indicate that rice cultivation in The Gambia started as early as 1818, but that by 1836 the country was already importing rice. Quinn (1972) contends that although there was a variety of

foods available, unproductive methods of cultivation and uncertain rainfall meant that famine was a continuing theme of life around the 19th century. Annual imports of rice are said to have risen substantially after 1857.

In the 1960's domestic rice production increased by about 3.3% annually or a little more than the estimated population growth rate of 2.8% per annum. However, in the 1970's rice production actually declined by an average of nearly 3.8% per annum. Where output increased, it was due mainly to increases in area cultivated. Estimated yield per hectare declined from a high of 2,079 kgs/ha in 1967 to a low of 1,000 kg/ha in 1980. Actual milled equivalent of paddy production has dropped from 28,300 metric tons in 1971 to 16,800 tons in 1980 (WARDA, 1981). What is significant about these statistics is that over the period of decline, the government had focused on food production projects more than ever before. From 1975-76 to 1980-81, more than D57.4m was invested in agriculture and most of the investments went into the development of irrigated perimeters for rice production.

As was earlier indicated, rice has become the stable food in The Gambia replacing the traditional subsistence crops of millet and sorghum. At an estimated per capita consumption of more than 80 kg, the country becomes the third highest per capita consumer of rice in West Africa ranking only behind Sierra Leone and Liberia. The shift in consumption toward rice is disturbing because rice is more costly to produce than the other cereals and it has a high production cost as compared to rice imports. The situation is even made worse with

the downward trend in domestic production and an increasing population and income. Figure 1.2 shows that the gap between domestic production and total consumption is widening. Per capita consumption of rice has increased from an average of 67.9 kg in 1960-64 to 79.3 kg in 1976-80. Rice imports have increased from an average of 9,100 metric tons in 1960-64 to 26,620 tons in 1975-79. These imports are valued at D1.9m and D12.5m, respectively (WARDA, 1981).

Although no detailed consumer surveys estimating the calorific contribution of different food items in The Gambia are available, it can safely be said that rice contributes a substantial amount of these calories. Norman et al., (1979) quotes Grant (1950) who showed that in 1949 Gambian farmers consumed about 1,575 to 2,144 calories per day per head, depending on the season. In neighboring Senegal, the average is estimated at 2,300 calories per capita with rice contributing about 30% (Craven and Tuluy, 1981).

Need for the Study

Despite their importance in the economy of The Gambia, the agricultural sector and the rice subsector in particular have, until recently, received very scanty attention from economists. Agronomists, sociologists, and anthropologists have examined in some detail the soils, cultural practices, land tenure systems, tools, and basic techniques used by Gambian rice farmers. Their efforts, however, have failed to produce much needed basic information such as crop acreages, yields, prices, and other data that are most relevent for policy formation. Recent efforts to collect such information, through

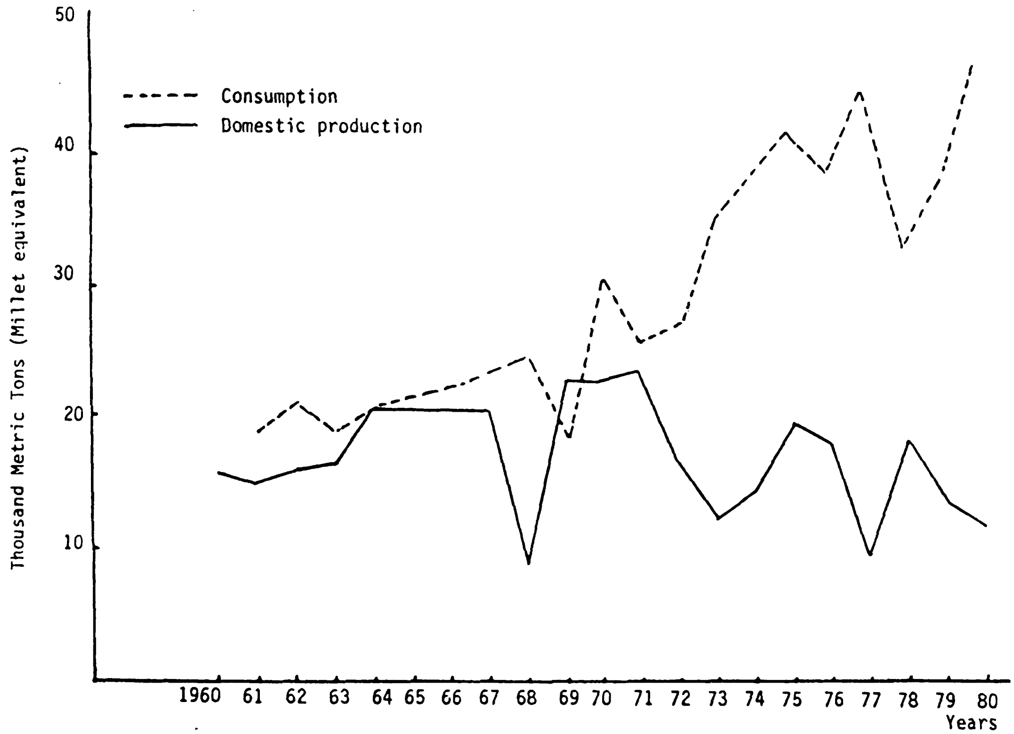

Figure 1.2.--Total consumption and domestic production of rice in The Gambia.

the Food and Agriculture Organization's agriculture surveys, have only succeeded in getting rough approximations which are at best unreliable, although in the context of a developing country such information can be of extreme importance in the design of a development strategy.

Like other West African countries, The Gambia has, since independence, adopted self-sufficiency of food staples as a national policy goal. This policy has been chosen in the nationalistic desire to minimize foreign leverage, reduce foreign exchange requirements for the import of foodstuffs, and maintain internal political tranquility. It is assumed that producing rice domestically by any means will use less foreign exchange than purchasing rice from abroad.

While current efforts are being devoted to increasing the commercial production of rice, the country lacks microeconomic data that will assist planners in making decisions that will contribute to increasing domestic rice production. Outside of studies done by the West Africa Rice Development Association (WARDA), there is currently very little information on the economics of rice production. Most of the literature that is available deals with the agronomy and genetics of rice production. Weil (1973) indicates that in the early 1950's research on the economics and social problems of rice production was carried out by V. O. Van der Plas in 1955, 1957, and 1958. Paul Kleene (no date) is also quoted by Weil to have researched current (1960-1967) rice methods and economics in the Central Gambia.

In recent years, Weil (1973), Haswell (1975), Dunsmore et al. (1976), and Dey (1980, 1981, 1982) have all written on some

socioeconomic aspects of rice production in The Gambia. Weil discusses the adaptation of the Gambian woman to a changing economy. He contends that if we are to understand and learn from the success or failure of development initiatives (rural or national), we must examine the political and economic dynamics of the societies involved in these initiatives (p. 20). Weil tries to demonstrate that the shift in food production among the Mandinka of The Gambia, where the cultivation of millet and sorghum has been replaced by rice production by women, is an adaptation in an increasingly commercial economy. "This," he says, "is taking place by channelling competition for two vital scarce resources, namely, tidal swamp land and skilled female labor, through endogenous political and economic mechanisms" (p. 28).

Haswell (1975) examined these political and economic dynamics through a case study of one village on the south bank of the river Gambia. The study is based on an initial survey in 1947-49 and resurveys in 1962 and 1973-74. The changes that occurred in the village are set against changes in the economy of the country and West Africa as a whole over a twenty-five year period. The thesis which emerges from the analysis is that whereas the subsistence farmer made decisions and faced hardship with weather as the main variable, entry into the cash crop economy not only brought him into contact with the world market situation, but forced choices between cash and subsistence crops and introduced alien concepts of living standards. She contends that the Western World has compounded the

situation by failing to understand the intricacies which have led to the institutionalization of poverty through aid programs and other devices which increase economic expectations and dependence. She returned to this theme in 1977.

Dey (1980) examined women's and men's control of land, labor, and the crop in swamp rice cultivation and women's control of the same factors of production in the cultivation of irrigated rice. She concludes that men have not only benefited more than women from the rice development programs, but that moreover, the virtual exclusion of women from the control of irrigated rice production has led to a partial failure of the programs (p. 1). The subjects of her papers in 1981 and 1982 were further extensions of this thesis.

Dunsmore et al. (1976) reports on the crop and animal production practices in The Gambia and on land use and capability. The results of a detailed socioeconomic study at village level are reported. On the basis of the study recommendations are made which are aimed at improving food production of both crops and animal origin for local consumption, increasing exports of crop products, and enlarging the forest reserve.

Throughout the literature on agriculture in The Gambia, no attempt has been made to produce an in-depth study of the rice subsector and its relationship to other crop enterprises in the farming system. The availability of such information is crucial for the achievement of the goal of food self-sufficiency. This study aims at providing such information.

Objectives of the Study

The main objective of this study is to provide a description of the major rice production systems and to determine the financial and economic costs and returns of the different rice production systems in The Gambia. The specific objectives are to:

1. describe the agro-climatic conditions of rice production and the social structure of rice farmers in The Gambia
2. identify and describe the major rice production systems in The Gambia
3. determine and compare the financial and economic costs and returns of the major rice production systems on a hectare basis
4. estimate the total amount of resources used in rice farming and the farm incomes of rice farmers on a household basis by type of predominant rice cultivation system and by size of land area cultivated

Research Method

The information used in this study forms part of the data collected on a socioeconomic survey of rice farmers in The Gambia

for the West Africa Rice Development Association (WARDA).[1] The main objective of that survey was to give a description of the socioeconomics of rice production in The Gambia and to provide input/output data of the different rice production systems. Because of the high degree of interdependence between production and consumption, consumption and investment, investment and resource availability, and social and cultural constraints (Low, 1978) that is often characteristic of farming in West Africa, it was necessary to extend the scope of the survey beyond collecting input/output data for rice systems alone. Thus data for other crop enterprises cultivated by rice farmers were also collected.

Sampling Procedure

Because rice cultivation in The Gambia is concentrated in the middle and eastern parts of the country, the westernmost part was excluded from the study. The rest of the country was then divided into ten enumeration areas using district political boundaries. A list of every village[2] where rice cultivation was important in the farming operations was made for each of these enumeration areas.

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[1]WARDA is a regional body charged with the responsibility of assisting member countries in the subregion to attain self-sufficiency in rice production through strengthening of their national programs.

[2]Only villages with ten or more compounds (extended family units) in the 1973 census were included in this list. Ten was the minimum number of households wanted in each village. It was assumed that by 1981 these villages would have had more than ten compounds to allow for a random sample selection.

Using random sampling, thirteen villages were initially selected--one each from seven enumeration areas and two each from the remaining three enumeration areas. Ten villages was the actual number wanted, but thirteen were selected to make room for future dropouts.

A list of all dabada[3] heads who were certain to cultivate rice in the season of the study was made for each village. From this list a simple random sampling procedure was again adopted to select ten farmers from each village. These farmers were to participate in the survey. At some stage in the survey, three villages had to be abandoned for reasons ranging from inaccessibility in the rains to poor quality of data collected in the initial stages.

Conduct of Survey[4]

The collection of data started in early June, 1981, when one enumerator was posted in each of the villages. Stock questionnaires for land, labor, machinery, equipment, draft animals, productive animals, and farm houses were collected first. This was repeated at the end of the survey to capture changes in stock inventory. Stock

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[3]See Chapter II for a definition of the dabada. The dabada was chosen as a sampling unit because it better approximated the production unit. More than 80% of the dabadalu were themselves whole compound units.

[4]The questionnaires used in the survey were adapted from the Food and Agriculture Organization, Farm Management and Data Collection and Analysis System (FMDCAS). For details see K. H. Friederich, Farm Management Data Collection and Analysis: An Electronic Data Processing, Storage and Retrieval System, Farm Management Unit, Agricultural Services Division, FAO, Rome, 1977.

questionnaires for credit and crops were completed at a later date in the survey.

Resource utilization (flow data) for all farm activities were collected on a twice weekly basis. This started at the end of June, 1981, and ended at the end of June, 1982. This approach was employed to collect the flow data because of the lack of household labor time allocation data. Several authors including Spencer (1972), Norman (1973), Tollens (1975), and Kearl (1976) have all discussed methods of data collection in developing countries. The choices concerning the number of days of recall (frequency of interview) to be used often reflect a trade-off between sampling and measurement errors (Lynch, in Smith et al., 1979). Time and cost considerations are also relevant.

All labor input was measured in hours with differentiation made in terms of sex, age, and type of labor--family or hired. Machinery and animal inputs were measured in terms of hours, and other material inputs such as seed and fertilizer were measured in terms of quantity and value. A yield plot method was used to determine yield. Yield plots of approximately 3.35 and 6.70 meters square were laid on all swamp and upland fields respectively. As much as possible, harvesting, threshing, and winnowing of the yield plot output was done by household members or supervised by them. The weight of the dry produce was taken when the produce was brought home and dried. Thus yield measures represent the actual yield that reached home. Adequate precautions were taken to ensure that the yield plot produce was not mixed with other produce.

Area of fields was taken either during or soon after harvest and represents area planted to crops even though it might not have been harvested.

At the end of July, 1981, one month after the start of the resource utilization data collection, the attempted rebellion in The Gambia brought all work to a standstill. Scared enumerators left their villages for about two weeks. When things returned to normality, about mid-August, enumerators were asked to estimate, in cooperation with the farmers, all inputs and outputs for the farming activities for the period for which data were not collected.

Data Preparation

From The Gambia, the completed questionnaires were sent to Freetown, Sierra Leone for punching into cards. The punched cards were air-freighted to Monrovia before being shipped to Michigan. Once in East Lansing, the data were copied onto discs and edited. All information belonging to farmers who did not have complete year-round data were discarded. The edited data were then copied onto a magnetic tape for permanent storage and retrieval when necessary. Subsequent analysis of the data was carried out within the limitations of FMDCAS as described by Frederich (1977).

The Analytic Approach

The choice of an analytic approach depends primarily on the purpose of the study, the quality of the available data, and time and cost considerations. The nature of the problem addressed in this study call

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study calls for a system of analysis that will present reliable estimates of the costs and returns of the various crop enterprises considered. To this end, a financial and economic analysis technique has been employed.

Both systems of analysis provide a framework within which all aspects of a given enterprise or farm can be evaluated and coordinated in a systematic manner. Basically, the financial analysis identifies the money profit accruing to the enterprise and is concerned with the return to equity capital that is provided by the farmer. Financial analysis takes into consideration income distribution and capital ownership.

On the other hand, economic analysis measures the effects of an enterprise or farm on the fundamental objectives of the economy as a whole. Thus, attention is diverted to the return or productivity to the whole society of all the resources committed to the enterprise, regardless of who in the society contributes them and regardless of who in the society receives them. Economic analysis is thus neutral to income distribution and capital ownership. The differences in profits between financial and economic analysis is a result of the differences in the items considered as costs and benefits and in their valuation.

It is worthwhile to note that there is a lack of general agreement on both the need to use shadow prices and on the method of determining the shadow prices in economic analysis. Items to be included and excluded in either the financial or economic analysis have gener

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have generally not provoked a lot of controversy as in the need for and method of shadow price determination. Market prices are used in valuing inputs and outputs in financial analysis, while shadow prices, sometimes called accounting prices, are said to be appropriate for economic analysis.

The argument in favor of using shadow prices rests on the assumption that in a competitive market the price of a good tends to that level at which the quantity supplied is equal to the quantity demanded. This is the equilibrium price and at this price resources are said to be efficiently allocated. Problems arise when the market forces are constrained in such a way as to prevent the attainment of this equilibrium price. In this case it is advocated that shadow prices should be used. However, Weckstein (1972) argues that although market failures may be responsible for social loss and constitute part of the barrier to economic development, it is not generally possible to mitigate these failures by using shadow prices in the valuation and that there is no known source of shadow prices that generally gives better guidance. Weckstein concludes by stating that the use of shadow prices can under some unfortunate set of circumstances contribute to a further fracturing of an economy and decreasing of efficient project choice (p. 492). Gittinger (1972) comments that shadow pricing is a very tricky and controversial aspect of the economic analysis of projects (p. 38). Bearing this in mind, this study will, nevertheless, use shadow prices in the economic analysis when appropriate. Like other authors, with no source of

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source of shadow prices, certain simplifying assumptions will be made to arrive at reasonably appropriate prices.

Both the financial and economic analysis are based on budgets. Budgets are prepared by stating the income, expenses, and resource needs of each enterprise of the farming business on a per unit basis (Harsh et al., 1981). They are formulated primarily to evaluate the efficiency of a particular productive activity within a prescribed period, usually a year (Brown, 1979). Budgets are prepared to reflect comparative performances under actual conditions for the study period rather than for the purpose of optimization.

Plan of the Remaining Chapters

Chapter II presents a description of the study area with emphasis on the agro-climatic conditions and social structure of the farmers included in the sample. Some major characteristics of the sample households are also presented. In Chapter III the major rice production systems are identified and described. The rice marketing system and pricing policy are also described. Chapter IV presents the financial and economic analysis of the rice production systems on a hectare basis. Farm income analysis on a household basis, categorized by preominant rice cultivation systems, and size of land holding is given in Chapter V. The last chapter is a summary of the findings of the study, policy recommendations, and some suggestions for future research.

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CHAPTER II

A DESCRIPTION OF THE STUDY AREA

Introduction

The main purpose of this chapter is to describe both the physical and social characteristics of the study area. Because The Gambia is a very small country and spatial mobility within the country is unrestricted, the social characteristics tend to be similar in all villages. The little variations that do exist are of minor importance. Except for rainfall variations the physical structures are also very similar.

Location

The area included in the study covered much of the central and eastern part of the country as is shown in the location of villages included in the survey in Figure 2.1. The area covers much of the intensive rice cultivation regions extending from Geneiri in the Lower River Division to Hella Kunda in the Upper River Division. Except for one village, Karantaba Tobakoto, all villages in the study were not more than ten kilometers away from an all-weather motorable road. Karantaba Tobakoto is about 30 kilometers from the nearest all-weather road. Health centers equipped with qualified registered nurses or nurse superintendents are scattered throughout the country in such a


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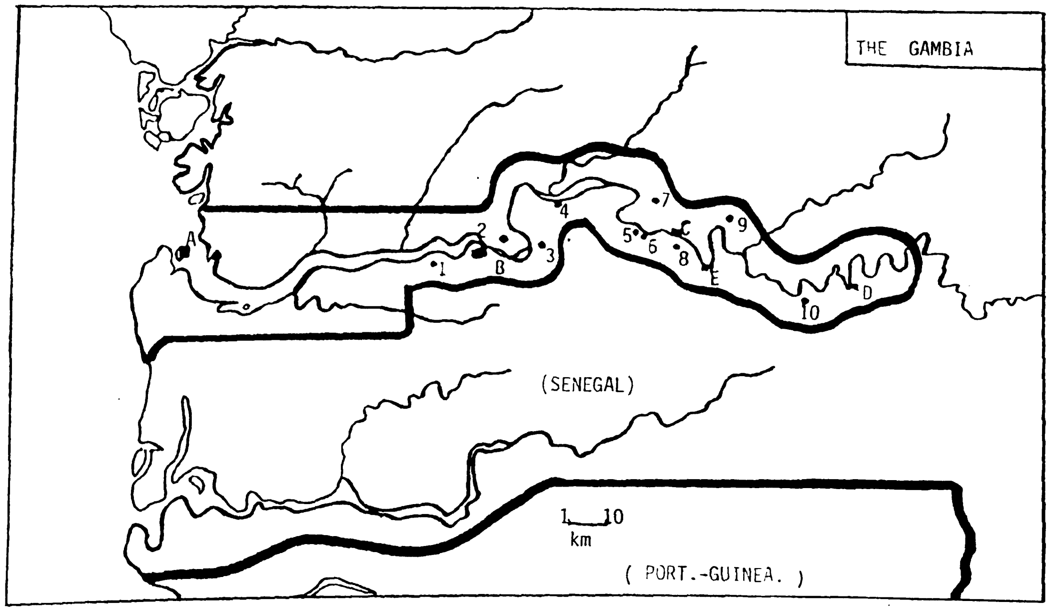

Key:
- • = Villages included in the survey
- ▰ = Other towns
- 1 = Geneiri
- 2 = Kerr Bamba
- 3 = Pakaliba
- 4 = Jarreng
- 5 = Kerewan Samba Sira (Mondinga Kunda)
- 6 = Kerewan Samba Sira (Fula Kunda)
- 7 = Kuntaur Fula Kunda
- 8 = Sankulev Kunda
- 9 = Karantaba Tobakoto
- 10 = Hella Kunda
- A = Banjul
- B = Jenoi
- C = Georgetown
- D = Basse
- E = Bansang

Figure 2.1.--Area Covered in the Survey.

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Physical Characteristics

Climate

The Gambia is within the Sahelian Zone, and since 1974, it has been a member of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS). Like all Sahelian countries, its climate is characterized by a long, dry season, which lasts from November to May, and a short, rainy season, which extends from June to October.

The mean annual rainfall is 1,056 mm in Banjul along the Atlantic Coast. Rainfall declines progressively toward the interior to reach 868 mm in Jenoi and 832 mm in Sapu. It then rises again to the east reaching 936 mm in Georgetwon and 999 mm in Basse. Table 2.1 shows the mean annual rainfall and August means for some weather stations around the country. Histograms of actual rainfall in 1981 and ten day normals for two stations together with isohyets for the entire country are also shown in Figure 2.2.

Rainfall in The Gambia is very variable from year to year. In Banjul rainfall has ranged from a low of 561.8 mm in 1972 to a high of 1,628.8 mm in 1968. Records show that annual rainfall in this area decreased by 30% from an average of 1,053 mm in 1943-46 to 898 mm in 1978-81.

The average temperature in The Gambia varies from 25°C in January to 30°C in May. However, from December to February the

TABLE 2.1.

Weather St
Banjul
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Georgetown
Basse

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TABLE 2.1.--Mean Annual Rainfall and August Means

Weather Station	Distance from Banjul (km)	Number of Observations	Mean Annual[a] (mm)	August Means (mm)
Banjul	--	38	1055.8 (279.9)	395.7
Jenoi	184	16	867.6 (183.0)	277.1
Sapu	284	15	832.3 (206.1)	255.1
Georgetown	306	59	936.1 (194.0)	286.1
Basse	382	36	998.6 (196.6)	310.3

Source: Derived from The Republic of The Gambia, "Monthly Rainfall Data for The Gambia to 1980," 1982, and from "Report of Annual Rainfall 1981," 1982.

[a]Figures in parenthesis are standard deviations.


THE GAMBIA Average Annual Rainfall (mm)
1981

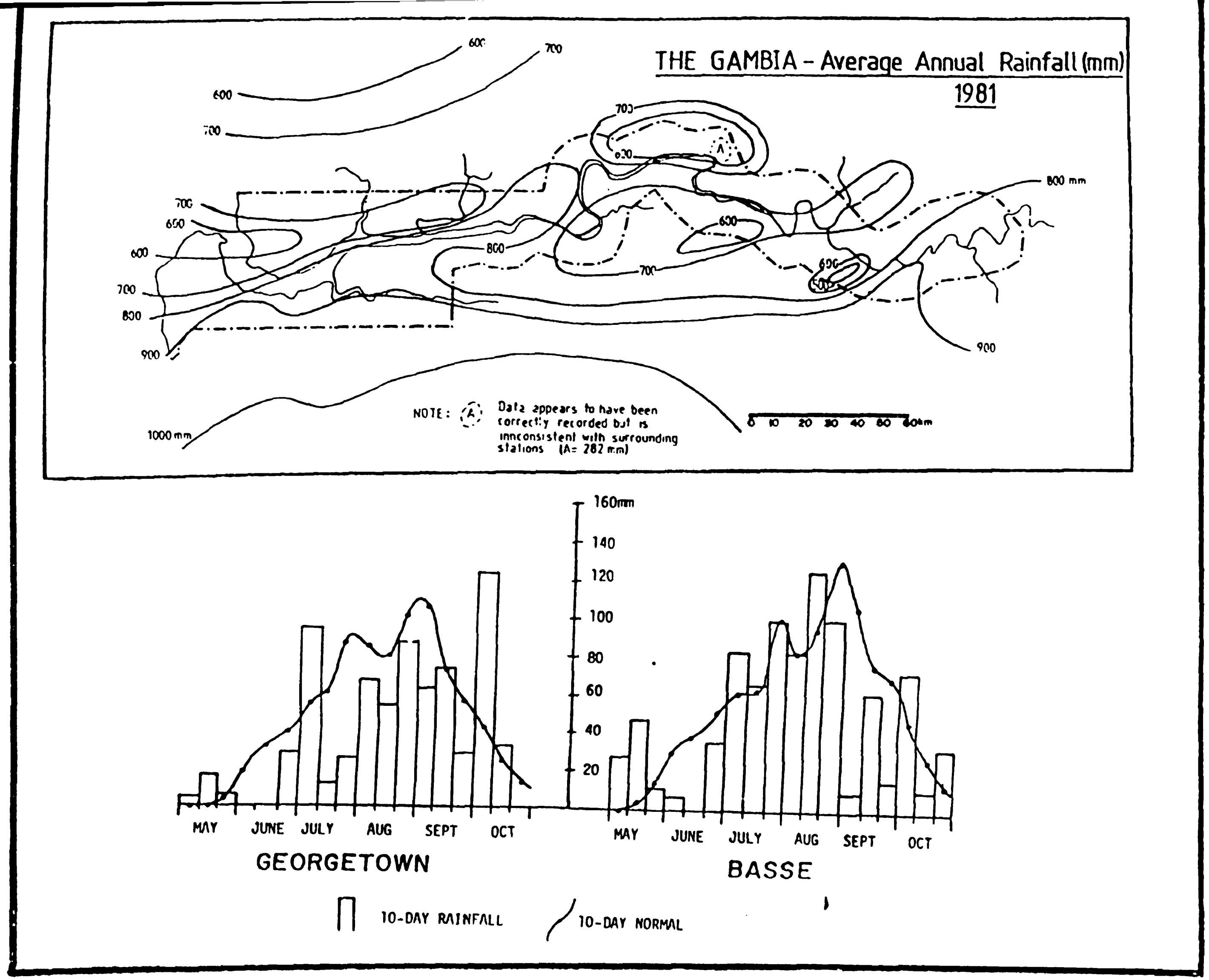

Figure 2.2.--Average Annual Rainfall, 1981.

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minimum temperatures can reach as low as 15°C (Diurnal temperature ranges are greater in the east than in the west). The cool temperatures at this time are due to a dry northwest wind--the harmattan--which begins in December and continues intermittently until April. These cool winds are known to seriously affect the yields of dry season irrigated rice.

Soils and Vegetation

A survey of land resources carried out in 1972-73 and reported by Dunsmore et al. (1976) shows that the soils are generally low in plant nutrient levels throughout The Gambia. Texture varies from sandy, sandy loams, and clay loams found on the higher ground to the heavy clay alluviums in the river flats. The nature of these soils makes them generally responsive to phosphate and nitrogen fertilizers, including animal manuring. An estimation of soil suitability groups over the entire country gave the figures shown in Table 2.2. About 40% of the total land area in the country is classified as suitable for agricultural production.

The structure of the soils and man's manipulation of the vegetative cover is said to have facilitated an increasing amount of gulley erosion in various spots throughout the country. A study which compared aerial photographs taken in 1946 and 1968 revealed some significant shifts in the country's ecology as is evident in Table 2.3. Although the validity of the figures has been questioned by UNSO (1979), the data do shed some light on the general trend over time. The most important of these are: a rapid depletion of

TABLE 2.2.

Soil Group
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Source:

TABLE 2.2.--Soils Suitability Groups

Soil Group	Area (Ha)	Percent of Total
Unsuitable	355,115	34
Marginal	126,127	12
Suitable with qualification	147,781	14
Suitable	326,344	34
Suitable and Irrigable	81,116	8

Source: J. R. Dunsmore et al., "The Agricultural Development of The Gambia: An Agricultural, Environment, and Socio-Economic Analysis," Land Resource Study 22, Land Resource Division, The Gambia, 1976.

Table 2.3.

Vegetation
1 Forest
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[a] Fi

Table 2.3.--Changes in Vegetation Cover

Vegetation and Land Use Description	1946 (%)	1968 (%)	Change[a]
1 Forest (Complete ground cover by trees as viewed from above)	29.9	3.4	(25.5)
2 Woodland Savannah (Tree canopy over 50-70% of ground)	31.3	4.6	(26.7)
TOTAL (1 + 2)	60.2	8.0	(52.2)
3 Savannah (25% of tree canopy)	14.0	17.6	3.6
4 Thorn and small trees (marginal areas usually not suitable for annual crops)	7.8	31.7	23.9
5 Low bush shrub (some low bush and shrubs, visible bare soil/erosion)	0.4	19.9	19.5
TOTAL (4 + 5)	8.2	51.6	43.4
6 Cropping with fallow	17.6	5.5	(12.1)
7 Continuous cropping	0.0	17.3	17.3

SOURCE: Derived from AID, "Gambia Soil and Vegetation Management, Project No. 635-0202, 1977.

[a]Figures in parenthesis are negative.

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the national forest area (60% to 8.0%), a rapid increase in marginally useful agricultural area (8.2% to 51.6%), a reduction of cropping with fallow (17% to 5.5%), and a rapid increase in continuous cropping (0.0% to 17.3%). Haswell (1975) found similar trends in her study of Geneiri.

Social Structure

The Gambia is divided into six divisions which are further subdivided into thirty-five districts for administrative purposes. The Divisions are governed by appointed commissioners while the districts are headed by elected _seyfos_ (chiefs). The dominant social unit is the village which forms a cohesive political and economic entity. The leadership role in the village is played by the _alkali_, who is generally the eldest male of the senior branch of the lineage claiming direct descent from the original founder-settlers of the community.

A common and very important feature of all villages is the _banta ba_, which is a raised platform usually under a large tree. This is the meeting place for male elders of a village. Internally the village is divided into two subdivisions: wards (_kabilolu_, sing. _kabilo_) and compounds (_kordo_ or _suo_). The _kabilo_ varies from a few to a considerable number of _kordos_. The core of a _kabilo_ is a patrilineal kin group emphasizing mutual solidarity between members of the same line.

The _kordo_ or _suo_ is the basic residential unit that accommodates an extended family group with an average of about eleven persons.

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Boundaries between kordos are often separated by a fence to reinforce the privacy of the kordo. The head of the kordo (kordo-tio or suo-tio) is usually the eldest male member of the family and will normally be succeeded by his next eldest brother or son. The kordo-tio is traditionally in a very powerful position in that he maintains complete authority over the social and economic affairs of the family. He is by right a member of the elder age group (keba kafo) in the village. The status and caste of a kordo-tio's family background determines, to a large extent, the power and prestige that he holds in the keba kafo. The kordo may be divided into subunits of dabadalu and/or sinkirolu or it may operate as a unit.

The dabada, the basic production unit, is a semi-autonomous work group within the larger family structure. Gamble (1958) was among the first persons to identify the existence of several types of smaller family units based on brothers and uncles within the larger kordo. Since then several researchers have noticed an increasing tendency for kordos to fracture into smaller kordos. The underlying reasons for this development are said to revolve around the increased contact with the outside world and the monetization of the economy. In this study, reasons given by respondents for forming these smaller units ranged from a desire to be independent to quarrels between brothers. The number of dabadalu within a kordo ranged from 1 to 6 with an average of 1.4. The average number of persons per dabada was 7.8.

The sinkiro forms a group of people who eat together from the same pot. Usually a woman or group of women undertake to cook for a cle

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for a clearly defined set of people. A simple _sinkiro_ might consist of a man, his wives, and their children. The number of _sinkirolu_ in the sample averaged 1.4. Figures 2.3 and 2.4 show a kinship diagram and a _kordo_ layout diagram, respectively. As illustrated in the diagrams, in very large families the relationship between _dabada_ and _sinkiro_ can be very complex.

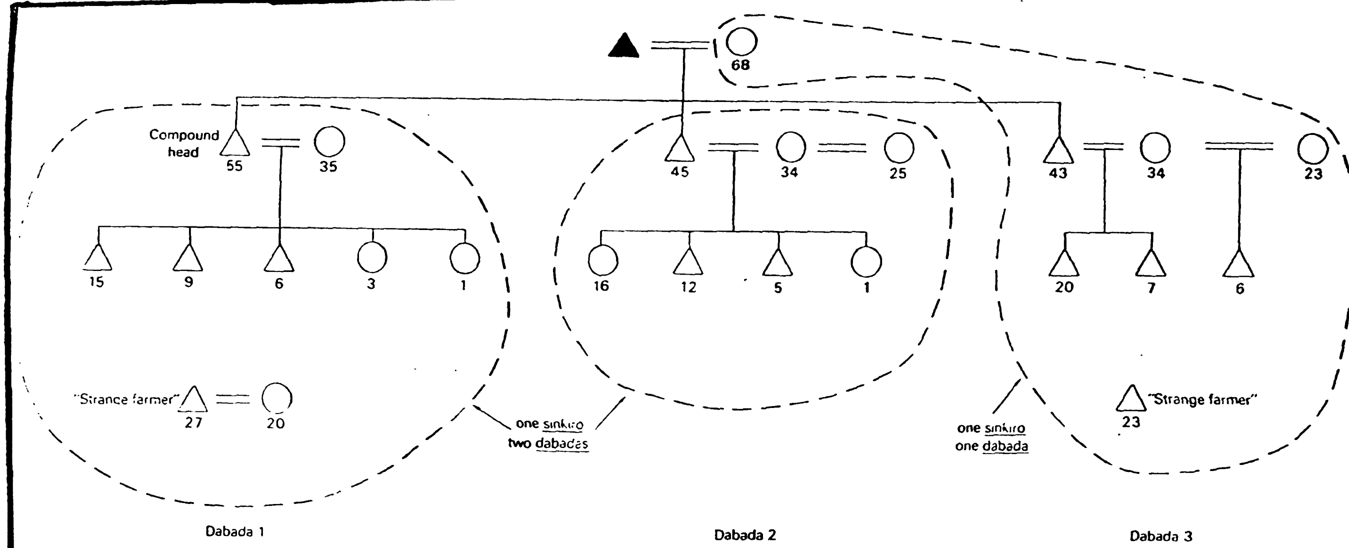
Age Grades (kafos)

Every Gambian villager belongs to an age set from which he progresses through a structure of age grades (_kafos_). The age sets are made up of peer groups which have an age range of five years. Boys and girls join an age set at the age of between 8 and 12 years, after they have undergone circumcision. Above these age sets is a wider structure of age grades called _kafos_. The first is a young boy's _kafo_ (_ding ding messengo kafo_) to which a boy belongs before circumcision. The second is the young men's _kafo_ (_kambani kafo_) which stretches from the early teens to approximately thirty-five. The last one is the elder _kafo_ (_keba kafo_). The leader of each kafo is called _keba-tio_.

Women _kafos_ are more loosely organized. There are basically a young women's _kafo_, before marriage, a married women's _kafo_, and an elder women's _kafo_.

The _kafo_ used to be an important organization as a supplementary farm labor for farmers who requested it. Recently, however, _kafo_ labor has been called upon more frequently for public works than for farm work. Supplementary labor on women's rice fields is


Compound head



Village	Bureng
Compound	Nasso Kunda
Ethnic group	Mandingo
Caste	Nyamaio (blacksmith)
Population	24
Dabadas	3
Sinkiros	2
Strange farmers	3 (all Fulas)

Key

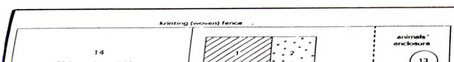
male △ marriage ═
female ○ age ○ 3
dead ▲ delineates dabadas — — —

Notes

1. This compound has 3 dabadas because the compound head has 2 brothers who are fairly old, each with a well established family of wives and children.
2. Members of dabada 3 belong to one sinkiro. Members of dabadas 1 and 2 belong to another
3. Strange farmers are all Fulas
4. There are no compound members living away from the compound
5. All ages are approximate because exact ages, especially with older people, are often not known
6. The elderly mother of the compound head belongs to the dabada and sinkiro of the youngest son because of an especially close relationship with his first wife
7. If the present compound head dies before his brothers, the oldest surviving brother will become the next compound head

Source: Dunsmore et al., 1976.

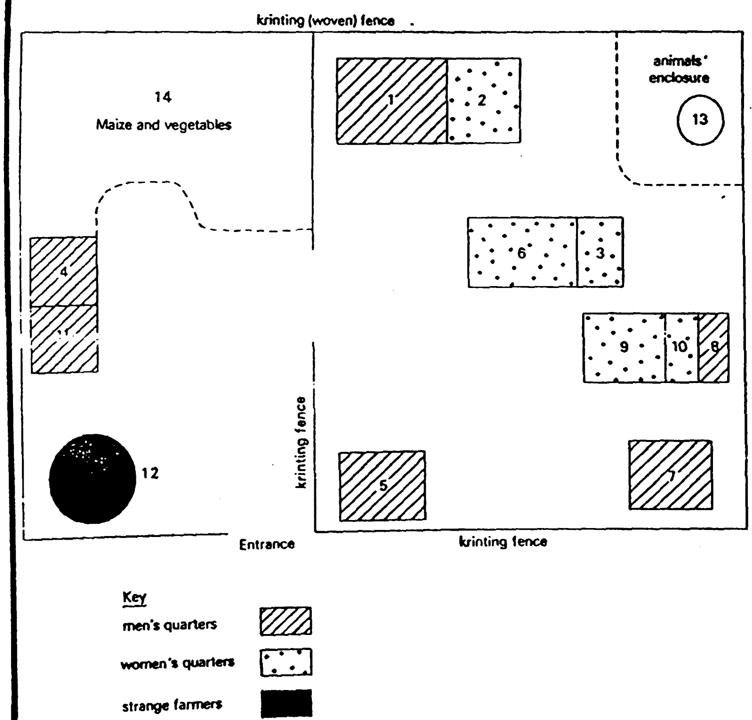
Figure 2.3.--Nasso Kunda, Bureng: Kinship Diagram.



Notes

Dabada 1

1. House of compound head (sitting room/bedroom)
2. Sleeping house of compound head's only wife and her children
3. Kitchen/storeroom of compound head's wife, shared with two



Notes

Dabada 1

1. House of compound head (sitting room/bedroom)
2. Sleeping house of compound head's only wife and her children
3. Kitchen/storeroom of compound head's wife, shared with two wives of head's younger brother
4. Storeroom of compound head

Dabada 2

5. Sleeping house of compound head's younger brother
6. Sleeping house of wives and children of 5. His wives share a kitchen (building 3) with the wife of the compound head

Dabada 3

7. Sleeping house/sitting room of youngest brother of compound head
8. Storeroom for 7
9. Sleeping house for wives and children of 7
10. Kitchen of wives of 7

11. Sleeping house for older boys
12. House of "strange farmers"
13. Fenced area and shelter for sheep
14. Fenced area for growing maize and vegetables

All houses except the boy's sleeping quarters/storeroom (11 and 4), strange farmers' house and animal shelter have corrugated-iron roofs

There are 2 sinkiros in this compound, one sinkiro including two dabadas

Source: Dunsmore et al., 1976.

Figure 2.4.--Nasso Kunda, Bureng: Diagram of the Compound.

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usually provided on exchange bases. A woman simply requests help from her age set or friends and will be expected to return the help when required. This small work group is called barikiyo.

Demography

In 1973 The Gambia boasted of a population of 493,499, excluding 1,082 people referred to as temporary residents. At an annual population growth rate of 2.8% the 1980 population was estimated at 603,000. This puts the population density at about 53 people per square kilometer, making it the highest in West Africa. There are various ethnic groups with the Mandingo making up about 42.3% of the population followed by Fula and Wollof who form 18.2% and 9.5%, respectively (Dunsmore et al., 1976). The sample population had an ethnic distribution of 69.1%, 16.4%, and 14.5% for Mandingo, Fula, and Wollof, respectively.

The 1973 census showed that 47% of the population fell within the 15 to 49 years age group bracket, constituting the main labor force, and 25% were between the ages of 5 and 14 years. Those under 4 years of age constituted 17%, and those over 50 years made up the rest.

The structure of the sample population is shown in Table 2.4. The population has been categorized by sex and age for each village included in the study and for each predominant rice growing region. For example, Kuntaur Fula Kunda had a sample average family size of 7.1 people of which 3.3 are males and 3.8 are females. In the irrigated rice growing region, the sample average family size was

TABLE 2.4.--Structure of the Sample Population

	Males (ages)	Females (ages)		Total Family
Sample			Total	

TABLE 2.4.--Structure of the Sample Population

Village/Region	Sample Size	Males (ages)				Females (ages)					Total Family
		16-60[a]	10-15	>10	Total Male	<60	16-60	10-15	>10	Total Female	
Kerr Bamba	9	3.0	1.1	0.8	4.9 (2.20)[b]	0.6	4.1	0.7	1.0	6.3 (1.00)	11.2 (2.82)
Geneirī	9	3.1	0.8	0.7	4.6 (1.51)	0.0	2.8	0.0	1.0	3.8 (1.48)	8.3 (2.50)
Pakaliba	10	3.2	1.6	0.4	5.2 (1.32)	0.0	3.1	0.9	0.9	5.0 (0.82)	10.2 (1.87)
Mangrove Rice Growing Region	28	3.1 (1.03)	1.2 (0.94)	0.6 (0.50)	4.8 (1.66)	0.2 (0.42)	3.3 (1.09)	1.0 (0.64)	1.0 (0.33)	5.0 (1.50)	9.9 (2.61)
Jarreng	8	3.6	0.6	0.8	5.0 (2.07)	0.0	3.6	0.4	0.9	4.9 (1.46)	9.9 (2.53)
Kuntaur Fula Kunda	10	2.1	0.7	0.5	3.3 (1.34)	0.0	2.6	0.4	0.8	3.8 (1.32)	7.1 (2.13)
Kerewan S. Sira (Mandigo)	9	1.6	0.8	0.3	2.7 (1.22)	0.0	1.7	0.1	0.3	2.1 (1.76)	4.8 (2.49)
Karewan S. Sira (Fula)	9	1.4	0.0	0.2	1.7 (1.12)	0.0	2.0	0.0	0.8	2.8 (0.97)	4.4 (1.94)
Swamp (Inland) Rice Growing Region	36	2.1 (1.29)	0.5 (0.61)	0.4 (0.56)	3.1 (1.83)	0.0 (0.00)	2.4 (1.23)	0.2 (0.42)	0.7 (0.52)	3.4 (1.69)	6.5 (3.05)
Sankuley Kunda	7	2.6	1.1	0.9	4.6 (1.51)	0.0	1.9	1.1	0.9	3.9 (1.21)	8.4 (2.51)
Karantaba Tobakoto	10	2.2	0.0	0.5	2.8 (0.79)	0.0	3.5	0.0	0.8	4.3 (1.06)	7.1 (1.20)
Hella Kunda	9	2.2	1.0	0.4	3.7 (1.32)	0.0	1.6	0.4	0.6	2.6 (1.13)	6.2 (1.72)
Irrigated Rice Growing Region	26	2.3 (0.74)	0.7 (0.74)	0.6 (0.58)	3.6 (1.36)	0.0 (0.00)	2.4 (1.13)	0.5 (0.86)	0.7 (0.53)	3.6 (1.33)	7.2 (1.93)
TOTAL	90	2.5 (1.14)	0.8 (0.80)	0.5 (0.54)	3.8 (1.81)	0.07 (0.25)	2.7 (1.22)	0.4 (0.65)	0.8 (0.49)	3.9 (1.69)	7.7 (3.00)

SOURCE: Survey Data

[a]Includes head of household

[b]Figures in parenthesis are standard deviations

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7.2 people, including 3.6 males and 3.6 females. For the entire sample the average family size was 7.8 people. About 67.5% of these were in the 16 to 60 age bracket, 15.6% in the 10 to 15 years bracket, and 10.8% were less than 10 years. The rest was made up of women older than 60. Women made up about 51.6% of the total population.

The Role of Women

Women have played an important part in the economic development of Africa and in recent years a lot of research efforts have been devoted to studying their role in agricultural development. The usual factors characteristic of women in the Muslim society exist in The Gambia as are to be found in other African countries. In the village community men and women play distinct and separate economic, social, and political roles. These roles are not seen as overlapping nor are they competitive, rather they are complementary. Each sex has its clearly outlined duties and spheres of influence. A member of one sex encroaches on the other's territory at the danger of derision and sometimes even ostracism. However, no important function affecting both sexes can take place in a village or be complete without the participation of both sexes. It is necessary for both women and men to perform their own, separate duties in order for any village activity to be successful (AID, 1979).

This separation of roles extends into life as well. In agriculture men usually cultivate dryland crops--sorghum, maize, millet, and groundnut--while women are responsible for rice cultivat

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cultivation and in the past, the famine crop, findo.[1] In addition, both men and women cultivate vegetable gardens. Since men clearly take first and senior place in this kind of arrangement, on account of their control of the cash crop, it has been assumed by outsiders and even by many Gambians themselves that development plans should involve men and that female's role is minor since it is secondary. It is assumed that benefits will "trickle down" to the less fortunate women.

This trickle-down approach has unsurprisingly provoked sharp criticism from several writiers on The Gambia. Among them, Haswell (1975), Weil (1973), and most recently, Dey (1980, 1981, 1982) have been most prominent. All generally agree that development benefits in The Gambia in recent years have accrued more to men than to women and that the introduction of groundnut as a cash crop with ox-drawn implements has resulted in men neglecting the cultivation of cereals. Consequently, and especially in the rice growing areas, a heavier dependence has been placed on women to provide a bigger share of the family food.

Although Mettrick (1980) agrees that men have benefited more from the oxenization program in The Gambia than women, he does not agree with the conclusion that the effect of oxenization has been for men to reverse the trend toward concentration on groundnuts at the expense of other cereals. Unfortunately, Mettrick has no statistics to support his statements, but Lowe's (in Dunsmore et al.,

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[1]See Chapter III for a more detailed discussion on the specialization of labor by sex along crop enterprise lines.

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1976) findings tend to corroborate Mettrick's contention. In his study of farmers in The Gambia, Lowe found that the pattern of female labor use between oxenized, manual, and control compounds was very much the same. In all cases he found that there was a greater expenditure of male than female labor. AID (1979) argues that focusing development attention on women and nonirrigated rice may lead to women's greater economic efficiency, but that this could lead to a profound influence on the role and function of women within the family. "The commercialization of rice production," the report suggests, "will tend to increase the amount of time spent on back breaking labor" (p. 22).

With the increased research interest in the socioeconomics of Gambian agriculture and as more data become available, the question of women's participation in the development programs will remain a heated subject of debate for years to come. There is no doubt that women are continuing to play a significant role in the development of agriculture, especially rice cultivation in The Gambia. The traditional sexual division of labor (with women specializing in rice cultivation), the increasing commercialization of rice production, and the increasing contact with the outside world, make it imperative for women to be an integral part of any rural development program in The Gambia. The society has demonstrated some flexibility to change. In recent years women have been called upon to assume responsibility that was hitherto a traditionally male domain. For example, about 11% of respondents in this study indicated that their eldest wives will assume leadership of the household in case of death of the cu

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of the current head of the household. This compares to 37% and 52% for those who said that the brother and eldest son, respectively, will assume the leadership role. Also about 42% indicated that their wives were the most important person influencing their major decisions. This is contrary to the traditional view that women should be seen and not heard.

In the irrigated rice cultivation areas, most heads of households (about 68%) indicated a desire for their wives to participate fully in irrigated rice cultivation. However, almost all respondents in the sample were against women having complete control over a groundnut field. Reasons for this negative attitude varied from following tradition, to difficulty in cultivating both rice and groundnuts, to expressed fears that women will use the income from groundnuts to file for divorce. On the other hand, about 66% indicated that women can sell up to one-fourth of the rice output they obtain from their fields without accounting for the income received. Heads of households will generally not buy rice from their wives. Women contribute their rice, as part of the family food voluntarily. Only about 7% of the respondents indicated that they will buy rice from their wives if need be. Also, family labor, including wives, is never paid for working on fields belonging to males within the same household.[3]

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[3]This is contrary to Dey's (1980) findings who reported that men will usually buy rice from their wives for family use and that they pay their wives for working on their fields in Saruja. In the traditional society, the main responsibility for feeding a family rests on the head of the household, but every family member is obliged to contribute either in the form of labor, in cash, kind, or both.

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The implication from the foregoing discussions is that for women to achieve economic independence, development programs in The Gambia will have to concentrate on programs specifically directed toward improving the crop of women, which is rice. However, the repercussions on the family structure will have to be watched very carefully.

Land Tenure

Land in The Gambia has a social importance beyond its use as a productive resource. And as indicated by Upton (1973), the area controlled by any community represents the territory, the space for living, and indeed the home of the individual members. The literature is replete with arguments for and against the communal system of land ownership, but it is not intended to review that here. Eicher et al. (1980) state that the conclusion that communal land tenure institutions are flexible and not an immediate constraint on increasing agricultural production is outdated and call for increased attention to be paid to land tenure and land use policy issues in the 1980's and 1990's. Whatever attention is paid to these issues in The Gambia, it is doubtful whether land reform in the direction of individual ownership is needed at this time. It is recognized, however, that long-term plans which take into consideration the total welfare of the community including education, health, urbanization, etc., will have to address the land tenure problem.

Land in the provinces of The Gambia is not individually owned. The land is owned by the government. Individuals or groups simply have use

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have use rights. The land is vested in and administered by the district authority. The distribution of rights to use land among the local people is governed and regulated by local customary laws and is usually the responsibility of the <u>alkali</u>. The present land tenure system has been largely determined by historical factors. The first patrilineage to move into an otherwise previously unoccupied territory receives exclusive use rights to the land after making sacrifices to the deities. A village is then born. All other immigrant families arriving later are given land by descendants of the original patrilineage. The founder-settler patrilineage or patrons (<u>langsarlu</u>) grants land to the new patrilineage or clients (<u>falifalu</u>) more commonly referred to as strangers (<u>lungtango</u>).

<u>Land Allocation</u>

Around the 19th century the allocation of land was closely associated with the caste system in that the <u>langsarlu</u> in the past used land allocation to reinforce caste hierarchies. Poorer land almost invariably went to members of low caste compounds. However, as Lowe (1976) points out, the emphasis on caste is slowly dying out although residuals of its effects are still perceived today, primarily in marriage customs. The importance of land as a source of local political power is also diminishing, and the accumulation of wealth through trading and money lending has begun to usurp traditional methods of achieving and maintaining influence.

The mechanics of land allocation are straightforward and are summarized by Lowe. Each village has an identifiable area of land in a com

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(in a community sense, there are no physical boundaries) that falls within the jurisdiction of its own alkali. The alkali has the authority to allocate land to a lungtango. At the end of every year each kordo-tio makes a symbolic return of lands in his control to the jurisdiction of the alkali, who then has power to retain these lands. This authority is rarely enforced.

Any kordo-tio has a right to clear land outside the village jurisdiction if it is unclaimed by any other community or persons and attach it to the store of land used by the kordo. That particular piece of land is held in perpetuity by the kordo that cleared it, and the alkali has no claim on it. The kordo-tio has the right to reallocate any of the kordo lands to outside individuals either to people from other kordos in the same or neighboring village. No other member of the kordo has that right. Allocation of kordo land to outsiders is usually done on a year-to-year basis.

Although the village communities are strongly Muslim, the inheritance procedures, where land and other possessions are divided among sons upon death of a kordo-tio, are not followed as far as land is concerned. Upon death of a kordo-tio, the kordo lands are inherited by the succeeding kordo-tio. Thus, while fragmentation might be a problem in land use, existing parcels of land are retained intact without further divisions.

Allocation of Land Used by Women

Because of the exogamous and patrilocal marriages, the allocation of land to be used by women in rice cultivation is not as strai

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as straightforward as described above. It, however, demonstrates certain flexibility in the land tenure system.

There are three main channels through which a woman can obtain rice land. The most important source is the husband. These are usually lands that were being worked by the mother-in-law. Since young men usually stay in the same _kordo_ after marrying, the fields are thus left in the same _kordo_. The second source is from the woman's parent's _kordo_. In most cases these are fields that were previously being used by their mothers. These fields are mobile since they can be returned to the woman's original _kordo_ , if requested, because of shortage there or in the case of divorce. These same lands could be passed on to the woman's daughter when the daughter marries, thus transferring the use rights to a third _kordo_. The third source is rice land on loan from another _kordo_.

Allocation of Land to Strange Farmers

The strange farmer is a migrant farmer and a source of labor to the _kordo-tio_. In 1930 the total number of strange farmers in The Gambia were estimated at 50,000, and around 1976 they were variously estimated at between 12,000 and 17,000. The numbers are believed to be steadily declining because of the unpredictability of rainfall in recent years. This has made groundnut production unprofitable to strange farmers when one considers both monetary and non-monetary costs. In the sample there was an average of 0.2 strange farmers per household.

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In return for three or four days of labor per week on fields designated by the kordo-tio, the strange farmer receives an allocation of land for growing his own groundnuts, food, accommodation, sometimes tobacco, use of farm implements, and the product of his work on his field of groundnut. At the end of the season the migrant returns home. He usually provides a gift to the kordo-tio as a recognition of his host's hospitality.

Land Use and Land Use Pattern

Both Weil (1968) and Lowe (1976) found a system of land use that followed a more prosaic pattern based on facility of access. Weil indicates that land is first brought into use in the immediate vicinity of the village settlement area and land use consequently expands in concentric increments as a result of population increases. The founder settlers, langsarlu, utilized the land closest to the village, and the later arrivals, generally of a lower caste, were given more outlying and less fertile land to cultivate. Netting et al. (1980) discerned a similar pattern of cultivation in West Africa: house gardens, intensive nongarden cultivation, and non-permanent fields at a greater distance from the house.

Because of the geographical specificity of certain crops, Lowe qualifies the concentric pattern as described by Weil. He notes that most of the 24 villages included in his study were located on the colluvial soils where the range of soil fertility is limited. Sorghum, millet, maize, and groundnuts would usually be situated in the immediate vicinity of the village and the bulk of the rice

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the rice crop is restricted to the alluvial areas along the river. It is, however, true that where population pressure had absorbed all of or most of the colluvial soils, new immigrants would be allocated holdings on the less fertile soils of the lower plateau and plateau soils.

The land use pattern as practiced today more closely follows the pattern described by Lowe. The amount of land that any kordo uses irrespective of caste, is a function of the size of the kordo membership and the agricultural technology used. Kordo members that have above average wealth are usually able to command extra labor and thus increase their total hectarage. Table 2.5 shows the average area of each crop cultivated by village and region as found in the present study. For the whole sample, the average area cultivated per household for the 1981-82 cropping season was 2.24 ha. Of this area, 39.3% was devoted to groundnut production, and 29.9% each was devoted to upland cereals and rice cultivation. The rest was devoted to cotton production.

The mangrove rice growing region, with the highest average family size of 9.9 persons, had the highest average area cultivated of 2.90 hectares.

Summary

This chapter is a description of the agro-climatic conditions found in The Gambia and the social structure of the rice farmers. The climate is characterized by a very short, rainy season and a long, dry season. The soils are generally infertile and are said to

TABLE 2.5.--Average Area of Crops Cultivated by Village and Region per Household

Village/Region	Sample Size	Mean Crop Area (Hectares)												Total Mean Area (ha)
		Ground	Early	Late	Sorghum	Maize	Funio	Cotton	Mangrove Rice	Inland Swamp	Dry Irrigated	Wet Irrigated	Rainfed Rice	

TABLE 2.5.--Average Area of Crops Cultivated by Village and Region per Household

Village/Region	Sample Size	Mean Crop Area (Hectares)												Total Mean Area (ha)
		Ground Nut	Early Millet	Late Millet	Sorghum	Maize	Funio	Cotton	Mangrove Rice	Inland Swamp	Dry Irrigated	Wet Irrigated	Rainfed Rice	
Kerr Bamba	9	1.88	1.12	--	--	--	--	--	1.00	--	--	--	--	4.00 (1.33)[a]
Geneiri	9	1.36	0.50	--	--	0.01	--	--	0.61	--	--	--	--	2.48 (0.75)
Pakaliba	10	0.98	0.58	--	--	0.08	--	--	0.64	--	--	--	--	2.29 (1.23)
Mangrove Rice	28	1.39	0.73	--	--	0.03	--	--	0.75	--	--	--	--	2.90
Region		(1.11)	(0.47)			(0.06)			(0.36)				--	(1.34)
Jarreng	8	0.55	--	--	--	0.49	--	--	--	1.19	--	--	--	2.22 (0.73)
Kuntaur Fula Kunda	10	0.13	--	0.23	--	0.34	--	--	--	0.61	--	0.28	--	1.60 (1.09)
Kerewan S. Sira (Mandingo)	9	0.83	0.17	0.05	0.35	0.31	--	--	--	0.43	0.08	--	--	2.23 (0.83)
Kerewan S. Sira (Fula)	9	0.68	0.13	0.27	0.38	0.16	--	--	--	0.24	--	--	--	1.86 (1.06)
Swamp (Inland Rice)	36	0.54	0.07	0.15	0.18	0.32	--	--	--	0.60	0.02	0.08	--	1.96
Growing Region		(0.60)	(0.22)	(0.23)	(0.35)	(0.37)	--	--	--	(0.50)	(0.04)	(0.22)	--	(0.95)
Sankuley Kunda	7	0.35	0.06	0.12	0.02	0.13	--	0.03	--	--	0.06	0.16	0.03	0.95 (0.63)
Karantaba Tobakoto	10	1.08	--	--	0.37	0.16	--	--	--	--	0.37	0.34	0.38	2.73 (1.31)
Hella Kunda	9	0.83	--	--	0.36	0.26	0.03	0.15	--	--	0.06	0.03	0.05	1.76 (1.04)
Irrigated Rice Growing	26	0.80	0.02	0.03	0.27	0.19	0.01	0.06	--	--	0.18	0.19	0.17	1.19
Region		(0.72)	(0.06)	(0.10)	(0.34)	(0.20)	(0.03)	(0.16)	--	--	(0.18)	(0.19)	(0.24)	(1.26)
TOTAL	90	0.88	0.26	0.07	0.15	0.19	0.00	0.02	0.23	0.24	0.06	0.09	0.05	2.24
		(0.89)	(0.43)	(0.17)	(0.30)	(0.29)	(0.02)	(0.09)	(0.40)	(0.43)	(0.12)	(0.19)	(0.15)	(1.24)

Source: Survey Data

[a]Figures in parentheses are standard deviations.

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respond well to fertilizer application. The land tenure system is of the communal type where land cannot in principle be sold or rented.

Despite the country's high effective population, land is not yet an exceptionally scarce resource. Less than half of the agriculturally suitable land is under cultivation at the present time. However, although there is still a high percentage of fallow and uncultivated land, the pressure on this resource base is becoming evident. Fallow periods have decreased from the traditional 10 to 20 years to 5 to 7 years. The increased population pressure, incentives to grow more cash crops, and the availability of ox-drawn implements to work more area with the limited labor supply have all resulted in progressively shorter bush-fallow periods. In some areas today, many farmers are practicing almost continuous cultivation. This increasing pressure is likely to lead to social conflict over land rights unless methods are introduced which will increase yields per hectare.

It should be noted that as the agricultural systems change and land acquires value, tenurial practices adjust, often in a spontaneous and almost insensible manner. They may be recognized in litigation and legal precedent long before either customary or statutory law includes them. This gradual process may be preferable to any attempt to institute individual rights in land as a way of hastening intensification. Though no one should expect a painless and automatic transition in the socio-cultural factors of household and villa

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and village organization of land tenure rules, it seems apparent that these institutions show some degree of correlation with agricultural systems and that individuals,when given a choice, may act so as to bring about change that adjusts their social behavior to an altered set of ecological constraints and options (Netting et al., 1980).

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CHAPTER III

A DESCRIPTION OF THE RICE PRODUCTION SYSTEMS AND THE SEXUAL DIVISION OF LABOR

Introduction

The main objectives of this chapter are to identify and describe the major types of rice production systems in The Gambia and to discuss the sexual division of labor in crop production.

Five major types of rice production systems are recognized throughout The Gambia. The distinction between the systems are based on their differing ecological characteristics and cultural practices. Subtypes of the major systems are known to exist, but they vary more in degree than in kind and the names and descriptions attached to them are often regionally and ethnically dependent.

The Gambia is unique in West Africa in that there is a distinct, though not rigid, division of labor by sex which follows crop enterprise lines. In other West African countries, sexual division of labor in farm operations is usually along activity lines with women performing the jobs demanding less strength and men concentrating on the more difficult and strength-demanding jobs.

Also in this chapter a description of the marketing mechanism and pricing policy for rice and groundnut will be presented. The contents of this chapter sets the stage for the financial and economic analysis

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analysis to follow, but first, a comment on labor measurement and input and output aggregation is in order.

Labor Measurement

Labor is the most important single factor of production in traditional African agriculture. However, by its nature, analysis of this factor of production has in the past presented some problems and to present there is no universally accepted method for dealing with it. There is a need to distinguish between the amount of labor available, a stock concept, and the amount of labor actually utilized, a flow concept.

The definition of how much labor is available is somewhat arbitrary depending on who is included in the labor force and how many hours they are able and willing to work. The size of the family labor force depends upon the age at which children are expected to help on the farm and in other productive activities and whether women and old persons are included. In The Gambia, the definition of the farming household affects the size of the stock of labor. The size of labor of the kordo, encompassing the extended family system will differ from that of the dabada which more closely approximates the nuclear family system. The latter, which is used in this study, will invariably be smaller than the former.

In like manner, the hours available for farm work per person per year depend on the number of hours individuals are prepared to work and the extent of their off-farm commitments. This means that the size of the labor force and the hours worked will depend on customs

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customs and traditions, attitudes toward knowledge, leisure, and income. As Byerlee et al. (1977) indicate, one cannot use conventional measures of labor utilization, such as labor force participation and unemployment rates in rural Africa, where most of the population is self-employed in producing largely for home consumption. Almost all the adult population participates in the labor force at some time of the year and a negligible proportion of the labor force is unemployed and seeking work.

For most purposes the use of labor hours or labor days have been found to be satisfactory. It is usual to assume, regardless of actual work habits, that eight hours are equal to one labor day. This system is the one adopted by the Food and Agriculture Organization Farm Management and Data Collection System and has been used by Kamuanga (1982) and Eponou (1983). The limitations of this unit of measurement are apparent. Workers vary in skill, strength, and application, while jobs to be done on a farm also vary in the demands they impose on a worker (Dillon and Hardaker, 1980).

The practice is sometimes adopted of measuring labor in man-hour or manday equivalents, applying arbitrary conversion factors. There is no general agreement on the magnitude of these conversion factors. Norman (1973), for example, used the following conversion factors: small children under six years = 0.00 man-equivalent; large children, 7-14 years = 0.50 man-equivalent; male adults, 15-64 years = 1.00 man-equivalent; female adults, 15-64 years = 0.75 man-equivalent; and men and women over 64 years = 0.50 man-equivalent. Spencer et al. (1976) on the other hand, used the following convers

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conversions: adult-equivalent (over 19 years) = 1.5 youths (10-19 years) = 2.0 children (under 10 years). Also in 1979, Spencer et al., used 0.75 male hour = 1 female hour = 2.0 child hours. The weights were based on relative wage rates. The weakness of these approaches is that for some tasks a woman or child might be at least as effective as a man and it could only be for tasks involving physical strength and endurance that such conversions would apply.

As Brown (1979) puts it, experience throughout the world has shown that it is a fallacy to assume that a woman's or child's effective output is less than a man's, for jobs on the farm are highly specialized. In a study on the farming systems in the high altitude areas of the Ankole district in Uganda, Ssentongo (1973) is quoted by Brown as presenting a photograph which showed the outcome of a contest between a farmer's wife and a male extension worker in harvesting finger millet. The male extension worker is said to have lost the contest both in the quantity harvested and the quality of the product. Ssentongo's comments were that "you just cannot beat a professional" (p. 53).

Strictly speaking, when conversion factors are used, they are better worked on a task-by-task basis. This method, however, is sometimes impracticable. Notwithstanding the above comments, it is assumed in this study that family members would ordinarily be assigned to jobs according to what they do best. Thus, all labor inputs are given equal weights. Although labor inputs were originally measured in hours, the total hours for each labor input category have been giv

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been divided by eight to obtain a measuring unit referred to as workday[1] in this study.

Input and Output Aggregation

All input and output coefficients used in this chapter were first converted to units per hectare for each field and each household. Aggregations were done by weighting each input or output by the field area before obtaining a weighted mean. Thus the averages used here are different from the simple means that are obtained by summing over a variable and dividing by the number of observations.

The Rice Production Systems

Upland Rice

There are two different types of Upland rice in The Gambia, namely Tandakos and Bantafaro. Tandako is rice grown on upland soils that are under free drainage. The soils are generally sandy to sandy clay, and are of moderate fertility. They are known to be highly responsive to nitrogen fertilizers but their water retention capacity is very poor.

Tandakos are mainly found in the western area where rainfall is relatively high and extends over a longer period than is obtained in other parts of the country. The total potential area

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[1]Workday as used here is equivalent to Manday as defined in K. H. Friedrich, Farm Managerment Data Collection and Analysis (1977), p. 53. The term "workday" is preferred over Manday because it does not give the impression that a conversion factor(s) has been used.

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is estimated at between 4,000 and 15,000 hectares, but they are often confused with associated mangrove swamps which require leaching before planting.

Bantafaro, which literally translated means outside the swamp, refers to rice grown on shallow depressions that accumulate water during the wet season, through rainfall and runoff water from the surrounding higher grounds. The depressions are bowl-shaped so that the accumulated water is often shallower on the edges and becomes progressively deeper in the center. They more closely resemble the "bolilands" of Sierra Leone. The soils are hydromorphic and are of moderate to heavy alluvial clay which are often rich in organic matter as a result of silt deposit from the runoff water.

Although bantafaros can be found throughout the country, they are more concentrated on the Eastern third of the country. The potential area has been estimated at between 8,000 and 10,000 hectares. Basically, bantafaros are a transition zone between the dryer upper lands and the wetter lower lands. Because of their similarity in cultural practices, both tandakos and bantafaros are considered in this study as one type and are labelled as upland rice.

The average area of upland rice cultivated per dabada was 0.20 hectares. Except for dry season irrigated rice, this area is lower than any of the other rice systems analyzed. As is shown in Table 3.1, upland rice had the lowest total labor input per hectare with an average of 253.8 workdays. Of this amount, family labor contributed about 98.7 percent, strange farmers put in about 0.1 percent, while hired labor contributed 1.1 percent.

TABLE 3.1.--Summary of Input/Output Data on the Different Types of Rice Production Systems

Item	Unit	Upland Rice	Bafaro	Mangrove Rice	Irrigated Rice Dry	Irrigated Rice Wet
Yield	Kgs/ha	1326 (858.11)[a]	1828 (953.87)	1880 (958.29)	2767 (1597.27)	2429 (1419.80)
Seedrate	Kgs/ha	46 (44.42)	50 (6.66)	46	77 (63.21)	95
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TABLE 3.1.--Summary of Input/Output Data on the Different Types of Rice Production Systems

Item	Unit	Upland Rice	Bafaro	Mangrove Rice	Irrigated Rice	
					Dry	Wet
Yield	Kgs/ha	1326 (858.11)[a]	1828 (953.87)	1880 (958.29)	2767 (1597.27)	2429 (1419.80)
Seedrate	Kgs/ha	46 (44.42)	50 (6.66)	46	77 (63.23)	95
Fertilizer	Kgs/ha	0	0	0	14	25
Total Labor	Workdays/ha	253.8 (193.83)	361.1 (235.49)	326.0 (111.43)	331.0 (232.08)	324.1 (274.11)
of which Family	Workdays/ha	250.4	324.1	313.3	280.6	307.1
Strange Farmers	Workdays/ha	0.5	15.8	0.0	20.6	6.4
Hired	Workdays/ha	2.9	21.2	12.7	29.8	10.6
Animal Power[b]	Hours/ha	--	3	12	--	--
Ox Equipment[b]	Hours/ha	--	3	12	--	--
Power Tiller	Hours/ha	--		--	24	27
General Data						
No. of Households (dabada)[c]		14	31	26	25	23
Average area	Ha	0.20 (0.16)	0.50 (0.34)	0.68 (0.26)	0.17 (0.12)	0.30 (0.19)
Enterprise wage rate	Dalasis[d]/wd	2.50	2.87	2.74	3.86	3.50
Farm Gate Price of Output[e]	Dalasis/Kg	0.51	0.51	0.51	0.51	0.51

Source: Survey Data

[a]Figures in parentheses are standard deviations.

[b]Animal power and ox-drawn equipments are used mainly for transporting produce to the village after harvest.

[c]Includes households whose cultivated area of a given crop fell within two standard deviations of the mean area.

[d]$1.00 = 2.20 Dalasis in May 1982.

[e]Quaranteed producer price in the 1981/82 season.

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The cultivation season for upland rice started from early June and extended up to the end of January. Figure 4.1 shows the monthly labor profile for upland rice cultivation. There were two monthly labor peak periods, in August and November, which corresponded with the weeding and peak harvesting periods, respectively. The month of August had the highest labor demand period per hectare.

Land preparation and planting.--The land is usually cleared well before the start of the rains by brushing/slashing and burning. As soon as the rains start and when the ground is soft enough, the land is dug to a depth of about three to four inches. Planting is by direct broadcast of pregerminated seeds at an average density rate of 46 kilograms per hectare. Only moderately drought tolerant and short duration varieties of about 90-100 days are planted. The Department of Agriculture recommends the use of *Se 302G*, *Se 314G*, *Se 319G*, *IR 528*, and *Soavina* varieties for upland rice, but these are rarely used by farmers because they are seldom available. Instead, farmers rely on seeds preserved from the previous season.

The combined operation of land preparation and planting required on the average about 70 workdays per hectare. This was lower than the other two main activities in upland rice cultivation and lower than similar activities in the other rice enterprises.

Care and cultivation.--Care and cultivation includes weeding, thinning, and bird scaring after broadcasting and before harvest. Two weedings at about four and eight weeks after broadcasting are

Figure 5.1

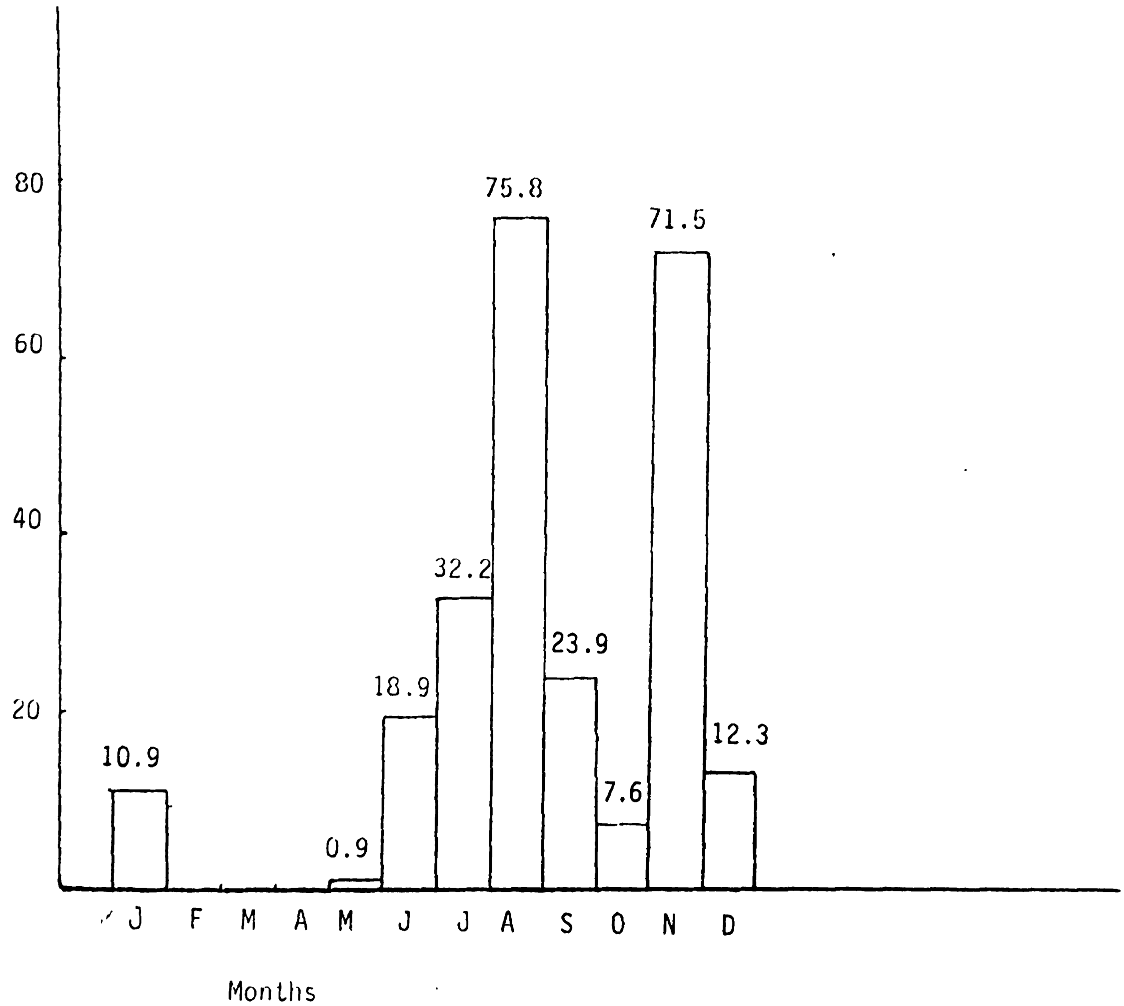

Figure 3.1--Monthly Distribution of Labor per Hectare in Upland rice Cultivation.

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required. Moderate bunding is sometimes practiced as a means of controlling the water. Chemical fertilizers are rarely applied. About 94 workdays nearly 37 percent of the total labor requirements per hectare, were utilized in care and cultivation, and except for the dry season irrigated rice, this demand on labor was higher than the demand on labor for similar activities in the other rice systems.

Harvesting.--Harvesting of upland rice started in November and extended up to the end of January. The rice is ready for harvest when matured and practically dry. Harvesting is done by cutting single panicles with a small knife. The panicles are tied into bundles and left in the field until the end of the day when they are collected and transported to the village for storage. On the average, a total of about 90 workdays per hectare were used for harvesting upland rice.

The yield per hectare averaged 1,327 kilograms. This was the lowest among all the rice enterprises analyzed in this study. It was, however, higher than the 780 kilograms and 962 kilograms per hectare reported by Spencer et al. (1979) for upland rice and hand boliland rice respectively in Sierra Leone. Upland rice and bolilands in Sierra Leone have similar ecological characteristics to the upland rice in The Gambia.

Bafaro

Bafaro, which literally translated means inside the swamp, is rice grown on fresh water marshlands along the upstream two thirds of

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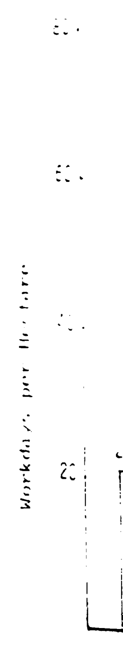
the main river, or marshes along the tributaries which are further away from the lower bed of the river. The fields reach various levels of submersion periodically from the tides and river floods. The soils are of rich clay and do not need much fertilizers. The estimated potential area is about 12,000 hectares.

The average area of bafaro cultivated per dabada was 0.50 hectares. This is second only to mangrove rice among the rice enterprises. Bafaro had the highest demand on labor per hectare when compared to the other rice systems. Of the estimated average total demand of 361 workdays, family labor accounted for about 89.9 percent, strange farmers accounted for about 4.4%, and hired labor accounted for about 5.8%. The cultivation season for bafaro extended from late May to the end of January. The monthly labor profile in Figure 3.2 shows two labor peak periods in August and December. These peak periods occurred at the time of intense planting and harvesting respectively. The month of August had the highest labor demand of 71.7 workdays.

Land preparation.--Land clearing and digging is done in the early part of the rainy season. Some of the fields can be plowed by power tillers. The land is puddled by hand and feet to break up any compact soil and bury some weeds before planting starts in August and September. On the average, land preparation required about 114 workdays per hectare. This was more than 31 percent of the total labor demand per hectare and was higher than similar activities in the other rice enterprises.



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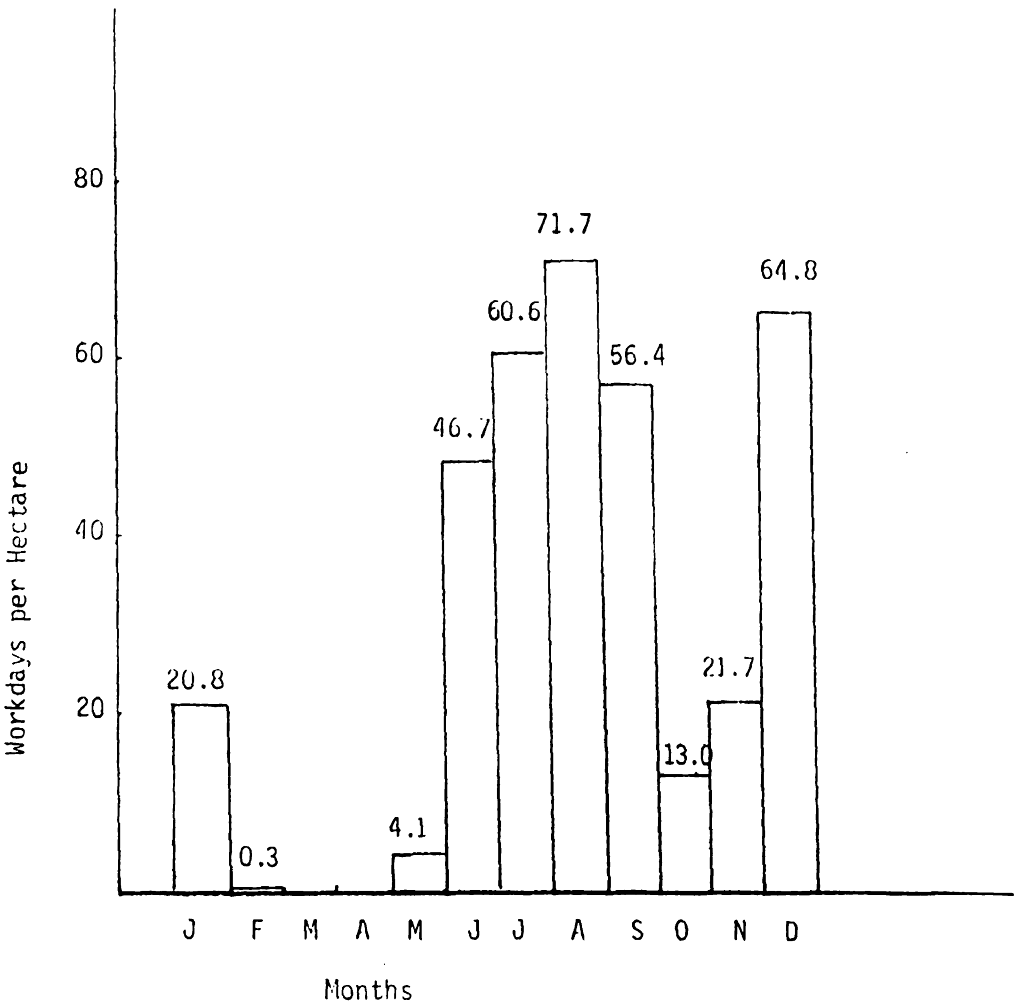

gure 3.2--Monthly Distribution of Labor per Hectare in Bafaro rice Cultivation.

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Planting and nursing.--Seeds are either directly broadcast in July or transplanted from drybed nursery in August and September. Two varieties of seed are recommended for use in bafaros; a medium duration (135-155 days) variety like Rok 5 to be planted on the outer shallower edges of the fields and a long duration (155 to 175 days) variety like Phar Com En to be planted on the deeper center. Where transplanting occurs, seedlings are planted in single plants per stand at distances of between 13 and 15 cm apart. Seedlings are usually ten weeks old at the time of transplanting. The combined operation of planting and nursing required about 99 workdays per hectare. The average seed rate was estimated at about 50 kilograms per hectare.

Care and cultivation.--Broadcasted fields need at least two weedings at six and ten weeks after planting. Weeding on transplanted fields is normally done about four weeks after transplanting. An average of about 63 workdays per hectare was needed for care and cultivation. This was the third lowest when compared to similar activities in the other rice enterprises and except for nursing of seeds, it placed the lowest demand on labor in relation to the other activities.

Harvesting.--Harvesting is done by the single panicle method and is similar to upland rice harvesting. The average labor demand for harvesting was about 85 workdays per hectare. The average yield was estimated at about 1,828 kilograms per hectare. This was higher than the yields

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than the yields recorded for upland rice but was lower than those of the other rice systems. The yields are also lower than the 1923 kilograms per hectare reported for inland swamps in Sierra Leone by Spencer et al. (1979).

Mangrove Rice

This is rice grown on brackish water marshes on areas which are subject to salt water intrusions along the lower parts of the river Gambia. Some of the soils contain acid sulphides and both the *Rhizophora* and *Avicenia* type of vegetation are present. The flooding and tidal action provide moderate fertility from the silt deposits. The potential area is estimated at 10,000 hectares.

Mangrove swamps are known to be very sensitive to prolonged droughts for there is a risk that the sulphides in the soil might change to sulphates which would induce a sudden fall in the pH down to 4 or 5. This fall in pH, increases the acidity on the soil and makes it impossible for rice to be grown.

The average area of mangrove rice cultivated per *dabada* was 0.67 hectares. This is higher than any of the other rice enterprises and is a reflection of the abundant supply of mangrove lands to farmers living in the mangrove rice growing areas. Total labor demand per hectare was estimated at 326 workdays. This was not substantially different from the labor demands of irrigated rice. The family contributed about 96 percent of the total labor, while the rest was satisfied by hired labor.

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Work on mangrove rice extended longer than any of the other rice enterprises. Land preparation started in late May or early June and harvesting did not finish until February. There were two peak periods in September and January at the times of planting and harvesting, respectively. Figure 3.3 depicts these labor peaks. The highest monthly labor demand was in September.

Land preparation.--Because the soils are usually soft, minimum tillage is required as a means of controlling weeds and as a means of accelerating the desalinization process through the washing action of rain water and river flooding. Thus, early digging is carried out in May and June and sometimes extends up to July. The average amount of labor used in land preparation was estimated at about 71 workdays, which was a little more than 21 percent of the total labor required per hectare.

Planting and nursing.--All planting in mangrove swamps is done by transplanting seedlings from a dry bed nursery. Most of the planting is carried out in September when the top soils are generally free of salt. Seedlings are transplanted in single plants per stand and at distances of between five and seven inches. Seedlings should usually be old enough to withstand any salinity effects and damage from small crabs. Salt tolerant varieties such as Phar Com En and SR 26B are recommended for mangrove conditions. The average seed rate was estimated at 46 kilograms per hectare. The combined operation of planting and nursing required about 112 workdays per hectare.

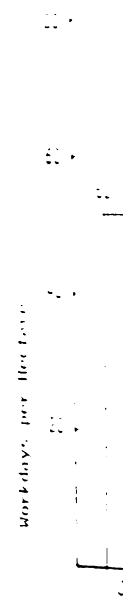

Figure 3.3--Mont
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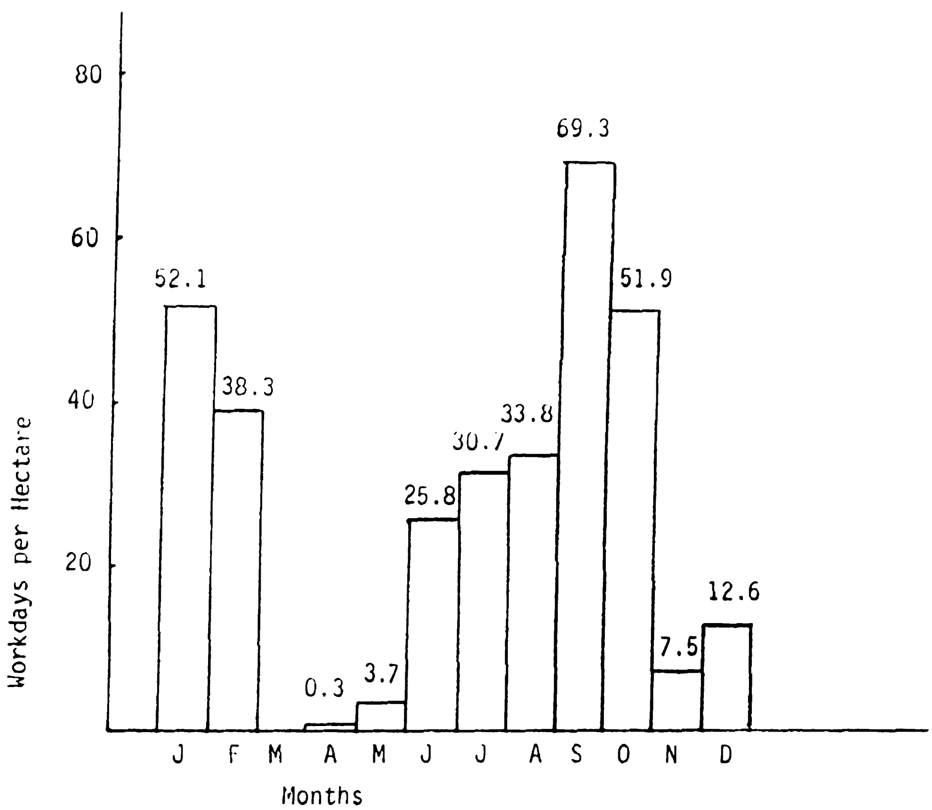

ure 3.3--Monthly Distribution of Labor per Hectare in Mangrove Rice Cultivation.

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Transplanting alone accounted for nearly 29 percent of the total labor requirements per hectare.

Care and cultivation.--Before transplanting is carried out, the land is thoroughly puddled and all weeds buried. Weeding is done only on the outer edges of the fields where the soils are not subject to prolonged flooding. Thus, total labor demand for care and cultivation was only 43 workdays which was the lowest for similar operations in the other rice enterprises.

Harvesting.--Harvesting is by the single panicle method with an average demand on labor of about 101 workdays. This was higher than the harvesting demands on any of the other rice enterprises. This is mainly due to the soft nature of the soil which makes mobility during harvesting very difficult and time consuming as harvesters have to be careful not to destroy the plants. Average yields were estimated at 1,880 kilograms per hectare. In Sierra Leone yields of up to 2260 kilogram per hectare were reported by Spencer et al. (1979) for mangrove rice.

Irrigated Rice

Irrigated rice is grown along the upper river banks in small perimeters that are supplied with water from the river by means of eight to ten inch pumps. Irrigated rice is concentrated on the eastern half of the country where a total of 2,500 to 3,000 hectares are said to have been developed. The perimeters are capable of producing two crops in a

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two crops in a year--a rainy season crop lasting from the end of June to early January and a dry season crop lasting from the beginning of March to July.

The average area cultivated per dabada was 0.30 and 0.17 hectares for the wet and dry season crops, respectively. The higher area in the wet season is probably due to the lower demand for irrigated perimeters during that season. Farmers usually prefer to concentrate on groundnut production in the wet season. In the dry season, when labor is free, there is an increased demand for the limited irrigated perimeters, thus the plots are shared by a larger number of farmers.

As can be seen in Table 4.1, the total labor demands were estimated at 331 workdays for the dry season crop and 324 workdays for the wet season crop. In the dry season crop family labor contributed 84.8 percent of the labor while strange farmers contributed 6.2 percent and hired labor contributed 9.0 percent. The distribution in the wet season crop was 94.8 percent, 2.0 percent, and 3.2 percent respectively. Hired labor is scarce in the wet season when every adult is busy on his dabada's farms.

The monthly labor profiles are shown in Figures 3.4 and 3.5 for the dry and wet season crops, respectively. Both crops show a distinct monthly peak period during the planting months of April and September for the dry and wet crops, respectively. The month of April accounted for about 31 percent of the total labor used in dry season irrigated rice cultivation, whereas the month of September

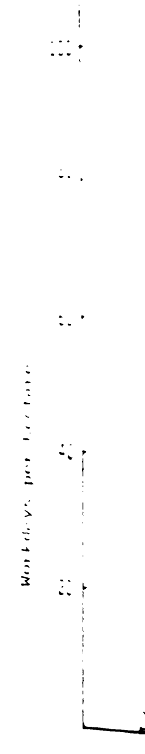


Figure 3.4--Mont
Rice

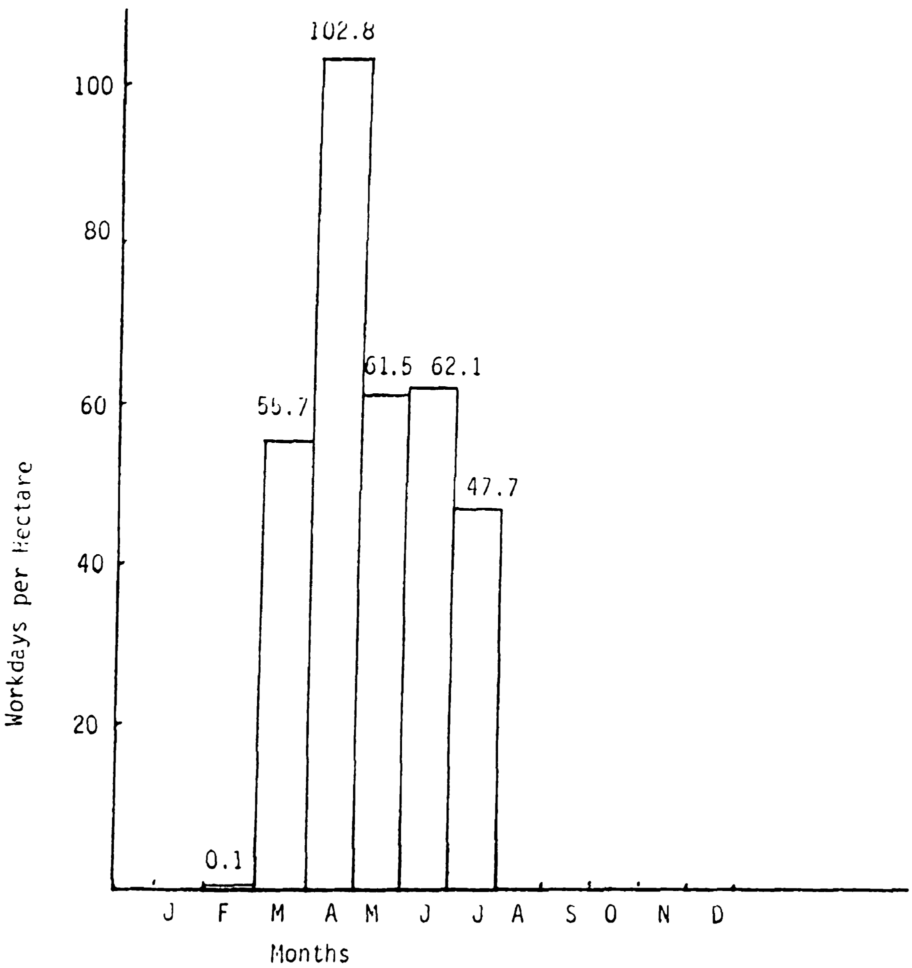


Figure 3.4--Monthly Distribution of Labor per Hectare in Dry Season Rice Cultivation.

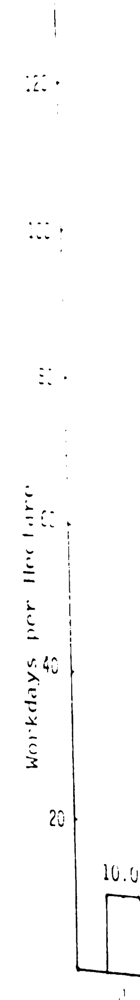
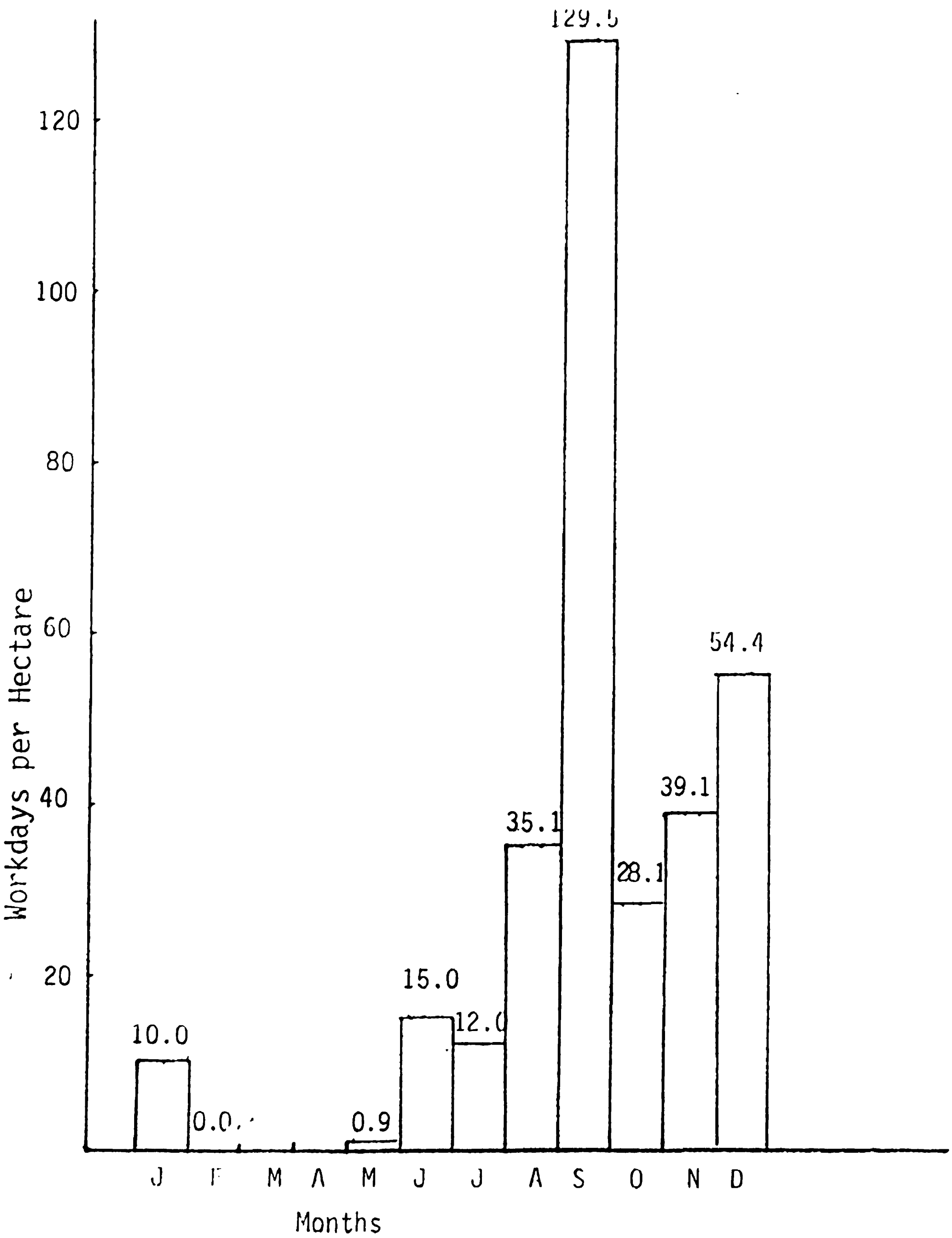


Figure 3.5.-



igure 3.5.--Monthly Distribution of Labor per Hectare in Wet Season Rice Cultivation.

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accounted for about 40 percent of the total labor used in wet season irrigated rice cultivation.

Land preparation.--The land is usually cleared soon after the previous crop has been harvested and removed from the fields. The perimeters are then flooded with water to soften the soil for power tilling. Farmers pay an average of D37.07 per hectare for this operation. Levelling and puddling after plowing is done manually by the farmers. On the average, power tillers used about 24.0 hours and 27.0 hours for plowing the dry and wet season crops, respectively. Labor input for levelling and puddling was estimated at 37.5 and 49.1 workdays for the dry and wet season crops, respectively.

Planting and nursing.--All seedlings are transplanted from wet bed nurseries when still very young to allow for maximum tillering. Transplanted seedlings are usually about three weeks old. Seedlings are planted in rows at about six per stand and six inches apart. The combined operations of planting and nursing required about 104 workdays for the dry season crop and 136 workdays for the wet season crop. In both cases planting accounted for more than 94 percent of that labor. On the average seed rates were estimated at 77 kilograms per hectare for the dry season crop and 95 kilograms per hectare for the wet season crop. These rates are about two times higher than the seed rates used in the other rice enterprises.

Care and cultivation.--Water is pumped periodically into the fields from a central pumping station. Individual farmers control the amount of water entering their plots by closing or opening slots that are located along the water channels. Farmers pay a fixed amount of D247.00/hectare per crop for water. It is estimated that the dry season crop requires two times as much water pumping as does the wet season crop. Two weedings are required at about four and eight weeks after transplanting. Three fertilizer applications at transplanting, tillering, and panicle formation at the rate of 40 kilograms of phosphate and 110 kilograms of nitrogen are recommended. These are substantially higher than the observed rates of about 14 and 25 kilograms per hectare for the dry and wet season crops, respectively.

Average labor demand for care and cultivation was estimated at about 100 workdays and 49 workdays for the dry and wet crops, respectively. The large difference in these two labor demands is hard to explain, except that the wet season crop had a higher labor input in land preparation and planting. Both activities help to kill weeds through trampling by feet and so could have reduced the weeding problem. Also competition for labor from the other upland crops might have drastically reduced the amount of time devoted to weeding the wet season irrigated crop.

Harvesting.--Irrigated rice is harvested when mature, but still very wet. Harvesting is done with the use of a sickle. Bundles of stalks of rice are cut at near ground level and the harvested

crop is left in the fields either in the form of tied sheaves or loose. Sometimes the harvested crop is taken home immediately for threshing or it is left in the field for storage. Field storage can last from one to fourteen days.

Labor demand for harvesting averaged about 90 workdays for each crop. The average yields were recorded at 2,767 kilograms and 2,429 kilograms per hectare for the dry and wet crops, respectively.

To summarize, Table 3.2 has been provided to show the monthly and activity labor profile relationships between the various systems of rice production. Except for dry season irrigated rice cultivation, the highest demand for labor occurred either in August or September which corresponded with the planting activity. In the dry season crop, the month of April had the highest demand on labor and also corresponded with the planting activity. On the activity section, however, it is only in irrigated rice that planting tended to have a higher labor demand than the other activities. Instead, care and cultivation demanded more labor in upland rice cultivation; land preparation in <u>bafaro</u> and harvesting in mangrove rice. It is difficult to draw any conclusions or make statements establishing a pattern of relationships between activity labor demand and monthly labor peak periods. For as Cleave (1974) points out, when labor profiles are compiled in calendar months, critical peaks of short duration may not show up in the data because the labor time is spead over a month or an extended peak may not be apparent because it is divided between months.

TABLE 3.2.--Summary of Monthly and Activity Labor Profiles in Rice Cultivation

Item	Unit	Upland Rice	Bafaro	Mangrove Rice	Irrigated Rice	
					Dry	Wet
Months						
January	Workdays/ha	10.9 (37.95)[a]	20.8 (22.06)	52.1 (35.23)	---	10.0 (32.93)
February	Workdays/ha	---	0.3 (0.80)	38.3 (47.91)	0.1 (0.38)	0.0 (0.31)
March	Workdays/ha	---	---	---	55.7 (78.54)	---
April	Workdays/ha	---	---	0.3 (1.3)	102.8 (69.21)	---
May	Workdays/ha	0.9 (3.03)	4.1 (10.00)	3.7 (5.86)	61.5 (63.38)	0.9 (2.81)
June	Workdays/ha	18.9 (36.45)	46.7 (67.13)	25.8 (20.46)	62.1 (70.43)	15.0 (13.26)
July	Workdays/ha	32.2 (47.50)	60.6 (41.40)	30.7 (18.63)	47.7 (78.25)	12.0 (32.77)
August	Workdays/ha	75.8 (82.08)	71.7 (46.12)	33.8 (21.93)	---	35.1 (65.57)
September	Workdays/ha	23.9 (33.48)	56.4 (41.84)	69.3 (26.90)	---	129.5 (101.79)
October	Workdays/ha	7.6 (17.30)	13.0 (11.68)	51.9 (41.29)	---	28.1 (57.65)
November	Workdays/ha	71.5 (62.93)	21.7 (24.82)	7.5 (16.33)	---	39.1 (61.77)
December	Workdays/ha	12.3 (19.14)	64.8 (43.60)	12.6 (24.70)	---	54.4 (63.74)
Total Monthly Labor	Workdays/ha	253.8 (193.83)	361.1 (235.49)	326.0 (111.43)	331.0 (232.08)	324.1 (274.1)
Activities						
Nursery	Workdays/ha	---	4.3 (6.15)	17.2 (12.42)	4.3 (10.16)	7.4 (14.00)
Land Preparation	Workdays/ha	70.1 (74.13)	113.9 (79.92)	70.5 (43.22)	37.5 (128.24)	49.1 (70.86)
Planting	Workdays/ha	---	95.5 (101.28)	94.5 (49.39)	99.7 (74.50)	128.4 (107.11)
Care and Cultivation	Workdays/ha	93.9 (89.81)	62.8 (56.13)	42.9 (59.53)	99.8 (68.46)	48.7 (81.50)
Harvesting	Workdays/ha	89.8 (73.70)	84.6 (56.00)	100.9 (54.36)	89.7 (79.79)	90.5 (66.24)
Total Activity Labor	Workdays/ha	253.8 (193.83)	361.1 (235.49)	326.0 (111.43)	331.0 (232.08)	324.1 (274.1)

Source: Survey Data

[a]Figures in parentheses are standard deviations.

The high standard deviations, relative to the mean averages, are due to the existence of considerable differences among farmers in their deployment of labor. Resources available on farms and farmers' preferences in crop combinations vary. This is especially true when aggregations are made from different villages as in the case with the figures in Table 3.2.

Post-Harvest Activities

Threshing

Threshing of irrigated rice is usually done after a whole field has been harvested. Bundles of rice are beaten against forty-four gallon empty drums so that the grains fall off. Bundles of traditionally short-cut panicles are often stored in the village at home and threshed only when ready for consumption. Threshing is done with the use of mortar and pestle and only small quantities are threshed at a time.

Winnowing

The most common traditional way of winnowing is to toss the grains up in the air from a bowl-like round or oval tray, usually made from bamboo. The wind carries away the husk and other light materials. Another method is by tilting the container, containing the paddy so that the grain flows out of it freely. Again the wind separates the chaff from the grain.

Drying

Short cut bundles of panicles are exposed to drying on the day of harvest, but actual slow drying takes place in the village store rooms. In Kuntaur, where The Gambia Produce Marketing Board (GPMB) owned rice mill is located, hot air drying of paddy is carried out. There are two separate units. One is used to dry a stack of wet paddy in bags and the other is used as a heat and air source for in-bin drying of paddy in three round outdoor silos of about 80 tons capacity each. Irrigated rice that is threshed in the fields is usually dried on flat surfaces under direct sunlight.

Milling

Small village milling machines are almost nonexistent in the rural areas. There was one small mill operating in Jarreng. Almost all village milling is by hand using a mortar and a pestle. The rice mill in Kuntaur handles mostly rice purchased by GPMB. It is said to be operating at below 50 percent capacity.

Rice Irrigation Projects in The Gambia

Since pre-independence times, The Gambia has devoted a substantial amount of scarce resources to the development of irrigated rice cultivation. The droughts of the 1970s reinforced the belief that irrigated agriculture was the only solution to the uncertainties inherent in the weather and provided further justifications for massive and ambitious investment plans in irrigated agriculture. This section provides a brief description of some of these investment projects.

The Jakhally and Patcharr Swamps

The scheme was implemented between 1950 and 1956 by the then Commonwealth Development Corporation and covered some 1,173 hectares of land. It has been described as the largest hydro-agricultural development project in The Gambia and was located about 18 kilometers downstream from Georgetown.

The operation of this scheme was a failure because of the inadequacy of the basic studies in hydrology and topography, constraints associated with labor force availability and the relatively low producer prices at the time. Deficiencies in the drainage system were the main technical defect. The development comprised of a suction valve on the Jakhally Bolon, a pumping station at Sapu, and an earth-made canal that was more than three kilometers long. These swamps have been cultivated under rainfed conditions since the project was abandoned in 1956.

In 1977, The Gambian government decided to rehabilitate this scheme. A feasibility study was carried out in 1977/78 that covered about 1,190 hectares in Patcharr and 1,451 hectares in Patchen. Under the second five-year development plan, it is envisaged that 400 hectares will be developed for irrigation by pumping and 1,000 hectares of swamp land will be improved in this area. The project is to serve as a pilot program and model in riverine swamp development, irrigation method testing, and irrigation method evaluation for the much larger future swamp development program to be undertaken following the construction of the anti-salt water intrusion bridge-barrage on the river in Yelitenda. The project is expected to benefit 15,000 people in 14 villages.

The Taiwan Mission Project

Between 1966 and 1974 a Cooperative mission from Taiwan selected a number of sites along the river in the McCarthy Island and Upper River Divisions. Each site had a minimum cultivable surface area of four hectares and was divided into 10 to 20 allotments per hectare. Water was pumped from the river and flowed from field to field by gravity.

The scheme developed about 607 hectares introduced new rice varieties and organized growers into cooperatives through which inputs were channeled. All inputs, except labor, were supplied free in the first year. Inputs for subsequent cropping was to be purchased by farmers. The scheme was not able to produce two crops per year because of the farmers' lack of familiarity with machines and the strict water management practices. It was terminated eight years later because of changes in The Gambia's foreign relations with Taiwan.

Agricultural Rice Development Project

Encouraged by the Taiwanese initiative, The Gambian government reaffirmed its commitment to pursuing a policy of rice self-sufficiency. From 1973 to 1976 the International Bank for Reconstruction and Development and the International Development Association financed a $3.7 (about D 6.7m) program whose initial objective was the development of 1,200 hectares of irrigated land in the McCarthy Island Division. In practice, only 580 hectares were developed. The project was developed along the lines of the Taiwanese initiative with a slight modification in terms of introducing a credit component into the system. The irrigation infrastructure was costed against the cooperative societies and production inputs were extended on a credit basis to farmers.

The scheme was terminated in 1976 leaving behind a huge amount of unpaid debts. Poor and inadequate financial estimates, inefficient canal construction and poor management have been mentioned as reasons for the failure of this project.

The Agro-Chinese Project

In 1975 a bilateral aid program with the People's Republic of China was signed and a Chinese mission arrived in The Gambia in 1976. Its objectives were to develop 1,200 hectares of irrigated land, consolidate an existing 1,800 hectares, and develop a pilot scheme to improve the Patcharr swamps. The project fulfilled its basic objectives of reclaiming 1,200 hectares of land, increased the mechanical stock of pumps, power tillers and threshers, and introduced motorized threshers, transplanters and four-wheel drive small tractors. The project also made an impact on local mechanical skills by offering on-the-job training for local mechanics and assisting in the training of local blacksmiths. Since the Chinese experts left in 1980, however, most of the mechanical equipment have broken down beyond repair.

Future Plans for Irrigated Rice

The greatest threat to the development of irrigated rice in The Gambia is posed by the annual intrusion, upstream, of the salt

tongue. Salinity rises upstream at the pace of about 15 to 20 kilometers per month in the dry season. This rate is accelerated in years of poor rainfall. In 1978, the salt tongue is said to have penetrated as far as Kuntaur, 256 kilometers from Banjul. Other measurements indicate that the process is intensified by the withdrawal of water for irrigation purposes. It is estimated that each cubic meter of water drawn for irrigation will increase the speed at which salt water enters the river by one kilometer per month. At this rate the withdrawal of 10 million cubic meters of water per second during three months for irrigation of 5,000 hectares of rice fields could bring the salt tongue close to Georgetown, 280 kilometers from the mouth of the river (Peter et al., 1979). This would prevent the development of irrigation in the McCarthy Island Division.

Thus, hopes of any full-scale development of irrigated rice lie on the construction of the anti-salt dam-bridge in Yelitenda at the existing ferry crossing on the Koalak-Farafenni-Zinquinchor road. The dam is expected to perform three basic functions. It will store fresh water originating from the upper and middle basin, control rising salt water, and allow a passage way for the transgambia road. The dam will also allow approximately 24,000 hectares of rice to be irrigated in double cropping. The estimated cost of the dam in 1978 prices was D 138 million. It is expected that construction of the dam will commence at the end of the second five-year plan. The development of 24,000 hectares of irrigated rice is then expected to be completed in the year 2000.

Although technical studies have established the feasibility of the dam, both social, economic, and environmental impact analysis have yet to lend credence to its construction. In addition, experiences in other countries have shown that large-scale irrigation projects such as that envisaged after the construction of the dam are often unprofitable and inefficient. A number of lessons could be drawn from the mistakes and problems that plagued the past small-scale irrigation projects. First, there has been a lack of adequate and sound technical, social, economic, and environmental studies which are all necessary for determining the feasibility of a project. The farmers' perceptions, preferences, and priorities are often assumed away when irrigation projects are implemented in The Gambia. Jennie Dey (1982) addressed herself to this problem in a paper entitled, "Development Planning in The Gambia: The Gap between Planners' and Farmers' perceptions, expectations, and Objectives."

Second, both farmers and extension workers have been introduced to alien techniques of rice cultivation with no rigorous and determined efforts to provide them with adequate training before and during the implementation of the projects. The result is that projects have had to be terminated shortly after the departure of the expatriate technicians. Third, most of the projects' failures can be attributed to financial and technical mismanagement. If future irrigation projects are to achieve any amount of success, a concerted effort has to be made to study the causes of failure of

the past projects with a view to minimizing their occurrences in succeeding projects.

Rice Marketing and Pricing Policy

Marketing

In addition to holding a monopoly for the import of rice, The Gambia Produce Marketing Board (GPMB) also participates in the collection of locally produced rice. Figure 3.6 depicts the marketing channels for rice in The Gambia. Imported rice is sold to wholesalers, such as the National Trading Company (NTC) who, in turn, can sell either to small traders, retailers, or directly to consumers at wholesale prices. Marketing margins at each level of transaction are controlled.

Locally produced rice is purchased by the GPMB, through the Cooperatives, who pay the guaranteed producer price to farmers. Because of the low price offered by the cooperatives, farmers have often preferred to sell any marketable surplus to small traders or directly to the consumer, who pays above the official producer price. GPMB's purchases of locally produced rice have averaged less than 2,000 tons, representing less than 10 percent of the total production, in the past ten years. There is, however, no incentive on the part of GPMB to participate actively in the marketing of locally produced rice because of the high processing cost. Paddy purchased from farmers by the Cooperatives is first conveyed to Kuntaur for milling before being transported to Banjul. Both the locally produced

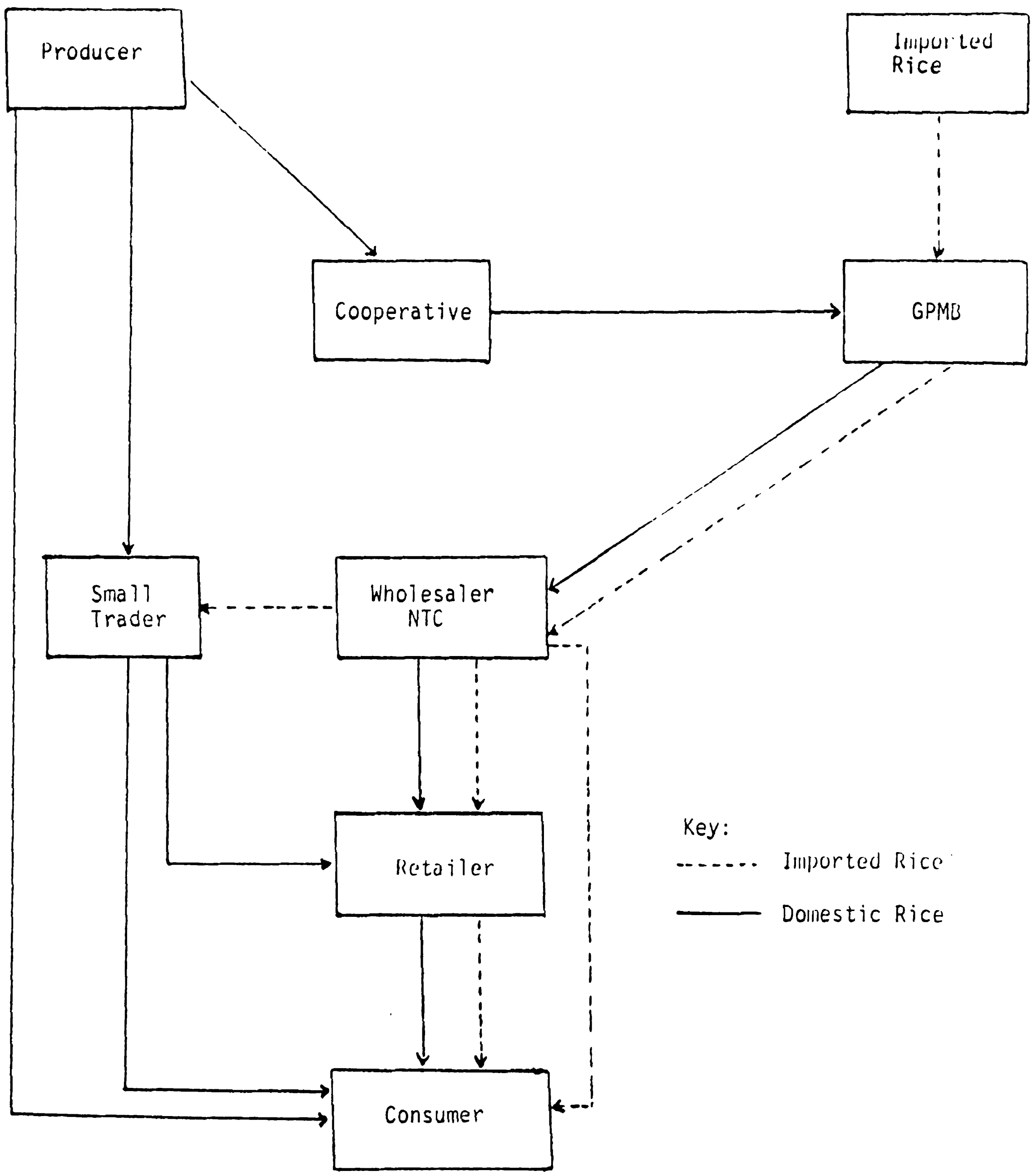


Figure 3.6--Rice Marketing Channels.

rice and the imported rice are sold at the same price despite the fact that the locally produced rice is often of better quality.

Pricing Policy

The Gambian government's pricing policy for cereals is passive at best. There is no coarse grain pricing policy and it is unknown to what extent there exists an informal market. However, it is known that a high percentage of the cereal production is auto-consumed. Only rice among the local cereals has any resemblance of a pricing policy. The price for rice, however, is so unattractive that only a small percentage is offered for sale to GPMB. It has been suggested that a key constraint to food production in The Gambia is the absence of a formal official marketing structure for locally produced cereals. This had led to the lack of a readily perceived demand for farmers to produce in excess of their subsistence needs (AID, 1979).

Both producer and consumer prices in The Gambia are effectively controlled. In setting and controlling these prices, the government has a dual policy objective. It wants to provide adequate incentives for increasing food production and it also seeks to protect the interest of the consumers at the same time. These two objectives are at variance and in practice the objective of ensuring an adequate supply of rice at reasonable prices for consumers has tended to dominate. For example, before 1977, imported rice was being subsidized by selling it below the cost of importation. In addition, producer prices have always been set below market

clearing levels. The immediate effect of this policy has been to stimulate rice consumption at the expense of substitutable cereals. Thus, relative price changes which could have been favorable to domestic traditional staples were checked and preferences for rice reinforced.

Because producer prices are lower than the retail market price, the official producer price has only been partially effective, since producers have been able to sell directly at the higher retail prices. This minimizes the direct price effects on production, but there is little doubt that the policy of setting low official producer prices has a negative effect on farmers' incentives to produce and to sell. Official producer prices offered by GPMB increased by an average of nearly 28 percent annually from D 134.40 per ton of paddy in 1971/72 to D 510.00 per ton in 1981/82.[2] Despite these apparent increases in prices, domestic production actually declined for this period. This is probably because farmers have either not interpreted these price increases as a permanent correction of the pattern of incentives or real and relative prices are still not high enough to induce farmers to increase their resources in rice farming and thus increase production.

Production Practices on Upland Crops

Before proceeding to a discussion of the gender division of labor, it is informative to first decribe the production practices

[2]Assuming a 66 percent milling recovery rate, these figures translate to D 203.60 and D 727.70 per ton of milled rice, respectively. The controlled consumer price of milled rice in 1981/82 was nearly D 790.00 per ton.

on upland crops. Almost all Gambian farmers depend entirely on the production of groundnut for cash income. Although cotton was introduced as an alternative crop, very few farmers are involved in its cultivation. Only four farmers in this study cultivated cotton. It is, therefore, not included in this description.[3] Maize, sorghum, early (suno) and late (sanyo) millet are grown as supplementary cereals for home consumption. Findo (digitaria) used to be an upland cereal cultivated by women, but it has gradually been replaced by other cereals. Only one farmer in this sample cultivated findo for the period of the survey. Table 3.3 is a summary of the major input/output coefficients for groundnut and the four major upland cereals.

Groundnuts

Groundnut was introduced in The Gambia by European travelers in the early eighteenth century. Since then it has served as the backbone of The Gambian economy. The average area cultivated per dabada was 0.92 hectares. This was the largest hectarage devoted to any single crop emphasizing the importance attached to that crop.

The total labor input per hectare was estimated at about 119 workdays. This is almost equal to the labor demands of the other upland crops with the exception of sorghum which has less labor. Of this total labor input, about 91 percent was provided by the family, 5 percent was provided by strange farmers and the rest was satisfied

[3]See Appendix A for a similar Tables on cotton.

TABLE 3.3.--Summary of Input/Output Data on Upland Crops

Item	Unit	Groundnut	Maize	Sorghum	Early Millet (*Suno*)	Late Millet (*Sanyo*)
Yield	kgs/ha	1717 (539.07)[a]	1013 (551.19)	884 (465.94)	827 (544.34)	961 (759.03)
Seedrate	Kgs/ha	83 (29.28)	33 (30.09)	24 (19.18)	12 (8.09)	32 (28.67)
Fertilizer	Kgs/ha	28	2[e]	2[e]	3[e]	---
Total Labor	Workdays/ha	118.9	116.2	91.0	117.8 (146.93)	120.6 (113.32)
of which Family	Workdays/ha	108.3	106.4	78.8	112.7	110.0
Strange Farmers	Workdays/ha	5.4	5.8	10.0	3.8	7.2
Hired	Workdays/ha	5.2	4.0	2.2	1.3	3.4
Animal Power	Hours/ha	37	36	21	21	22
Ox-drawn Equipment	Hours/ha	37	36	21	21	22
General Data						
No. of Households (*dabada*)[b]		73	52	28	34	17
Average Area	Ha	0.92 (0.60)	0.23 (0.19)	0.39 (0.30)	0.62 (0.37)	0.30 (0.18)
Enterprise Wage Rate	Dalasis[c]/wd	3.04	2.05	2.80	2.90	2.89
Farmgate Price of Output[d]	Dalasis[c]/kg	0.50	0.49	0.49	0.49	0.49

Source: Survey data.

[a]Figures in parentheses are standard deviations.

[b]Includes households whose cultivated area of a given crop fell within two standard deviations of the mean area.

[c]$1.00 = 2.20 dalasis in May 1982.

[d]Guaranteed producer prices for groundnut and maize in the 1981/82 season. Prices of other cereals are assumed to be equal to that of maize.

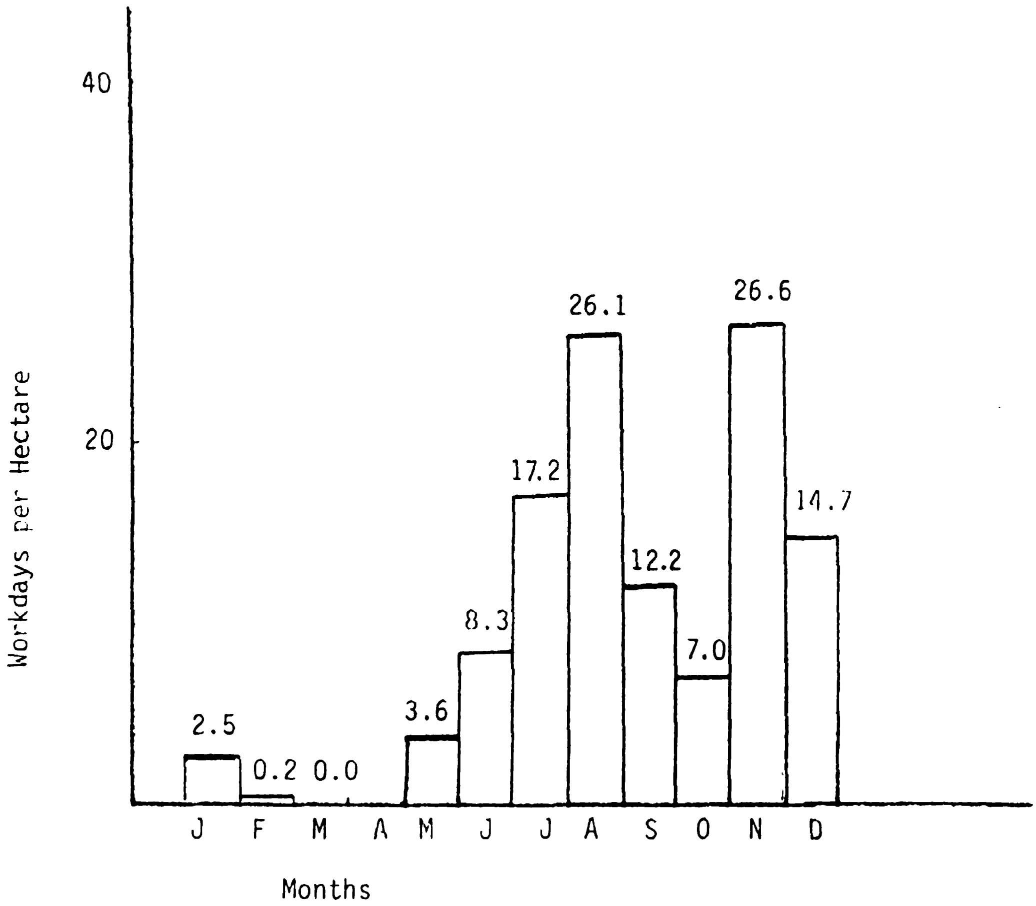
[e]Only one household applied fertilizer in each case.

by hired labor. The monthly labor profile shown in Figure 3.7 shows two monthly labor peaks in August and November. These are the months of intense weeding and uprooting of groundnuts respectively The two months account for a little more than 44 percent of the total labor utilized.

Slashing and burning of groundnut fields started in the later part of May and continued up to the end of June. As soon as the first heavy rain falls, farmers construct ridges (if possible) to get ready for planting. Some of the farmers prefer to plant on flat ground as it makes weeding with the use of ox-drawn equipment easier. On the average, land preparation required about 13 workdays per hectare.

Planting is carried out as soon as the second heavy rains fall in July. The rainfall must be heavy enough to soak at least eight inches of the top soil. The main variety grown is the Senegal (Bombay) 28/206, on upright growing variety which lends itself to weeding by animal-drawn equipment. Where ridges are not constructed, planting is usually done on flat ground without initial plowing with the help of ox-drawn equipment. Planting on ridges is done by hand. The average seed rate was 83 kilograms per hectare and planting demand on labor was estimated at about 8 workdays per hectare.

Care and cultivation, a combined operation of weeding and hoeing is done about two to three weeks after planting for those who planted on flat ground. The other care and cultivation activity, a combined operation of weeding and earthing up is done before the



ure 3.7--Monthly Distribution of Labor per Hectare in Groundnut Cultivation.

plants flower. Fertilizer (if any) was applied at time of planting and before the plants flowered at an average rate of 28 kilograms per hectare. Most farmers use animal manure to fertilize their fields by asking cattle owners to tether their cattle on the groundnut field overnight for about a week. This is usually done in the months of March, April, and May. Care and cultivation had the highest demand on labor of about 51 workdays when compared to the other operations. The combined operation of planting and weeding used, on the average, about 38 hours of animal and ox-drawn equipment.

Harvesting started at the end of the rains in November, when the soil was still soft to make uprooting easier. When the groundnut is uprooted, it is left in the fields to dry until ready for threshing. Threshing is done by beating the nuts-on-straw with a stick. This mechanism separates the nuts from the straw. The groundnut is then winnowed by a mechanism similar to that used in winnowing rice and bagged before being taken home to await the marketing season. About 39 percent of the total labor was used in harvesting, threshing, and on-the-field winnowing. The average yield was estimated at 1,717 kgs per hectare.

Maize

Maize is usually grown in back yards near dwelling houses where the soil can be fertilized by household refuse and animal manure. It is usually the first grain to be grown. The average household area devoted to maize was about 0.23 hectares and is the lowest among the other upland cereals. The total labor requirements

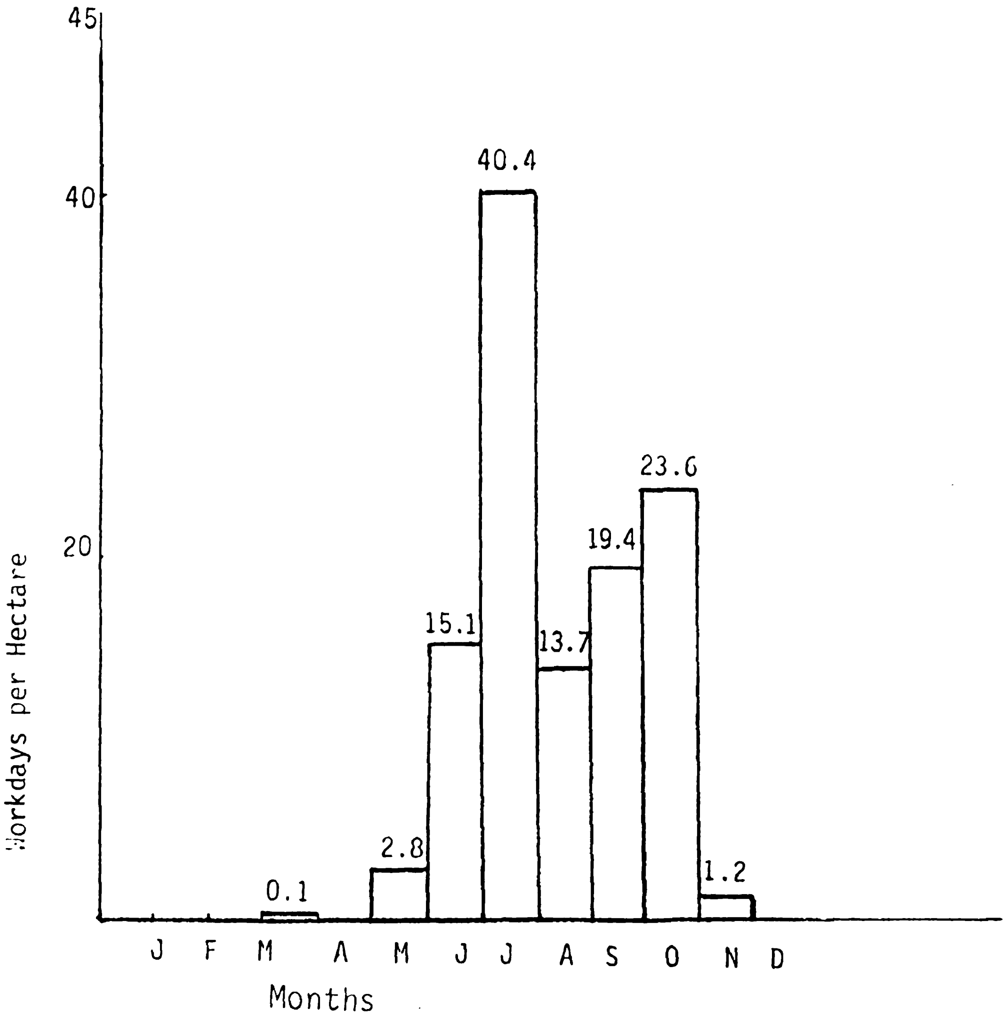
per hectare were estimated at about 116 workdays with the family contributing a little more than 91 percent of that labor. Strange farmers and hired labor contributed about 5 percent and 4 percent, respectively. The monthly labor profile is depicted in Figure 3.8. The month of July had the highest monthly demand on labor and this was followed by the month of October. These are the periods of intense care and cultivation and harvesting, respectively.

Land brushing and clearing starts in late May before the rains begin. Planting is done on ridges or on flat, unplowed soil. The average seed rate was estimated at about 33 kilograms per hectare. Care and cultivation placed the greatest demand on labor and more than 40 percent of the total labor was devoted to this activity alone. Two weedings (if planting is done on flat ground) and one weeding (if planting is done on ridges) are normally required. The last weeding is combined with earthing up. Fertilizer was applied at the average rate of 2 kilograms per hectare. Only one farmer applied fertilizer.

The crop is sometimes harvested and used as vegetables when the ears are still very fresh. But most of the crop is harvested when dry. In this form it can be stored for longer periods of time and used for regular meals in the form of _cherre_. The average yield was estimated at 1,103 kilograms of dry grain.

Sorghum

Sorghum is sometimes grown in a mixture with groundnut, but in recent times such mixtures have become less common. They are, therefore, not considered in this study. Where such mixtures occur,



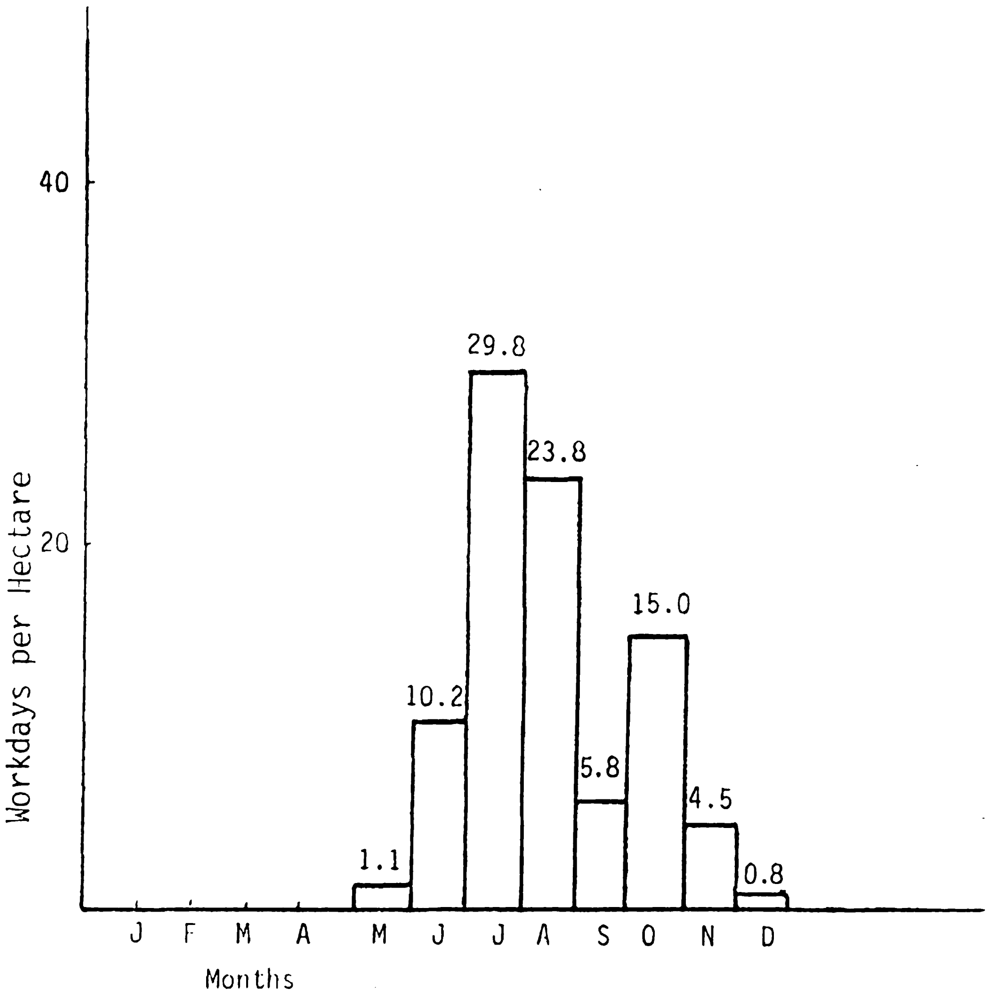
re 3.8--Monthly Distribution of Labor per Hectare in Maize Cultivation.

however, they are usually planted in ratios of 15 to 20 rows of groundnuts to one row of sorghum. Higher ratios in favor of sorghum would usually reduce the yield of groundnut because of the shading effect of the sorghum plant. The more common practice is to plant sorghum as a sole crop.

Sorghum is believed to grow very well in less fertile soils that would normally be left for fallow. The average area devoted to sorghum per household was 0.39 hectares. The total labor requirements was on the average about 91 workdays per hectare. This makes it the lowest total labor demand per hectare for all the upland crops considered in this study. Family labor contributed a little more than 86 percent of this labor, strange farmers about 11 percent, and hired labor less than 3 percent. The monthly labor profile in Figure 3.9 shows that July had the highest monthly labor demand, followed by August. These are the months of intense weeding.

Land preparation starts in late May and continues up to the middle of June. Planting is mostly done on flat ground at an estimated seed rate of 24 kilograms per hectare. Hoeing and initial weeding is done in July with the aid of ox-drawn equipment. A second weeding and earthing up is done in August. Care and cultivation used a little more than 51 percent of the total labor and required on the average about 21 hours of animal and ox-drawn equipment . On the average, chemical fertilizer was applied at the rate of 2 kilograms per hectare (only one household applied fertilizer).

Harvesting is done in October and November. The plants are felled so that the panicles can be easily cut with a small knife.



igure 3.9--Monthly Distribution of Labor per Hectare in Sorghum Cultivation.

The short cut panicles are taken home at the end of a harvesting day and stored on roof tops or ceilings until ready for consumption. Threshing is done with the use of a mortar and pestle. The grains are ground to form a local diet called footo. The average dry grain yield was estimated at 884 kilograms per hectare.

Early (suno) and Late (Sanyo) Millet

The major difference between early and late millet is that if planted at the same time early millet matures about four to six weeks earlier than late millet. Otherwise, they have similar cultural practices. The average areas devoted to early and late millet was 0.62 hectares and 0.30 hectares per household cultivating these crops, respectively. Early millet had the highest average area among the upland cereals.

Total labor per hectare engaged in these two crops was estimated at about 118 workdays and 121 workdays for early and late millet, respectively. These labor inputs are unexpectedly high. This is due to the very high labor demands in care and cultivation which account for more than 57 percent of the total labor demand in each of the crops. Although it was impossible to separate the labor inputs per activity in greater details, it is suspected that bird scaring accounted for a substantial amount of the labor in care and cultivation. This suspicion is clearly confirmed in the monthly labor profile for early millet in Figure 3.10, which shows a peak monthly labor demand in September, just before the harvest in October.

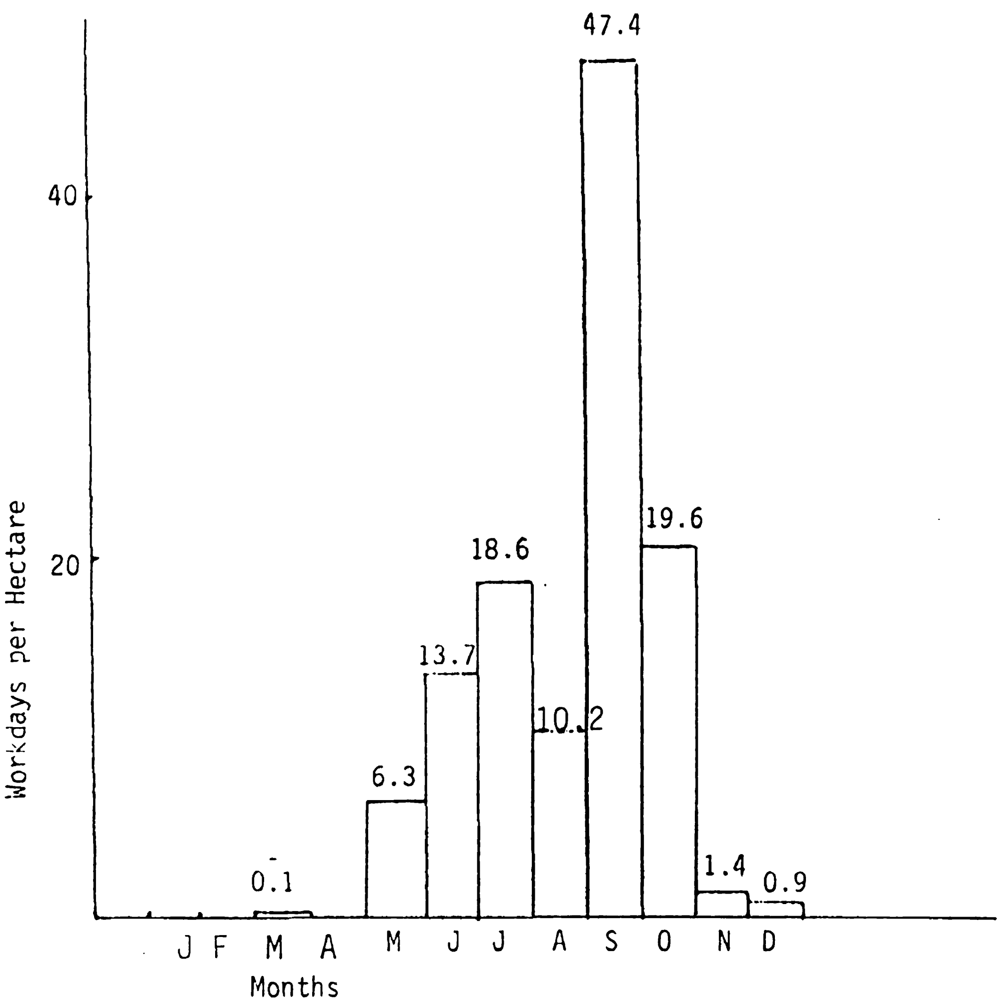


Figure 3.10--Monthly Distribution of Labor per Hectare in Early(suno) Millet Cultivation.

This is not very apparent in Figure 3.11, although the ratio of the labor inputs in the month of October to the harvest month of November is still relatively high.

Cultivation of early millet extends from May to October while that of late millet extends from May to November. Both crops are used to make footo and have similar cultural practices to that of sorghum. Estimated average yields were 827 kilograms and 961 kilograms of dry grain for early and late millet, respectively.

Table 3.4 helps to summarize the monthly and activity labor inputs for each of the five upland crops considered. It is similar to the summary for the rice enterprises presented in Table 3.2. Three crops--maize, sorghum, and late millet--had the highest monthly labor demand in July. The highest monthly labor demands for groundnut and early millet were in November and September, respectively. Care and cultivation had the highest activity labor demand in all crops.

Marketing and Pricing Policy for Groundnut

Marketing

The Gambia Produce Marketing Board (GPMB) holds a monopoly in the purchase and export of groundnut. To purchase groundnut from the producers, GPMB depends heavily on Licensed Buying Agents (LBA's) and the Cooperatives. Purchased groundnut is transported either to Banjul or Kaur where crushing mills are located. The nuts are exported in the raw form (decorticated) or in the form of oil (milled). All transport of groundnut products out of The Gambia is handled by The Gambia Produce Marketing Company Ltd., a subsidiary of GPMB. A

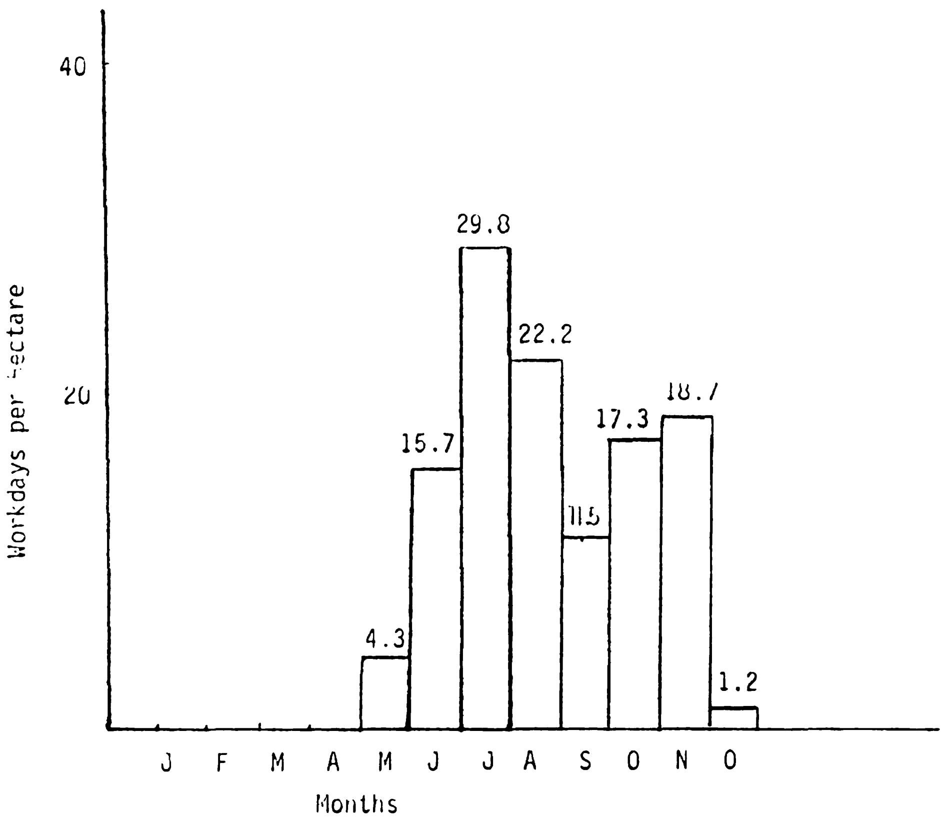


Figure 3.11--Monthly Disribution of Labor per Hectare in Late(<u>sanyo</u>) Millet Cultivation.

TABLE 3.4.--Summary of Monthly and ACtivity Labor Profiles in Upland Crops

Item	Unit	Groundnuts	Maize	Sorghum	Early Millet (Suno)	Late Millet (Sanyo)
Months						
January	Workdays/ha	2.5 (7.75)[a]	--	--	--	--
February	Workdays/ha	0.3 (1.50)	--	--	--	--
March	Workdays/ha	0.0 (0.10)	0.1 (0.72)	--	0.1 (0.23)	--
April	Workdays/ha	---	--	--	--	--
May	Workdays/ha	3.6 (6.75)	2.8 (6.93)	1.1 (3.94)	6.3 (15.11)	4.3 (7.22)
June	Workdays/ha	8.3 (40.80)	15.1 (21.31)	10.2 (16.24)	13.7 (12.51)	15.7 (23.04)
July	Workdays/ha	17.2 (45.36)	40.4 (37.56)	29.8 (32.33)	18.6 (32.05)	29.8 (29.55)
August	Workdays/ha	26.1 (209.43)	13.7 (24.28)	23.8 (44.24)	10.2 (19.50)	22.2 (23.68)
September	Workdays/ha	12.2 (12.16)	19.4 (21.77)	5.8 (14.59)	47.4 (81.06)	11.5 (21.18)
October	Workdays/ha	7.0 (12.74)	23.6 (36.23)	15.0 (22.37)	19.6 (25.38)	17.2 (25.49)
November	Workdays/ha	26.0 (134.83)	1.2 (6.82)	4.5 (13.62)	1.4 (11.41)	18.7 (33.91)
December	Workdays/ha	14.7 (56.26)	---	0.8 (3.38)	0.9 (3.43)	1.2 (5.39)
Total Monthly Labor	Workdays/ha	118.9 (92.75)	116.2 (85.66)	91.0 (91.87)	117.8 (146.93)	120.6 (113.32)
Activities						
Land Preparation	Workdays/ha	13.3 (46.73)	20.4 (28.89)	11.2 (14.10)	17.0 (18.83)	22.1 (27.59)
Planting	Workdays/ha	8.0 (36.40)	12.5 (13.19)	11.6 (16.77)	5.9 (5.41)	12.9 (12.13)
Care and Cultivation	Workdays/ha	51.2 (218.23)	46.9 (46.88)	46.5 (57.38)	68.3 (123.68)	72.7 (90.97)
Harvesting	Workdays/ha	46.4 (190.27)	36.4 (38.47)	21.7 (22.83)	26.6 (22.73)	12.9 (14.43)
Total Activity Labor	Workdays/ha	118.9 (92.75)	116.2 (85.66)	91.0 (91.87)	117.8 (146.93)	120.6 (113.32)

Source: Survey Data

[a]Figures in parentheses are standard deviations.

London based office negotiates the sale of groundnuts, mostly to EEC countries.

Producers are free to choose which LBA to sell to, but only members can sell to the cooperatives. Figure 3.12 shows the channels through which the groundnuts pass from the producer to the London office. LBA's utilize licensed traders who make direct purchase from the farmers. Both licensed traders and the cooperatives pay the guaranteed producer prices. The GPMB then purchase all groundnut collected by the LBA's and cooperatives. Based on relative profits on the world market, a decision is made on how much raw product and processed product is to be exported.

Generally, purchased groundnut is transported to Produce Depots, located on strategic positions along the river, by the buying agents. From here transportation to Kaur or Banjul is done by the Gambia River Transport Company, another subsidiary of GPMB. It should be noted that some of the groundnut purchased by the LBA's and cooperatives come directly from Senegal through illegal crossing of the border. This is most common when the buying campaign opens far in advance of the Senegalese campaign and when prices are higher in The Gambia.

Pricing Policy

The Gambian pricing policy centers first and foremost around the producer price of groundnut which is set annually by the government prior to the buying season. In doing so, the government takes into account current and anticipated prices in the world market, the

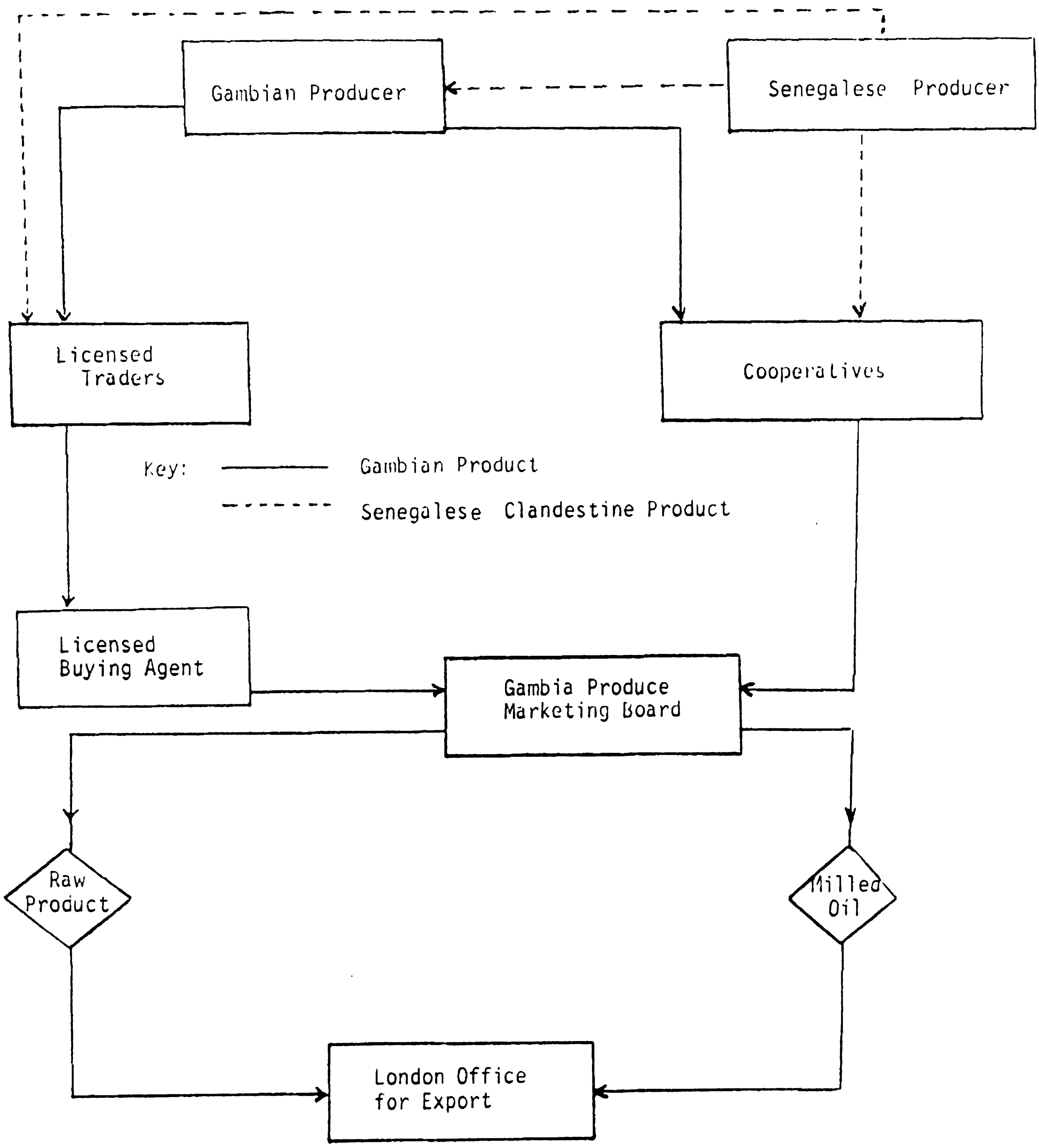


Figure 3.12--Groundnut Marketing Channels.

evel of producer prices in neighboring Senegal and the incentive actor for increasing domestic production. Social justice and poliical factors also weigh heavily.

Over the period 1972/73 to 1976/77, the producer price of roundnuts increased substantially by about 20 percent annually. rom 1976/77 to 1981/82 prices increased by a little more than 4 ercent annually. Despite the successive increases in producer rices, relatively favorable weather conditions from 1972/73 to 977 and a continued subsidization of fertilizers, purchases of oundnut by GPMB did not increase appreciably. In fact, a decline purchases has been registered since 1974/75. This has led some itics, such as AID (1979), to comment that the incentive element increasing cash crop production has virtually peaked out in the ntext of the current agricultural practices. And unless one is epared to concede that the average Gambian farmer shows a distinct eference for leisure over money and is completely indifferent to e recommended improved cultural practices, it is difficult to count for the very low production. Total purchases by GPMB creased steadily from a high of 134,840 tonnes in 1973/74 to a low 82,222 tonnes in 1977/78.

Vagaries of weather aside, the only other probable explanaon is related to The Gambian price structure vis-a-vis Senegal. e rapid increases in prices in The Gambia between 1972 and 1976 ght have encouraged Senegalase farmers to engage in increased ndestine operations, thus swelling up the GPMB's purchases, which was incorrectly interpreted as an increase in production by Gambian farmers. The increase in prices of groundnut in Senegal around 1975 probably reduced this clandestine operation, resulting in a drastic fall of produce reaching GPMB. In Senegal prices were increased by almost 43 percent from 29,000 CFA/ton (about D246.50/ton) in 1974 to 41,500 CFA/ton (about D352.80/ton) in 1975. The producer price in The Gambia at this time was D 310.40/ton. Prices in Senegal remained constant until 1979 when they were again increased by 10 percent in 1980 and a further 10 percent in 1981. Although prices have been relatively higher in The Gambia since 1976, the difference has probably not been high enough to induce further clandestine operations.

Producer prices for groundnut have been consistently lower than the border prices obtained by GPMB. Since 1969/70, the nominal protection coefficient[4] has risen above 0.41 only once in 1975/76 when it was 0.51. Profits made in groundnut trading are supposedly used for price and income stabilization for farmers. While prices might have been stabilized real incomes to farmers have probably been destabilized over the years.

Policy makers in The Gambia are aware that increasing the producer price of groundnut would stimulate production which is a

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[4] $NPC = 1 + (Pd - rPw)/rPw = Pd/rPw$

where NPC = Nominal Protection Coefficient

Pd = Domestic producer price

Pw = Border price (FOB price)

r = Equilibrium exhange rate which is assumed here to be equal to one irable effect. But they also know that revenue, which is a ncipal source of finance, for public sector activities will be rificed. In addition the scope for higher prices is obstructed two sides. On the domestic marketing side, marketing margins orb a large share of total proceeds and perhaps more important is effect of a positive pricing policy on foodgrain, especially e production. Higher prices for groundnuts are likely to draw ources from cereal production and thus defeat the food crop self-ficiency objective.

Gender Division of Labor in Crop Production

Throughout West Africa, The Gambia is probably the only coun- where gender division of labor in agriculture has strictly followed p enterprise lines. With the exception of irrigated rice, an alien hnique introduced to men, women in The Gambia dominate the rice p enterprises while men dominate the cultivation of groundnut and and cereals. In other places where studies have shown the gender ision of labor, women have been known to participate actively in cultivation of all crops, but that they are often assigned the s heavy and less strength-demanding jobs. For example, clearing h is usually the work of men, while women are more important in ding upland rice in Sierra Leone (Byerlee et al., 1977). Kamuanga 82) reports that in rice production, land preparation, sowing and tivation appear to be typical male activities and that adult en contribute the most in harvesting-related activities in Mali.

In this section the amount of labor contributed by type
labor--family, strange farmer, and hired by sex and age, was
lculated on a hectare basis for each individual crop considered in
is study to assess the degree of specialization in the utiliza-
on of labor. The results are shown in Tables 3.5 to 3.14.

The percentage of labor contributed by type of labor for
ch crop has already been alluded to in preceeding sections. Here
phasis is laid on specialization according to sex and age for each
op and for each activity.

In the rice crop enterprises and excluding irrigated rice,
e results show that female labor contribution dominates both in
rms of total labor and in terms of labor contributed in each activ-
y. No less than 87 percent of the total labor in upland rice,
faro and mangrove rice was contributed by women. In all of the
tivities and in all the three crops, women contributed more than
percent of the labor. Both the low labor input and the rela-
vely higher standard deviations in comparison to the mean labor
put suggest that men's participation in these rice cultivation
actices is casual. The highest male labor participation was in
faro where they contributed about 12 percent of the labor, most of
ich was in the land preparation activity. It is interesting to
te that for these three crop enterprises, men used relatively more
ntract labor than exchange labor.[5] The opposite is true for women.

[5]Exchange labor, as used here, is nonfamily labor that is
ither paid in cash nor provided with food during work. Persons
rticipating in this system of labor bring along their own lunch.

Labor Input		Land Preparation and Sowing		Care and Cultivation		Harvesting		Total	
		Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%
Family									
Males	16-60 yrs	7.5		10.2		3.9		21.6	
	10-15 yrs					0.3		0.3	
	0-9 yrs								
Total Males		7.5 (17.02)[b]	10.7	10.2 (31.06)	10.8	4.2 (12.68)	4.7	21.9	8.7
Females	16-60 yrs	60.4		82.7		84.3		227.4	
	10-15 yrs	1.1						1.1	
	0-9 yrs								
	Over 60 yrs								
Total Females		61.5 (65.08)	87.7	82.7 (86.05)	88.1	84.3 (71.76)	93.9	228.5	90.0
Other Family[c]									
Total Family Labor		69.0 (75.08)	98.4	92.9 (88.50)	98.9	88.5 (75.66)	98.6	250.4	98.7
Strange Farmers (Males)						0.5	0.5	0.5	0.2
Hired Labor									
Exchange Males									
Exchange Females				0.5		0.8		1.3	
Contract Males		1.1		0.3				1.4	
Contract Females				0.2				0.2	
Total Hired		1.1	1.6	1.0	1.1	0.8	0.9	2.9	1.1
Total Labor Input		70.1 (74.13)	100.0	93.9 (89.81)	100.0	89.8 (73.71)	100.0	253.8 (193.83)	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figures in parentheses are standard deviations.

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or kind.

TABLE 3.6.--Distribution of Labor per Hectare in Bafaro Rice Cultivation by Type of Labor and Activity

Labor Input	Nursery		Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
	Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family												
Males 16-60 yrs	0.6		9.1		4.8		2.7		2.8		20.0	5.8
10-15 yrs	0.1		0.4		0.7						1.2	
0-9 yrs												
Total Males	0.7 (1.61)[b]	16.3	9.5 (30.37)	8.3	5.5 (11.05)	5.8	2.7 (5.20)	4.3	2.8 (16.36)	3.2	21.2	
Females 16-60 yrs	3.5		87.0		81.3		52.8		75.7		300.3	
10-15 yrs			0.7		1.3		0.2		0.4		2.6	
0-9 yrs					0.0						0.0	
Over 60 yrs												
Total Females	3.5 (5.45)	81.4	87.7 (79.16)	77.0	82.6 (97.96)	86.5	53.0 (45.92)	84.4	76.1 (55.33)	90.0	302.9	83.9
Other Family[c]												
Total Family Labor	4.2 (5.90)	97.7	97.2 (80.36)	85.3	88.1 (99.22)	92.3	55.7 (56.55)	88.7	78.9 (56.67)	93.2	324.1	89.9
Strange Farmer (Males)	0.0		7.2	6.3	2.1	2.2	6.1	9.7	0.4	0.5	15.8	4.4
Hired Labor[d]												
Exchange Male			0.2		1.6		0.0		1.8		3.6	
Exchange Female	0.1		4.3		3.2		0.3		2.3		10.2	
Contract Male			3.0		0.1		0.7				3.8	
Contract Female	0.0		2.0		0.4				1.2		3.6	
Total Hired	0.1	2.3	9.5	8.4	5.3	5.5	1.0	1.6	5.3	6.3	21.2	5.8
Total Labor Input	4.3 (6.15)	100.0	113.9 (79.92)	100.0	95.5 (101.28)	100.0	62.8 (56.13)	100.0	84.6 (56.00)	100.0	361.1 (235.49)	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figures in parentheses are standard deviations.

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or kind.

TABLE 3.7.--Distribution of Labor per Hectare in Mangrove Rice Cultivation by Type of Labor and Activity

Labor Input	Nursery		Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
	Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family												
Males 16-60 yrs	0.1		0.1		8.5		0.7		6.3		15.7	
10-15 yrs	0.1				0.4		1.7		0.1		2.3	
0-9 yrs									0.2		0.2	
Total Males	0.2 (0.71)[b]	1.2	0.1 (0.25)	0.1	8.9 (13.98)	9.4	2.4 (18.24)	5.6	6.6 (11.96)	6.5	18.2	5.6
Females 16-60 yrs	16.1		66.7		77.9		39.0		89.8		289.5	
10-15 yrs	0.6		1.3		1.8		1.2		0.0		4.9	
0-9 yrs			0.0		0.1		0.2				0.3	
Over 60 yrs	0.3										0.3	
Total Females	17.0 (11.00)	98.8	68.0 (39.66)	96.5	79.8 (39.01)	84.5	40.4 (42.46)	94.2	89.8 (61.23)	89.0	295.0	90.5
Other Family					0.1	0.1					0.1	0.0
Total Family Labor	17.2 (11.85)	100.0	68.1 (39.67)	96.6	88.8 (46.30)	94.0	42.8 (46.21)	99.8	96.4 (62.39)	95.5	313.3	96.1
Strange Farmers (Male)												
Hired Labor[d]												
Exchange Males			0.3		1.4						1.7	
Exchange Females			1.9		2.6		0.1		3.2		7.8	
Contract Males					0.5				0.6		1.1	
Contract Females			0.2		1.2				0.7		2.1	
Total Hired			2.4	3.4	5.7	6.0	0.1	0.2	4.5	4.5	12.7	3.9
Total Labor Input	17.2 (12.42)	100.0	70.5 (43.23)	100.0	94.5 (49.39)	100.0	42.9 (59.53)	100.0	100.9 (54.36)	100.0	326.0 (111.43)	100.0

SOURCE: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figures in parentheses are standard deviations.

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or kind.

TABLE 3.8.--Distribution of Labor per Hectare in Dry Season Irrigated Rice Cultivation by Type of Labor and Activity

Labor Input	Nursery		Land Preparation		Planting		Care and Cultivation		Harvesting		Total Labor	
	Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family												
Males 16-60 yrs	3.2		18.6		32.7		22.0		24.2		100.7	
10-15 yrs			0.1		1.1		0.1		3.6		4.7	
0-9 yrs												
Total Males	3.2 (7.37)[b]	74.4	18.7 (59.20)	49.9	33.8 (43.72)	33.9	22.1 (32.40)	22.1	27.8 (38.27)	31.0	105.6	31.9
Feamles 16-60 yrs			1.4		38.9		67.4		44.4		152.1	
10-15 yrs					0.5		0.1		0.5		1.1	
0-9 yrs												
Over 60 yrs												
Total Females			1.4 (3.86)	3.7	39.4 (31.97)	39.5	67.5 (60.93)	67.6	44.9 (38.52)	50.1	153.2	46.2
Other Family	1.0	23.3	14.5	38.7	2.2	2.2	2.3	2.3	1.8	2.0	21.8	6.7
Total Family Labor	4.2 (12.14)	97.7	34.6 (124.51)	92.3	75.4 (46.22)	75.6	91.9 (69.01)	92.0	74.5 (53.94)	83.1	280.6	84.8
Strange Farmers (Male)			1.4	3.7	6.4	6.4	6.2	6.2	6.6	7.4	20.6	6.2
Hired Labor[d]												
Exchange Males			0.2		2.5				0.8		3.3	
Exchange Females					10.8		0.7				11.5	
Contract Males	0.1		0.9		4.5		0.9		7.4		13.8	
Contract Females			0.4		0.1		0.1		0.4		1.0	
Total Hired	0.1	2.3	1.5	4.0	17.9	18.0	1.7	1.8	8.6	9.5	'29.8	9.0
Total Labot Input	4.3 (10.16)	100.0	37.5 (128.24)	100.0	99.7 (74.50)	100.0	99.8 (68.46)	100.0	89.7 (79.79)	100.0	331.0	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figures in parentheses are standard deviations.

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or in kind.

TABLE 3.9.--Distribution of Labor per Hectare in Wet Season Irrigated Rice Cultivation by Type of Labor and Activity

Labor Input		Nursery		Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
		Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family													
Males	16-60 yrs	1.0		23.8		18.6		20.0		16.0		79.4	
	10-15 yrs	0.3		3.7		8.2		12.5		7.3		32.0	
	0-9 yrs			1.0		0.7						1.7	
	Total Males	1.3 (2.65)[b]	17.6	28.5 (49.06)	58.0	27.5 (52.99)	21.4	32.5 (80.87)	66.7	23.3 (53.27)	27.7	113.1	34.9
Females	16-60 yrs	3.6		13.3		87.4		12.5		64.8		181.6	
	10-15 yrs	1.6		2.3		2.3		0.1				6.3	
	0-9 yrs							0.1				0.1	
	Over 60 yrs												
	Total Females	5.2 (13.66)	70.3	15.6 (29.23)	31.8	89.7 (105.65)	69.9	12.7 (16.91)	26.1	64.8 (70.28)	71.6	188.0	58.0
Other Family[c]		0.1	1.3	0.8	1.6	0.3	0.2	3.2	6.7	1.6	0.2	6.0	1.9
Total Family Labor		6.6 (13.91)	89.2	44.9 (71.19)	91.4	117.3 (111.78)	91.5	48.4 (82.04)	99.5	89.7 (81.21)	99.1	307.1	94.8
Strange Farmers (Males)		0.3	4.1	3.6	7.3	1.7	1.3			0.8	0.9	6.4	2.0
Hired Labor[d]													
Exchange Male		0.1										0.1	
Exchange Female		0.4				5.1						5.5	
Contract Male				0.6		2.1		0.3				3.1	
Contract Female						1.9						1.9	
Total Hired		0.5	6.7	0.6	1.3	9.2	7.2	0.3	0.5			10.6	3.2
Total Labor Input		7.4 (14.00)	100.0	49.1 (70.86)	100.0	128.4 (107.11)	100.0	48.7 (82.50)	100.0	90.5 (66.24)	100.0	324.1	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figures in parentheses are standard deviations

[c]Includes family members that were not disaggregared by sex and age.

[d]Only contract labor is paid in cash and/or kind.

TABLE 3.10.--Distribution of Labor per Hectare in Groundnut Cultivation by Type of Labor and Activity

Labor Input	Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
	Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family										
Males 16-60 yrs	10.2		6.0		40.6		35.0		91.8	
10-15 yrs	1.0		0.6		5.1		2.6		9.3	
0-9 yrs	0.4		0.2		0.2				0.8	
TOTAL MALES	11.6 (14.93)[b]	87.2	6.8 (7.43)	85.0	45.9 (217.52)	89.7	37.6 (33.20)	81.0	101.9	85.7
Females 16-60 yrs	0.1		0.1		1.1		3.4		4.7	
10-15 yrs			0.1		0.3		0.2		0.6	
0-9 yrs			0.2		0.0		0.0		0.2	
Over 60 yrs	0.0				0.0				0.0	
TOTAL FEMALES	0.1 (0.72)	0.8	0.4 (1.40)	5.0	1.4 (5.76)	2.7	3.6 (8.05)	7.8	5.5	4.6
Other Family[c]	0.5	3.8	0.2	2.5	0.2	0.4	0.0	0.0	0.9	0.8
Total family labor	12.2 (14.78)	91.8	7.4 (7.85)	92.5	47.5 (219.97)	92.8	41.2 (34.16)	88.8	108.3	91.1
Strange Farmers (Males)	0.8	6.0	0.4	5.0	2.0	3.9	2.2	4.7	5.4	4.5
Hired Labor[d]										
Exchange Males	0.1		0.1		0.9		2.1		3.2	
Exchange Females					0.0		0.0		0.0	
Contract Males	0.2		0.1		0.8		0.9		2.0	
Contract Females										
TOTAL HIRED	0.3	2.2	0.2	2.5	1.7	3.3	3.0	6.5	5.2	4.4
TOTAL LABOR INPUT	13.3 (46.73)	100.0	8.0 (36.4)	100.0	51.2 (218.23)	100.0	46.4 (190.2)	100.0	118.9 (92.75)	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work
[b]Figures in parentheses are standard deviations
[c]Includes family members that were not disaggregated by sex and age
[d]Only contract labor is paid in cash and/or in kind.

TABLE 3.11.--Distribution of Labor per Hectare in Maize Cultivation by Type of Labor and Activity

Labor Input	Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
	Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family										
Males 16-60 yrs	14.0		10.4		39.5		22.1		86.0	
10-15 yrs	1.9		0.6		3.1		1.3		6.9	
0-9 yrs	0.5		0.1		0.2		0.0		0.8	
TOTAL MALES	16.4 (22.41)	80.4	11.1 (13.19)	88.8	42.8 (40.44)	91.3	23.4 (23.34)	64.3	93.7	80.6
Females 16-60 yrs	0.2		0.1		0.7		9.5		10.5	
10-15 yrs	0.1		0.1		0.3		0.2		0.7	
0-9 yrs	0.1						0.1		0.2	
Over 60 yrs	0.1								0.1	
TOTAL FEMALES	0.5 (2.45)	2.4	0.2 (0.78)	1.6	1.0 (6.86)	2.1	9.8 (23.79)	26.9	11.5	9.9
Other family[c]	0.4	2.0	0.1	0.8	0.7	1.5			1.2	1.0
Total family labor	17.3 (24.99)	84.8	11.4 (13.34)	91.2	44.5 (43.05)	94.9	33.2 (35.92)	91.2	106.4	91.5
Strange Farmers (Males)	1.0	5.0	0.8	6.4	1.5	3.2	2.5	6.9	5.8	5.0
Hired Labor[d]										
Exchange Males	0.7		0.2		0.6		0.7		2.2	
Exchange Females	0.2						0.0		0.2	
Contract Males	1.2		0.1		0.3		0.0		1.6	
Contract Females										
Total Hired	2.1	10.2	0.3	2.4	0.9	1.9	0.7	1.9	4.0	3.5
TOTAL LABOR INPUT	20.4 (28.89)	100.0	12.5 (13.19)	100.0	45.9 (46.88)	100.0	36.4 (38.47)	100.0	116.2 (85.66)	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figure in parentheses are standard deviations

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or kind.

TABLE 3.12.--Distribution of Labor per Hectare in Sorghum Cultivation by Type of Labor and Activity

Labor Input	Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
	Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family										
Males 16-60 yrs	7.8		7.9		32.0		12.4		60.1	
10-15 yrs	1.3		1.1		7.4		0.5		10.3	
0-9 yrs					0.4				0.4	
TOTAL MALES	9.1 (13.53)	81.3	9.0 (12.86)	77.6	39.8 (49.40)	85.6	12.9 (14.87)	59.4	70.8	77.9
Females 16-60 yrs					0.0		5.6		5.6	
10-15 yrs										
0-9 yrs										
Over 60 yrs										
TOTAL FEMALES					0.0 (0.14)	0.0	5.6 (13.71)	25.8	5.6	6.1
Other Family[c]	0.2	1.8	1.4	12.1	0.8	1.7			2.4	2.6
Total family labor	9.3 (13.48)	83.1	10.4 (15.13)	89.7	40.6 (48.76)	87.3	18.5 (22.91)	85.2	78.8	86.6
Strange Farmers (Males)	1.8	16.1	1.1	9.5	5.1	11.0	2.0	9.2	10.0	11.0
Hired Labor[d]										
Exchange Males			0.1		0.1		1.2		1.4	
Exchange Females					0.1				0.1	
Contract Males	0.1				0.6				0.7	
Contract Females										
TOTAL HIRED	0.1	0.8	0.1	0.8	0.8	1.7	1.2	5.6	2.2	2.4
TOTAL LABOR INPUT	11.2 (14.10)	100.0	11.6 (16.77)	100.0	46.5 (57.38)	100.0	21.7 (22.83)	100.0	91.0 (91.87)	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figures in parentheses are standard deviations.

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or in kind.

TABLE 3.13.--Distribution of Labor per Hectare in Early Millet (<u>Suno</u>) Cultivation by Type of Labor and Activity

Labor Input		Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
		Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family											
Males	16-60 yrs	13.4		4.7		52.8		20.5		91.4	
	10-15 yrs	1.7		0.9		9.8		4.1		16.5	
	0-9 yrs.	0.0				2.2		0.0		2.2	
	TOTAL MALES	15.1 (17.12)[b]	88.8	5.6 (5.14)	94.9	64.8 (109.28)	94.9	24.6 (24.62)	92.5	110.1	93.5
Females	16-60 yrs	0.0		0.1		1.4				1.5	
	10-15 yrs			0.0		0.3				0.3	
	0-9 yrs							0.1		0.1	
	Over 60 yrs										
	TOTAL FEMALES	0.0 (0.17)	0.0	0.1 (0.34)	1.7	1.7 (14.05)	2.5	0.1 (1.78)	0.4	1.9	1.6
Other Family[c]		0.0	0.0	0.1	1.7	0.6	0.9			0.7	0.6
TOTAL FAMILY LABOR		15.1 (17.17)	88.8	5.8 (4.98)	98.3	67.1 (113.68)	98.3	24.7 (24.52)	92.9	112.7	95.7
Strange Farmers (Males)		1.4	8.2	0.1	1.7	1.2	1.7	1.1	4.1	3.8	3.2
Hired Labor[d]											
Exchange Males		0.0		0.0		0.0		0.6		0.6	
Exchange Females		0.2								0.2	
Contract Males		0.3						0.2		0.5	
Contract Females											
TOTAL HIRED		0.5	3.0	0.0	0.0	0.0	0.0	0.8	3.0	1.3	1.1
TOTAL LABOR INPUT		17.0 (18.83)	100.0	5.9 (5.41)	100.0	68.3 (123.68)	100.0	26.6 (22.73)	100.0	117.8 (146.93)	100.0

Source: Survey data

[a]One workday is equivalent to eight hours of work

[b]Figures in parenthesis are standard deviations.

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or kind.

TABLE 3.14.--Distribution of Labor per Hectare in Late Millet (Sanyo) Cultivation by Type of Labor and Activity

Labor Input		Land Preparation		Planting		Care and Cultivation		Harvesting		Total	
		Workdays[a]	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family											
Males	16-60 yrs	20.2		8.4		57.3		9.6		95.5	
	10-15 yrs	1.1		1.0		2.1				4.2	
	0-9 yrs					2.0				2.0	
	TOTAL MALES	21.3 (28.03)	96.4	9.4 (12.06)	72.9	61.4 (58.13)	84.5	9.6 (12.91)	74.4	101.7	84.3
Females	16-60 yrs			0.4		0.3		0.1		0.8	
	10-15 yrs							0.0		0.0	
	0-9 yrs										
	Over 60 yrs										
	TOTAL FEMALES			0.4 (1.59)	3.1	0.3 (1.14)	0.4	0.1 (0.16)	0.8	0.8	0.7
Other Family[c]				0.4	3.1	5.7	7.8	1.4	10.9	7.5	6.2
TOTAL FAMILY LABOR		21.3 (28.03)	96.4	10.2 (11.72)	79.1	67.4 (51.49)	92.7	11.1 (11.72)	86.1	110.0	91.2
Strange Farmers (Males)		0.8	3.6	1.5	11.6	3.2	4.4	1.7	13.2	7.2	6.0
Hired Labor[d]											
Exchange Males				0.8		0.3				1.1	
Exchange Females											
Contract Males				0.4		1.8		0.1		2.3	
Contract Females											
TOTAL HIRED				1.2	9.3	2.1	2.9	0.1	0.7	3.4	2.8
TOTAL LABOR INPUT		22.1 (17.59)	100.0	12.9 (12.12)	100.0	72.7 (90.97)	100.0	12.9 (14.43)	100.0	120.6 (113.32)	100.0

Source: Survey Data

[a]One workday is equivalent to eight hours of work.

[b]Figures in parenthesis are standard deviations.

[c]Includes family members that were not disaggregated by sex and age.

[d]Only contract labor is paid in cash and/or kind.

This may be due to the better economic position enjoyed by men which provides them with the ability to make cash payments and provide adequate food for nonfamily workers. More nonfamily labor was utilized in land preparation for upland rice and bafaro and in planting for mangrove rice than in any of the other activities.

Turning now to irrigated rice, the story is similar, although it is less pronounced. This is true despite the fact that irrigated rice was introduced as a male crop. In the dry season irrigated rice crop, women contributed about 50 percent of the total labor while men contributed about 43 percent. The rest was satisfied by labor classified as other family. In the rainy season irrigated rice, women's contribution increased to more than 60 percent. Nursery and land preparation is clearly dominated by males in both crops. In the dry season crop women contributed more than half of the planting, care, and cultivation and harvesting labor requirements, and they contributed more than 70 percent of the planting and harvesting labor requirements in the rainy season crop. Again, men tended to use more contract labor than exchange labor while women used more exchange labor than contract labor. Most of the nonfamily labor was employed in the planting activity for both crops.

In all the rice enterprises, with the exception of the wet season irrigated rice, youths between 10 and 15 years old contributed less then 3 percent of the total labor. Children below 10 years only

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Such labor is paid back in kind. Contract labor is nonfamily labor that is paid either in cash or provided with food by the farmer during work or both.

participated in the cultivation of irrigated rice where their labor contribution was estimated at less than 1 percent for each crop. However, youths contributed about 11.8 percent of the total labor in wet season irrigated rice. Male youths contributed about 9.9 percent of the total labor. About one third each of these labor was contributed in planting and care and cultivation.

Upland crop cultivation is the territory of men. Percentage total labor contribution by men was 89.1 percent in maize, 91.3 percent in sorghum, 93.1 percent in late millet, 94.6 percent in groundnut, and 97.6 percent in early millet. In all of the activities, men contributed no less than 73 percent of the labor in any given crop. Female labor contribution was generally higher in the harvesting activities when compared to other activities. The low labor inputs and the relatively higher standard deviations in relation to the means for the female labor inputs are indicative of the casual participation of females in groundnut and upland cereals cultivation.

Youths, 10 to 15 years, contributed between 4 percent in early millet to 14.3 percent in late millet and children under ten years contributed between 0.4 percent in sorghum to 2 percent of the total labor in late millet. Most of the labor contributed by youths and children was in the care and cultivation activity.

All nonfamily female labor in groundnut and upland cereals was of the exchange type. There was a higher use of male contract labor than male exchange labor. The highest percentages of nonfamily labor in the upland crops was recorded in groundnut cultivation.

Taking into account all of the crops considered, the highest percentage of nonfamily labor was used in dry season irrigated rice where hired labor accounted for about 9 percent of the total labor per hectare. The lowest percentage of nonfamily labor was in upland rice and early millet with a percentage hired labor of 1.1 percent each. The higher percentage of hired labor in the dry season crop is due to an increased supply of employable labor in the slack season. Ironically, however, enterprise wage rate was highest on the dry season irrigated rice crop. This may be due to the fact that this crop is cultivated at a time in the year when farmers have money obtained from selling groundnut and there is plenty of food. This appears to increase their propensity to spend on hired labor.

Summary

This chapter has provided a description of the major rice production systems in The Gambia, and the gender division of labor. Four major types of rice cultivation are described--upland, *bafaro*, mangrove, and irrigated rice. Upland rice had both the lowest yield and the lowest total labor input per hectare. Dry season irrigated rice had the highest yield while the highest labor input per hectare was recorded in *bafaro* rice.

Total labor input in upland crops were similar, with the lowest labor input recorded in sorghum and the highest in late millet. The rice crops generally had a higher labor input per hectare than groundnut and the other cereals.

The monthly labor profiles show a marked seasonality in labor demand with the high peaks coming at the time of planting and harvesting. Family labor is the predominant form of labor in Gambian agriculture. Nonfamily labor accounted for no more than 9 percent of the total labor input per hectare. There is a distinct, though not rigid, division of labor by sex along crop enterprise lines. Women dominate the cultivation of rice, while men dominate the cultivation of groundnuts and upland cereals.

The next chapter presents the financial and economic analysis of the crop enterprises described in this chapter and compares their costs and returns.

CHAPTER IV

A FINANCIAL AND ECONOMIC ANALYSIS OF THE RICE PRODUCTION SYSTEMS AND OTHER CROPS

Introduction

There are three main objectives in this chapter. The first is to define and estimate the private costs and benefits of rice production to rice farmers based on the production practices of the year of the survey. This will be achieved through the help of budgets that will be prepared on a hectare basis. The second objective is to estimate the economic costs and benefits of rice production from the national point of view. Related to the above objectives, a comparison of the financial and economic costs and benefits of the different rice production systems will also be presented. The third objective is to compare the financial and economic costs and benefits of the rice crop enterprises to the financial and economic costs and benefits of groundnut and other upland cereals.

The analysis in this chapter will help in determining the degree of comparative advantage enjoyed by The Gambia in the production of these crops. First the method used in the valuation of the inputs and outputs for the rice production systems is presented before discussing the financial and economic analysis. Later, the same approach is adopted in dealing with the goundnut and upland cereal enterprises.

Input Valuation for the Rice Enterprises

Land and labor are the two most important factors of production in Gambian agriculture. The amount of capital and the proportion of income invested in agriculture are very low. The use of simple hand tools has been the tradition and the use of draft animals, ox-drawn equipment, improved seeds, and chemical fertilizers are a recent innovation. In this section the availability and valuation of resources used in rice production are discussed.

Land

The land tenure system has already been discussed in Chapter II. In principle, land cannot be sold, rented, or pledged in the rural areas in The Gambia. However, the introduction of irrigated rice cultivation in some areas of the country is resulting in the development of a land market in the form of rent. Farmers sometimes rent irrigated rice land to outsiders for a fee of between D35.00 to D45.00 a plot of about one-tenth of a hectare. This practice is more common in the rainy season than in the dry season. About 30% of the farmers rented part or all of their irrigated lands either in the wet or in the dry season. No other type of agricultural land is known to have a similar rental market.

It is estimated that initial land clearing, channel construction, and levelling of irrigated land require about 100 mandays per acre (= 247 mandays per hectare). At the controlled minimum wage rate of D5.00 a day, the cost of initial clearing and levelling of one hectare of land is approximately D1,235.00 for labor. But other costs are involved which cannot be easily estimated. These costs include supervision and other capital goods such as tractor depreciation and repairs and maintenance. Added to these problems is the fact that irrigated perimeters were developed at different times by different sponsors. Some of them are redevelopments.

In the absence of any reliable estimates on the costs of development, an opportunity cost principle has been used to value land both in the financial analysis and economic analysis. The opportunity cost of land is defined as its return from its best alternative use outside of the enterprise for which it was being used at the time of the survey. For upland rice, bafaro, and mangrove rice lands, the opportunity cost of land is assumed to be zero. This is because lands cultivated with these crops have neither a rent value nor any other alternative uses. This does not mean that the lands, especially for bafaro and upland rice, could not be used to grow any other crop. Rather, it means that these lands are not in scarce supply to the extent that farmers would have to forego the output of another enterprise if the lands were used for the cultivation of either upland or bafaro rice. The other crop could be grown on another land with similar yield potentials. Mangrove lands are salty and so their potential for any other use are negligible.

For the irrigated rice lands, an opportunity cost of D400.00 per hectare is assumed. This is based on the average rent value of these lands. In the absence of an active land market, this method of land valuation is suggested by Brown (1979) and Gittinger (1972) for use in the economic analysis of projects.

A word of caution is in order at this point. While this method of land valuation might seem appropriate under existing conditions, the use of zero opportunity cost of land is questionable when one considers future developments which may bring pressure on the demand for land or which may increase its relative profitability. For example, increases in population may reduce the amount of cultivable land available to the extent that further expansions may require substantial investments in land development and reclamation. Under such conditions the cost of land will necessarily be positive. The above assumptions also ignores the fact that there might be wide variations in soil fertility which will affect their opportunity costs.

Labor

Labor input is reported as eight-hour workdays. In the preceeding chapter, total labor input was disaggregated into family labor, strange farmer, and hired labor. Hired labor included exchange labor and contract labor. These two types of hired labor are paid differently. Exchange labor is paid in kind, that is, the farmer or family member returns work for work and no cash or food is provided. In this analysis, therefore, exchange labor is treated like family labor. Contract labor is paid either in cash, in kind in the form of food or tobacco, or both. The value of the food and the cash is used to estimate the enterprise wage rate which is used to value contract labor both in the financial and economic analysis. The estimated enterprise wage rates were D2.50, D2.87, D2.74, D3.86, and D3.50 per workday for the upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. The minimum agricultural wage rate, as established by the government, was D5.00 per adult workday.

The cost of the strange farmer labor input is derived from an estimate of the value of food and lodging provided to him by the farmer in return for work on fields assigned to him. The cost of food was estimated at D30.00 a month and the cost of lodging was estimated at D30.00 a month[1] for a total of D60.00 a month. On the average, the strange farmer stays with his host for about six months in the year. Thus, annual estimated cost for keeping a stranger farmer was about D360.00. Actual labor input per strange farmer was estimated at 75 workdays in the year. This translates to an estimate of D4.80 per actual workday. This price was used in both the financial and economic analysis to value the labor input of strange farmers.

The valuation of family labor for the economic analysis presents some problems. Theoretically the appropriate price to use is one that reflects the opportunity cost of labor. In a perfectly competitive market, this would be determined by the marginal value product of labor. If there is an active labor market, then the enterprise wage rate would be a good approximateion of the real marginal value product. However, this is not the case in the rural area of The Gambia where less than 5% of the labor employed in agriculture

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[1]These costs are based on what enumerators paid for food and rent in each village.

could be considered hired labor. Valuing family labor in such situations is therefore a complex matter. In the end any method employed will involve the use of arbitrary or inappropriate values.

One could even question the theoretical use of marginal analysis in economic analysis for a country in which policy recommendations are made, for changes which are nonmarginal in nature. The problem is made even more complex by the heterogenous nature of family labor. Family labor productivity vary by sex and age. Within each category the marginal productivities of labor will also vary by the task performed and the time in the year in which the task is performed.

Because of this complex nature of labor valuation, economists have often ignored the demands of theory and used methods to value labor which are at variance with theoretical expectations. In all the studies edited by Pearson et al. (1981), the economic value or shadow price of unskilled labor was based on the rural market wage rate with adjustments made to account for some of the complexities involved in the determination of market wages. Kamuanga (1982), and Winch (1976) based their labor values on observed enterprise wage rates. Eponou (1983) borrowed a "real wage rate" from another author, Fane (1981). The problems and dangers associated with such approaches are a subject of study currently being undertaken by Kelley (1983). Kelly proposes to evaluate the correspondence between theory and practice with respect to valuing the opportunity cost of labor; examine the policy implications of highly fragile labor cost estimates; demonstrate the sensitivity of labor cost estimates to various assumptions and estimation techniques and recommend steps which can be taken to produce more robust cost estimates.

To date, there is no acceptable practical method to handle this problem. Conventional wisdom indicates that the marginal product of labor in agriculture in developing countries is positive, but very close to zero. To accept this notion, however, is to ignore the fact that even in labor-abundant societies, there are peak seasons when rural workers can find employment. At these seasons the marginal product of labor is significantly different from and greater than zero. If there is an active labor market, the wage rate paid at that time could be a good approximation of the opportunity cost of labor. Even in the slack periods an assumption of zero opportunity cost is inappropriate. Farmers, being economic men, have a reservation price below which they are unwilling to forgo their leisure time or other social commitments, for any alternative employment. This reservation price might represent the real opportunity cost of labor in those slack periods.

Notwithstanding the above comments, the economic analysis is carried on with family labor valued at the enterprise wage rate or the rate paid to contract labor. Because of the thin rural labor market, this approach is admittedly inappropriate. Later in the study a sensitivity analysis is carried out by valuing labor at zero opportunity cost and at half the enterprise rate to demonstrate the effect that the value used for family labor might have on the conclusions. The enterprise wage rate and the zero value could be considered as upper and lower limits of the real opportunity cost of family labor, respectively.

In the financial analysis, the return to family labor and management is calculated as a residual rent after deducting the costs of all other inputs.

Seed

Seed inputs consisted largely of seed retained from previous harvests. Seeds for irrigated rice cultivation were normally supplied at cost by the Department of Agriculture from its seed multiplication center in Sapu. However, due to internal problems improved seed was not available to farmers during the period of the survey. Farmers were thus forced to use either rice seed from the previous seasons or to buy from other farmers. Because rice seed for planting is usually scarce during the planting season, the market price was used to value seed for both the financial and economic analysis. The cost of seed per kilogram was D0.52, D0.53, D0.56, D0.55, and D0.57 for upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice seeds, respectively.

Fertilizer

Fertilizer availability to farmers was also a problem during the period of the survey. Most of the farmers cited a lack of fertilizer as a major problem in their farming activities. Some of the farmers who used fertilizer were able to do so because they had stored some fertilizer in the previous season. The most frequently used fertilizer is the compound (20:10:0) fertilizer and is sold to farmers at the subsidized rate of D0.18 per kilogram. This cost is used in the financial analysis.

In the economic analysis, the costs are adjusted to remove the subsidies and make allowance for handling, storage, and transportation. In 1981/82 the CIF (cost-insurance-freight) cost of imported compound fertilizer was estimated at D524.00[2] per ton or D0.52 per kilogram. It was also estimated that handling and storage was about 5% of the CIF cost. Transportation from Kombo St. Mary to Georgetown was estimated at about D25.00[3] per ton. This gives an estimated economic cost of D575.20 per ton.

Irrigation and Plowing Charges

In the irrigated rice cultivation areas, farmers are in principle charged a fee of D100.00/acre (D247.00/ha) and D15.00/acre (or D37.07/ha) per annum for irrigation water and plowing, respectively. In practice, however, a lot of confusion exists on whether the charges are on an annual basis or on a cropping season basis. This confusion exists even among well-placed personnel. Extension agents have used this to an advantage by charging the farmers the same cost on a cropping season basis. Thus in the financial analysis, a cost of D247.00 and D37.07 per hectare has been used for each of the irrigation rice systems for irrigation water and plowing, respectively.

Estimation of the costs of irrigation and plowing for the economic analysis is a bit shaky. Although it was generally agreed

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[2]From Dr. R. Kagbo, personal communication.

[3]Quotation from private truck drivers in Serrekunda.

that the financial costs were subsidized, it was impossible to get an estimate of the amount of subsidy from officials and operating personnel. Even actual costs of machines, fuel, and oil consumption rates and length of operation could not be obtained as was the estimates on repair and maintenance. In the absence of any recent data, costs of water and plowing were projected from a 1972 source.

In a project appraisal report for irrigated rice,[4] it was estimated that the annual cost of the pumps, spares, and repairs and fuel will be D42.00/acre. At an estimated annual general inflation rate of 19%,[5] this cost is equivalent to D239.00 acre (or D590.00/ha) in 1982. This cost is about 139% above the current water charges. It is, therefore, assumed that plowing costs would also have increased by 139% to D35.85/acre (or D88.54/ha). Because pumping machines are said to operate about twice as long in the dry season as in the wet season, the irrigation water costs were adjusted to reflect this proportion. With these assumptions, the following costs were used in the economic analysis--cost of irrigation water and plowing in the dry season was D393.33 and D44.77 per hectare and for the wet season it was D196.67 and D44.77 per hectare, respectively.

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[4]IBRD/IDA, "Appraisal of an Agricultural Development Project--The Gambia," 1972. The charges were such that farmers were to pay the full costs of the equipment.

[5]Derived from "Central Bank of The Gambia Bulletin, Quarterly Reports 1975 and 1982. Consumer Price Indices." The cost of fuel and light is estimated to have increased by 26% annually.

Overhead Costs

Overhead costs, such as depreciation, are difficult to allocate or apportion to individual crop enterprises. The overhead costs involved in rice cultivation and which are considered here are related to depreciation of ox-drawn equipment and draft animals which, if used at all, are employed in transporting output from the field to the village.

Farmers who don't own these facilities can often rent these inputs for about D3.00 per trip of about three hours. To estimate the cost of depreciation in the financial analysis, a joint cost allocation method was employed. The average depreciation for draft animals and ox-drawn equipment per farm was estimated at D33.00. The average time input of draft-animal-ox-equipment combination was estimated at 50 hours. Thus the hourly depreciation was estimated by dividing the annual depreciation by the annual number of hours worked. This was equal to D0.66 per hour and was used in the financial analysis. In the economic analysis the average rent per hour was used to value depreciation. It was assumed that the rent value was a better approximation of the economic user cost of the draft animals and equipment.

Output Valuation

Output here refers to the quantity of produce reaching home and before storage. It does not refer to the potential yield which can be substantially higher if post-harvest losses are not taken into consideration. For example, Kamuanga (1982) reports that post-harvest

losses in Mali averaged about 21% of the potential yield. In the financial analysis, the producer price of paddy guaranteed by the government was used to value the output. This price is D0.51 per kilogram of paddy.

In the economic analysis the conventional project analysis approach of valuing tradable goods was employed. This method is justified by the fact that The Gambia imports more than half of her domestic rice consumption. The method of calculating the import parity price of paddy is shown on Table 4.1. The economic value of paddy is estimated at about D340.00 per metric ton. This price is used in the economic analysis.

As an alternative to using the import parity price, another method, emphasizing the policy objectives of the government, can be employed. This method was used by Franzel (1979) in estimating the economic value of irrigated rice in Senegal. The method is based on the premise that since the government is pursuing a policy of rice self-sufficiency, it values an additional ton of locally produced rice at a higher price than a ton of the imported rice. Using this approach, the guaranteed producer price of D510.00 per ton is used as a base. From this base, the estimated cost of milling, transportation, and storage are deducted as done in the import parity price calculation. The estimated economic price based on government policy is then calculated as D447.00 per ton. This price is about 31.5% higher than the import parity price. In the economic analysis the net economic benefit will be derived by using the import parity

TABLE 4.1.--Import Parity Price of Paddy

CIF Banjul in \$/MT[a]	272.00
CIF Banjul in D/MT[b]	598.40
Plus storage	12.00
Wholesale cost of imported rice in D/MT	610.40
Value of paddy[e]	402.86
Minus milling cost[c]	30.00
Minus transportation[d]	25.00
Minus storage	8.00
Import parity price in D/MT	339.86

[a]Estimated cost in 1981/82. Personal communication with Dr. R. Kagbo WAROA Subregional Coordinator, Banjul.

[b]Official exchange rate in May 1982. \$1 = D2.20. Assumed to be equal to the shadow exchange rate.

[c]Estimated by officials at the GPMB owned rice mills in Kaur.

[d]Quotations from truck drivers in Serre Kunda. Estimate from Banjul to Georgetown.

[e]Assumes a 66% recovery rate.

price. The government policy oreinted method will only be used for comparative purposes.

Financial Analysis of the Rice Production Systems

In order to estimate the costs and returns of the different rice production systems, survey data were employed to derive enterprise budgets for each of the systems. Sufficient details are included in the budgets to show both the physical amounts and the financial value of each input or output and to make possible the calculations of financial returns to selected factors of production. It should be borne in mind that the input/output coefficients derived in Chapter III and which are employed in this chapter reflect the pattern of use of resources in The Gambia during the 1981/82 survey. As such they may vary considerably from data collected in other years. The rice enterprise budgets per hectare are shown in Tables 4.2 to 4.6.

Comparison of Financial Costs and Benefits

Value of production.--The value of output was highest for the dry season irrigated rice and lowest for the upland rice. Since all output was valued at the same price of D0.51 per kilogram, the differences in value are purely a reflection of the differences in yield per hectare. The value of output was D676.26, D932.28, D958.80, D1,411.17, and D1,238.79 per hectare for upland rice, *bafaro* rice, mangrove rice, dry and wet season irrigated rice, respectively.

TABLE 4.2.--Upland Rice Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	14	--	--
2. Average Holdings	0.20 Ha	--	--
B. Income and Expenditure			
1. Value of Output	1326 Kgs.	0.51	676.26
2. Variable Costs			
Seed	46 Kgs	0.52	23.92
Fertilizer	--	--	--
Nonfamily Labor			
Contract Labor	1.6 Wd	2.50	4.00
Plowing	--	--	--
Irrigation	--	--	--
Hired ox-equipment	--	--	--
Total Variable Costs	--	--	25.92
3. Gross Margin	--	--	648.34
4. Fixed Expenses			
Strange Farmer[a]	0.5 Wd	4.80	2.40
Depreciation	--	--	--
5. Returns to land, family labor, capital and Management	--	--	645.94
6. Opportunity cost of Capital (15%)[b]	D27.92	--	4.19
7. Net returns to land, family Labor and Management	--	--	641.75
8. Opportunity cost of land	1 ha	0.00	0.00
9. Net return to family Labor and Management	--	--	641.75
10. Return per workday to family labor and management	251.7	--	2.55

Source: Survey Data

[a]Semi-permanent labor. Once accepted food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

TABLE 4.3.--Bafaro Rice Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	31	--	--
2. Average Holdings	0.50 Ha	--	--
B. Income and Expenditure			
1. Value of output	1828 Kgs	0.51	932.28
2. Variable Costs			
Seed	50 Kgs	0.53	26.50
Fertilizer	--	--	--
Nonfamily Labor			
Contract Labor	7.4 Wd	2.87	21.24
Plowing	--	--	--
Irrigation	--	--	--
Hired ox-equipment	3 hours	1.00	3.00
Total Variable Costs	--	--	50.74
3. Gross Margin	--	--	881.54
4. Fixed Expenses			
Strange Farmer[a]	15.8 Wd	4.80	75.84
Depreciation	--	--	--
5. Returns to land, family labor, capital and Management	--	--	805.70
6. Opportunity Cost of Capital (15%)[b]	D50.74	--	7.61
7. Net returns to land, family labor and management	--	--	798.09
8. Opportunity cost of land	1.0 ha	0.00	0.00
9. Net return to family labor and management	--	--	798.09
10. Return per workday to family labor and management	337.9 Wd	--	2.36

Source: Survey Data

[a]Semi-permanent labor. Once accepted food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

TABLE 4.4.--Mangrove Rice Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	26	--	--
2. Average Holdings	0.68 Ha.	--	--
B. Income and Expenditure			
1. Value of output	1880 Kgs.	0.51	958.80
2. Variable Costs			
Seed	46 Kgs	0.56	25.76
Fertilizer	--	--	--
Nonfamily Labor			
Contract Labor	3.2 Wd	2.74	8.77
Plowing			
Irrigation			
Hired Ox-equipment	4 hours	1.00	4.00
Total Variable Cost	--	--	38.53
3. Gross Margin	--	--	920.27
4. Fixed Expenses			
Strange Farmer[a]			
Depreciation	8 hours	0.66	5.28
5. Returns to land, family labor, capital and Management	--	--	914.32
6. Opportunity cost of capital (15%)[b]	D38.53	--	5.78
7. Net returns to land, family labor and management	--	--	908.54
8. Opportunity cost of land	1.0 ha	0.00	0.00
9. Net return to family labor and management	--	--	908.54
10. Return per workday to family labor and management	322.8 Wd	--	2.81

Source: Survey Data

[a]Semi-permanent labor. Once accepted food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperative to farmers

TABLE 4.5.--Dry Season Irrigated Rice Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	25	--	--
2. Average Holdings	0.17 Ha	--	--
B. Income and Expenditure			
1. Value of Output	2767 Kgs.	0.51	1411.17
2. Variable Costs			
Seed	77 Kgs	0.55	42.35
Fertilizer	14 Kgs.	0.81	2.52
Nonfamily Labor			
Contract labor	14.8 Wd	3.86	57.13
Plowing	1.0 Ha	37.07	37.07
Irrigation	1.0 Ha	247.00	247.00
Hired ox-equipment			
Total Variable Costs	--	--	386.07
3. Gross Margin	--	--	1025.10
4. Fixed Expenses			
Strange Farmer[a]	20.6 Wd	4.80	98.88
Depreciation	--	--	0.00
5. Returns to land, family labor, capital and management	--	--	926.22
6. Opportunity cost of capital (15%)[b]	D386.07	--	57.91
7. Net returns to land, family labor and management			868.31
8. Opportunity cost of land	1.0 ha	400.00	400.00
9. Net return to family labor and management	--	--	468.31
10. Return per workday to family labor and management	295.6 Wd	--	1.58

Source: Survey data

[a]Semi-permanent labor. Once accepted, food and lodging has to be provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

TABLE 4.6.--Wet Season Irrigated Rice Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	23	--	--
2. Average Holdings	0.30 Ha	--	--
B. Income and Expenditure			
1. Value of Output	2429 Kgs	0.51	1238.79
2. Variable Costs			
Seed	95 Kgs	0.57	54.15
Fertilizer	25 Kgs	0.18	4.50
Nonfamily labor			
Contract labor	5.0 Wd	3.50	17.50
Plowing	1.0 Ha	37.07	37.07
Irrigation	1.0 Ha	247.00	247.00
Hired Ox-equipment			
Total Variable Costs	--	--	360.22
3. Gross Margin	--	--	878.57
4. Fixed Expenses			
Strange Farmer[a]	6.4 Wd	4.80	30.72
Depreciation	--	--	--
5. Returns to land, family labor, capital and management	--	--	847.85
6. Opportunity cost of capital (15%)[b]	D360.22	--	54.03
7. Net returns to land, family labor and management	--	--	793.82
8. Opportunity cost of land	1.0 ha	400.00	400.00
9. Net return to family labor and management	--	--	393.82
10. Return per workday to family labor and management	312.7 Wd	--	1.26

Source: Survey data

[a]Semi-permanent labor. Once accepted, food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to the farmers.

Variable costs.--There were substantial differences in total variable costs between the rice systems. This reflects differences in the amounts of any given variable used, in the enterprise costs of these variables, and in the composition of the costs. The irrigated rice enterprises generally had a substantially higher total variable cost than the rest of the rice enterprises. This was mainly due to the costs of irrigation water and plowing which accounted for 73.6% and 79.8% of the total variable costs in the dry and wet season crops, respectively. In the nonirrigated rice enterprises, seed costs accounted for more than 50% of the total variable costs, but less than 15% in the irrigated rice enterprises.

The total variable costs were D27.92, D50.74, D38.53, D386.07, and D360.22 for upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. Contract labor accounted for 14.3%, 41.9%, 22.8%, 14.8%, and 4.9% of the total variable costs, respectively.

The operating ratios, which relate variable costs to gross income,[6] were 0.04, 0.05, 0.04, 0.27, and 0.29 for the upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. These ratios show, for example, that in upland rice cultivation, operating expenses amounted to D0.04 per dalasis of gross income and in wet season irrigated rice cultivation operating expenses amounted to D0.29 per dalasis of gross income.

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[6]Gross income is equal to the value of output.

Fixed expenses.--Fixed expenses include estimated costs of the strange farmer and depreciation. The cost per workday for the strange farmer was imputed from an estimate of the value of food and lodging, and the average number of mandays worked per strange farmer. Similarly, cost of depreciation attributable to each enterprise was estimated from the average annual depreciation per farm and the average number of hours worked by each animal ox-equipment combination.

The total fixed expenses were estimated as follows: D2.40 for upland rice, D75.84 for bafaro rice, D5.28 for mangrove rice, D98.88 for dry season irrigated rice, and D30.72 for wet season irrigated rice. The fixed ratios which relate fixed expenses to gross income were less than 0.00, 0.08, 0.01, 0.07, and 0.02 for upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. This means that fixed expenses amounted to no more than D0.08 per dalasis of gross income in all the rice enterprises. These low ratios reflect the low level of fixed investments in rice production.

Net enterprise income.--Net enterprise income is the value of output or gross income less total costs, where total costs is the sum of the total variable costs and the total fixed costs. Net enterprise income represents the reward to land, family labor, operating capital, and management for the period covered by the survey. The total costs of producing a hectare of rice were estimated at D30.32 for upland rice, D126.58 for bafaro rice, D43.81 for mangrove rice, D484.95 for dry season irrigated rice, and D390.94 for wet season irrigated rice. The net enterprise income was highest for dry season irrigated rice and lowest for upland rice which were estimated at D926.22 and D645.94 per hectare, respectively. Net enterprise income for bafaro, mangrove rice, and wet season irrigated rice were D805.70, D914.32, and D847.85, respectively.

The net enterprise income is probably the most important return factor that is of interest to the individual farmers. It represents the net contribution of an enterprise to the net farm income. Farmers are not so much interested in the returns of an enterprise to the individual factors of production. This is because of the traditional social pressure on the more able and prosperous individuals in a community to share their income with the less able relatives or neighbors. Higher total incomes, even with lower returns to the indivdiual factors of production may enable the farmers to meet these traditional obligations.

Return to family labor and management.--Returns to family labor and management are derived from net enterprise income by deducting an opportunity cost for operating capital and land. In this analysis, the opportunity cost of operating capital was assumed to be 15%.[7]

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[7]This is the interest rate charged by the cooperatives for subsistence loans to the farmers on an annual basis. In actual fact, operating capital is tied up in rice farming for a period of about six to eight months in the year. If farmers were to borrow operating capital at an annual rate of 15% but forced to pay in six months, say soon after harvest, the actual interest rate would be 30% per annum. In the absence of production credit on which to base interest rates, the interest rate for subsistence credit is used here.

The opportunity costs of land for upland rice, bafaro, and mangrove rice are assumed to be zero.

The opportunity cost for irrigated rice land was assumed to be D400.00 per hectare based on an estimate of income foregone from rent. Taking these opportunity costs into account, the returns to family labor and management were estimated as D641.75, D798.09, D908.54, D468.31, and D392.82 for upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. The low returns to family labor and management in irrigated rice are mainly due to the high opportunity costs of land.

The net returns to family labor and management per workday of family labor can be compared to the enterprise wage rates received by contract labor. The enterprise wage rates were estimated at D2.50, D2.74, D3.86, and D3.50 for upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. This compares to the returns to family labor and management per workday of family labor of D2.55, D2.36, D2.81, D1.58, and D1.26, respectively. Only in upland rice and mangrove rice was the return to family labor and management per workday of family labor higher than the enterprise wage rate. In the irrigated rice crops, the enterprise wage rates were about two times higher than the return to family labor and management per workday of family labor. If the assumptions made in this analysis are true, then farmers engaged in the cultivation of rice, except for upland and mangrove rice, will have a financial advantage by seeking wage employment in other farmer's rice farms.

To make returns per workday to family labor and management equal to the enterprise wage rate and assuming that other things remained unchanged, yields per hectare of bafaro rice, dry and wet season irrigated rice must be increased by at least 337 kilograms, 1,320 kilograms, and 1,374 kilograms (Kgs), respectively. This means that total yields per hectare of these crops must be 2,165 kgs, 4,091 kgs, and 3,803 kgs, respectively, for the returns per workday to family labor and management to equal the enterprise wage rates. However, the attainment of these yields might require an increase in total labor input and improvements in cultural practices such as increased use of fertilizer.

Alternatively, all returns per workday to family labor and management could be made equal to the enterprise wage rates by increasing the producer price of rice to a minimum of D0.80 per kilogram. This is the minimum price required to make the returns per workday to family labor and management of wet season irrigated rice production equal to the enterprise wage rate. This will require a close to 57% increase in the current producer price. Experience in West Africa has shown that such drastic increases in the price of a staple commodity are politically impracticable.[8] Thus, improvements in cultural practices with a view to increasing the productivity of labor might be the only feasible alternative to improving the returns to family

[8]Political unrest in Liberia in 1980 and labor union disturbances in Sierra Leone in 1982 could all be traced back to high consumer prices of rice. It is too simplistic to view the pricing of rice as a political will or commitment alone.

labor and management. In the long run, however, a combination of increasing the price of rice received by farmers and improving labor productivity is needed to maintain a high return in the cultivation of all types of rice.

Economic Analysis of the Rice Production Systems

The purpose of this section is to determine the economic costs and benefits of each of the rice crop enterprises and to compare the systems in order to identify rice production systems with high economic returns. The theoretical framework for this analysis was discussed in an earlier chapter and the method of valuing the inputs and outputs was also discussed in earlier sections of this chapter. Valuing the output at the import parity price and making possible adjustments for all factor price distortions, the economic costs and benefits per hectare of the major rice production systems are shown in Table 4.7. In Table 4.8 the economic costs and benefits per ton of paddy has been calculated from Table 4.7. In the economic analysis interest is shifted away from the individual farmer to a consideration of costs and benefits as they affect the nation as a whole. Thus the necessary question is what are the costs and benefits of producing a certain quantity, in this case one ton of paddy domestically.

A Comparison of the Economic Costs and Benefits in Rice Production

The economic cost of producing one ton of rice domestically was highest in the dry season irrigated rice and lowest in mangrove

TABLE 4.7.--Economic Costs and Benefits of Rice Production in The Gambia per Hectare

	Unit	Upland Rice	Bafaro	Mangrove	Irrigated Rice	
					Dry	Wet
1. Value of Output[e]	D/ha	450.84	621.52	639.20	940.78	825.86
2. Variable Costs						
a. Seeds[a]	D/ha	23.92	26.50	25.76	42.35	54.15
b. Fertilizer	D/ha	0.00	0.00	0.00	8.05	14.37
c. Contract Labor[a]	D/ha	4.00	21.24	8.77	57.13	17.50
d. Plowing	D/ha	--	--	--	44.77	44.77
e. Irrigation	D/ha	--	--	--	393.33	196.67
f. Hired Ox-Equipment[a]	D/ha	--	3.0	4.00	--	--
3. Opportunity Cost of Operating Capital[d]	D/ha	4.19	7.61	5.78	81.84	49.12
4. Fixed Costs						
a. Strange Farmer	D/ha	2.40	75.84	0.00	98.88	30.72
B. Depreciation[b]	D/ha	--	--	8.00	--	--
5. Opportunity Cost of Land	D/ha	0.00	0.00	0.00	400.00	400.00
6. Opportunity Cost of Family Labor[c]	D/ha	629.25	969.77	884.47	1141.02	1094.45
7. Total Economic Costs	D/ha	663.76	1103.96	936.78	2267.37	1901.75
8. Net Economic Returns per Hectare	D/ha	-212.92	-482.44	-297.58	-1326.59	-1075.89

Source: Survey Data.

[a]Valued at the market rate.

[b]Includes depreciation of owned animal/ox-drawn equipments.

[c]Valued at the enterprise wage rate. This may differ from market determined family labor wage rates.

[d]Estimated at 15% of the total variable costs.

[e]Valued at the import parity price.

TABLE 4.8.--Economic Costs and Benefits of Producing One Ton of Paddy in The Gambia

	Unit	Upland Rice	Bafaro	Mangrove Rice	Irrigated Rice	
					Dry	Wet
1. Value of Output	D/ton	340.00	340.00	340.00	340.00	340.00
2. Variable Costs						
a. Seed	D/ton	18.04	14.50	13.70	15.31	22.29
b. Fertilizer	D/ton	0.00	0.00	0.00	2.91	5.92
c. Contract Labor	D/ton	3.02	11.62	4.66	20.65	7.20
d. Plowing	D/ton	--	--	--	16.18	18.43
e. Irrigation	D/ton	--	--	--	142.15	80.96
f. Hired Ox-equipment	D/ton	--	1.64	2.13	--	20.22
3. Opportunity cost of Operating capital	D/ton	3.16	4.16	3.07	29.58	20.22
4. Fixed Costs						
a. Strange Farmer	D/ton	1.81	41.49	0.00	35.73	12.65
b. Depreciation	D/ton	--	--	4.26	--	--
5. Opportunity Cost of Land	D/ton	0.00	0.00	0.00	144.56	164.68
6. Opportunity Cost of Family Labor	D/ton	474.55	530.51	470.46	412.37	450.58
7. Total Economic Costs	D/ton	500.58	603.92	498.28	819.44	782.93
8. Net Economic Returns per Ton	D/ton	-160.58	-263.92	-158.28	-479.44	-442.93

Source: Derived from Table 5.7 by dividing each value by the yield in tomes.

[a]Valued at the market rate.

[b]Includes depreciation of owned animal/ox-drawn equipment.

[c]Valued at the enterprise wage rate. This may differ from market determined family labor wage rates.

[d]Estimated at 15% of the total variable costs.

[e]Valued at the import parity price.

rice cultivation with total costs estimated at D819.44 and D498.29, respectively. The costs in upland rice, <u>bafaro</u> rice, and wet season irrigated rice were D500.58, D603.92, and D782.93 per ton, respectively. The economic costs in irrigated rice cultivation were generally higher than those of the other rice production systems.

Total labor, including the costs of strange farmers, contract labor and the opportunity cost of family labor accounted for more than half of the economic costs in all the rice producing systems. Labor costs contributed about 95.8%, 96.5%, 95.4%, 57.2%, and 60.1% of the total costs per ton in upland rice, <u>bafaro</u> rice, mangrove rice, dry and wet season irrigated rice, respectively. The opportunity cost of land was responsible for 17.6% and 21.0% of the dry and wet season irrigated crops' economic costs, respectively, while plowing and irrigation costs accounted for 19.3% and 12.7% of the costs, respectively.

Using the import parity price to value the output, all systems of rice production showed a negative economic benefit with the highest economic loss coming from the dry season irrigated rice and the lowest coming from mangrove rice. If the assumptions made in valuing the inputs and outputs hold and if the input and output coefficients derived in this study are correct, then The Gambia has a comparative disadvantage in rice production. This means that the nation as a whole is better off by importing rice and shifting the resources currently engaged in rice production to other enterprises where the country enjoys a comparative advantage. This is true even when output is valued at the government policy oreinted price of D447.00 per ton.

If output is valued at D340.00 per ton, net economic losses amount to D160.58, D263.92, D158.28, D479.44, and D442.93 per ton in upland rice, <u>bafaro</u>, mangrove rice, dry and wet season irrigated rice, respectively. If output is valued at D447.00 per ton the corresponding economic losses are D53.58, D156.92, D51.28, D372.44, and D335.95, respectively.

Assuming that output is valued at the import parity price as estimated in this study, the output per hectare required to make net economic returns per ton at least equal to zero can be estimated. This is done by dividing the total economic costs per hectare by the import parity price. The results are shown in Table 4.9. At the minimum yields of 1,953 kgs, 3,247 kgs, 2,755 kgs, 6,669 kgs, and 5,594 kgs per hectare[9] for upland rice, <u>bafaro</u> rice, mangrove rice, dry and wet season irrigated rice, respectively, can be required for economic benefits per ton of paddy to be equal to zero. These yields are 47.3%, 77.6%, 46.5%, 141.0%, and 130.3% higher than the observed yields, respectively. Unless there is a technological change, these increased outputs are difficult to achieve without a corresponding increase in the use of inputs.

The results of Table 4.9 show that only upland rice and mangrove rice have required yields that lie within one standard

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[9]These assume that production costs remain unchanged. In actual fact, increases in output are likely to increase production costs through increased use of inputs unless such increases in output are the results of a technological change.

TABLE 4.9.--Comparison of Output Required to Make Net Economic Returns per Ton Equal to Zero

	Yield (Ka)	Coefficient[a] of Variation	1 Standard Deviation[b]		2 Standard Deviation[c]		Required[a] Yield (Kgs)
			Minus	Plus	Minus	Plus	
Upland Rice	1326	64.7	468	2184	-390	3042	1953
Bafaro Rice	1828	52.2	874	2782	- 80	3736	3247
Mangrove Rice	1880	51.0	922	2838	- 36	3796	2755
Dry Season Irrigated Rice	2767	57.7	1170	4364	-427	5961	6669
Wet Season Irrigated Rice	2429	58.5	1010	3848	-409	5267	5594

Source: Survey Data

[a]Coefficient of variation expresses the standard deviation as a percentage of the mean yield.

[b]Shows average yield if one standard deviation is substracted (minus) from or added (plus) to the mean yield.

[c]Shows average yield if two standard deviations are subtracted (minus) from or added (plus) to the mean yield.

[d]Yields per hectare needed to make net economic returns per ton at least equal to zero. Derived by dividing the total economic returns per hectare by the import parity price per ton. This assumes that other costs remain unchanged.

deviation of the observed mean yields. Even at two standard deviations, the required yields for irrigated rice are still out of range. Under good management practices, yields are estimated to vary from 1,500 kgs to 2,500 kgs per hectare for bafaro and mangrove rice and between 3,000 to 5,500 kgs per hectare for irrigated rice.[10] All this points to the difficulty of making irrigated rice cultivation economically profitable from the national point of view.

Given that The Gambian government is committed to achieving rice self-sufficiency at some time in the future, the results show that only mangrove rice and upland rice and to a limited extent bafaro rice cultivation systems offer any hope for optimism from the national point of view. Through improved cultural practices and adoption of technology that will improve labor productivity, it is possible to make these three systems of rice cultivation economically profitable.

The above analyses are based on the valuation of family labor at the enterprise wage rate which is an estimate of wages paid to hired labor irrespective of the task done. However, in economic analysis, the appropriate price of labor to use is the one that reflects the opportunity cost of labor, which is determined by the marginal value product of labor. This, however, is difficult to estimate.

Several economists agree that in developing countries the marginal value product of labor employed in agriculture is positive

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[10] Department of Agriculture, The Gambia, "Rice Cultivation in The Gambia, Extension Workers Handbook," October 1977.

but very close to zero. If this is true in The Gambia, then valuing family labor at zero opportunity cost will alter the above analysis and conclusions. For purposes of comparison and to show the sensitivity of the above conclusions on the method used in valuing family labor, two different prices are used. The first values family labor at zero opportunity costs and the second values family labor at half the enterprise wage rate used above. The results are shown in Table 4.10.

At zero opportunity cost, only dry season irrigated rice showed a negative net economic return. The wet season irrigated rice net economic return, although positive, was very low and estimated at D7.65 per ton of paddy.

When family labor was valued at half the enterprise wage rate, the results showed negative net economic benefits for the two irrigated rice systems. The net economic benefits of the other three systems were all positive. However, the net economic returns per ton of paddy for <u>bafaro</u> rice was very low.

These results tend to support the skepticism expressed about irrigated rice when family labor was valued at the enterprise wage rate. Subsequent discussions on the rice enterprises, therefore, will be based on the results obtained when family labor was valued at the enterprise wage rate.

TABLE 4.10.--Economic Costs and Benefits per Ton of Paddy with Family Labor Valued at Different Rates

	Zero Opportunity Cost		Half Enterprise Wage Rate	
	Costs	Net Benefits	Costs	Net Benefits
Upland Rice	26.03	313.97	263.31	76.69
Bafaro Rice	73.41	266.59	338.65	1.35
Mangrove Rice	27.82	312.18	263.05	76.95
Dry Season Irrigated Rice	407.07	-67.07	613.26	-273.26
Wet Season Irrigated Rice	332.35	7.65	557.64	-217.64

Financial and Economic Analysis of Groundnut and Upland Cereals

Input Valuation

The valuation of all the inputs used in the financial and economic analysis of groundnuts and upland cereals is similar to that adopted in the rice enterprises with only one exception. In the upland cereals, the cost of seed for both the financial and economic analysis is an average of the farmers' subjective valuation and does not represent market prices.

Output Valuation

In the financial analysis the guaranteed producer price was used to value the output of groundnut and maize. These were the only two upland crops that had official prices. For the rest of the cereals the price per kilogram was assumed to be equal to that of maize. In the economic analysis the export parity price as estimated in Table 4.11 was used to value the output of groundnuts. Since there is very little, if any, external trade on upland cereals, the economic price was estimated at the financial price less an estimate for transportation to the market. This transportation cost was estimated at D0.025 per kilogram.[11]

Comparison of Financial Costs and Benefits

Enterprise budgets were prepared to estimate the financial costs and benefits of each of the upland crops. These budgets are

[11] It was assumed that transportation cost of upland cereals was similar to that of rice.

TABLE 4.11.--Export Parity Price for Groundnut[a]

F.O.B. Banjul in $/MT[b]	$ 461.80
F.O.B. Banjul in D.MT[c]	$ 1015.97
Minus Transportation[d]	35.00
Minus storage[e]	12.00
Minus losses[d]	101.60
Export parity price	867.36

[a]Undecorticated.

[b]Free-on-Board (FOB) price in 1981/82

[c]Official exchange rate in May 1982. $1 = D2.20. Assumed to be equal to the shadow exchange rate.

[d]Estimate of transport and storage costs by GPMB officials.

[e]Estimated 10% loss from farmer to time of shipment.

shown in Tables 4.12 to 4.16. Like the rice enterprises, the estimates in these budgets are based on coefficients derived in Chapter III and refer to production practices at the time that the data were collected.

Value of production.--The value of total output per hectare was highest for groundnut and lowest for early (suno) millet. The differences in value reflect both a difference in yields per hectare and a difference in price per kilogram. The total value of the groundnut output per hectare was D858.50 and the values of maize, sorghum, early (suno) and late (sanyo) millet were D496.37, D433.16, D405.23, and D470.89 per hectare, respectively.

Variable costs.--Total variable costs were estimated at D57.77, D24.12, D14.32, D8.11, and D25.97 per hectare of groundnut, maize, sorghum, early (suno) and late (sanyo) millet, respectively. The value of seed made up about 79.0%, 76.6%, 83.8%, 75.5%, and 62.8% of the total variable costs, respectively. The only other input with relatively high contribution to the variable costs was contract labor which contributed no less than 10% of the total variable costs in any of the crops.

The operating ratios were estimated at 0.07, 0.05, 0.03, 0.02, and 0.06 for groundnut, maize, sorghum, early (suno) and late millet (sanyo), respectively. This means that operating expenses amounted to no more than D0.07 per dalasis of gross income.

TABLE 4.12.--Groundnut Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No.of Households	73	--	--
2. Average Holdings	0.92 Ha	--	--
B. Income and Expenditure			
1. Value of Output	1717 Kgs.	0.50	858.5
2. Variable Costs			
Seed	83 Kgs.	0.55	45.65
Fertilizer	28 Kgs.	0.18	5.04
Nonfamily Labor			
Contract Labor	2.0 Wd	3.04	6.08
Hired ox-equipment	1 hr.	1.00	1.00
Total Variable Cost	--	--	--
3. Gross Margin	--	--	800.73
4. Fixed Costs			
Strange Farmer[a]	5.4 wd	4.80	25.92
Depreciation	36 hrs	0.66	23.76
5. Returns to land, family labor, capital and management	--	--	751.05
6. Opportunity cost of capital (15%)[b]	D57.77	--	8.67
7. Net returns to land, family labor and management	--	--	742.38
8. Opportunity cost of land	1.0 ha	0.00	0.0
9. Net return to family labor and management	--	--	742.38
10. Return per workday to family labor and management	111.5 Wd		6.66

Source: Survey data

[a]Semi-permanent labor. Once accepted food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

TABLE 4.13.--Maize Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	52	--	--
2. Average holdings	0.23 ha	--	--
B. Income and Expenditure			
1. Value of output	1013 Kgs	0.49	496.37
2. Variable Costs			
Seed	33 Kgs.	0.56	18.48
Fertilizer	2 Kgs	0.18	0.36
Nonfamily labor			
Contract labor	1.6 Wd	2.05	3.28
Hired ox-equipment	2 hrs.	1.00	2.00
Total Variable Cost	--	--	24.12
3. Gross Margin	--	--	472.25
4. Fixed Costs			
Strange Farmer[a]	5.8 Wd	4.80	27.84
Depreciation	34 hrs.	0.66	22.44
5. Returns to land, family labor capital and management	--	--	421.97
6. Opportunity Cost of Capital (15%)[b]	D24.12	--	3.62
7. Net returns to land, family labor and management	--	--	418.35
8. Opportunity cost of land	1.0 ha	0.00	0.00
9. Net return to family labor and management	--	--	418.35
10. Return per workday to family labor and management	108.8		3.85

Source: Survey data.

[a]Semi-permanent labor. Once accepted, food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

TABLE 4.14.--Sorghum Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	28	--	--
2. Average Holdings	0.39 ha	--	--
B. Income and Expenditure			
1. Value of output	884 Kgs.	0.49	433.16
2. Variable costs			
Seed	24 Kgs.	0.50	12.00
Fertilizer	2 Kgs	0.18	0.36
Nonfamily Labor			
Contract labor	0.7 Wd	2.80	1.96
Hired Ox equipment	--	--	--
Total Variable Costs	--	--	14.32
3. Gross Margin	--	--	418.84
4. Fixed Expenses			
Strange Farmer[a]	10.0 Wd	4.80	48.00
Depreciation	21 hrs.	0.66	13.86
5. Returns to land, family labor, capital and management	--	--	356.98
6. Opportunity cost of capital (15%)[b]	14.32	--	2.15
7. Net returns to land family labor and management	--	--	354.83
8. Opportunity cost of land	1.0 ha	0.00	0.00
9. Net return to family labor and management	--	--	354.83
10. Return per workday to family labor and management	80.3		4.42

Source: Survey data

[a]Semi-permanent labor. Once accepted food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

TABLE 4.15.--Early Millet (suno) Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	34	--	--
2. Average Holdings	0.62 ha	--	--
B. Income and Expenditure			
1. Value of output	827 Kgs.	0.49	405.23
2. Variable Costs			
Seed	12 Kgs.	0.51	6.12
Fertilizer	3 Kgs	0.18	0.54
Nonfamily Labor			
Contract Labor	0.5 Wd	2.90	1.45
Hired Ox equipment			
Total Variable Costs	--	--	8.11
3. Gross Margins	--	--	397.12
4. Fixed Costs			
Strange Farmer[a]	3.8 Wd	4.80	18.24
Depreciation	21 hrs	0.66	13.86
5. Returns to land, family labor capital and management	--	--	365.02
6. Opportunity cost of capital (15%)[b]	D8.11	--	1.22
7. Net returns to land, family labor and management	--	--	363.80
8. Opportunity cost of land	1 ha.	0.00	0.00
9. Net return to family labor and management	--	--	363.80
10. Return per workday to family labor and management	113.5 Wd	--	3.20

Source: Survey data.

[a]Semi-permanent labor. Once accepted food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

TABLE 4.16.--Late Millet (Sanyo) Enterprise Budget per Hectare

	Amount	Price/Unit (Dalasis)	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	17	--	--
2. Average Holdings	0.30 Ha	--	--
B. Income and Expenditure			
1. Value of output	961 Kgs.	0.49	470.89
2. Variable Costs			
Seed	32 Kgs	0.51	16.32
Fertilizer	0 Kgs	0.81	0.00
Nonfamily labor			
Contract labor	2.3 Wd	2.89	6.65
Hired Ox Equipment	3 hrs.	1.00	3.00
Total Variable Costs	--	--	--
3. Gross Margins	--	--	444.92
4. Fixed Expenses			
Strange Farmer[a]	7.2 Wds	4.8	34.56
Depreciation	19 hrs.	0.66	12.54
5. Returns to land, family labor	--	--	397.82
6. Opportunity cost of capital (15%)[b]	D25.97	--	3.90
7. Net returns to land family labor and management	--	--	393.92
8. Opportunity cost of land	1 ha	0.00	0.00
9. Net return to family labor and management	--	--	393.92
10. Return per workday to family labor and management	111.1 Wd	--	3.55

Source: Survey Data

[a]Semi-permanent labor. Once accepted food and lodging is provided even if there is no work to be done.

[b]15% is the interest rate charged by cooperatives to farmers.

Fixed expenses.--Fixed expenses included estimated costs of strange farmer labor and depreciation of fixed capital. These amounted to D49.68 for groundnuts, D50.28 for maize, D61.86 for sorghum, D32.10 for early (suno) millet, and D48.10 for late (sanyo) millet. The corresponding fixed ratios were 0.06, 0.10, 0.14, 0.08, and 0.10, respectively. The low fixed ratios indicate a low level of fixed capital investment.

Net enterprise income.--Net enterprise income, which represents the returns to operating capital, land, and family labor and management was highest for the groundnut enterprise and lowest for the sorghum enterprise with net enterprise incomes of D751.05 and D356.98 per hectare, respectively. Maize, early (suno) and late (sanyo) millet had net enterprise incomes of D421.97, D365.07, and D397.82 per hectare, respectively.

Return to family labor and management.--To arrive at the returns to family labor and management, the opportunity cost of operating capital was assumed to be 15% and that of land was assumed to be zero for all the crop enterprises. The highest return to family labor and management was recorded in the groundnut enterprise with an estimate of D742.38 per hectare. This was followed by the maize enterprise with D418.35 per hectare, the late (sanyo) millet enterprise, with D393.92 per hectare, the early (suno) millet enterprise with D363.80 per hectare and the sorghum enterprise with a return to family labor and management of D354.83 per hectare.

A comparison of the returns to family labor and management per workday of family labor and the enterprise wage rate for each crop show that farmers are financially better off by working on their upland crops than by taking employment in another farmer's crop. This is because all the enterprise wage rates of D3.04, D2.05, D2.80, D2.90, and D2.89 per workday were lower than the return to family labor and management per workday of family labor of D6.66, D3.85, D4.42, D3.20, and D3.55 for groundnut, maize, sorghum, early (suno) and late (sanyo) millet, respectively.

Economic Analysis

In this section an estimate of the economic costs and benefits of each of the upland crops is made in order to facilitate a comparison among the upland crops on the one hand and between the upland crops and rice crops on the other hand. Table 4.17 summarizes the economic costs and benefits of the groundnut and upland crops per hectare. In Table 4.18 the economic costs and benefits per hectare are converted to costs and benefits per ton of output.

The lowest economic cost per ton was obtained in the groundnut crop enterprise, while the highest was in the late (sanyo) millet enterprise. The differences in economic costs were mainly due to differences in total labor costs which accounted for 74.1%, 81.1%, 88.3%, 89.6%, and 92.0% of the total economic costs per ton in groundnut, maize, sorghum, early (suno) and late (sanyo) millet, respectively. The corresponding total costs per ton were D291.63, D309.5, D352.06, D420.92, and D458.38, respectively.

TABLE 4.17.--Economic Costs and Benefits of Groundnuts and Upland Cereals per Hectare

	Unit	Groundnut	Maize	Sorghum	Early Millet (<u>Suno</u>)	Late Millet (<u>Sanyo</u>)
1. Value of Output[a]	D/ha	1489.26	471.05	411.06	446.87	384.56
2. Variable Costs						
a. Seed	D/ha	45.65	18.48	12.00	16.32	6.12
b. Fertilizer	D/ha	16.10	1.15	1.15	--	1.73
c. Contract labor	D/ha	6.08	3.28	1.96	6.65	1.45
d. Bags[b]	D/ha	18.00	--	--	--	--
e. Hired Ox Equipment	D/ha	1.00	2.00	--	3.00	--
3. Opportunity Cost of Operating Capital[c]	D/ha	13.02	3.74	2.27	3.90	1.40
4. Fixed Costs						
a. Strange Farmer	D/ha	25.92	27.84	48.00	34.56	18.24
b. Depreciation	D/ha	36.00	34.00	21.00	19.00	21.00
5. Opportunity Cost of Land	D/ha	0.00	0.00	0.00	0.00	0.00
6. Opportunity Cost of Family Labor[d]	D/ha	338.96	223.04	224.84	321.08	329.15
7. Total Economic Costs	D/ha	500.73	313.53	311.22	404.51	379.09
8. Net Economic Returns	D/ha	988.53	157.52	99.84	42.36	5.47

Source: Survey Data

[a] Groundnut is valued at the export parity price. Maize, sorghum, early and late millet are valued at the assumed produce price of D490 per ton less transportation of D25.00 per ton.

[b] Bags for groundnut are supplied free to farmers.

[c] Estimated at 15% of the total variable costs.

[d] Valued at the enterprise wage rate.

TABLE 4.18.--Economic Costs and Benefits of Groundnuts and Upland Cereals per Ton

	Unit	Groundnut	Maize	Sorghum	Early Millet (Suno)	Late Millet (Sanyo)
1. Value of Output	D/ton	867.36	465.00	465.00	465.00	465.00
2. Variable Costs						
a. Seed	D/ton	26.59	18.24	13.57	16.98	7.40
b. Fertilizer	D/ton	9.38	1.14	1.30	--	2.09
c. Contract labor	D/ton	3.54	3.24	2.22	6.92	1.75
d. Bags	D/ton	10.48				
e. Hired Ox-equipment	D/ton	0.58	1.97		3.12	
3. Opportunity Cost of Operating Capital[c]	D/ton	7.58	3.69	2.57	4.06	1.69
4. Fixed Costs						
a. Strange Farmer	D/ton	15.10	27.48	54.30	35.96	22.06
b. Depreciation	D/ton	20.97	33.56	23.76	19.77	25.39
5. Opportunity Cost of Land	D/ton	0.00	0.00	0.00	0.00	0.00
6. Opportunity Cost of Family Labor	D/ton	197.41	220.18	254.34	334.11	398.00
7. Total Economic Costs per Ton	D/ton	291.63	309.50	352.06	420.92	458.38
8. Net Economic Returns	D/ton	575.73	255.50	112.94	44.08	6.62

Source: Derived from Table 5.18.

[a]Groundnut is valued at the export parity price. Maize, sorghum, early and late millet are valued at the assumed produce price of D490 per ton less transportation of D25.00 ton.

[b]Bags for groundnut are supplied free to farmers.

[c]Estimated at 15% of the total variable costs.

[d]Valued at the enterprise wage rate.

Net economic returns per ton were D575.73, D155.50, D112.94, D44.08, and D6.62 for groundnut, maize, sorghum, early (suno) millet and late (sanyo), respectively. If the assumptions made in the above analysis are a true reflection of actual conditions and if the estimated coefficients are correct, then the results show that The Gambia has a comparative advantage in the cultivation of all the upland crops considered in this study.

Comparison of the Financial and Economic Costs and Returns of All the Crop Enterprises

Table 4.19 is a summary of the financial and economic costs and returns per ton of all the crop enterprises analyzed in this study. The results show that except for the irrigated rice crops, gross margin per ton of output was above D460.00 for all of the crop enterprises. Gross margin per ton of the irrigated rice crop was nearly D100.00 less than the lowest gross margin of the other crops.

In general, fixed costs are higher in the upland crops than in the rice crops. This is because all of the inputs included in the fixed costs--strange farmer, draft animals, and ox-equipment--are generally controlled by men and are, therefore, utilized more in the upland male crops than in the female rice crop.

Net return to family labor and management was lowest in the irrigated rice crops and highest for upland rice and mangrove rice. The low net returns to family labor and management in irrigated rice are due to the positive and high opportunity cost of land.

In the economic analysis, the results showed that The Gambia enjoys a comparative advantage in the cultivation of all of the

TABLE 4.19.--Comparison of the Financial and Economic Costs and Returns per Ton of Crop

		Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice		Ground-nut	Maize	Sorghum	Millet	
					Dry	Wet				Early	Late
FINANCIAL	A. Value of output	510 00	510.00	510.00	510.00	510.00	500.00	490.00	490.00	490.00	490.00
	B. Total Variable Costs	21.06	27.76	20.49	139.53	148.30	33.65	23.81	16.20	9.81	27.02
	C. Gross Margins	488.94	482.24	489.51	370.47	361.70	466.35	466.19	473.80	480.19	462.98
	D. Fixed Costs	1.81	41.49	2.81	35.74	12.65	28.93	49.63	69.98	38.81	49.02
	E. Returns to land, family labor Capital and Management	487.13	440.75	486.34	334.73	349.05	437.42	416.56	403.82	441.38	413.96
	F. Net return to family labor and management	483.97	436.59	483.27	169.25	162.13	432.37	412.98	401.39	439.90	409.91
	G. Return per workday to family labor and management	1.92	1.29	1.49	0.57	0.52	3.88	3.80	5.00	3.87	3.69
ECONOMIC	I. Value of output	340.00	340.00	340.00	340.00	340.00	867.36	465.00	465.00	465.00	465.00
	J. Total Economic Costs	500.58	603.92	498.28	819.44	782.93	291.63	309.5	352.06	420.92	458.38
	K. Net Economic Returns	(160.58)	(263.92)	(158.28)	(479.44)	(442.93)	575.73	155.50	112.94	44.08	6.62

Source: Derived from Tables 4.2 to 4.6, 4.8, 4.12 to 4.16, and Table 4.18.

[a]Figures in parentheses are negative.

upland crops. Net economic returns in all of these crops were positive. In the cultivation of rice, The Gambia has a comparative disadvantage as is reflected in the negative economic returns.

The return per workday to family labor and management is generally higher on the upland crops than on the rice crops. Given this difference in returns on family labor, one may wonder why farmers should continue to produce rice instead of shifting their resources to the production of upland cereals and groundnut. The answer to this lies in the sexual division of labor, the subjective value attached to rice as distinct from the producer price, the desire to minimize the risk of total crop failure by means of diversification and the higher total income that the family could get by distributing the available labor between two or more crops.

As was indicated earlier, labor input in agriculture in The Gambia is differentiated by sex along crop enterprise lines with women cultivating the rice crops and men cultivating upland cereals and groundnut. This division is not necessarily based on returns to any factor of production but, rather on an inherited tradition and a paranoia by male farmers on the effect that females economic independence will have on the traditional family structure. Thus, women have been relegated to the production of rice even though returns per unit of labor may be lower than those obtained on upland crops.

The subjective value of rice to a farming household may be another reason why farmers continue to grow rice. This subjective value may be higher than the producer price used in this analysis.

This is supported by the fact that farmers are reluctant to sell rice to the Gambia Produce Marketing Board at the existing producer price.

Rice crops and the other upland crops are cultivated on two differing ecological environments and they have different demands on moisture. Short dry spells during the growing period of crops may have different effects on the potential yields of these crops. By cultivating both upland cereals and rice, farmers avoid the risk of a total food crop failure.

Another important reason may be related to the fact that farmers get a higher total income by cultivating both upland crops and rice, than they would have if all efforts were devoted to upland crops. This is related to the seasonal demands that the individual crops have on the available labor. For illustrative purposes, Figure 4.1 shows the monthly labor profile per hectare for three crops--mangrove rice, late millet, and groundnut. Except for the early part of the rainy season when demands on labor for all crops increase, the figure shows that the rice demand on labor is at a peak when the demand on labor for the upland crops is at its lowest. Thus, labor is being used on rice at the time that its return from upland crops is lowest. Similarly, more labor is used on upland crops when its return from rice is lowest. With this kind of arrangement, the total marginal product of labor is higher, at anytime during the year, than it would have been if labor was devoted to upland crops alone. This suggests that total income is higher if both rice and

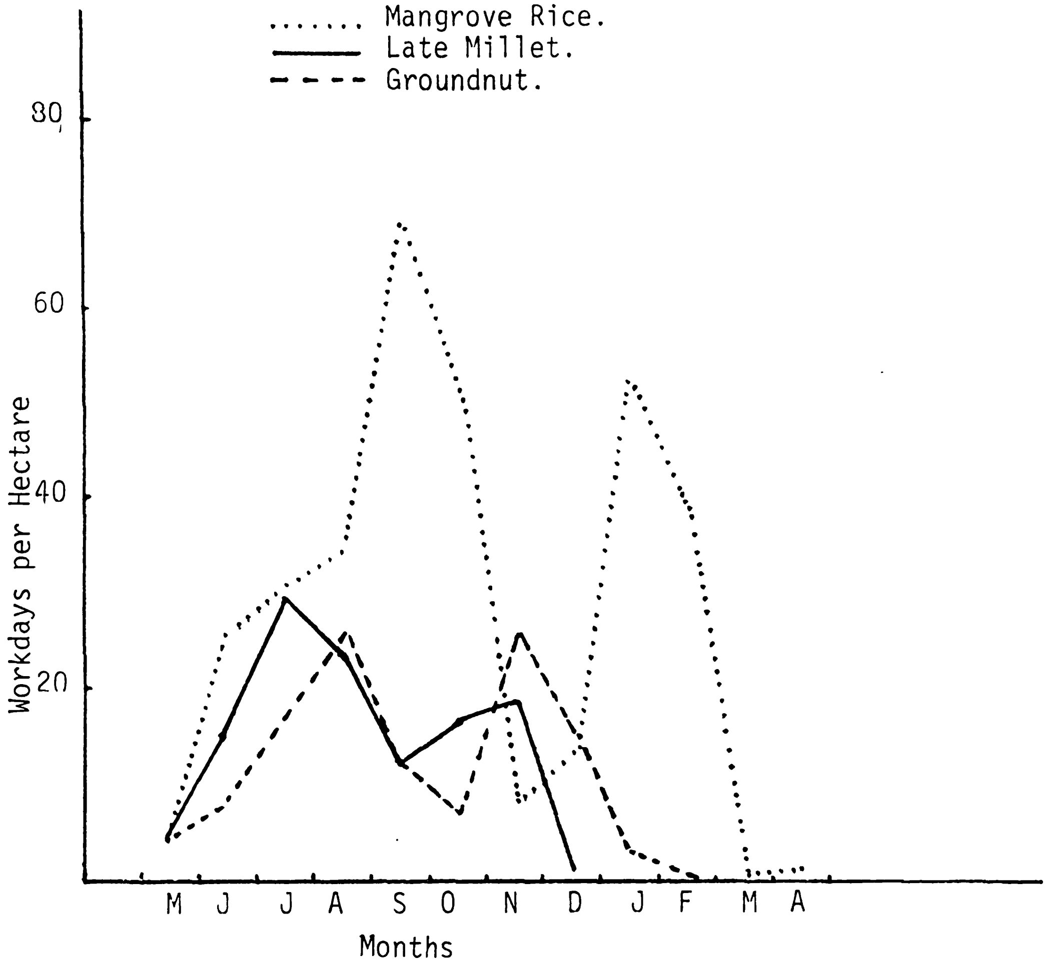

Figure 4.1.--Labor Profile per Hectare of Mangrove Rice, Late Millet and Groundnut.

upland crops are cultivated than if only upland crops were cultivated.

Costs and Benefits of Rice Self-Sufficiency

The above analysis has shown that the production of rice domestically to substitute for imported rice is an economic loss to The Gambia. However, dependence on the outside to satisfy domestic demand can often by very dangerous. Aspirations for national integrity and political stability can often override economic considerations and so justify a country's pursuance of a policy of self-sufficiency in food regardless of the economic costs. These aspirations are not without their costs and so it is informative at this point to attempt to quantify the costs of such policies.

The Gambia is integrated into the world economy. In the past the country has had to export groundnuts to earn foreign exchange which, in turn, is used to import food grains. In this section an attempt is made to evaluate the economic costs and benefits of substituting domestically produced rice for imported rice by looking at different world price ranges for both rice and groundnut. First, the effect of changes in the world price of rice on the comparative advantage of domestic rice production is presented. Later, the effect of achieving rice self-sufficiency on the Gross Domestic Product is examined.

Table 4.20 shows the changes in net economic returns per ton of domestically produced paddy with respect to changes in the world price of rice and more specifically with respect to changes in

TABLE 4.20.--Net Economic Returns per Ton of Paddy in Relation to World Price of Rice

Rice System	Import Parity Price per Ton of Paddy in Dalasis[a]									
	300.00[b]	340.00[d]	400.00	500.00	600.00	700.00	800.00	900.00	950.00	1000.00
Upland Rice	(200)[c]	(160)	(100)	(0)	100	200	300	400	450	600
Bafaro Rice	(304)	(264)	(204)	(104)	(4)	96	196	296	346	396
Mangrove Rice	(198)	(158)	(98)	2	102	202	302	402	452	502
Dry Season Irrigated Rice	(519)	(479)	(419)	(319)	(219)	(119)	(19)	81	131	181
Wet Season Irrigated Rice	(483)	(443)	(383)	(283)	(183)	(83)	17	117	167	217

Source: Derived from Table 5.8.

[a]The CIF price is equal to the import parity price plus estimate for milling, transportation and storage. Estimate for milling, transportation, and storage was D63.00. Assuming a 66% recovery rate, the CIF price per ton of milled equivalent is equal to (impart parity price + D63)/0.66).

[b]$1.00 = D2.20 in May 1982.

[c]Figures in parentheses are negative.

[d]Current situation as observed in 1981/82 study.

the import parity price of rice. The results show that two rice systems--upland rice and mangrove rice--will have positive economic returns if the world price of rice were such that the import parity price was above D500.00, or if the CIF price were above D563.00 per ton of paddy. This is about 40% above current price levels. Based on current production practices, The Gambia can expect to have a positive economic return on all the rice enterprises only if the CIF price of paddy were above D863.00 or 114% above current levels.

Looking at the production practices as observed in 1981/82, it is possible to estimate the economic losses to the country if it were to achieve rice self-sufficiency. Assuming a maximum per capita consumption of 90 kgs/year[12] and based on the current estimated population of 603,000, The Gambia will require at least 54,300 tons of milled rice in order to be self-sufficient. Assuming a 66% recovery rate, this is equivalent to 82,300 tons of paddy. The current strategy for achieving rice self-sufficiency is based on an expansion of irrigated rice in the Central and Eastern portions of the country, where 24,000 hectares of land are earmarked for development by the year 2000. From 1976 to 1980 the average domestic production of paddy was about 29,000 tons per year (WARDA, 1981). At this rate of production, The Gambia is left with a deficit of 53,000 tons of paddy to be satisfied through expansion of irrigated land. At an average economic loss of D461 [(479 + 443)/2] per ton

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[12]This is the highest per capita consumption of rice recorded since 1960 (WARDA, 1981).

of rice (in irrigated rice cultivation) this amounts to a total economic loss of at least D24.57 million a year.

The analysis can be carried further by assuming that the expansion of rice cultivation will necessarily result in the reallocation of labor either from upland cereals or groundnut to rice production.[13] The underlying assumption here is that irrigated rice cultivation can be expanded to meet the needed increase in domestic production. It is further assumed that labor will be reallocated from groundnuts instead of cereals. In this case the benefits from eliminating the rice imports can be compared to the cost of reduced groundnut production and exports. The comparison will have to be made between wet season irrigated rice and groundnut since these two crops can be expected to compete for labor in the rainy season. In the dry season there is abundant labor available for the dry season irrigated rice.

Thus it can be assumed that half of the 53,300 of additional paddy needed for rice self-sufficiency will be produced in the wet season. The current yield of the wet season irrigated rice was estimated at 2,429 kilograms per hectare. Assuming that these yields are maintained on an expanded hectarage, an increase of 10,972 hectares [(53,300/2)/2.429] will be needed to produce 26,650 tons (53,300/2) of paddy. A hectare of wet season irrigated rice land

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[13]A similar analysis was carried out by CRED in 1977 using different assumptions. They arrived at generally the same conclusions arrived at in this study.

demands about 324 workdays[14] (about 38% contributed by males) and a hectare of groundnut demands about 119 workdays (about 96% by males). Without regard to labor distribution by sex, an increase in one hectare of wet season irrigated rice will necessitate a decrease in groundnut hectarage of about 2.72 hectares (324/119). However, because of the division of labor along crop enterprise lines, the relevant labor affected is only that contributed by males. To also account for the labor contributed by females in groundnut production, it can be assumed that the relevant labor that will be affected is only 40% of the wet season irrigated rice labor demand or 130 workdays. This means that an increase in one hectare of wet season irrigated land will reduce the area of groundnut by only 1.1 hectares (130/119).

Following the above assumptions an increase of 10,972 hectares in wet season irrigated land will reduce groundnut hectarage by 12,069. At current yield levels of 1,717 kgs per hectare of groundnut, a reduction of 12,069 hectares will reduce total groundnut production by 20,722 tons (12,069 x 1.717).

This analysis suggests that the replacement of 53,300 tons of the imported paddy, with half being grown in the wet season could cost a minimum of 20,722 tons in foregone groundnut production. The economics of such a strategy obviously depends on the relative world market prices of the two crops. Table 4.21 shows the savings or losses that the country would incur given different levels of world

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[14]This does not include initial labor input in land development.

TABLE 4.21.--Effect of Rice Self-sufficiency on Gross National Product Given Different World Prices (in thousand Dalasis)

Import Parity Price of Rice (Dalasis/Ton)	Export Parity Price of Groundnut (Dalasis/Ton)									
	700	800	870	900	1000	1050	1100	1150	1200	1250
300	(6510)	(8583)	(10033)	(10655)	(12727)	(13763)	(14799)	(15835)	(16871)	(17908)
340	(5444)	(7517)	(8976)	(9589)	(11661)	(12697)	(13733)	(14769)	(15805)	(16842)
400	(3845)	(5918)	(7368)	(7990)	(10062)	(11098)	(12134)	(13170)	(14206)	(15242)
500	(1180)	(3253)	(4703)	(5325)	(7397)	(8433)	(9469)	(10505)	(11541)	(12578)
600	1485	(588)	(2038)	(2660)	(4732)	(5768)	(6804)	(7840)	(8876)	(9913)
700	4150	2017	627	(5)	(2076)	(3103)	(4139)	(5175)	(6211)	(7248)
800	6815	4742	3292	2670	598	(438)	(1474)	(2510)	(3546)	(4583)
900	9480	7407	5957	5335	3263	2227	1191	155	(881)	(1918)
950	10813	8740	7290	6668	4596	3560	2524	1488	452	(587)
1000	12145	10072	8622	8000	5928	4892	3856	2820	1784	747

[a]Figures in parentheses are negative.

prices if a strategy of import substitution is pursued to the extent of rice self-sufficiency through irrigated cultivation.[15] The figures represent the sum of rice import savings plus groundnut export losses.

It should be stressed that the figures shown are minimum because the costs of developing the irrigated perimeter and other variable and fixed costs are not accounted for. Although the statistics should be interpreted with caution, the results are indicative of the possible effects on the Gross National Product of The Gambia if a policy of rice self-sufficiency is pursued. For example, at the estimated import parity price for rice of D340 per ton and the export parity price for groundnut of D867 per ton, the reduction in gross national product will be in excess of D8.9 million [20,722 x 867) - (26,650 x 340)]. For any groundnut/rice price ratio higher than 1.28, there will be a reduction in Gross National Product.

Summary

The purpose of this chapter was to estimate the financial and economic costs and returns of the rice crop enterprises and the upland crop enterprises. Financial enterprise budgets were constructed from survey data for each of the crops analyzed.

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[15]Similar analysis could be carried out using the other systems of cultivation to achieve rice self-sufficiency. However, their potential areas for expansion are very limited.

Among the rice enterprises, total variable costs plus fixed expenses were highest in the dry season irrigated rice and lowest in the upland rice. Dry season irrigated rice, however, had the highest net enterprise income. This was due to the higher yields of dry season irrigated rice and the lower yields of upland rice.

A calculation of the returns to family labor and management showed that mangrove rice had the highest returns while the lowest returns were recorded in wet season irrigated rice.

Only two rice enterprises showed returns per workday to family labor and management higher than the enterprise wage rate--upland rice and mangrove rice. The rest of the rice enterprises returns to family labor and management that were lower than the enterprise wage rates. Wet season irrigated rice had the lowest returns to family labor and management. Further analysis revealed that for returns per workday to family labor and management to equal the enterprise wage rates, in all the rice enterprises, price per kilogram of paddy will have to be increased by at least 57% above current levels.

The economic analysis of the rice enterprises showed that The Gambia had a comparative disadvantage in rice production. Net economic returns per ton were all negative. Mangrove rice had the lowest negative economic returns and dry season irrigated rice had the highest negative economic returns. For the rice enterprises to have positive economic returns, current yields per hectare must be increased by at least 47.3% for upland rice, 77.6% for _bafaro_ rice, 46.5% for mangrove rice, 141.0% for dry season irrigated rice, and 130.3% for wet season irrigated rice without affecting costs.

In the upland crops, groundnuts had the highest variable costs while early millet had the lowest variable costs per hectare. Fixed expenses were highest in sorghum and lowest in late (sanyo) millet. Groundnut had the highest net enterprise income of D751.05 per hectare among all the crop enterprises considered. The lowest net enterprise in the upland crops was in sorghum. Returns to family labor and management was also highest in groundnut and lowest in sorghum. Management income was positive for all the upland crops.

The Gambia enjoys a comparative advantage in the cultivation of all upland crops. This was indicated by the positive net economic returns for all the crops with groundnut enjoying a higher net economic return than any of the crops considered.

Finally, a simple exercise showed that a policy designed to achieve self-sufficiency in rice through the expansion of irrigated perimeters can lead to substantial economic losses and a reduction of the gross national product. An expansion in rice production will necessarily lead to a reduction in groundnut export earnings, as farmers reallocate labor from groundnut to meet the growing demand in rice cultivation.

CHAPTER V

FARM INCOME ANALYSIS AND RESOURCE USE AMONG GAMBIAN RICE FARMERS

Introduction

The central objective of this chapter is to provide an understanding of the current organization of production and resource use among rice farmes in The Gambia. This basic understanding is of paramount importance in determining the relevance, practicality, suitability, and potential success of any change, innovation, or development process that is targeted toward the achievement of food self-sufficiency and the diversification of agriculture in The Gambia.

Specifically, the current farming system will be described based on information obtained during the year of the survey; the data will be interpreted for the effects of such factors as regional specificity, size of land holding, and animal traction adoption on labor employment and farm incomes; and from the descriptions and analysis, some implications for achieving food self-sufficiency will be offered.

The preceeding chapters placed emphasis on individual crop enterprises and evaluated their financial and economic costs and benefits. In this chapter the unit of analysis is the household (dabada). Farm budgets[1] will be developed to shed some light on dabada farm organization, labor employment, or use and sources of farm income. As a first step, an average dabada farm budget is developed from the sample as a whole. In subsequent sections, some criteria are used to divide the sample into regions, and size of land holding. Such divisions make possible a detailed analysis of the data to elucidate certain information that may otherwise be masked in the aggregate samole.

Background

The social structure of the family unit was described in a previous chapter. The basic residential unit is the kordo which may have subdivisions of dabadalu and sinkirolu. The dabada is the basic production unit which more closely represents a nuclear family. Eventually dabadalu break off to form independent kordos. The head of the kordo, the kordo-tio is usually the oldest male member of the family. The kordo-tio is considered as the father of the family and he wields considerable power and influence over members of his kordo. He is responsible for all the social, political, and economical aspects of the family and he has authority over all the factors of production and over the use and disposal of the farm output.

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[1]For each budget or variable average used in this chapter, the quantities were estimated as simple farm averages of the individual farms. This procedure gives equal weight to the individual farm variables and is therefore different from the weighted averages used in the preceeding chapters. This is because the objective in this chapter is to estimate averages of resource use and farm income from each dabada and not to determine a representative household that can be used as a model for planning purposes.

Defining the Farm

The farm as used in this study is defined to include all those activities that are directly related to the crop enterprises that are owned and controlled by a given dabada. This includes all work on the crop enterprises plus work on general farm activities. Farm work on fields owned by strange farmers are not included in this definition.

General farm activities include all those activities that cannot be attributed to any single crop but are nevertheless related to the farm. For example, fencing an area of land that contained more than one crop or return of exchange labor[2] received was considered as a general farm activity.

Off-farm activities included a rather broad and vaguely defined set of activities that made use of resources which would otherwise have been employed in the farm at the time of such activities. Religious and social activities or ceremonies--hunting, fishing, and working for pay either on government or quasi-government owned institutions or on another farmer's fields--were considered as off-farm activities. Activities of family members permanently employed outside of the farm were not recorded under this category.

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[2]Exchange labor received is accounted for under specific crop enterprises. However, the return of exchange labor received has been considered as a general farm activity because farmers do not necessarily have to return labor on a crop or activity for which labor was received. Also even though the number of days of exchange labor received might equal the number of days of exchange labor returned, the number of effective hours of work might differ. It is also possible that the person receiving the labor might be different from the one returning the labor.

Resource Use by the Sample Population

Land

The land tenure system was discussed in Chapter II. In principle, land in the rural areas cannot be sold, pledged, or rented. Local residents only have usufruct rights. Table 5.1 shows the average size of land holding for each dabada and the average area devoted to each crop together with their relative distribution. The average area of land managed per dabada was 2.24 hectares or given an average family size of 7.8 persons, the average size of land cultivated per person was 0.29 hectares. Of this total area, 39.3% was devoted to groundnut production and less than 1% to cotton production. Upland cereals, which include maize, sorghum, early (suno) millet, late (sanyo) millet and findo (digitaria), accounted for 29.9% of the total land cultivated and all rice enterprises also accounted for 29.9% of the total land area cultivated. This gives an equal area of land per person devoted to upland cereals and rice. More land was devoted to food crops than to cash crop production.

The largest area of upland cereals cultivated was early (suno) millet with an average of 0.26 hectares per dabada. Mangrove rice and bafaro rice were the dominant rice cultivation systems with average dabada areas of 0.23 and 0.24 hectares, respectively. In all, the average area devoted to food crops--upland cereals and rice--per person was 0.17 hectares and the average area devoted to cash crops was 0.12 hectares per person.

TABLE 5.1--Average Area per Household (Dabada) Devoted to Each Crop for the Sample Population

Crop	Area (Ha)	Percent of Total
Groundnut	0.88	39.3
Early (Suno) millet	0.26	11.6
Late (Sanyo) millet	0.07	3.1
Sorghum	0.15	6.7
Maize	0.19	8.5
Findo (digitaria)	0.00[a]	0.0
Cotton	0.02	0.9
Mangrove rice	0.23	10.3
Bafaro Rice	0.24	10.7
Dry Season Irrigated rice	0.06	2.7
Wet Season Irrigated rice	0.09	4.0
Upland Rice	0.05	2.2
Total	2.24	100.0

Source: Survey Data

[a]Less than 0.005 hectares.

Labor

Family size and composition. Table 5.2 presents the average number of persons per dabada by sex and age. The average dabada size was 7.8 persons with 3.8 males and 4.0 females. The average number of strange farmers was 0.2 per dabada. Adults 16-60 years old, made up about 67% of the dabada size. Children below 10 years accounted for about 17% of the total average family size and youths, between 10 and 15 years, made up about 15% of the family size.

Work on the farm. A detailed breakdown of labor input on the crop enterprises by type of labor, sex, and age is shown in Table 5.3. On the average labor input on the crop enterprises was 371.3 workdays per dabada or 165.8 workdays per hectare of land. Of this total, family labor provided 91.3%, strange farmers 3.9%, and other nonfamily labor accounted for 4.8%. Hired contract labor accounted for only 2.0% of the labor input on crops. The low nonfamily labor input may be due to the nature of the land tenure system which has prevented the development of a landless laboring class.

Family labor input per person on the crop enterprises averaged 43.5 workdays for the year. The average labor input per adult was 60.3 workdays or 482.4 hours. Female adults averaged 61.7 workdays while male adults averaged 58.7 workdays.[3] These are equivalent

[3]The amount of exchange labor should be added to these averages because all exchange labor received must be returned. However, although the days of work between exchange labor received and exchange labor returned might be the same, the number of actual hours worked might differ substantially.

TABLE 5.2--Average Number of Persons Per Household (Dabada) by Type of Labor for the Sample Population

Labor Type	Average Number
Males 16-60 years	2.5
10-15 years	0.8
0-9 years	0.5
Total Male	3.8
Females Over 60 years	0.1
16-60 years	2.7
10-15 years	0.4
0-9 years	0.8
Total Females	4.0
Total Family	7.8
Strange Farmers	0.2

Source: Survey Data

TABLE 5.3-- Average Distribution of Labor Input per Household (Dabada) by Type of Labor and Crop Enterprise (In Workdays) for the Sample Population

Type of Labor	Groundnut	Maize	Sorghum	Early Millet	Late Millet	Findo	Cotton	Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice		Totals	
											Dry	Wet	Amt	%[a]
Family a) Males 16-60 yrs.	73.6	12.5	7.9	22.9	5.7	-	1.7	0.8	6.0	4.4	5.2	6.1	146.8	39.9
10-15 yrs.	7.3	1.2	1.3	3.9	0.2	-	0.1	0.0	0.2	0.9	0.2	2.5	17.8	4.8
0-9 yrs.	0.5	0.1	-	0.5	0.1	-	-	-	0.0[c]	0.2	-	0.1	1.5	0.4
Total Males	81.4	13.8	9.2	27.3	6.0	-	1.8	0.8	6.2	5.5	5.4	8.7	166.1	44.7
b) Females 16-60 yrs.	3.9	1.4	1.0	0.4	0.0	0.2	0.2	8.5	61.5	66.5	8.8	14.2	166.6	44.9
10-15 yrs.	0.5	0.1	-	0.1	0.0	-	0.1	0.0	0.4	1.1	0.0	0.6	2.9	0.8
0-9 yrs.	0.1	0.0	-	0.0	-	-	-	-	0.0	0.1	-	0.0	0.2	0.0
Over 60 yrs.	0.0	0.0	-	-	-	-	-	-	0.0	0.1	-	-	0.1	0.0
Total Females	4.5	1.5	1.0	0.5	0.0	0.2	0.3	8.5	61.9	67.8	8.8	14.8	169.8	45.7
c) Other Family	0.7	0.2	0.3	0.2	0.4	-	0.0	-	-	-	1.0	0.5	3.3	0.9
Total Family Labor Input	86.6	15.5	10.5	28.0	6.4	0.2	2.1	9.3	68.1	73.3	15.2	24.0	339.2	91.3
Strange Farmer (Male)	4.0	1.5	1.2	1.0	0.4	-	1.6	0.0	3.4	0.0	1.0	0.5	14.6	3.9
Hired Labor: Exchange Males	2.5	0.3	0.2	0.2	0.1	-	0.2	-	0.6	1.2	0.3	0.0	5.6	1.5
Exchange Females	0.1	-	0.0	-	-	-	-	0.1	1.7	1.5	0.7	0.4	4.5	1.3
Contract Males	2.5	0.2	0.1	0.1	0.1	-	0.2	0.0	2.0	0.2	0.6	0.2	6.2	1.7
Contract Females	-	0.0	-	0.0	-	-	-	0.0	0.6	0.4	0.0	0.2	1.2	0.3
Total Hired	5.1	0.5	0.3	0.3	0.2	-	0.4	0.1	4.9	3.3	1.6	0.8	17.5	4.8
Total Labor Input	95.7	17.5	12.0	29.3	7.0	0.2	4.1	9.4	76.4	76.6	17.8	25.3	371.3	100.0
Percent of Total[b]	25.8	4.7	3.2	7.9	1.9	0.0	1.1	2.5	20.6	20.6	4.8	6.9	100.0	

Source: Survey data

[a]Shows percent of total labor input contributed by each type of labor

[b]Shows percent of total labor devoted to each crop.

[c]All figures entered as 0.0 indicate a labor input of less than 0.05 workdays

to 493.6 hours for females and 469.6 hours for males on the crop enterprises.

The highest labor input per crop was devoted to groundnut which utilized 25.8% of the total labor input on crops. This was followed by bafaro rice and mangrove rice which each utilized 20.6% of the total labor input on crops, while rice and upland cereals used 55.4% and 17.7%, respectively. Labor input in subsistence food production was about three times that on cash crop production.

In terms of employment, the highest employer of labor per hectare was in the rice enterprises. The estimated labor inputs per hectare based on this simple averages were 33.0, 318.3, 296.7, 281.1 and 188.0 workdays for mangrove rice, bafaro rice, dry season irrigated rice, wet season irrigated rice, and upland rice, respectively. Labor inputs per hectare for groundnut, maize, sorghum, early (suno) millet, late (sanyo) millet and cotton were 108.8, 92.1, 80.0, 112.7, 100.0, and 205.0 workdays, respectively.[4] In terms of year-round employment, irrigated rice will be the highest employer of labor per hectare. This is not surprising because irrigated rice cultivation is a biological-chemical technology that is land saving but labor using and can be carried on throughout the year.

Total labor input. The total labor input is the sum of the labor inputs in the crop enterprises, general farm activities, and off-farm activities. These labor inputs are summarized in Table 5.4

[4]These labor inputs differ from those in the preceeding Chapters because of the different methods employed in arriving at the averages.

TABLE 5.4--Distribution of Labor Input per Household (Dabada) by Type of Labor and Major Activity (In Workdays) for the Sample Population

Type of Labor		Crop	General Farm	Off-farm	Total
Family a) Males	16-60 years	146.8	10.3	97.0	254.1
	10-15 years	17.8	0.7	1.3	19.8
	0-9 years	1.5	0.0[a]	---	1.5
	Total Males	166.1	11.0	98.3	275.4
b) Females	16-60 years	166.6	8.4	42.9	217.9
	10-15 years	2.9	0.0	1.0	3.9
	0-9 years	0.2	---	---	0.2
	Over 60 years	0.1	0.0	---	0.1
	Total Females	169.8	8.4	43.9	222.1
c) Other Family		3.3	0.3	0.0	3.6
Total Family Labor		339.2	19.7	142.2	501.1
Strange Farmer		14.6	0.6	---	15.2
Hired Labor:	Exchange Males	5.6	0.1	---	5.7
	Exchange Females	4.5	---	---	4.5
	Contract Males	6.2	0.1	---	6.3
	Contract Females	1.2	---		1.2
Total Hired Labor		17.5	0.2	---	17.7
Total Labor Input		371.3	19.9	142.2	533.4
Percent of Total		69.6	3.7	26.7	100.0

Source: Survey data

[a]Figures entered as 0.0 are less than 0.05

and are differentiated by type of labor, sex, and age. The total labor input per dabada was 533.4 workdays. Of this total, crop enterprise activities accounted for 69.6%, general farm activities 3.7%, and off-farm activities 16.7%.[5] Most of the general farm activities and all of the off-farm activities were performed by family labor. Male family labor accounted for 55.2% of the general farm activities and 69.1% of the off-farm activities. Female family labor accounted for 42.4% and 30.9% of the general farm and off-farm activities, respectively.

On the whole, family males contributed 51.6% of the total labor while family females contributed 41.6% of the total labor input. The average total labor input per adult was 90.8 workdays or 726.4 hours. This excludes labor input on livestock and on household activities. Livestock activities are mainly the responsibility of youths between the ages of 10 and 15 years.

Adult females put in 80.7 workdays or 645.6 hours per person while adult males put in 101.6 workdays of 813.1 hours per person. These annual labor inputs are low by international standards and are also low when compared to other studies in Africa. In a review of fifty studies in tropical Africa, Cleave (1974) noted that about 1,000 hours per year are spent by adults on agricultural field operations. In Sierra Leone, a nationwide rural survey revealed that about

[5]This doesn't include household activities of cleaning, cooking, babysitting, etc., which are usually done by women. These household activities can average about two hours every day of the week.

1,200 hours are spent by adults on agricultural activities, processing and nonfarm work (Byerlee et al., 1977).

However, caution must be exercised in making this comparison. The amountof labor input in agricultural activities is strongly influenced by the monthly distribution of rainfall. Other things being equal, one would expect the amount of labor in agricultural activities in areas with longer rainy seasons to be higher than those in areas with shorter rainy seasons as experienced in The Gambia. Similarly, labor inputs in off-farm activities are affected by sociological factors and the availability of nonfarm work opportunities. This is especially true in The Gambia where nonfarm activities, like blacksmithing, goldsmithing, etc., are considered lower caste job opportunities. This caste constraints limits the opportunities of the higher caste families in nonfarm income earning activities.

Notwithstanding the above comments, it seems as if the total time spent on agricultural and nonagricultural activities over the course of the year is low. Labor inputs on the farm and on off-farm activities were estimated at about 64 workdays (512 hours) and 27 workdays (216 hours) per adult family member, respectively. At the peak monthly labor period in September, the adult family member total labor input was about 13 workday (104 hours) for the month. Given a 22-day work month,[6] farm labor input averaged 4 hours a day, and total

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[6]This is estimated by subtracting two days, Friday and Wednesday, from the week and multiplying that by the number of weeks in the year (52). The product is then divided by 12 to get an estimate of the possible days of work in a month.

labor input averaged about 5 hours a day per adult during the peak month.

This low labor input, even in the month of greatest activity, may be evidence of underemployment in Gambian agriculture. But such an assumption should not be made without an examination of the uses to which nonagricultural time is put and the extent to which it could be diverted to farming given the existence of an opportunity for a profitable employment in agricultural production and the constraint on the use of labor on farm work.

Off-farm activities accounted for about 27% of the total labor input. Remunerative nonfarm labor, that is, labor input which earned money or produced output that could be sold accounted for less than 10% of the total labor input on off-farm activities. Remunerative nonfarm labor input averaged about one workday per dabada per month, except for January and December which averaged two workdays each. The rest of the off-farm activities labor input was on social, religious, and other activities that could not easily be valued.

There was an inverse relationship between farm labor input and nonrenumerative off-farm labor input on the one hand, and farm labor input and estimated leisure time on the other hand.[7] An increase in the demand for labor in farm activities was associated with a reduction in nonremunerative off-farm work and estimated leisure

[7]Leisure time was estimated by deducting the total monthly labor input on farm and off-farm activities from the potential monthly labor supply for the average dabada.

time.[8] Labor input on remunerative off-farm activities was about constant throughout the year.

The implication from the above is that Gambia farmers prefer to reduce their labor input on nonpaying off-farm activities and on leisure time, rather than reduce the time spent on remunerative activities whenever there is an increased demand for farm labor. It is difficult to reduce time spent on remunerative activities because some of these activities either require year round commitments to ensure continuity or urgent financial needs of families may cause family members to devote time on these activities even at the peak labor demand periods.

The extent to which labor input on nonpaying off-farm activities and leisure time could be tapped for productive agricultural activities will depend on the marginal utility obtained for working on the farm and the marginal disutility of giving up time in other activities and leisure. The fact that farmers are willing to reduce their leisure time and nonpaying off-farm commitments suggest that

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[8] Linear equations using ordinary least squares showed the following coefficients:

$$Y_1 = 15.24 - \underset{(-4.8185)}{0.14X} \qquad \bar{R} = .067$$

$$Y_2 = 97.62 - \underset{(23.7593)^*}{0.86X} \qquad \bar{R} = 0.98$$

where Y_1 = Labor input on nonremunerative off-farm activity

Y_2 = Estimated leisure time

X = Labor input on the farm

*Figures in parentheses are t-values.

farmers attach a higher value to their farm work. The problem is that it is difficult to quantify the utilities obtained in leisure time and nonpaying off-farm commitments to determine how far these diversions could be carried out. The degree to which labor time could be diverted to agriculture is also constrained by the seasonality of farm work.

Seasonality of labor. Although the annual total work by family members is rather low, one must also consider the overriding importance of the seasonality of farm work. The total monthly distribution of labor is shown in Table 5.5 and is graphically depicted in Figure 5.1. Average dabada labor input peaked in September which accounted for 14.1% of the total labor demand. This month corresponded with the transplating of rice. This emphasizes the high demand placed on labor by the rice enterprises in general and by the transplanting activity in particular. The monthly coefficient of variation in farm work was about 61%. This coefficient may vary depending on the duration of the rainfall.

The allocation of time worked by family members on farm and off-farm activities is undertaken in such a way as to attempt to even out the annual flow of labor. For example, general and off-farm activities were concentrated in the dryer months of December to May. This period accounted for about 60% of the labor input in the general and off-farm activities. Also the monthly coefficient of variation for the total labor input was about 38% which indicates an attempt to even out the monthly labor input. However, for a number of reasons

TABLE 5.5--Monthly Distribution of Labor Input by Activity for the Sample Population (in workdays)

	Crop	General Farm	Off-Farm	Total
January	21	2	17	40
February	13	2	14	29
March	5	2	15	22
April	7	2	13	22
May	11	3	15	29
June	34	3	10	47
July	55	2	5	62
August	58	-	7	65
September	64	1	10	75
October	33	1	13	47
November	37	1	11	49
December	33	1	11	45
Total	371	20	141	532

Source: Survey Data

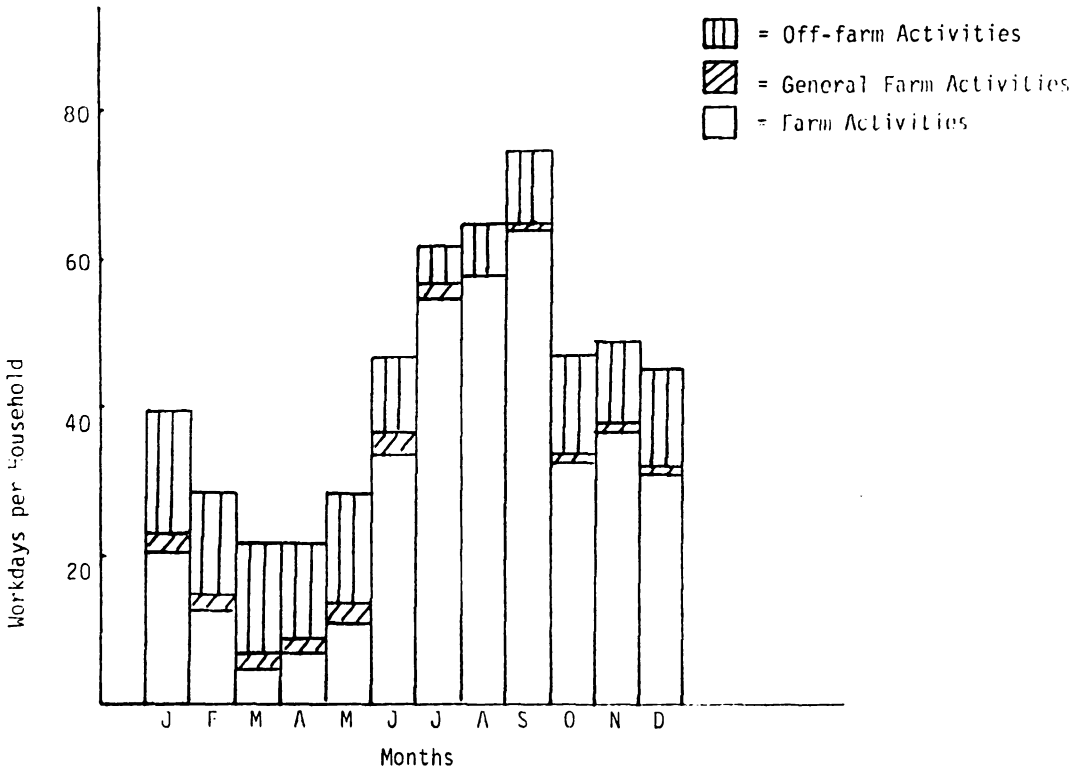

Figure 5.1--Monthly Labor Profile per Household(<u>Dabada</u>) of the Whole Sample.

farmers are not able to even out the total monthly labor input. These reasons are related to the lack of off-farm employment opportunities and to the short rainy season.

The implications for development programs and the introduction of improved technology are important. In order to introduce relevant improved technology, planners must take cognizance of the timing of the labor required for its adoption. Too often the technological development aim of maximizing yields per unit area or of the increase in the area cultivated, has resulted in the development of irrelevant improved technology which, if adopted, could result in even greater seasonality and sometimes bottlenecks of labor (Norman et al., 1979).

The labor equation. It is usual for studies like this to develop a labor equation where the potential labor supply less the observed labor demand is made equal to a labor surplus or deficit. This is often interpreted as evidence of underemployment or full employment. Assuming a 22-day work month and based on average adult population of 5.2 persons per dabada, the potential monthly supply of labor per dabada was 114.4 workdays. This was higher than any monthly labor demand in Table 5.5. This is often interpreted as a presence of surplus labor throughout the year and is, therefore, used as evidence of underemployment.

However, neither the existence nor the absence of a monthly labor demand higher than the potential monthly labor supply can provide any conclusive evidence of full employment or underemployment. As was stated in an earlier chapter, when labor profiles are aggregated in months, critical peak periods of labor of shorter durations may not show up in the profiles because the labor input is spread over a month. Similarly, it is true that an extended peak may not be apparent because it has been divided between months.

It is also possible that a monthly labor demand higher than the monthly labor supply could appear if the monthly labor input was disaggregated by sex. This is especially true where the division of labor by sex is along crop enterprise lines whose peak demand on labor comes at different times of the year. In The Gambia, women are usually fully engaged in the planting and harvesting months of September and January, respectively. At this time men are relatively less busy. Conversely, men are very busy in the months of August and October/November when women are relatively less busy. In this kind of arrangement, aggregating data on a monthly basis without regard to sexual differences as is done here may tend to even out the busy and slack periods of the different sexes. The observed low labor inputs may also be due to the fact that home production activities, especially for women, are not fully accounted for.

Farm Equipment

Capital investment in farming in The Gambia is limited to the purchase of ox-drawn equipment and draft animals. Ox-plowing started in The Gambia around the 1950's when single purpose implements were introduced. It was not until the late half of the seventies, however, that widespread use of this equipment was achieved. By the middle of the 1970's the sine hoe was introduced and popularized. The sine hoe basically consists of a T-shaped frame which can be pulled by draft animals. Several attachments, including a seeder for planting, mouldboard plows for plowing or ridging and weeding tines can be attached to the frame. Carts were also introduced to be used for transportation.

The average number of each type of equipment and draft animals owned per dabada is shown in Table 5.6. The most common implement was the seeder which can be used for planting upland cereals even without initial plowing. Donkeys were the most common draft animals in use mainly because they are cheaper than the other animals, averaging about D150 per animal. Horses and bulls, on the other hand, sold for more than D500 per animal. Allowing for depreciation, the opening values of the equipment and animals were estimated at D130 and D285 per dabada, respectively.

Animal traction was used on the farm for an average of about 50 hours per dabada.

Farm Income Analysis

An average farm budget per dabada is shown in Table 5.7. Other general data on household resources are also included.

Value of Output

The average value of farm output or gross farm income represents the sum of the values of all the crop enterprise outputs. The output values of each crop enterprise and their total contributions to the total gross farm income are presented in Table 5.8. All

TABLE 5.6--Average Number of Ox-Drawn Equipment/Animals Owned per Household (Dabada) for the Sample Population

Equipment/Animal	Average Number
Seeder (with Plates)	0.69
Mouldboard Plow	0.41
Cart	0.22
Weeding Tines	0.36
Bulls	0.14
Donkeys	0.57
Horses	0.13

Source: Survey Data

TABLE 5.7--Average Household (Dabada) Farm Budget for the Sample Population

1.	General Data	
	a. Average Land Holding (Ha)	2.24
	b. Average Family Size:	
	Males	3.8
	Females	4.0
	Total	7.8
	c. Adult Family Members (16-60 years)	5.2
	d. Strange Farmers	0.2
	e. Hours of Animal/Ox-equipment Input	50.0
	f. Number of Households (Dabada)	90.0
2.	Income and Expenditure	(Dalasis)
	a. Value of Farm Output	1777.59
	b. Operating Expenses	
	Labor	27.24
	Seeds	65.09
	Fertilizer	5.79
	Animal/Ox-equipment	1.85
	Irrigation/Plowing	42.60
	Total Operating Expenses	142.57
	c. Gross Margin	1635.02
	d. Fixed Costs	
	Depreciation	
	Animals	18.00
	Ox-equipment	15.00
	Other Hand-tools	3.04
	Strange Farmer	24.00
	Total Fixed Costs	60.04
	e. Total Costs	202.61
	f. Net Farm Income	1574.98
	g. Off-farm Earnings	50.31
	h. Net Family Earnings	1625.29

Source: Survey data

TABLE 5.8--Sources of Farm Income and Percentage Land and Labor Used for Each Crop for the Sample Population [Per Household (Dabada)]

Crop	Source of Farm Income Amount (Dalasis)	%	Percent of Land Used	Percent of Labor Used
Groundnut	780.47	43.9	39.3	25.8
Maize	105.84	6.0	8.5	4.7
Sorghum	65.17	3.7	6.7	3.2
Early (Suno) Millet	109.76	6.2	11.6	7.9
Late (Sanyo) Millet	29.40	1.6	3.1	1.9
Findo (Digitaria)	0.49	0.0[a]	0.0	0.0
Total Upland Cereals	310.66	17.5	29.9	17.7
Upland Rice	21.93	1.2	2.2	2.5
Bafaro Rice	222.36	12.5	10.7	20.6
Mangrove Rice	223.38	12.6	10.3	20.6
Dry Season Irrigated Rice	81.60	4.6	2.7	4.8
Wet Season Irrigated Rice	110.16	6.2	4.0	6.9
Total Rice	659.43	37.1	29.9	55.4
Cotton	27.03	1.5	0.9	1.1
Totals	1777.59	100.0	100.0	100.0

Source: Derived from Survey Data and Tables 5-1 and 5-3.

[a]Figures recorded as 0.0 are less than 0.05

output was valued at the official producer farm gate prices of D0.50, D0.51, D0.49, and D0.53 per kilogram of groundnut, rice, upland cereals, and cotton, respectively.

The average gross value was D1,777.59 per dabada or D227.80 per person. The groundnut enterprise was by far the largest single contributor to the total gross-farm income with a percentage of 43.9%, further emphasizing its importance in The Gambian economy. Upland cereals and rice contributed about 17.5% and 37.1% of the total gross farm income, respectively. Early (suno) millet contributed the highest percentage to the gross farm income among the upland cereals, while mangrove rice and bafaro rice contributed the highest among the rice enterprises. Gross farm income per hectare was D793.57 and gross farm income per unit of farm labor input was D4.54.

A comparison of the percent of income contributed to the percent of land and labor used show that while groundnut contributed 43.9% of the gross income, it utilized only 39.3% of the land and 25.8% of the total farm labor. In contrast, upland cereals contributed 17.5% of the gross income, but used 19.9% of the land and 17.7% of the labor. The rice enterprises, on the other hand, contributed 37.1% of the income while using 29.9% of the land and 55.4% of the labor. These results show that upland cereals are less productive per unit of land than both groundnut and rice, and they are also less productive per unit of labor than groundnut, but more productive per unit of labor than rice. Rice is more productive per unit of land than groundnuts.

The large differences in proportions of income contributed by each crop and the proportions of labor devoted to each crop may be due to the method of valuation employed. Assuming that resources are efficiently allocated, one would expect that farmers would devote more of their labor to the enterprise which contributes most to the gross or net farm income per unit of labor. This is not apparent in Table 5.8, especially for the groundnut and rice enterprises. Groundnut account for a higher percentage of the income than does rice, but a lesser percentage of the labor is devoted to it than is devoted to rice. This seeming discrepancy may suggest that farmers' subjective valuation of the paddy output may be higher than the price used to value it in this study.

Operating Expenses and Gross Margin

The operating expenses are made up of labor, seeds, fertilizer, animal, and ox-equipment hire, and irrigation and plowing expenses. The total average operating costs per dabada was estimated at D142.57. Of this cost, seeds made up about 45.7% while irrigation and plowing, and labor made up 29.9% and 19.1%, respectively. Hiring of animal and ox-equipment accounted for a small percentage of the operating expenses because farmers are often able to borrow equipment at no cost.

The average operating ratio, which relates operating expenses to gross income, was 0.08. This means that D0.08 was spent on operating expenses for every D1.00 of gross income.

The gross margin per dabada is obtained by deducting the total operating expenses from the gross farm income. The gross margin amounted to D1,635.02 per dabada or D209.62 person or D729.92 per hectare of land managed. The gross margin per workday of family labor on the farm was D4.56.

Fixed Costs

Fixed costs were made up of depreciation on draft animals, ox-equipment, and other hand tools and an estimated cost of the strange farmer who, in this study, is considered as a permanent laborer. Depreciation was calculated by the straight line method in which the salvage value was deducted from the purchase price and the remainder divided by the life expectancy of the equipment or total productive life of the animal. The values obtained for each item were accumulated to obtain the total depreciation.

Bulls appreciated in value while donkeys and horses had zero salvage value.[9] Thus, the appreciation in bulls was deducted from the depreciation in horses and donkeys to arrive at an estimate of the animal depreciation. The total fixed cost per dabada was estimated at D60.04. The fixed ratio, which relates the fixed costs to the gross income, was 0.03. In other words, for every D1.00 gross income generated, D0.03 was spent on fixed costs.

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[9]Donkeys or horses which either for sickness or age are no longer productive in the farm are simply left to die. The carcasses are left to rot. The average productive life of bulls was about six years after which they are either replaced or sold for meat.

Total Costs

Total cost, which is the sum of the operating expenses and the fixed costs, amounted to D202.61 per dabada. The gross ratio, which indicates the proportion of gross farm income needed to meet total expenses, is the sum of the operating ratio and the fixed ratio. The gross ratio amounted to 0.11. Thus, for every D1.00 generated in gross income, D0.11 or 11% of it was used to meet total expenses.

Net Farm Income

Net farm income is the total value of the farm output less total expenses. It is a measure of the reward to the family for their labor, management, capital, and land. The average net farm income per dabada was D1,574.98 or D201.92 per person. Net farm income per unit of family labor and per unit of land was D4.39 and D703.12, respectively. Since no capital was borrowed for productive purposes and there was no interest paid, net farm income was equal to net farm earnings.

Return to Family Labor and Management

The return to family labor and management can be estimated by inputing a charge on equity capital and an opportunity cost on land. Assuming a 15% interest charge on capital and an opportunity cost of D400.00 per hectare of irrigated land only, the net return to family labor and management was estimated at D1,488.59 per dabada or D190.84 per person. Net return to family labor and management per unit of family labor input was D4.15.

Net Family Earnings

Net family earnings is the sum of the net farm income plus off-farm earnings. The average off-farm earnings per dabada was D50.31 or about 3% of the total gross income. Total net family earnings were thus estimated at D1,625.29 per dabada or D208.37 per person.[10] This is an estimate of the disposable income available to each person for all purposes in the 1981/82 season. If all this income were to be spent on rice purchases and at the retail price of D0.79 per kilogram of milled rice, this means that each individual would have had about 264 kilograms of rice for consumption.

In 1981 R. A. Thamos estimated that 182.5 kilograms per capita per year of cereals was the minimum food grain production target which would meet FAO/WHO[11] recommendations for a daily intake of cereals in The Gambia. This amount was estimated to provide 1,750 calories per day. At this rate Gambian rice farmers would have to spend about 69% of their income or D143.78 per person on cereals if their minimum daily calorie intake was to be satisfied from rice consumption alone. The average gross value of cereals produced on the farm was D124.37 per person and was less than 69% of the gross income. This means that farmers would be unable to meet their minimum calorie intake from grain produced on the farm if rice were to completely replace the other cereals as a source of calories.

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[10]At the exchange rate of $1 = D2.20 in May, 1982, this is equal to a per capita income of $94.71.

[11]FAO/WHO = Food and Agriculture Organization/World Health Organization.

In summary, the above discussions have tried to throw light on the farm organization of rice farmers. The results showed that groundnut was the most important source of income among the crop enterprises. Off-farm income accounted for about 3% of total gross income. The above results, however, are based on a single average for all the sample population. This approach tends to mask a lot of other details. In the following sections, an attempt is made to disaggregate the data in a manner that will give a better understanding of the farming systems.

Regional Influence on Farm Organization and Farm Income

The crops grown in any area are determined by three fundamental factors, that is, social, physical, and economic considerations. Rainfall, temperature, and soil conditions are the main determinants of the physical ability of crops to grow. Nevertheless, although the physical condition might be favorable as far as growth of a particular crop is concerned, social, e.g., personal tastes, tradition, etc., and economic factors, e.g., prices and ease of transportation, may bring about cropping pattens very different from what would physically be possible (Norman, 1973).

To examine the effects of some of these factors, the sample villages were divided into three regions based on the predominant rice cultivation system in each village. These regions were mangrove rice region, bafaro rice region, and irrigated rice region. The mangrove rice region roughly corresponded to the western one-third of the area covered by the survey. The sample population in this region was made up of about 32.1% Wollof and 67.9% Mandingo.

The *bafaro* region corresponded to the central one-third of the area covered in the survey. This region normally has less rainfall than the western and eastern regions. The sample population was made up of about 62.8% Fulla and 47.2% Mandingo. The irrigated rice region roughly corresponded to the eastern one-third of the country and all the sample *dabadalu* in this region were of the Mandingo Tribe.

Resource Use

Land

The area devoted to each crop and its relative contribution to the total land holding per *dabada* is shown in Table 5.9 for each of the three regions. The average total area cultivated per *dabada* was 2.90 hectares, 1.96 hectares, and 1.91 hectares for the mangrove, *bafaro*, and irrigated rice regions, respectively. In the mangrove and irrigated rice regions, groundnut accounted for more than 40% of the total land area, while it accounted for only 17.6% of the land in the *bafaro* rice region. In fact, *bafaro* rice accounted for 30.6% of the total average land cultivated in the *bafaro* region.

In the mangrove rice growing region, upland cereals and rice accounted for 26.2% and 25.9% of the total land area, respectively. In the *bafaro* rice region, the percentages were 36.8% and 35.6%, while in the irrigated rice regions, they were 27.1% and 27.9%, respectively. The area of land cultivated per adult person was 0.45, .44, and 0.41 hectares in the mangrove, *bafaro*, and irrigated rice regions, respectively.

The figures in Table 5.9 seem to show a movement in the direction of a specialization in one upland cereal crop in each region.

TABLE 5.9--Average Area per Household (Dabada) Devoted to Each Crop by Major Type of Rice Cultivation Region

Crop	Mangrove Rice (28)[a]		Bafaro Rice (36)[a]		Irrigated Rice (26)[a]	
	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
Groundnut	1.39	47.9	0.54	27.6	0.80	41.9
Early (Suno) Millet	0.73	25.2	0.07	3.6	0.02	1.0
Late (Sanyo) Millet	-	-	0.15	7.7	0.03	1.6
Sorghum	-	-	0.18	9.2	0.27	14.1
Maize	0.03	1.0	0.32	16.3	0.19	9.9
Findo (digitaria)	-	-	-	-	0.01	0.5
Cotton	-	-	-	-	0.06	3.1
Mangrove Rive	0.75	25.9	-	-	-	
Bafaro Rice	-	-	0.60	30.6	-	-
Dry Season Irrigated Rice	-	-	0.02	1.0	0.18	9.4
Wet Season Irrigated Rice	-	-	0.08	4.0	0.19	9.9
Upland Rice	-	-	-	-	0.17	8.6
Total	2.90	100.0	1.96	100.0	1.91	100.0

Source: Survey data

[a] Figures in parentheses show the number of households in each region.

This movement seems to be nearly complete in the mangrove rice region where early (suno) millet accounted for 96.1% of the total area devoted to upland cereals. The only other upland cereal grown is maize. In the bafaro rice region, the movement is toward a specialization in maize which accounted for 44.4% of the total area devoted to upland cereals. The other major cereals, sorghum and late (sanyo) millet, accounted for about 25.0% and 10.8% of the upland cereals area, respectively.

In the irrigated rice region, the movement in specialization on upland cereals is toward sorghum. This crop accounted for about 53% of the total area devoted to upland cereals. The other major cereal was maize which accounted for 37.3% of the area under upland cereals.

The movement toward a regional specialization of certain upland cereals implies that development efforts which are targeted toward improving cereal cultivation in The Gambia must be region specific. Concentration on one crop only means that certain regions might benefit to the total exclusion of other regions.

Labor

Family size and composition. Table 5.10 shows the average number of people per household (dabada) by sex and age for each of the regions. The mangrove rice region had the highest number of people per dabada with an average of 9.9 people. The bafaro and irrigated rice regions had an average of 6.3 and 7.2 people per dabada, respectively. Males made up no more than 50% of the dabada

TABLE 5.10--Average Number of Persons per Household (Dabada) by Type of Labor and by Type of Major Rice Cultivation Region

Type of Labor		Mangrove Rice (28)[a]	Bafaro Rice (36)[a]	Irrigated Rice (26)[a]
Males	16-60 years	3.1	2.1	2.3
	10-15 years	1.2	0.5	0.7
	0-9 years	0.6	0.4	0.6
	Total Male	4.9	3.0	3.6
Females	Over 60 years	0.2	-	-
	16-60 years	3.3	2.4	2.4
	10-15 years	0.5	0.2	0.5
	0-9 years	1.0	0.7	0.7
	Total Females	5.0	3.3	3.6
Total Family		9.9	6.3	7.2
Strange Farmers		0.3	0.1	0.2

Source: Survey data

[a]Figures in parentheses show number of households (dabadalu) in each region.

population in each region. Adult persons of 16 to 60 years old, made up 64.6%, 71.4%, and 65.3% of the _dabada_ population in the mangrove, _bafaro_, and irrigated rice regions, respectively. The average number of strange farmers in each region was 0.3, 0.1, and 0.2, respectively.

Work on the farm. Tables 5.11, 5.12, and 5.13 show a breakdown of labor input on the crop enterprises by type of labor, sex, and age for the mangrove, _bafaro_, and irrigated rice regions, respectively. On the average, total labor input on the crop enterprises per _dabada_ was 491.1 workdays in the mangrove rice region, 291.8 workdays in the _bafaro_ rice region, and 351.8 workdays in the irrigated rice region. Of these totals, family labor contributed no less than 89.6% in each region. Nonfamily labor contributed 3.5%, 5.2%, and 4.3%, while strange farmers contributed 2.0%, 5.2%, and 6.0% of the total labor input on crops in the mangrove, _bafaro_, and irrigated rice regions, respectively.

The average labor input on crops per family adult was 67.2, 56.7, and 58.1 workdays in the mangrove, _bafaro_, and irrigated rice regions, respectively. These results are contrary to expectations. Since irrigated rice cultivation is a labor intensive technology and can be carried out throughout the year, one would have expected that adult labor input in the irrigated rice region would be substantially higher than in the other regions. The results show a higher labor input in the mangrove rice region than in the _bafaro_ and irrigated rice regions (which are about equal). This may be due to the fact that when irrigated rice was introduced, male farmers in this region

TABLE 5.11--Average Distribution of Labor Input per Household (Dabada) by Type of Labor and Crop Enterprise in the Mangrove Rice Growing Region (In Workdays)

Type of Labor	Groundnut	Maize	Sorghum	Early Millet	Late Millet	Findo	Cotton	Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice		Totals	
											Dry	Wet	Amount	%[a]
Family														
a) Males														
16-60 yrs.	120.2	4.9	-	68.4	-	-	-	-	-	14.2	-	-	207.7	42.3
10-15 yrs.	11.7	0.4	-	11.1	-	-	-	-	-	2.9	-	-	26.1	5.3
0-9 yrs.	1.3	-	-	1.7	-	-	-	-	-	-	-	-	3.0	0.6
Total Males	133.2	5.3	-	81.2	-	-	-	-	-	17.1	-	-	236.8	48.2
b) Females														
16-60 yrs.	7.6	0.4	-	0.2	-	-	-	-	-	213.9	-	-	222.1	45.2
10-15 yrs.	0.8	0.2	-	0.2	-	-	-	-	-	3.6	-	-	4.8	1.0
0-9 yrs.	0.0[c]	-	-	0.0	-	-	-	-	-	0.3	-	-	0.3	0.0
Over 60 yrs.	0.1	-	-	-	-	-	-	-	-	0.2	-	-	0.3	0.0
Total Females	8.5	0.6	-	0.4	-	-	-	-	-	218.0	-	-	227.5	46.3
c) Other Family	0.1	-	-	-	-	-	-	-	-	-	-	-	0.1	0.0
Total Family Labor Input	141.8	5.9		81.6						235.1			464.4	94.5
Strange Farmer (Male)	6.0	0.5	-	3.0	-	-	-	-	-	0.1	-	-	9.6	2.0
Hired Labor:														
Exchange Males	4.3	-	-	0.3	-	-	-	-	-	4.0	-	-	8.6	1.8
Exchange Female	0.1	-	-	-	-	-	-	-	-	4.9	-	-	5.0	1.0
Contract Males	1.1	-	-	0.1	-	-	-	-	-	0.7	-	-	1.9	0.4
Contract Female	-	0.0	-	0.1	-	-	-	-	-	1.3	-	-	1.4	0.3
Total Hired	5.5	0.0	-	0.5	-	-	-	-	-	10.9	-	-	16.9	3.5
Total Labor Input	153.3	6.4	-	85.1	-	-	-	-	-	246.3	-	-	491.1	100.0
Percent of Total[b]	31.2	1.3	-	17.3	-	-	-	-	-	50.2	-	-	100.0	

Source: Survey data

[a]Shows percent of total labor input contributed by type of labor.

[b]Shows percent of total labor devoted to each crop.

[c]Figures entered as 0.0 are less than 0.5.

TABLE 5.12--Average Distribution of Labor Input per Household (Dabada) by Type of Labor and Crop Enterprise in the Cafaro Rice Growing Region (In Workdays)

Type of Labor		Groundnut	Maize	Sorghum	Early Millet	Late Millet	Findo	Cotton	Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice Dry	Irrigated Rice Wet	Totals Amt	Totals %[a]
Family															
a) Males	16-60 yrs.	42.7	15.8	2.4	2.1	7.9	-	-	-	16.9	-	1.9	1.6	91.3	31.3
	10-15 yrs.	1.4	1.1	0.1	0.6	0.3	-	-	-	0.5	-	0.2	-	4.2	1.4
	0-9 yrs.	0.0[c]	0.2	-	-	-	-	-	-	0.0	-	-	-	0.2	0.1
	Total Males	44.1	17.1	2.5	2.7	8.2	-	-	-	17.4	-	2.1	1.6	95.7	32.8
b) Females	16-60 yrs.	0.3	0.2	0.0	-	0.1	-	-	-	154.7	-	0.9	7.7	163.9	56.2
	10-15 yrs.	0.1	0.0	-	-	0.0	-	-	-	1.1	-	-	0.7	1.9	0.6
	0-9 yrs.	-	0.0	-	-	-	-	-	-	0.0	-	-	-	0.0	0.0
	Over 60 yrs.	-	-	-	-	-	-	-	-	0.0	-		-	0.0	0.0
	Total Females	0.4	0.2	0.0	-	0.1	-	-	-	155.8		0.9	8.4	165.8	56.8
c) Other Family		0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	
Total Family Labor Input		44.5	17.3	2.5	2.7	8.3	-	-	-	173.2	-	3.0	10.0	261.5	89.6
Strange Farmer (Male)		3.3	1.9	0.1	0.2	1.0	-	-	-	7.4	-	0.1	1.2	15.2	5.2
Hired Labor:	Exchange Males	1.1	0.3	0.4	0.1	0.0	-	-	-	1.5	-	0.2	-	3.6	1.2
	Exchange Females	-	-	-	-	-	-	-	-	4.3	-	0.1	0.1	4.5	1.5
	Contract Males	0.8	0.0	0.1	0.1	0.2	-	-	-	3.1	-	1.0	0.0	5.3	1.8
	Contract Females	-	-	-	-	-	-	-	-	1.6	-	0.1	-	1.7	0.7
Total Hired		1.9	0.3	0.5	0.2	0.2	-	-	-	10.5	-	1.4	0.1	15.1	5.2
Total Labor Input		49.7	19.5	3.1	3.1	9.5	-	-	-	191.1	-	4.5	11.3	291.8	100.0
Percent of Total[b]		17.0	6.7	1.1	1.1	3.3	-	-	-	65.5	-	1.5	3.8	100.0	

Source: Survey data

[a]Shows percent of total labor input contributed by type of labor.

[b]Shows percent ot total labor devoted to each crop.

[c]Figures entered as 0.0 are less than 0.05.

TABLE 5.13--Average Distribution of Labor Input per Household (Dabada) by Type of Labor and Crop Enterprise in the Irrigated Rice Growing Region (In Workdays)

Type of Labor		Groundnut	Maize	Sorghum	Early Millet	Late Millet	Findo	Cotton	Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice Dry	Irrigated Rice Wet	Totals Amt	Totals %[a]
Family	a) Males 16-60 yrs.	69.6	16.1	20.6	2.8	9.0	-	5.7	2.0[c]	-	-	15.3	19.0	160.1	14.5
	10-15 yrs.	10.7	2.2	3.9	0.9	0.2	-	0.4	0.0	-	-	0.5	8.5	27.3	7.8
	0-9 yrs.	0.4	0.4	0.1	0.1	-	-	-	-	-	-	-	0.5	1.5	0.4
	Total Males	80.7	18.7	24.6	3.8	9.2	-	6.1	2.0	-	-	15.8	28.0	188.9	53.7
	b) Females 16-60 yrs.	5.0	4.3	3.3	1.1	0.1	0.8	0.8	29.5	-	-	29.6	38.3	112.8	32.1
	10-15 yrs.	0.7	0.1	-	0.3	-	-	0.2	0.1	-	-	0.1	1.0	2.5	0.7
	0-9 yrs.	0.4	0.1	-	-	-	-	-	-	-	-	-	0.0	0.5	0.1
	Over 60 yrs.	0.0	0.1	-	-	-	-	-	-	-	-	-	-	0.1	0.0
	Total Females	6.1	4.6	3.3	1.4	0.1	0.8	1.0	29.6	-	-	29.7	39.3	115.9	32.9
	c) Other Family	2.2	0.6	1.0	0.6	1.5	-	0.0	-	-	-	3.5	1.6	11.0	3.1
Total Family Labor Input		89.0	23.9	28.9	5.8	10.8	0.8	7.1	31.6	-	-	49.0	68.9	315.8	89.7
Strange Farmer (Male)		5.4	1.9	4.0	-	-	-	5.5	0.8	-	-	3.3	0.0	20.9	6.0
Hired Labor:	Exchange Males	2.5	0.7	0.0	-	-	-	0.6	-	-	-	0.8	0.0	4.6	1.3
	Exchange Females	0.1	-	0.0	-	-	-	-	0.2	-	-	2.4	1.3	4.0	1.2
	Contract Males	2.4	0.3	0.3	0.2	0.3	-	0.8	0.1	-	-	0.8	0.8	6.0	1.7
	Contract Females	-	0.0	-	-	-	-	-	0.0	-	-	-	0.5	0.5	0.1
Total Hired		5.0	1.0	0.3	0.2	0.3		1.4	0.3			4.0	2.6	15.1	4.3
Total Labor Input		99.4	26.8	33.2	6.0	11.1	0.8	14.0	32.7	-	-	56.2	71.5	351.8	100.0
Percent of Total[b]		28.3	7.6	9.4	1.7	3.2	0.2	4.0	9.3	-	-	16.0	20.3	100.0	

Source: Survey data

[a]Shows percent of total labor input contributed by type of labor.
[b]Shows percent of total labor devoted to each crop.
[c]Figures entered as 0.0 are less than 0.05.

responded by reducing the hectarage devoted to upland crops and diverting the labor released to irrigated rice cultivation instead of making a substantial increase in labor input. The area per adult male of upland crops was 0.63, 0.57, and 0.48 hectares in the mangrove, bafaro, and irrigated rice regions, respectively.

Adult labor contributed about 77.6% of the total labor on crops in the mangrove rice region and 87.5% each in the bafaro rice region and irrigated rice regions. The total family female labor input on crops was 32.9%, 56.8%, and 46.3% of the labor input on crops in the mangrove, bafaro, and irrigated rice regions, respectively. The corresponding male labor inputs accounted for 53.7%, 32.8%, and 45.2% of the total farm crop labor input, respectively.

Labor input on the crop enterprises per adult family female was 67.3 workdays in the mangrove rice region, 68.3 workdays in the bafaro rice region, and 47.0 workdays in the irrigated rice region. The corresponding labor input per adult family male was 67.0, 43.5, and 69.6 workdays, respectively. In general, labor input on the farm crops per adult female was about equal, greater, and lesser than that of males in the mangrove, bafaro, and irrigated rice regions, respectively. These results tend to show that the introduction of irrigated rice in The Gambia increased both the absolute amount and the proportion of male labor contributed in farming. This was expected because irrigated rice cultivation was specifically introduced to men.

The average labor input on crops per strange farmer was 32.0, 152.0, and 104.5 workdays in the mangrove, bafaro, and irrigated rice regions, respectively.

The highest labor input per crop was devoted to mangrove rice, in the mangrove rice region, bafaro rice in the bafaro rice region, and groundnut in the irrigated rice region. These crops accounted for 50.2%, 65.5%, and 28.3% of the total crop labor input, respectively. The combined dry and wet season irrigated rice accounted for 36.3% of the total crop labor input in the irrigated rice region. On the whole, cash crops--groundnut and cotton--accounted for 31.2%, 17.0%, and 32.3% of the total crop labor input in the mangrove, bafaro, and irrigated rice regions, respectively. Upland cereals accounted for 18.6%, 12.2%, and 22.1%, while rice accounted for 50.2%, 70.8%, and 45.6% of the total crop labor input, respectively.

Total labor input. Table 5.14 summarizes the total labor input for the three major activities of crops, off-farm, and general farm activities for the three regions. Total labor input per household (dabada) was estimated at 601.7, 458.6, and 565.0 workdays for the mangrove, bafaro, and irrigated rice regions, respectively. Total family labor input accounted for 95.5% in the mangrove rice region, 93.4% in the bafaro rice region, and 93.2% of the total labor input in the irrigated rice region.

Farm activities accounted for 87.4%, 64.7%, and 66.8% of the total labor input in the mangrove, bafaro, and irrigated rice regions, respectively. The corresponding percentages for off-farm activities are 12.6%, 35.3%, and 33.2%, respectively. The relatively higher labor input on off-farm activities in the bafaro and irrigated rice

TABLE 5.14--Distribution of Labor Input Per Household (Dabada) by Type of Labor, Major Activity and Major Type of Rice Cultivation

Type of Labor		Mangrove Rice Region				Bafaro Rice Region				Irrigated Rice Region			
		Crops	General Farm	Off-Farm	Totals	Crops	General Farm	Off-Farm	Totals	Crops	General Farm	Off-Farm	Totals
Family a) Males	16-60 yrs.	207.7	25.8	68.5	302.0	91.3	3.0	86.8	181.1	160.1	14.3	142.3	316.7
	10-15 yrs.	26.1	0.2	0.3	26.6	4.2	-	2.5	6.7	27.3	1.8	-	29.1
	0-9 yrs.	3.0	-		3.0	0.2	-	-	0.2	1.5	0.1	-	1.6
	Total Males	236.8	26.0	68.8	331.6	95.7	3.0	89.3	188.0	188.9	16.2	142.3	347.4
b) Females	16-60 yrs.	221.1	8.6	7.1	237.8	163.9	2.1	69.5	235.5	112.8	5.7	45.6	164.1
	10-15 yrs.	4.8	-		4.8	1.9	-	2.9	4.8	2.5	-	-	2.5
	0-9 yrs.	0.3	0.0		0.3	0.0[a]	-	-	0.0	0.5	-	-	0.5
	Over 60 yrs.	0.3	-		0.3	0.0	-	-	0.0	0.1	-	-	0.1
	Total Females	227.5	8.6	7.1	243.2	165.8	2.1	72.4	240.3	115.9	5.7	45.6	167.2
c) Other Family		0.1	-	-	0.1	0.0	-	-	0.0	11.0	1.2	0.0	12.2
Total Family Labor		464.4	34.6	75.9	574.9	261.5	5.1	161.7	428.3	315.8	23.1	187.9	536.8
Strange Farmer		9.6	0.1		9.7	15.2	0.0	-	15.2	20.9	1.8	-	22.7
Hired Labor:	Exchange Males	8.6	-		8.6	3.6	-	-	3.6	4.6	0.2	-	4.8
	Exchange Females	5.0	-		5.0	4.5	-	-	4.5	4.0	-	-	4.0
	Contract Males	1.9	0.0		1.9	5.3	0.0	-	5.3	6.0	0.2	-	6.2
	Contract Females	1.4	-		1.4	1.7	-	-	1.7	0.5	-	-	0.5
Total Hired Labor		16.9	-		16.9	15.1	0.0	-	15.1	15.1	0.4	-	15.5
Total Labor Input		491.1	34.7	75.9	601.7	291.8	5.1	161.7	458.6	351.8	25.3	187.9	565.0
Percent of Total Labor		81.6	5.8	12.6	100.0	63.6	1.1	35.3	100.0	62.3	4.5	33.2	100.0

Source: Survey data

[a]Figures entered as 0.0 are less than 0.05

regions are difficult to explain. About 11, 35, and 40 workdays per adult were spent on off-farm activities and only about 32%, 9%, and less than 1% of these was spent in remunerative activities in the mangrove, bafaro, and irrigated rice regions, respectively. The only plausible explanation may be related to the regions' proximity to the urban Kombo St. Mary area. The mangrove rice region is closer to and the irrigated rice region is farther away from the urban area. The greater contact with the outside world in the mangrove rice region might be resulting in a breakdown of traditional community spirit, an increase in individualization and diminution of a feeling of responsibility for one's fellow man (Norman, et al., 1979). Thus, this is resulting in a reduced labor input in social and religious activities which form the bulk of the off-farm activities. The extent to which the labor input in off-farm activities in the bafaro and irrigated rice regions could be tapped for productive agricultural activities will depend on the social values attached to these off-farm activities. If the return from agricultural production are made higher than the perceived benefits from the religious and social activities, then there is room for large increases in agricultural production from these regions.

The total labor input per adult family male was 97.7, 86.2, and 137.7 workdays, while that for females was 72.1, 98.1, and 68.4 workdays for the mangrove, bafaro, and irrigated rice regions, respectively. These figures do not include labor input in livestock and household activities. Adult family male labor input was about two times that of family female labor input in the irrigated rice regions.

Females in the bafaro rice regions generally worked more than their counterparts in the other regions, while the same is true for males in the irrigated rice regions. Whether male labor input is higher than the female labor input will depend on the amount of labor contributed by each sex on livestock activities and on the assumptions made on household activity labor. However, the results above reveal that adult males worked more than adult females in the mangrove and irrigated rice regions, while females in the bafaro rice region worked more than men. With the sexual division of labor along crop enterprise lines, this means that intensification of rice production in the bafaro rice regions may lead to a greater disparity in workload between men and women, with women working more and more hours. Similarly intensification of irrigated rice cultivation without a greater participation of women may lead to men working far more than women in the irrigated rice regions.

Seasonality of labor. Figures 5.2, 5.3, and 5.4 depict the seasonal pattern of labor use in the mangrove, bafaro, and irrigated rice regions, respectively. In the mangrove rice region the seasonal pattern shows a peak in September and another in January, which corresponds with the transplanting and harvesting of mangrove rice, respectively. In the bafaro rice region, the peaks occur in August and December which also corresponded with the planting and harvesting of bafaro rice, respectively. The monthly peak periods in August/September

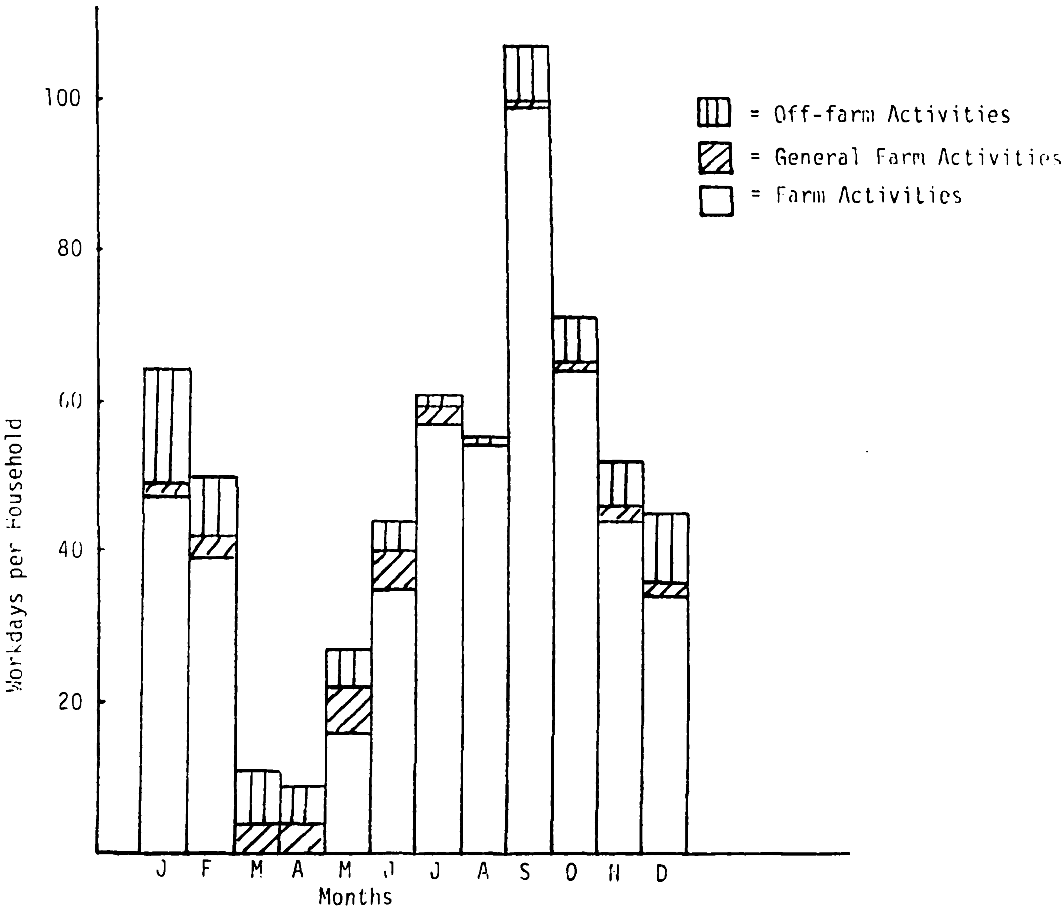

Figure 5.2--Monthly Labor Profile per Household(Dabada) in the Mangrove Rice Region.

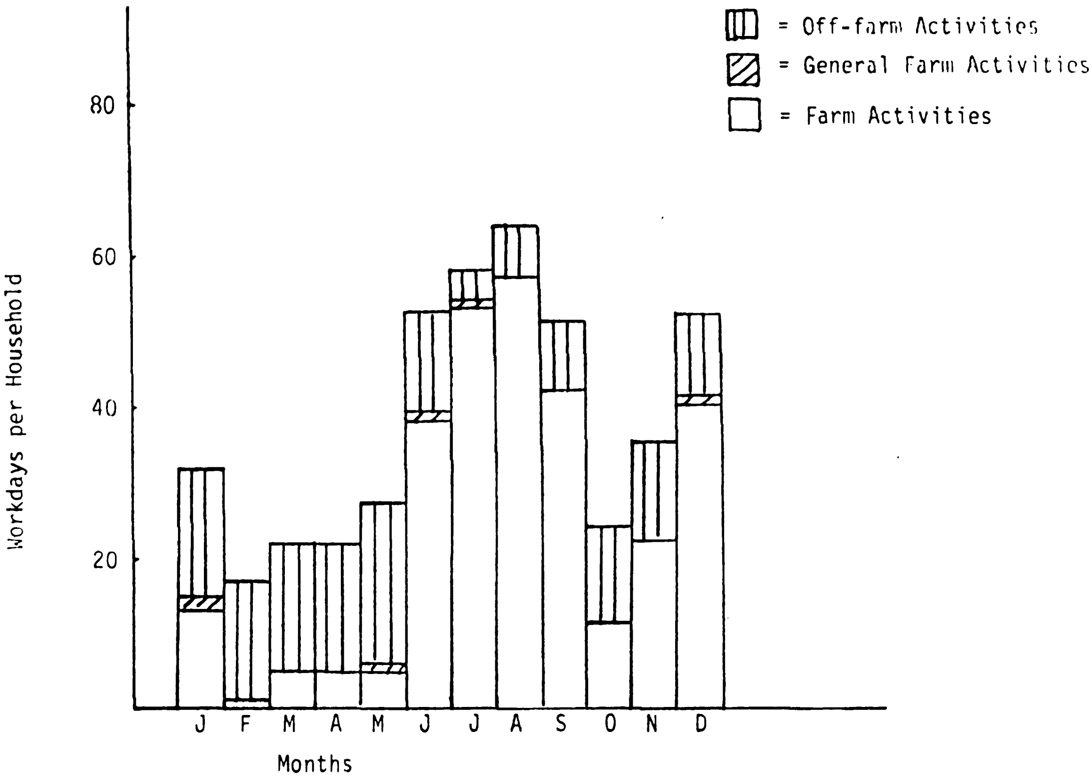

Figure 5.3--Monthly Labor Profile per Household(Dabada) in the Bafaro Rice Region.

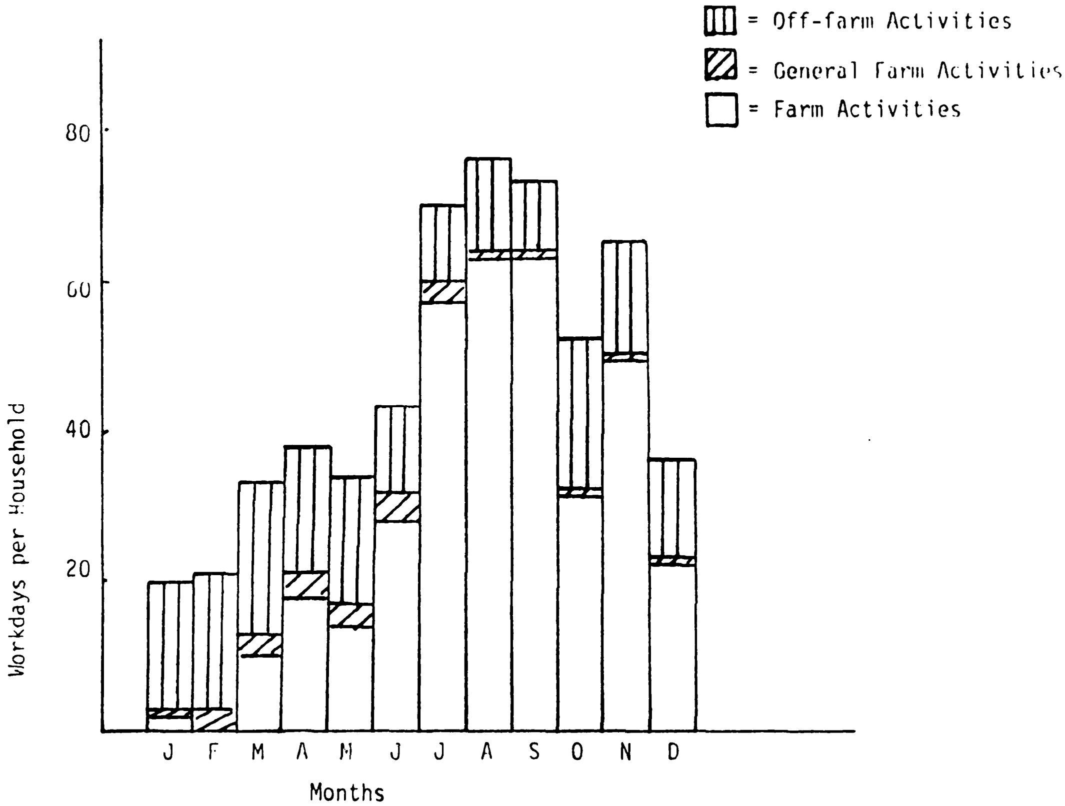

Figure 5.4--Monthly Labor Profile per Household(Dabada) in the Irrigated Rice Region.

and November in the irrigated rice regions correspond with the intense weeding and harvesting periods of upland crops, respectively.

The degree of seasonality in each region can be measured by the degree of dispersion of the monthly labor demands about a mean monthly labor demand. This, in turn, can be approximated by the standard deviation and for comparison purposes by the coefficient of variation.[12] The percentage coefficient of variation of the monthly labor demands around the mean monthly labor demand for the crops and general farm activities was 60.8%, 84.0%, and 69.9% for the mangrove, bafaro, and irrigated rice regions, respectively. The corresponding percentage coefficients of variation for the total labor input were 53.7%, 42.3%, and 42.7%, respectively. As expected, the relative variability or seasonality of labor on the farm activities was highest in the bafaro rice region which normally has a lower rainfall than the other two regions. The variation in monthly labor distribution was lower when the total labor input was considered than when only the farm labor input was considered in all regions. This indicates that farmers in all regions undertook off-farm activities in a manner that tended to smooth out the total monthly labor input.

The labor equation. A comparison of the monthly demand for labor and the potential monthly supply of labor show that in all the regions, the potential monthly labor supply was higher than the highest

[12]The coefficient of variation is the standard deviation divided by the mean. This is multiplied by 100 for expression in percentage terms.

labor demand. Assuming 22 days work a month and considering only family adults, the potential monthly labor supply was estimated at 140.8 workdays for the mangrove regions, 99.0 workdays for the bafaro region, and 103.4 workdays for the irrigated rice region. The highest total monthly demands on labor were 107 workdays in September, 64 workdays in August, and 76 workdays in August for the mangrove, bafaro, and irrigated rice regions, respectively.[13] Although these figures are indicative of the monthly pattern of demand and supply of labor in these regions, they must be interpreted with caution for reasons indicated earlier.

Farm Equipment

The average number of draft animals and ox-drawn equipment for each region are shown in Table 5.15. The seeder was the predominant farm ox-equipment in each region and the donkey was the predominant draft animal in each region. The estimated value of the equipment and animals in each region was D162 and D554 in the mangrove rice region, D77 and D102 in the bafaro rice region, and D168 and D248 in the irrigated rice region, respectively. The bafaro rice region was the least capitalized among the regions and this may explain the relatively smaller hectarage devoted to groundnut and upland cereals in this region. Animal traction was used for an average of 77 hours, 34 hours, and 41 hours in the farm per dabada in the mangrove, bafaro, and irrigated rice regions, respectively.

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[13] See Appendix B-1 for a breakdown of monthly labor demand by regions.

TABLE 5.15--Average Number of Ox-drawn Equipment/Animals Owned per Household (_Dabada_) by Major Type of Rice Cultivation Region

	Mangrove Rice (28)[a]	_Bafaro_ Rice (36)[a]	Irrigated Rice (26)[a]
Seeder (with plates)	0.86	0.44	0.88
Mouldboard Plow	0.71	0.19	0.42
Cart	0.43	0.11	0.19
Weeding Tines	0.14	0.38	0.69
Bulls	0.32	0.03	0.12
Donkeys	0.68	0.28	0.81
Horses	0.25	0.08	0.08

Source: Survey data

[a]Figures in parenthes s show number of Households in each region.

Farm Income Analysis

Value of Output

The average budgets per dabada for the three regions are shown in Table 5.16. A breakdown of the value of output for each crop and their relative contribution to the total value of the farm output or gross farm income is shown in Table 5.17. The average gross farm income per dabada was D2,301.51 in the mangrove rice region, D1,505.66 in the bafaro rice region, and D1,505.78 in the irrigated rice region. This is equal to D232.48, D238.99, and D220.83 per person or D793.62, D768.19, and D832.42 per hectare of land in the mangrove, bafaro, and irrigated rice regions, respectively. The gross income per unit of labor was equal to D4.38, D5.07, and D3.99, respectively. Thus, although the irrigated rice region had the highest gross income per hectare, this region had the lowest gross income per unit of labor input.

The groundnut enterprise contributed about 54.2% of the gross income in the mangrove rice region, 32.6% of the gross income in the bafaro rice region, and 41.3% of the gross income in the irrigated rice region. Upland cereals contributed 14.6%, 22.1%, and 15.9%. While rice contributed 31.2%, 45.3%, and 40.4% of the total gross income, respectively.

The absolute amount of income derived from food crops per person was D106.49, D161.03, and D124.30 in the mangrove, bafaro, and irrigated rice regions, respectively. This means that the bafaro rice region is in a better position to satisfy its food demands from the farm than does the other regions.

TABLE 5.16.--Average Household (Dabada) Farm Budget by Region

	Mangrove	Bafaro	Irrigated
General Data			
a. Average land holding (Ha)	2.90	1.96	1.91
b. Average family size			
Male	4.9	3.0	3.6
Female	5.0	3.3	3.6
Total	9.9	6.6	7.2
c. Active family members (10-60 years)	8.2	5.2	5.9
d. Strange farmers	0.3	0.1	0.2
e. Hours of Animal/ox-equipment input	77	34	41
f. Number of Households	28	36	26
Income and Expenditure	(Dalasis)	(Dalasis)	(Dalasis)
a. Value of farm output	2301.51	1505.66	1589.98
b. Operating expenses			
Labor	8.18	47.86	19.23
Seeds	82.63	46.69	71.68
Fertilizer	17.07	0.08	1.56
Animal/ox-equipment	1.75	2.64	0.86
Irrigation/Plowing	--	28.40	105.08
Total Operating Expenses	109.63	125.67	198.41
c. Gross Margin	2191.89	1379.99	1391.57
d. Fixed Costs			
Depreciation			
Animals	28.00	10.00	17.00
Ox-equipment	19.00	11.00	14.00
Other hand tools	3.01	2.62	3.67
Strange Farmer	36.00	12.00	24.00
Total Fixed Costs	86.01	35.62	58.67
e. Total Costs	195.64	161.29	257.08
f. Net farm income	2105.87	1344.37	1332.90
g. Off-farm Earnings	20.66	107.05	3.67
h. Net Family Income	2126.53	1451.42	1336.57

Source: Survey data.

TABLE 5.17.--Sources of Farm Income and Percentage Land and Labor Used for Each Crop by Major Type of Rice Cultivation [per Household (Dabada)]

	Mangrove Rice Area				Bafaro Rice Area				Irrigated Rice Area			
	Source of Farm Income				Source of Farm Income				Source of Farm Income			
	Amount (D)	%	% Land	% Labor	Amount (D)	%	% Land	% Labor	Amount (D)	%	% Land	% Labor
Groundnut	1247.27	54.2	47.9	31.2	491.12	32.6	27.6	17.0	656.0	41.3	41.9	28.3
Maize	20.58	0.9	1.0	1.3	173.95	11.6	16.3	6.7	103.38	6.5	9.9	7.6
Sorghum	--	--	--	--	71.54	4.8	9.2	1.1	126.42	8.0	14.1	9.4
Early (suno) Millet	315.07	13.7	25.2	17.3	25.97	1.6	3.6	1.1	4.41	0.3	1.0	1.7
Late (sanyo) Millet	--	--	--	--	62.23	4.1	7.7	3.3	15.68	0.9	1.6	3.2
Findo (Digitaria)	--	--	--	--	--	--	--	--	2.45	0.2	0.5	0.2
Total Upland Cereals	335.65	14.6	26.2	18.6	333.69	22.1	36.8	12.2	252.84	15.9	27.1	22.1
Upland Rice	--	--	--	--	--	--	--	--	75.48	4.7	8.6	9.3
Bafaro Rice	--	--	--	--	556.41	37.0	30.6	65.5	--	--	--	--
Mangrove Rice	718.59	31.2	25.9	50.2	--	--	--	--	--	--	--	--
Dry Season Irrigated	--	--	--	--	23.46	1.6	1.0	1.5	325.38	20.5	9.4	16.0
Wet Season Irrigated	--	--	--	--	100.98	6.7	4.0	3.8	241.23	15.2	9.9	20.3
Total Rice	718.51	31.2	25.9	50.2	680.85	45.3	35.6	70.8	642.09	40.4	27.9	45.6
Cotton	--	--	--	--	--	--	--	--	38.85	2.4	3.1	4.0
TOTALS	2301.51	100.0	100.0	100.0	1505.66	100.0	100.0	100.0	1589.78	100.0	100.0	100.0

Source: Derived from Survey data and Tables 5.9 and 5.11 to 5.13.

Table 5.17 also gives the percentage of land and labor used by each crop enterprise. A close examination of these percentages reveals that in all regions the percentage of income from groundnut is either almost equal to or greater than the percentage of land and labor devoted to this crop. In the case of upland cereals the percentage of income derived from these crops is lower than the percentage of land devoted to these crops and only in the *bafaro* rice region is the percentage of income higher than the percentage of labor allocated to these crops. The percentage of income received from the rice enterprises in all regions is higher than the percentage of land used in their cultivation but lower than the percentage of labor devoted to their cultivation.

The percentages on the upland cereals tend to support the earlier speculation that each region is tending toward a specialization in one upland cereal. Both the percentage of gross income received and the percentages of land and labor utilized among the upland cereals are highest in early (*suno*) millet in the mangrove rice region, maize in the *bafaro* rice region, and sorghum in the irrigated rice region.

Operating Costs and Gross Margin

The average operating costs per *dabada* were estimated at D109.63, D125.67, and D198.41 in the mangrove, *bafaro*, and irrigated rice regions, respectively. Labor accounted for 7.5%, 38.1%, and 9.8% of the total operating costs, while seed accounted for 75.4%, 37.2%, and 36.1% of the total operating costs in the mangrove, *bafaro*, and irrigated rice regions, respectively. The highest contributors to the operating costs were seed in the mangrove rice region, labor in the *bafaro* rice region, and irrigation and plowing in the irrigated rice region. Irrigation and plowing costs alone accounted for about 53% of the operating expenses in the irrigated rice region.

The operating ratios were estimated at 0.05, 0.09, and 0.17 in the mangrove, *bafaro*, and irrigated rice regions, respectively.

The gross margins per *dabada* were estimated at D2,191.89, D1,379.99, and D1391.57 or D755.82, D704.08, and D728.57 per hectare for the mangrove, *bafaro*, and irrigated rice regions, respectively. The corresponding gross margins per workday of farm labor input were D4.17, D4.65, and D3.69, respectively. Although the *bafaro* rice region had the lowest gross margin per hectare, it had the highest gross margin per unit of farm labor input.

Fixed Costs

Fixed costs were estimated at D86.01 for the mangrove rice region, D35.62 for the *bafaro* rice region, and D58.67 for the irrigated rice region. The strange farmer was the highest fixed cost item in all the three regions. The fixed ratios were 0.04, 0.02, and 0.04 in the mangrove, *bafaro*, and irrigated rice regions, respectively. This means that in each of the regions, no *dabada* spent more than D0.04 in fixed expenses for each dalasis of gross income generated on the average.

Total Costs

Total costs per dabada were highest for the irrigated rice region and lowest for the bafaro rice region. Total costs were D195.61, D161.29, and D257.08 corresponding to gross ratios of 0.09, 0.11, and 0.16 for the mangrove, bafaro, and irrigated rice regions, respectively.

Net Farm Income

The net farm income in each region was poistive. The highest net farm income per dabada was in the mangrove rice region with an average of D2,105.87. The lowest net farm income was obtained in the irrigated rice growing area with an average of D1,332.90 per dabada. The bafaro rice region had an average net farm income per dabada of D1,344.37. Since no interest was paid on capital in all the regions the net farm income was equal to net farm earnings.

Net farm earnings per person were equal to D212.71, D213.39, and D185.13 or D726.16, D685.90, and D697.85 per hectare of land in the mangrove, bafaro, and irrigated rice growing regions, respectively. Net farm earnings per workday of farm family labor was D4.22, D5.04, and D3.93 in the mangrove, bafaro, and irrigated rice regions, respectively. Land productivity was highest in the mangrove rice region, while family labor productivity was highest in the bafaro rice region.

Return to Family Labor and Management

Assuming a 15% interest charge on capital and a D400.00 per hectare opportunity cost of irrigated land, the net return to family

labor and management was estimated at D2,076.52, D1,280.18, and D1,146.34 per dabada in the mangrove, bafaro, and irrigated rice region, respectively. This is equivalent to D4.16, D4.80, and D3.38 per workday of family labor input in the farm, respectively.

Net Family Earnings

Net family earnings is the sum of net farm earnings plus off-farm earnings. Average off-farm earnings per household (dabada) were equal to D20.66, D107.05, and D3.67 or 0.9%, 6.6%, and 0.2% of the total gross income for the mangrove, bafaro, and irrigated rice regions, respectively. The total net family earnings per dabada were D2,126.53, D1,451.42, and D1,336.37, respectively. This means that the estimated income available for all purposes per person was D214.80, D230.38, and D185.63 for the mangrove, bafaro, and irrigated rice regions, respectively. The milled rice equivalent, at 1982 retail consumer prices, of these incomes are 272, 292, and 235 kilograms of rice per capita for the mangrove, bafaro, and irrigated rice regions, respectively. Assuming that all calorie intake is satisfied from rice, then to maintain a minimum per capita intake of 182.5 kilograms of cereals, farmers would have to spend 69.1%, 62.5%, and 77.7% of their disposable income on food purchases in the mangrove, bafaro, and irrigated rice regions, respectively. Even if land is assumed to have zero opportunity cost, farmers in the irrigated rice region would still have to spend about 70% of their income on rice.

In Table 5.17 the proportion of income received from food crops is 45.8% in the mangrove rice region, 67.4% in the bafaro rice region, and 56.3% in the irrigated rice region. The proportion of disposable income required to maintain a minimum calorie intake and the proportion of gross income received from food crops are not entirely comparable becaue the first is based on net returns while the latter is based on gross returns. They are, however, indicative of the relative positions of these regions. The figures show that both the mangrove and irrigated rice regions will have to buy food from outside in order to satisfy the minimum calorie intake requirement. In the bafaro regions, farmers are likely to meet their minimum requirements from the cereals produced on the farm.

In summary, the above discussions have shown the differences in farm organization and farm income when the sample villages were divided into three regions based on the predominant rice cultivation system in each village.

The results reveal that groundnut cultivation formed a significant part of the farming system in all three regions, although in the bafaro region, bafaro rice seemed to be replacing groundnut as the major income earner. A close look at the upland cereals showed a tendency for each region to specialize in one upland cereal. Specialization in early (suno) millet cultivation in the mangrove rice region

is almost complete. In the bafaro rice region, the evidence showed a direction toward specializing in maize whereas in the irrigated rice region, the direction was toward specializing in sorghum.

The average labor input per adult on the farm varied between 56 and 67. Female adults put in more time in the crop enterprises than did males in the bafaro rice region, while the opposite was true in the irrigated rice region. Adult male and female labor input in the farm crops was about equal in the mangrove rice region. There seemed to be evidence that the introduction of irrigated rice increased male labor input in the farm. Total labor input per adult male was higher than the labor input of females in the mangrove and irrigated rice regions, while total female labor input was higher than that of males in the bafaro rice region.

Total net farm earnings per person were lowest in the irrigated rice region and were about equal in the bafaro and mangrove rice regions. Farmers in the bafaro rice region are more likely to meet their minimum food or calorie intake requirements from cereals produced on the farm than do farmers in other regions.

The Influence of Size of Land Holding on Farm Organization and Farm Income

The main objective of this section is to study the effect of the size of land holding on the organization of the farm and level of farm income. More specifically, this section will examine the relationship between the size of land area cultivated in the year of the survey and resource endowment and utilization, the composition of

crops cultivated and their contribution to gross farm income, and the degree to which subsistence requirements are met from the farm output.

To achieve these objectives, the sample population was divided into three land size categories. In making this division, medium farmers included all those who fell within plus or minus one standard deviation of the total mean hectarage. Small farmers included those who fell below that range and large farmers included those who fell above that range.

Resource Use

Land

Table 5.18 presents the area of land devoted to each crop and its relative contribution to the total land holding for all the three size categories. The average total hectarage cultivated was 0.65 hectares, 2.17 hectares, and 4.30 hectares for the small, medium, and large farmers, respectively. Both the absolute value and the percentage devoted to groundnut increased with an increase in size of land holding. Small farmers devoted 27.7% of their land area to groundnut while medium and large farmers used 35.9% and 51.9% of their land holdings for groundnut cultivation, respectively.

Although there was an increase in the absolute number of hectares devoted to upland cereals and rice with an increase in size of land holding, the relative hectarage of these crops declined with an increase in size. The area devoted to upland cereals was 0.22, 0.61, and 1.02 hectares per dabada for the small, medium, and large farmers, respectively. Their corresponding percentage of the total

TABLE 5.18.--Average Area Per Household (Dabada) Devoted to Each Crop by Size of Land Holding

Crop	Small (14)[a]		Medium (64)[a]		Large (12)[a]	
	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
Groundnut	0.18	27.7	0.78	35.9	2.23	51.9
Early (suno) Millet	--	--	0.24	11.1	0.56	13.0
Late (sanyo) Millet	0.09	13.8	0.07	3.2	0.05	1.2
Sorghum	0.02	3.1	0.17	7.8	0.18	4.2
Maize	0.11	16.9	0.20	9.2	0.23	5.3
Findo (digitaria)	--	--	0.00[b]	0.0	--	--
Cotton	--	--	0.02	0.9	--	--
Mangrove rice	--	--	0.24	11.1	0.46	10.7
Bafaro rice	0.16	24.6	0.24	11.1	0.31	7.2
Dry Season Irrigated Rice	0.03	4.6	0.06	2.8	0.08	1.9
Wet Season Irrigated Rice	0.04	6.2	0.10	4.6	0.12	2.7
Upland Rice	0.02	3.1	0.05	2.3	0.08	1.9
Total	0.65	100.0	2.17	100.0	4.30	100.0

Source: Survey data.

[a]Figures in parenthesis show the number of households in each size group. Households were divided by taking medium farmers to include all those whose holdings were within puls or minus one standard deviation of the mean holding of the total sample.

[b]Less than 0.005 hectares.

land area were 33.8%, 31.3%, and 23.7%, respectively. Similarly, the average areas devoted to rice per dabada were 0.25, 0.73, and 1.05 hectares and the corresponding percentages were 38.5%, 31.9%, and 24.4% for the small, medium, and large farmers, respectively.

The total average area cultivated per person was 0.11 hectares for small farmers, 0.21 hectares for medium farmers, and 0.57 hectares for large farmers. The area devoted to food crops per person was 0.08 hectares, 0.13 hectares, and 0.27 hectares for the small, medium, and large farmers, respectively. The total area cultivated per adult family member was 0.17, 0.32, and 0.80 hectares for small, medium, and large farmers, respectively.

Labor

Family size and composition. A breakdown of the size of labor force by type, sex, and age for each size category is shown in Table 5.19. The medium farmers had the highest number of persons with an average of 10.3 per dabada. Small and large farmers had an average of 6.0 and 7.6 persons per dabada, respectively. In all cases the number of females was either equal to or larger than males. The percentage of the adult population, 16 to 60 years old was 42.4%, 66.0%, and 68.4% for the small, medium, and large farmers, respectively. Small farmers had no stranger farmers. The average number of strange farmers for the medium and large farmers was 0.3 and 0.2, respectively.

Work on the farm. Tables 5.20, 5.21, and 5.22 show a breakdown of the labor input on the farm by type of labor, sex, age, and

TABLE 5.19.--Average Number of Persons per Household (Dabada) by Type of Labor and by Land Size Holding

Type of Labor		Small (14)[a]	Medium (64)[a]	Large (12)[a]
Males	16-60 years	1.9	3.0	2.5
	10-15 years	0.6	1.7	0.8
	0-9 years	0.3	0.0	0.5
	Total Males	2.8	4.7	3.8
Females	Over 60 years	--	0.3	0.0[b]
	16-60 years	1.9	3.8	2.7
	10-15 years	0.6	0.6	0.3
	0-9 years	0.7	0.9	0.8
	Total females	3.2	5.6	3.8
Total Family		6.0	10.3	7.6
Strange Farmers		--	0.3	0.2

Source: Survey data.

[a]Numbers in parenthesis show number of households.

[b]Less than 0.05.

TABLE 5.20.--Average Distribution of Labor Input per Household (Dabada) by Type of Labor and Crop Enterprise--Small Farmers (in Workdays)

Type of Labor	Groundnut	Maize	Sorghum	Early Millet	Late Millet	Findo	Cotton	Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice		Totals	
											Dry	Wet	Amount	Percent[a]
Family														
a. Males 16-60 years	37.8	13.3	4.4	--	14.4	--	--	3.3	5.1	--	10.3	21.0	109.6	52.2
10-15 years	2.3	0.5	0.9	--	0.4	--	--	--	0.1	--	--	0.4	4.6	2.2
0-9 years	--	0.3	--	--	--	--	--	--	--	--	--	0.1	0.4	0.2
Total Males	40.1	14.1	5.3	--	14.8	--	--	3.3	5.2	--	10.3	21.5	114.6	54.6
b. Females 16-60 years	0.5	0.1	--	--	0.3	--	--	5.0	53.6	--	3.6	9.3	72.4	34.5
10-15 years	0.1	0.2	--	--	--	--	--	0.3	0.2	--	--	1.4	2.2	1.0
0-9 years	--	0.1	--	--	--	--	--	--	--	--	--	0.1	0.2	0.1
Over 60 years	0.0[c]	--	--	--	--	--	--	--	--	--	--	--	0.0	0.0
Total Females	0.6	0.4	--	--	0.3	--	--	5.3	53.8	--	3.6	10.8	74.8	35.6
c. Other Family	1.2	0.2	--	--	2.9	--	--	--	--	--	6.3	3.0	13.6	6.5
Total Family Labor Input	41.9	14.7	5.3	--	18.0	--	--	8.6	59.0	--	20.2	35.3	203.0	96.7
Strange Farmer (Males)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hired Labor:														
Exchange Males	0.6	0.5	--	--	--	--	--	--	0.2	--	--	--	1.3	0.6
Exchange Females	--	--	--	--	--	--	--	0.1	--	--	0.8	0.5	1.4	0.7
Contract Males	0.2	--	--	--	0.9	--	--	0.2	1.4	--	1.0	0.5	4.2	2.0
Contract Females	--	--	--	--	--	--	--	--	0.0	--	--	--	0.0	0.0
Total Hired Labor	0.8	0.5	--	--	0.9	--	--	0.3	1.6	--	1.8	1.0	6.9	3.3
Total Labor Input	42.7	15.2	5.3	--	18.9	--	--	8.9	60.6	--	22.0	36.3	209.9	100.0
Percent of Total[b]	20.3	7.2	2.5	--	9.0	--	--	4.3	28.9	--	10.5	17.3	100.0	--

Source: Survey Data

[a]Shows percent of total labor input contributed by each type of labor.

[b]Shows percent of total labor devoted to each crop

[c]Figures entered as 0.0 are less than 0.05.

TABLE 5.21.--Average Distribution of Labor Input per Household (Dabada) by Type of Labor and Crop Enterprise--Medium Farmers (in Workdays)

Type of Labor		Groundnut	Maize	Sorghum	Early Millet	Late Millet	Findo	Cotton	Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice		Totals	
												Dry	Wet	Amount	Percent[a]
Family															
a. Males	16-60 years	72.0	12.9	8.9	24.0	4.8	--	2.4	0.3	7.2	3.4	4.8	3.4	144.1	39.8
	10-15 years	7.7	1.2	1.6	4.7	0.2	--	0.1	0.0[c]	0.2	0.5	0.3	3.4	19.9	5.5
	0-9 years	0.3	0.0	--	0.7	0.1	--	--	--	0.0	0.1	--	0.1	1.3	0.3
	Total Males	80.0	14.1	10.5	29.4	5.1	--	2.5	0.3	7.4	4.0	5.1	6.9	165.3	45.6
b. Females	16-60 years	2.9	1.4	0.9	0.6	0.0	0.3	0.3	8.0	66.6	57.4	9.2	13.8	161.4	44.5
	10-15 years	0.6	0.1	--	0.1	0.0	--	0.1	0.0	0.5	1.1	0.0	0.5	3.0	0.8
	0-9 years	0.1	0.0	--	0.0	--	--	--	--	0.0	0.1	--	0.0	0.2	0.1
	Over 60 years	0.0	0.0	--	--	--	--	--	--	0.0	0.1	--	--	0.1	0.0
	Total Females	3.6	1.5	0.9	0.7	0.0	0.3	0.4	8.0	67.1	58.7	9.2	14.3	164.7	45.4
c. Other Family		0.7	0.2	0.4	0.3	0.4	--	0.0	--	--	--	0.0	0.0	2.0	0.6
Total Family Labor Input		84.3	15.8	11.8	30.4	5.5	0.3	2.9	8.3	74.5	62.7	14.3	21.2	332.0	91.6
Strange Farmer (Males)		4.4	1.3	1.7	1.2	0.6	--	2.3	0.0	0.8	0.0	1.4	0.0	13.7	3.8
Hired Labor:															
Exchange Males		2.1	0.2	0.3	0.2	0.1	--	0.3	--	0.2	0.3	0.4	0.0	4.1	1.2
Exchange Females		0.1	--	0.0	--	--	--	--	0.1	1.3	2.1	0.6	0.3	4.5	1.2
Contract Males		2.0	0.3	0.1	0.1	0.1	--	0.3	0.0	2.5	0.3	0.6	0.2	6.5	1.8
Contract Females		--	0.0	--	0.0	--	--	--	0.0	0.8	0.6	0.0	0.2	1.6	0.4
Total Hired Labor		4.2	0.5	0.4	0.3	0.2	--	0.6	0.1	4.8	3.3	1.6	0.7	16.7	4.6
Total Labor Input		92.9	17.6	13.9	31.9	6.3	0.3	5.8	8.4	80.1	66.0	17.3	21.9	362.4	100.0
Percent of Total[b]		25.6	4.9	3.8	8.8	1.7	0.1	1.6	2.3	22.1	18.2	4.8	6.1	100.0	--

Source: Survey Data

[a]Shows percent of total labor input by each type of labor.

[b]Shows percent of total labor devoted to each crop.

[c]Figures entered as 0.0 are less than 0.05.

TABLE 5.22.--Average Distribution of Labor Input per Household (Dabada) by Type of Labor and Crop Enterprise--Large Faremrs (in Workdays)

Type of Labor		Groundnut	Maize	Sorghum	Early Millet	Late Millet	Findo	Cotton	Upland Rice	Bafaro Rice	Mangrove Rice	Irrigated Rice		Totals	
												Dry	Wet	Amount	Percent[a]
Family															
a. Males	16-60 years	129.3	9.7	7.2	43.6	0.1	--	--	0.7	0.7	14.8	1.3	3.1	210.5	34.6
	10-15 years	16.6	2.0	--	4.4	0.0[c]	--	--	--	--	4.0	--	--	27.0	4.4
	0-9 years	2.1	0.3	--	0.0	--	--	--	--	--	1.2	--	--	3.6	0.7
	Total Males	148.0	12.0	7.2	48.0	0.1	--	--	0.7	0.7	20.0	1.3	3.1	241.1	39.7
b. Females	16-60 years	13.2	3.0	2.6	--	--	--	--	15.2	44.5	192.7	12.5	22.2	305.9	50.3
	10-15 years	0.4	--	--	0.4	--	--	--	--	--	2.5	--	0.3	3.6	0.6
	0-9 years	--	--	--	--	--	--	--	--	--	0.3	--	--	0.3	0.0
	Over 60 years	0.1	0.1	--	--	--	--	--	--	--	0.2		--	0.4	0.1
	Total Females	13.7	3.1	2.6	0.4	--	--	--	15.2	44.5	195.7	12.5	22.5	310.2	51.0
c. Other Family		--	--	--	--	--	--	--	--	--	0.2	--	--	0.2	0.0
Total Family Labor Input		161.7	15.1	9.8	48.4	0.1	--	--	15.9	45.2	215.9	13.8	25.6	551.5	90.7
Strange Farmer (Males)		6.3	4.5	--	1.3	1.0	--	--	--	21.3	0.3	--	3.6	38.3	6.3
Hired Labor:															
Exchange Males		1.5	0.4	0.0	0.7	--	--	--	--	3.0	2.0	--	--	7.6	1.3
Exchange Females		--	--	--	--	--	--	--	0.1	5.8	0.1	1.2	0.8	8.0	1.3
Contract Males		2.6	--	--	--	--	--	--	--	--	--	--	0.0	2.6	0.4
Contract Females		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Hired Labor		4.1	0.4	0.0	0.7	--	--	--	0.1	8.8	2.1	1.2	0.8	18.2	3.0
Total Labor Input		172.1	20.0	9.8	50.4	1.1	--	--	16.0	75.3	218.3	15.0	30.0	608.0	100.0
Percent of Total[b]		28.3	3.3	1.6	8.3	0.2	--	--	2.6	12.4	35.9	2.5	4.9	100.0	

Source: Survey Data

[a]Shows percent of total labor input by each type of labor.

[b]Shows percent of total labor devoted to each crop.

[c]Figures entered as 0.0 are less than 0.05.

crop enterprise for the small, medium, and large farmers, respectively. Total labor input per dabada on the crop enterprises was 209.9 work days for the small farmers, 362.4 work days for the medium farmers, and 608.0 work days for the large farmers. This is equivalent to labor inputs per hectare of 322.9, 167.0, and 141.4 work days, respectively. This shows a decline in labor input per hectare as the size of land holding increases and is consistent with findings by Norman (1973) and Kamuanga (1983).

The percentage of labor contributed by family members declined from 96.7% for small farmers to 91.6% for medium farmers to 90.7% for large farmers. The results are consistent with expectations because the area cultivated per adult increased with an increase in the size of land holding. Small farmers were able to supply most of their farm labor demands from their family labor source, while larger farmers had to employ nonfamily labor in order to satisfy the total farm labor demand especially in the peak season. Strange farmers contributed 3.8% and 6.3% of the total crop labor input in the medium and large farms, respectively. Other nonfamily labor contributed 3.3%, 4.6%, and 3.0% of the total crop labor input in the small, medium, and large farmers, respectively.

Of the total labor input on crops, family males contributed 54.6%, 45.6%, and 39.7% in the small, medium, and large farmers, respectively. Family females, on the other hand, contributed 35.6%, 45.4%, and 51.0%, respectively. Children fifteen years and below accounted for 3.5%, 6.7%, and 5.7% of the labor input on crops in the small, medium, and large farmers, respectively. Labor input per adult male in the crop enterprises was 57.8, 48.0, and 84.2 work days, while female adults labor input was 38.1, 42.5, and 113.3 work days for the small, medium, and large farmers, respectively. Both the relative contribution and absolute amount of labor input tend to indicate that female labor on the farm crops becomes increasingly important as the size of land holding increases. This implies that land extensive development technologies, which encourage the expansion of land area cultivated may lead to adverse effects on women in The Gambia as their work loads are increased.

The percentage of labor contributed by family females on upland crops increased with an increase in the size of land area cultivated whereas the percentage of labor contributed by family males on the rice enterprises decreased with an increase in the size of land area cultivated. Family females contributed 1.6%, 4.4%, and 7.8% of the labor input on upland crops while family males contributed 31.5%, 12.2%, and 7.3% of the labor input on the rice enterprises for the small, medium, and large farmers, respectively. Family female's labor input on the cash crops alone was 0.7%, 2.4%, and 5.4% of the total labor input on upland crops. Thus, as the land area cultivated increases and as the emphasis shifts to commercial agriculture, women increase their participation in upland crop production. At the same time, male participation on rice cultivation is decreased.

Small farmers devoted 20.3% of their total crop labor input on groundnuts, 18.7% on upland cereals,and 61.0% on rice. Medium farmers devoted 25.6% of their labor on groundnut, 19.3% on upland cereals, and 53.5% on rice. The corresponding percentages for the large farmers were 28.3%, 13.4%, and 58.3%, respectively. The labor distribution on these crop categories was similar for all three size groups. However, small farmers devoted a greater percentage, 79.7% on food crop production than did medium farmers with 72.8% and large farmers with 71.7%.

Total labor input. A summary of the total labor input by type of labor, sex, and major type of activity is shown in Table 5.23. Total labor input per dabada was estimated at 410.7 work days for small farmers, 509.7 work days for medium farmers, and 809.4 work days for large farmers. The percentage of total labor devoted to crops increased with an increase in the size of land holding while that devoted to off-farm activities decreased with an increase in size of land holding. The percentages of labor input in the farm were 55.3%, 74.7%, and 79.6% and that on off-farm activities was 44.7%, 25.3%, and 20.4% for small, medium, and large farmers, respectively. Of the total labor input on off-farm activities, small farmers devoted 8.7% of it on remunerative activities, while medium and large farmers devoted 6.2% and 2.4% of it on remunerative activities. Two conclusions are apparent from the above figures. The first is that as the size of land holding increases, farmers devote more of their time on farm activities than on off-farm activities. This is because the increased land size requires more labor for cultivation. The second is that as the land size holding increases, farmers devote less of their off-farm

TABLE 5.23.--Distribution of Labor Input per Household (Dabada) by Type of Labor, Major Activity, and Size of Land Holding (in Workdays)

Type of Labor		Small				Medium				Large			
		Crops	General Farm	Off-Farm	Total	Crops	General Farm	Off-Farm	Total	Crops	General Farm	Off-Farm	Total
Family													
a. Males	16-60 years	109.6	8.4	104.1	222.1	144.1	10.0	95.7	249.8	210.5	32.7	95.6	338.8
	10-15 years	4.6	0.3	--	4.9	19.9	0.9	1.1	21.9	27.0	0.3	4.9	32.2
	0-9 years	0.4	--	--	0.4	1.3	--	--	1.3	3.6	--	--	3.6
	Total Males	114.6	8.7	104.1	227.4	165.3	10.9	96.8	273.0	241.1	33.0	100.5	374.6
b. Females	16-60 years	72.4	6.9	79.5	158.8	161.4	6.4	31.7	199.5	305.9	3.0	60.3	369.2
	10-15 years	2.2	--	--	2.2	3.0	0.0	0.4	3.4	3.6	--	4.6	8.2
	0-9 years	0.2	--	--	0.2	0.2	--	--	0.2	0.3	--	--	0.3
	Over 60 years	0.0[a]	--	--	0.0	0.1	0.0	--	0.1	0.4	--	--	0.4
	Total Females	74.8	6.9	79.5	161.2	164.7	6.4	32.1	203.2	310.2	3.0	64.9	378.1
c. Other Family		13.6	1.3	--	14.9	2.0	0.1	--	2.1	0.2	--	--	0.2
Total Family Labor		203.0	16.9	183.6	403.5	332.0	17.4	128.9	478.3	551.5	36.0	165.4	752.9
Strange Farmer		--	--	--	--	13.7	0.8	--	14.5	38.3	--	--	38.3
Hired Labor													
Exchange Males		1.3	--	--	1.3	4.1	0.1	--	4.2	7.6	--	--	7.6
Exchange Females		1.4	--	--	1.4	4.5	--	--	4.5	8.0	--	--	8.0
Contract Males		4.2	0.3	--	4.5	6.5	0.1	--	6.6	2.6	--	--	2.6
Contract Females		0.0	--	--	0.0	1.6	--	--	1.6	--	--	--	--
Total Hired Labor		6.9	0.3	--	7.2	16.7	0.2	--	16.9	18.2	--	--	18.2
Total Labor Input		209.0	17.2	183.6	410.7	362.4	18.4	128.9	509.7	608.0	36.0	165.4	809.4
Percent of Total		51.1	4.2	44.7	100.0	71.1	3.6	25.3	100.0	75.1	4.4	20.4	100.0

Source: Survey Data

[a]Figures entered as 0.0 are less than 0.05.

activity time on remunerative activities. This may be due to the fact that large farmers are able to acquire most of their subsistence needs from the farm, while small farmers must take income earning off-farm employment to supplement their farm earnings.

Total family labor input accounted for about 98.2%, 93.8%, and 93.0% of the total labor input in small, medium, and large farmers, respectively. The rest was contributed by strange farmers and other nonfamily labor.

In all size groups men contributed a greater percentage of the labor in general and off-farm activities than did women. More than anything else, the low rate of women participation in nonfarm activities may be due to the traditional seclusion of women in Muslim societies, although in The Gambia this seclusion is not very rigid, plus the fact that household activities which are the domain of women were not included in this analysis. Total labor input per adult family male was 116.9, 83.3, and 135.5 work days, while the total labor input per adult family female was 83.6, 52.5, and 136.7 work days for the small, medium, and large farmers, respectively. In general, labor input per adult was highest in the large farmers and lowest in the medium farmers. Male labor input was higher than that of females in the small and medium farmers, but was about equal in the large farmers.

Seasonality of labor. Figures 5.5, 5.6, and 5.7 depict the histograms for the total monthly labor input per dabada for the small, medium, and large farmers, respectively. All three size groups

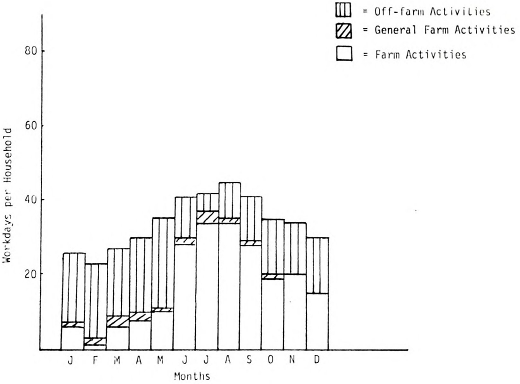

Figure 5.5--Monthly Labor Profile per Household(Dabada) of Small Farmers.

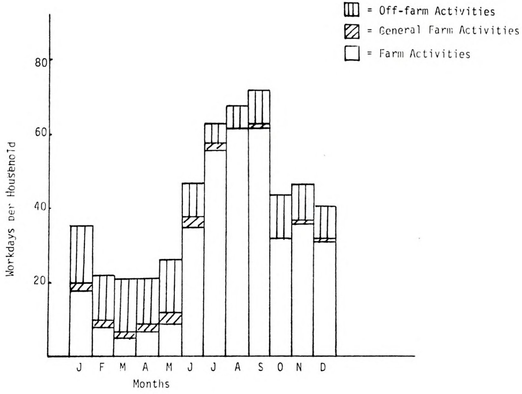

Figure 5.6--Monthly Labor Profile per Household(<u>Dabada</u>) of Medium Farmers.

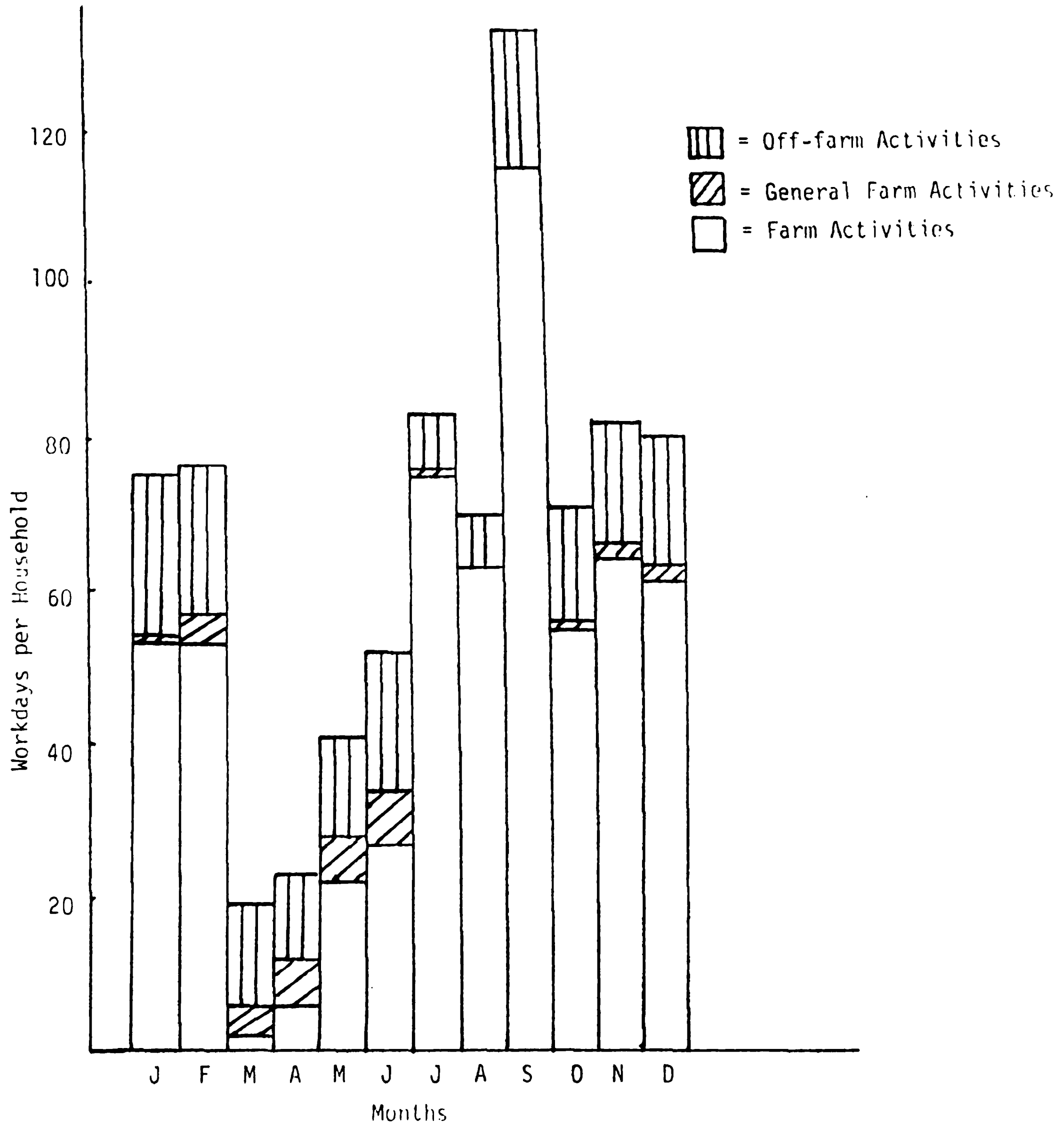

Figure 5.7--Monthly Labor Profile per Household(Dabada) of Large Farmers.

show a peak in monthly labor demand in either August or September. The highest total monthly labor demand for small farmers was in the month of August which accounted for about 11% of the total labor demand. For medium and large farmers, the month of September had the highest monthly labor demand accounting for about 14.1% and 16.4% of the total labor demand, respectively. The months of August in small farmer and September in medium and large farmers coincide with periods of intensive weeding of upland crops and transplanting of rice, respectively.

The coefficient of variation about the mean monthly demand for the farm activities was 61.0%, 66.0%, and 55.0% for the small, medium, and large farmers, respectively. The corresponding coefficients of variation about the mean monthly total labor demand was 21.0%, 43.0%, and 45.0%, respectively. There appeared to be no relationship between the size of land holding and the seasonality of labor in farm activities. However, variation in total labor input increased with an increase in size of land holding. Labor input in off-farm activities was carried out in a manner that tended to even out the total monthly labor fluctuations. This is evident in the lower coefficients of variation for the total labor input than the farm labor input.

The labor equation. The amount of labor surplus and deficit, notwithstanding reservations made earlier, can be estimated from the potential labor supply and the total labor demand. Assuming a 22-day work week, the potential adult monthly labor supply in small, medium, and large farmers was 83.6 work days, 149.6 work days, and 114.4

work days per dabada, respectively. The total monthly labor demand for small and medium farmers were all below the potential monthly labor supply for all months.[14] The highest total monthly labor demands for small and medium farmers were in the months of August and September which had total demands of 45 and 72 workdays, respectively.

For large farmers the month of September had a total labor demand of 133 workdays or 18.6 workdays above the potential family labor supply. Even when the potential monthly supply of strange farmers was included, the September deficit was 14.2 workdays. Off-farm activities were estimated at 16 workdays for this month and total nonfamily labor employed was 18.2 workdays. This means that about 78.0% of the hired labor was employed in the month of September.

Farm Equipment

The distribution of capital equipment by type and size group is shown in Table 5.24. For all types of equipment and draft animals, the average number owned per dabada increased with an increase in the size of land holding. Opening values for farm equipment were D47, D134, and D204 for small, medium, and large farmers, respectively. The corresponding values for draft animals were D86, D269, and D604 per dabada, respectively.

Animal traction was used for an average total of 14 hours in small farmers' fields, 45 hours in medium farmers fields, and 126 hours in large farmers fields.

[14] See Appendix B-2 for a monthly breakdown of the observed monthly labor demand.

TABLE 5.24.--Average Number of Ox-drawn Equipment/Animals Owned per Household (*Dabada*) by Size of Land Holding

Equipment/Animal	Small (14)[a]	Medium (64)[a]	Large (12)[a]
Seeder (with plates)	0.21	0.70	1.17
Mouldboard plow	0.14	0.45	0.50
Cart	--	0.19	0.67
Weeding tines	0.21	0.38	0.42
Bulls	0.07	0.13	0.33
Donkeys	0.29	0.59	0.75
Horses	--	0.13	0.33

Source: Survey data.

[a]Figures in parenthesis show the number of households in each size group.

Farm Income Analysis

Value of Output

The average budget per dabada for the different size groups is shown in Table 5.25. A breakdown of the sources of farm income, relative income contributed, percent of land and labor used in each crop for each size category is shown in Table 5.26. The total value of farm products or the gross farm income per dabada was D590.59 for small farmers, D1627.19 for medium farmers, and D3964.30 for large farmers. This is equivalent to a gross farm income per person of D98.43, D157.98, and D521.62 or D908.60, D749.86, and D921.93 per hectare of land, respectively.

The gross income per unit of farm labor devoted to crops was D2.60, D4.27, and D6.16 for small, medium, and large farmers, respectively. Both gross farm income per person and gross farm income per unit of labor increased with an increase in the size of land holding.

The percentage of income derived from groundnuts increased with an increase in the size of land holding while the percentage of income derived from food crops decreased with an increase in the size of land holding. Income from groundnuts was 23.7% of the total gross farm income for small farmers, 36.6% for medium farmers, and 55.9% for large farmers, while income derived from upland cereals was 18.6%, 19.8%, and 12.7% and that from rice was 57.7%, 41.3%, and 31.4% of the total gross farm income, respectively. Although the relative income from food crops decreased with an increase in the size of land holding, the absolute amount per person increased with an increase in the

TABLE 5.25.--Average Household (Dabada) Farm Budget by Size of Land Holding

		Small	Medium	Large
General Data				
a.	Average land holding	0.65	2.17	4.30
b.	Average family size			
	Male	2.8	4.7	3.8
	Female	3.2	5.6	3.8
	Total	6.0	10.3	7.6
c.	Active family member	5.0	9.1	6.3
	(10-60 years)	--	0.3	0.2
d.	Strange farmers	12	45	126
e.	Hours of animal/ ox-equipment input	14	64	12
f.	Number of households (Dabada)			
Income and Expenditure		(Dalasis)	(Dalasis)	(Dalasis)
a.	Value of farm output	590.59	1627.19	3964.30
b.	Operating expenses			
	Labor	15.46	30.64	22.85
	Seeds	29.03	62.88	118.92
	Fertilizer	1.66	3.45	23.11
	Animal/ox-equipment	1.60	1.99	1.36
	Irrigation/plowing	19.88	45.44	56.80
	Total Operating Expenses	67.63	144.40	223.04
c.	Gross Margin	522.96	1482.79	3741.26
d.	Fixed Costs			
	Depreciation			
	Animals	4.00	18.00	33.00
	Ox-equipment	8.00	14.00	24.00
	Other hand tools	2.63	2.80	4.49
	Strange Farmer	--	36.00	24.00
	Total Fixed Costs	14.63	70.86	85.49
e.	Total Costs	82.26	215.26	308.53
f.	Net Farm Income	508.33	141.93	3655.77
g.	Off-farm Earnings	45.36	55.64	27.66
h.	Net Family Income	553.69	1467.57	3683.43

Source: Survey Data.

TABLE 5.26.--Sources of Farm Income and Percentage Land and Labor Used for Each Crop by Size of Land Holding [per Household (Dabada)]

	Small				Medium				Large			
	Source of Farm Income				Source of Farm Income				Source of Farm Income			
	Amount (D)	%	% Land	% Labor	Amount (D)	%	% Land	% Labor	Amount (D)	%	% Land	% Labor
Groundnut	140.00	23.7	27.7	20.3	595.96	36.6	35.9	25.6	2215.00	55.9	51.9	28.3
Maize	67.13	11.4	16.9	7.2	107.80	6.6	9.2	4.9	141.12	3.6	5.3	3.3
Sorghum	8.82	1.5	3.1	2.5	72.03	4.4	7.8	3.8	98.00	2.5	4.2	1.6
Early (suno) Millet	--	--	--	--	107.31	6.6	11.1	8.8	249.90	6.2	13.0	8.3
Late (sanyo) Millet	33.81	5.7	13.8	9.0	33.81	2.1	3.2	1.7	15.19	0.4	1.2	0.2
Findo (Digitaria)	--	--	--	--	0.98	0.1	0.0	0.1	--	--	--	--
Total Upland Cereals	109.76	18.6	33.8	18.7	321.93	19.8	31.3	19.3	504.21	12.7	23.7	13.4
Upland Rice	41.11	7.0	3.1	4.3	14.79	0.9	2.3	2.3	64.24	1.6	1.9	2.6
Bafaro Rice	202.20	34.2	24.6	28.9	213.18	13.1	11.1	22.1	388.65	9.8	7.2	12.4
Mangrove Rice	--	--	--	--	216.24	13.8	11.1	18.2	622.05	15.7	10.7	35.9
Dry Season Irrigated	17.14	2.9	4.6	10.5	111.18	6.8	2.8	4.8	20.20	0.5	1.9	2.5
Wet Season Irrigated	80.38	13.6	6.2	17.3	116.28	7.2	4.6	6.1	149.95	3.8	2.7	4.9
Total Rice	340.83	57.7	38.5	61.0	671.67	41.3	31.9	53.5	1245.09	31.4	24.4	58.3
Cotton	--	--	--	--	37.63	2.3	0.9	1.6	--	--	--	--
TOTALS	590.59	100.0	100.0	100.0	1627.19	100.0	100.0	100.0	3964.30	100.0	100.0	100.0

Source: Survey Data.

size of land holding from D75.10 for small farmers to D96.47 for medium farmers to D230.17 for large farmers. In terms of food self-sufficiency this indicates that large farmers are in a better position to meet their food requirements from the farm than do medium and small farmers.

Bafaro rice was the highest income earner for small farmers, while groundnut was the highest income earner for medium and large farmers.

The percentages of both land and labor devoted to groundnut increased with an increase in size, whereas the percentage of land and labor devoted to both upland cereals and rice decreased with an increase in the size of land holding. These results suggest that small farmers give a higher priority to the satisfaction of their subsistence needs in terms of food than to the cultivation of commercial crops. As farmers accumulate capital and are able to increase their size of land holding, the emphasis tends to shift to commercial agriculture while maintaining a higher subsistence level of living.

Operating Costs and Gross Income

Total variable costs per dabada for small, medium, and large farmers was D67.63, D144.40, and D233.04, respectively. Seeds were the single highest cost item in all size categories, accounting for 42.9% in small farmers, 43.5% in medium farmers, and 53.5% in large farmers. Irrigation and plowing were the next highest cost item contributing about 29.4%, 31.5%, and 25.5% to the operating costs of small, medium, and large farmers, respectively. The operating ratio which relates operating costs to the gross income was 0.11, 0.09, and 0.06 for small, medium, and large farmers, respectively.

The gross margins per dabada was estimated at D522.96, D1,482.79, and D3,741.26 or D87.16, D143.96, and D492.27 per person for small, medium, and large farmers, respectively. This is equivalent to a gross margin per hectare of D804.55, D683.31, and D870.06, respectively. Gross margin per unit of farm labor input was D2.30, D3.89, and D5.81 for small, medium, and large farmers, respectively.

Fixed Costs

Fixed costs include depreciation for equipment, draft animals, other hand tools, and an estimated cost for strange farmers. These costs amounted to D14.63 for small farmers, D70.86 for medium farmers, and D85.49 for large farmers. The corresponding fixed ratios were 0.02, 0.04, and 0.02, respectively.

Total Costs

The sum of the operating costs and fixed costs were D82.26, D215.26, and D308.53 per dabada for the small, medium, and large farmers, respectively. The gross ratios, which relate the total costs to the gross incomes and are the sums of the operating ratios and fixed ratios, were equal to 0.14, 0.13, and 0.08 for the small, medium, and large farmers, respectively. This means that small farmers spent more than medium and large farmers for each dalasis of income generated, while large farmers spent the least for each dalasis of gross income generated.

Net Farm Income

Net farm income per dabada was highest for large farmers with an average of D3,655.77 and lowest for small farmers with an average of D508.33. Medium farmers had a net farm income of D1,411.93. Net farm incomes were equal to net farm earnings because no interest was paid on capital.

Net farm earnings per person was D84.72, D137.08, and D481.02 for the small, medium, and large farmers, respectively, or D782.05, D650.66, and D856.61 per hectare of land, respectively. Net farm earnings per unit of family labor input on the farm was D2.31, D4.04, and D6.22 for the small, medium, and large farmers, respectively. Large farmers had the highest net farm earnings per unit of land and labor input.

Return to Family Labor and Management

Assuming a 15% interest charge on capital and an opportunity cost on irrigated land of D400.00 per hectare, the net return to family labor and management was D467.99, D1,315.64, and D3,529.49 per dabada for small, medium, and large farmers, respectively. This is equal to D2.13, D3.96, and D6.01 per workday of family labor input on the farm, respectively.

Net Family Earnings

Net family earnings is the sum of net farm earnings plus off-farm earnings. Off-farm earnings per dabada amounted to D45.36, D55.64, and D27.66 for the small, medium, and large farmers,

respectively. This is equal to 7.1%, 3.3%, and 0.7% of the total gross income, respectively. Thus, there is a lesser reliance on off-farm income as the size of land holding increases. Total net family earnings were equal to D553.69, D1,467.57, and D3,683.43 per dabada for small, medium, and large farmers, respectively. This means that the total estimated disposable income available for all purpose use per person was D92.28 for small farmers, D142.48 for medium farmers, and D484.66 for large farmers. Net family earnings per person for large farmers was about five times that for small farmers and about three times that for medium farmers. These results agree with findings in Northern Nigeria by Norman (1973) who reports that large farmers earn more than twice as much as small farmers and that small farmers' reliance on off-farm income is much higher.

Since incomes are low, small farmers are unable to save and accumulate capital. This limits their ability to overcome adverse circumstances and may result in a conservative attitude to change (Norman, 1973).

If all the net family earnings per person were to be spent on purchasing rice, then net family earnings in milled rice equivalent would be about 117 kilograms for small farmers, 180 kilograms for medium farmers, and 613 kilograms for large farmers. Assuming that all calorie intake is satisfied from rice, then net family earnings per person for small and medium farmers cannot purchase the minimum 182.5 kilograms of cereals required. In contrast, large farmers would have to spend only about 30% of their income on rice to achieve this minimum.

To summarize, an analysis of the sample by size of land holding revealed that farm female labor becomes increasingly important as the size of land holding increases. Small farmers devoted most of their land and labor on food crops cultivation while larger farmers devoted a lesser proportion of their land and labor on food crops. Despite this, the results show that large farmers are in a better position to meet their food requirements from the farm than do small and medium farmers.

The farm income analysis showed a high disparity of income between small, medium, and large farmers. Large farmers net family earnings per person were more than three times that of medium farmers and more than five times that of small farmers. The proportion of total gross income derived from off-farm employment was higher in small farmers than in medium and large farmers.

Summary

The main objective of this chapter was to describe and discuss the organization of farm production and resource use among Gambian rice farmers. On the average the groundnut crop was the main income earner for the dabada accounting for about 44% of the total average gross farm income and utilizing about 39% of the total land area. Rice contributed less to total income than did groundnuts but used more than half of the total labor and about one-third of the total land area cultivated by the dabada. Labor input on the crop enterprises between adult males and females was about equal but men contributed more of the labor in general and off-farm activities than did females.

For the whole sample population average net family earnings per capita was D208.37 ($94.71). Farmers would have to spend about 69% of their income on rice in order to meet the minimum daily calorie intake of 1750 if all calorie requirements were to be satisfied from rice. The contribution of upland cereals and rice to gross income per dabada was only 54.6% or D124.37 per person. This shows that on the average, farmers cannot meet their minimum calorie requirements from cereals produced on the farm alone. They may have to depend on outside sources to supplement what is produced on the farm.

A division of the sample population into regions revealed a tendency for each region to specialize on one cereal crop. Specialization is moving toward early (suno) millet in the mangrove rice region, maize in the bafaro rice region, and sorghum in the irrigated rice region. The average adult woman in the bafaro region worked more than the average man on the crop activities. In the irrigated rice region, the average man labor input on the farm was higher than that of the average women and in the mangrove region they were about equal.

Total net farm earnings per workday of family labor were highest in the bafaro rice region and lowest in the irrigated rice region. Net family earnings per person was D214.80, D230.38, and D185.63 for the mangrove, bafaro, and irrigated rice regions, respectively. To be able to consume a minimum of 182.5 kilograms of rice, farmers would have to spend about 69.1%, 62.5%, and 77.7% of their net family earnings on rice in the mangrove, bafaro, and irrigated rice regions, respectively. The gross income from upland cereals and rice was D106.49 in the mangrove rice region, D161.02 in the bafaro rice region, and D124.30 in the irrigated rice region. The results show that only the bafaro rice region is likely to meet its cereals requirement from the cereals produced on the farm.

An analysis of the sample population by size of land holding showed that famale labor became increasingly important as the size of land holding increased. Small farmers devoted most of their land and labor on food crops while large farmers devoted a greater percentage of their land and labor on cash crops. Large farmers are in a better position to meet their food needs from the farm than small and medium farmers. The net family earnings per capita in large farmers was about three times as much as that of medium farmers and five times as much as that of small farmers.

CHAPTER VI

SUMMARY, CONCLUSIONS, POLICY IMPOICATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Summary and Conclusions

The Gambia is one of the smallest countries in the African continent. In 1980 it had an estimated population of 603,000. The main physical feature is the river, which is one of the finest water ways in Africa. It serves as an important means of transporting commodities to and from the capital city, Banjul. It is also an important source of irrigation water.

The Gambia's economic structure has not changed very much in recent years. There are still no known commercially exploitable minerals and the only sectors of the economy with any potential for development are agriculture and the tourist sector. In fact, agriculture assumes priority not only because a large percentage of the population derives its living from it but also because the development of agriculture appears to be the safest and most stable avenue for increasing rural income and employment and improving the shortage of foreign exchange. Agriculture accounts for about 28% of the Gross Domestic Product.

Groundnut is by far the most important single cash crop in the country. In addition to being the major source of rural income, it accounts for over 75% of the total export earnings, averaging about 90% in the past seven years. This heavy dependence on one cash crop means that the country's economic prospects are highly unpredictable and tend to fluctuate in sympathy with fluctuations in groundnut incomes.

Subsistence crops in The Gambia include rice, sorghum, millet, maize, and to a limited extent, cassava. Traditionally, sorghum and millet formed the main staple crops, but in recent years, rice has become the most important. In the 1960's domestic rice production increased by 3.3% per annum. But in the 1970's domestic production of rice declined by nearly 2.8% annually. This decline has been experienced despite a concerted effort to increase rice production during those years. Since independence, the government has adopted self-sufficiency of food staples as a national policy goal, but food imports have continued to increase to the extent that today the country imports more than half of its domestic rice consumption.

Despite their importance in the economy, the agricultural sector and the food grain subsector in particular have until recently received very little attention from economists. There is, therefore, a dearth of information to guide policy makers and planners in their quest for food self-sufficiency. This study was aimed at filling part of that gap.

The overall objective of the study was to provide a detailed description of rice production systems in The Gambia and to determine the financial and economic costs and benefits of the different rice production systems. The specific objectives were to:

1. describe the agroclimatic conditions of rice production and the social structure of rice farmers in The Gambia
2. identify and describe the major rice production systems in The Gambia
3. determine and compare the financial and economic costs and benefits of the major rice production systems on a hectare basis
4. estimate the total amount of resources used in rice farming and the farm incomes of rice farmers on a household (dabada) basis and type of predominant rice cultivation system and by size of land area cultivated

The information used in this study formed part of the data collected by the author on the socioeconomics of rice farmers in The Gambia for the West Africa Rice Development Association (WARDA). A two-stage stratified random sampling method was used to obtain a sample of 100 households from ten villages in the central and eastern portions of the country. The final sample used in the analysis contained ninety households. The dabada, an autonomous work group within the larger kordo structure was used as a sampling unit. Data collection was carried out over a one-year period from June 1981 to June 1982.

A financail and economic analysis technique was the major method of analysis employed in this study. Enterprise and farm budgets were prepared and discussed. Both the data collection and data analysis

were facilitated by the use of the FAO's Farm Management Data Collection and Analysis System (FMDCAS).

In the enterprise budgets, input/output coefficients were calculated on a weighted average basis per hectare for each of the enterprises cultivated by the sample population. The results showed that labor was the most important factor of production in Gambia farms. Among the rice enterprises, bafaro rice had the highest demand on labor with about 361 workdays per hectare and upland rice had the lowest demand on labor with about 254 workdays per hectare. Mangrove rice cultivation utilized nearly 326 workdays per hectare. Dry and wet season irrigated rice used almost 331 and 324 workdays per hectare, respectively.

Irrigated rice cultivation is the cornerstone of future rice production expansion in The Gambia. It is envisaged that when the proposed bridge-barrage at Yelitenda is completed by the year 2000, about 24,000 hectares of irrigated land will be developed for double rice cropping. Although technical analysis has established the feasibility of the proposed bridge-barrage, social, economic, and environmental impact analysis have yet to lend credence to that project. The Gambia has yet to learn from its mistakes in the small scale irrigation projects that have so far failed.

Given that The Gambia government is committed and determined to construct the bridge-barrage, then a development of 24,000 hectares of irrigated land for double crop rice production will generate close to 15.72 million workdays of employment in the year 2000. Assuming a 22 days work month, this means that about 59,545 persons per annum will be fully employed in rice cultivation. It is doubtful whether such a demand on labor will be satisfied from households within the irrigated rice cultivation area alone. It is most likely that the labor will be satisfied by migrant workers from within The Gambia and neighboring countries. Such magnitudes of migrants with their attendant health and social problems should be a matter of concern.

Assuming that the potential labor demand is satisfied by Gambians only, then nearly 12,000 dabadalu, each cultivating about two hectares, will be fully employed on irrigated rice cultivation. This is about 16% of the estimated population in 1980.

An expansion of any of the other rice systems by similar magnitudes will generate only about half the amount of employment generated in irrigated rice because only one crop can be produced in a year.

The highest yield per hectare was recorded among the irrigated rice systems and the lowest yield was recorded on the upland rice system. Yields were 1,326, 1,828, 1,880, 2,767, and 2,429 kilograms for the upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. The average area per dabada among those cultivating rice was 0.20, 0.50, 0.68, 0.17, and 0.30 hectares of upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively.

Substantial differences were not recorded for labor use per hectare among the upland crops. The highest labor input per hectare was on late (sanyo) millet with an average of 121 workdays. Sorghum

had the lowest labor input with an average of 91 workdays. Labor input on groundnut, maize, and early (suno) millet was about 119, 116, and 118 workdays per hectare, respectively. Groundnut had an average yield of 1,717 kilograms per hectare. The highest yield among the upland cereals was recorded in maize with an average of 1,013 kilograms per hectare. Sorghum, early (suno) millet and late (sanyo) millet had yields per hectare of 884, 827, and 961 kilograms, respectively.

A discussion of the gender division of labor showed that except for irrigated rice cultivation, there is a distinct, though not rigid, division of labor along crop enterprise lines. Women dominated the cultivation of upland rice, bafaro rice, and mangrove rice where they contributed more than 90%, 88%, and 94% of the total labor, respectively. In irrigated rice cultivation, women contributed approximately 50% and 60% of the total labor in the dry and wet season irrigated rice, respectively. Upland crops are the domain of men. Total labor contribution on groundnuts, maize, sorghum, early (suno) and late (sanyo) millet by men was close to 95%, 89%, 91%, and 93% of the total labor per hectare, respectively. In all the crop enterprices family labor contributed no less than 90% of the total labor per hectare. The implication here is that development programs that are geared toward individual crops are likely to affect the balance between male and female labor input and also the relative economic position of each sex. If the welfare of women, for example, is of primary concern, then programs should be directed toward the development of upland rice, bafaro rice, and mangrove rice. Although such

an approach will improve the economic positions of women, unless labor productivity is improved, it will also lead to women working more hours. Also to be carefully watched is the impact that women's economic independence will have on the traditional family structure.

A financial analysis showed that all systems of rice production had positive net enterprise incomes of about D656, D806, D914, D926, and D848 per hectare of upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. This represented the reward to family labor, land, operating capital, and management. However, the returns per workday to family labor and management were higher than the enterprise wage rate only in upland rice and mangrove rice with returns of D2.55 and D2.81 per workday of family labor, respectively. Bafaro rice, dry and wet season irrigated rice, respectively, showed lower returns than the enterprise wage rates of D2.36, D1.58, and D1.26 per workday of family labor. To make the returns to family labor and management greater than the enterprise wage rate for the bafaro, dry and wet season irrigated rice, it was estimated that yields would have to be increased by at least 337, 1,320, and 1,373 kilograms per hectare, respectively. Alternatively, prices would have to be increased by at least 57% above current levels to make all returns per workday to family labor and management greater than the enterprise wage rates in all the rice enterprises.

The economic analysis with output valued at the import parity price and family labor valued at the enterprise wage rate showed negative net economic returns per ton of paddy of about D161, D264, D158, D479, and D443 for the upland rice, bafaro rice, mangrove rice, dry

and wet season irrigated rice, respectively. If the assumptions made in the analysis are correct, then the results showed that The Gambia had a comparative disadvantage in the cultivation of rice when considered from the national point of view. The output per hectare required to make the net economic returns at least equal to zero were estimated at 1,953, 3,247, 2,655, 6,669, and 5,594 kilograms for the upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. These yield levels are nearly 47%, 78%, 47%, 141%, and 130% above the observed yields, respectively.

Since the economic analyses were so sensitive to the valuation of family labor, a sensitivity analysis was carried out by valuing labor at zero opportunity cost and then at half the enterprise wage rate. At zero opportunity cost for family labor, the net economic benefits per ton of paddy were approximately D314, D267, D312, D-68, and D8 for the upland rice, bafaro rice, mangrove rice, dry and wet season irrigated rice, respectively. When family labor was valued at half the enterprise wage rate, the corresponding net economic benefits per ton of paddy were D77, D1, D77, D-273 and D-218, respectively. This result showed that only upland rice and managrove rice and to a limited extent bafaro rice offered any hope for optimism from the national point of view.

A financial and economic analysis of the upland crops showed that both net enterprise incomes and net economic benefits were positive for all the crops even though family labor was valued at the enterprise wage rates. Net enterprise incomes per hectare were about D751, D423, D357, D365, and D398 for groundnut, maize, sorghum, early (suno) and late (sanyo) millet, respectively. The net economic returns per ton were D576 for groundnut, D156 for maize, D113 for sorghum, D44 for early (suno) millet, and D7 for late (sanyo) millet.

On the whole net enterprise incomes per hectare ranged from nearly D645 to D926 in the rice crops and from D357 to D751 in the upland crops. Net economic returns per ton of output, with family labor valued at the enterprise wage rate ranged from close to minus D479 to minus D158 for the rice crops and from D7 to D576 for the upland crops.

A simple analysis designed to estimate the costs and benefits of achieving a rice consumption rate of 90kg/cap./annum through the expansion of irrigated rice showed that such a policy could lead to substantial economic losses and a reduction of the gross national product by at least D9 million per annum.

A farm income analysis was carried out for a better understanding of the organization of the farm and to determine the sources of income on a household (dabada) basis. For the whole sample population the average land area cultivated was 2.24 hectares. Of this area about 39% was devoted to groundnut production, less than 1% to cotton, and the rest was equally shared between upland cereals and rice production. The average area per adult was 0.43 hectares.

The average family size per dabada was 7.8 people with 3.8 males and 4.0 females. Adults made up nearly 67% of the family size. A breakdown of the labor input in the farm showed that almost 91% of the labor was contributed by the family. Strange farmers who averaged 0.2 per household (dabada) contributed nearly 4%, the rest was contributed by other nonfamily labor. The highest labor input per crop was devoted to groundnut which utilized about 26% of the total labor input on crops. Upland cereals used about 18% and rice cultivation used about 55% of the total labor input on crops.

Total labor input on farm and off-farm activities averaged approximately 533 workdays per dabada. Farm activities accounted for 73% of the total labor input and off-farm activities accounted for 27%.

The average adult labor input on crop production was a little over 60 workdays. Female adults averaged 62 workdays and male adults averaged 59 workdays. Average total labor input per adult was 91 workdays, with females averaging 81 workdays and males averaging 102 workdays. This does not include household and livestock activities. There was an inverse relationship between farm labor input and labor input on off-farm activities and estimated leisure time. Farmers reduced labor input on nonremunerative off-farm activities and leisure time as labor demand for farm work increased. The extent to which labor input on off-farm nonremunerative activities and leisure time could be tapped for productive farm work purposes will depend on the marginal returns in agriculture and the marginal disutilities from giving up leisure time and off-farm activities. It is also constrained by the seasonality of labor.

A comparison of the sources of income showed that groundnut was the highest source of income, contributing almost 43% of the total gross income. Upland cereals and rice contributed 17% and 36%, respectively. Income from off-farm activities was very small amounting to less than 3% of the total gross income. The net farm income averaged D1,575 per dabada or D4.39 per unit of family labor input or D703 per hectare. Net family earnings, which are an estimate of the disposable income, were estimated at D1,625 per dabada or D208 ($94) per person. If all calorie requirements were to be satisfied from rice alone, this meant that farmers would have to spend nearly 69% of their income to meet a minimum daily calorie intake of 1,750 calories per capita. On the average this minimum could not be satisfied from the farm grain output.

To study the effect of regional specificity on farm organization and income, the sample was divided into three subsamples corresponding to the mangrove rice region, bafaro rice region, and irrigated rice region. Villages were assigned to this region on the basis of the predominant rice cultivation system in each village. The average area cultivated per dabada was 2.90, 1.96, and 1.91 in the mangrove, bafaro and irrigated rice regions, respectively. The average area cultivated per adult was 0.45 for the mangrove rice region, 0.44 for the bafaro region, and 0.41 for the irrigated rice region. Based on the proportion of area devoted to each upland cereal, there was a tendency for each region to specialize on one upland crop. Specialization in early (suno) millet in the mangrove rice growing area is almost complete as it accounted for about 96% of the area devoted to upland cereals. In the bafaro rice region, the movement is in the direction of specializing in maize cultivation which accounted for 44% of the area under upland cereals. In the irrigated rice region, sorghum accounted for 53%

of the area under upland cereals. If this movement continues, the implication is that development programs designed to improve upland cereals production must be region specific. Concentration on one upland cereal only may lead to one region benefiting to the total exclusion of other regions.

The average labor input per dabada on crop production was approximately 491, 292, and 352 workdays in the mangrove, bafaro, and irrigated rice regions, respectively. The crop labor input per adult was higher in the mangrove rice region with about 67 workdays than the other regions which averaged about 58 workdays each. Female labor input on the crop enterprises was about equal, greater, and lesser than that of males in the mangrove, bafaro, and irrigated rice regions, respectively. Female labor input per adult was almost equal in the mangrove and bafaro rice regions and greater than that of the irrigated rice region by about 44%. Labor input per adult family male was almost equal in the mangrove and irrigated rice regions and greater than that of the bafaro rice region by about 57%.

Family labor in each region contributed more than 90% of the total labor input. The average total labor input per dabada was about 602 workdays, 459, and 565 workdays for the mangrove, bafaro, and irrigated rice regions, respectively. Farm activities accounted for nearly 87%, 65%, and 67% of the total labor input for the mangrove rice region, bafaro rice region, and irrigated rice region, respectively. The total labor input per adult family male was nearly 98, 86, and 138 workdays and that of females was about 72, 98, and 68 workdays for the mangrove, bafaro, and irrigated rice regions, respectively.

Given the proper incentives, a substantial proportion of the labor input in off-farm activities in the bafaro and irrigated rice regions could be diverted to productive agricultural activities.

The bafaro rice region showed a greater seasonality in farm labor input than the other regions, probably because of the lower rainfall.

The budget analysis showed an average net farm income per dabada of approximately D2,106 for the mangrove rice region, D1,344 for the bafaro rice region, and D1,333 for the irrigated rice region. This was equal to net farm earnings per person of D213, D213, and D185 or D726, D686, and D698 per hectare, respectively. Net farm earnings per unit of family labor were highest in the bafaro rice region and lowest in the irrigated rice region. Off-farm earnings in each case were less than 7% of the total gross income. Net family earnings per person were approximately D215 in the mangrove rice region, D230 in the bafaro rice region, and D186 in the irrigated rice region. Households (dabadalu) would have to spend about 69%, 63%, and 78% of their incomes if the minimum daily calorie requirements were to be met from rice consumption alone.

The sample was also divided into three size categories to study the effect of size of land area cultivated on farm organizations and farm incomes. The average area cultivated per dabada was 0.65 hectares for the small farmers, 2.17 hectares for the medium farmers, and 4.30 hectares for the large farmers. Small farmers devoted 28% of their land to groundnut production, 34% to upland cereals, and 38% to rice production. Medium farmers allocated 36% to groundnut

production 31% to upland cereals, and 32% to rice. The corresponding percentages for large farmers was 52%, 24%, and 24%, respectively. The total area cultivated per adult family member was 0.17, 0.32, and 0.80 hectares for the small, medium, and large farmers, respectively.

Total labor input per dabada on the crop enterprises was lowest for the small farmers and highest for the large farmers. There was a decline in labor input per hectare as the sample size increased. Large farmers used a greater percentage of nonfamily labor than did the medium and small farmers.

Labor input per adult male on the crop enterprises was about 58, 48, and 84 workdays and that of females was 38, 43, and 113 workdays in small, medium, and large farmers. Female labor input increased with an increase in size of land holding. The labor distribution on groundnut, upland cereals, and rice was similar in all size categories. However, small farmers devoted a greater percentage, 80%, of their labor to food crop production than did medium farmers with 73% and large farmers with 72%.

The total labor input per dabada of large farmers was almost two times higher than that of small farmers and nearly one and a half times higher than that of medium farmers. The percentage of total labor devoted to farming increased with an increase in the size of land holding. Small farmers devoted a greater proportion of their off-farm activities on remunerative work than did medium and large farmers. Total labor input per adult was about 117, 83, and 136 workdays for the small, medium, and large farmers. There appeared to be no relationship between the size of land holding and the seasonality of farm labor. However, monthly variation in total labor input increased with an increase in the size of land holding. An estimation of the potential labor supply compared to the total labor demand showed that in the month of September large farmers must employ non-family labor to meet total labor demand.

Both the percentage of land and labor devoted to groundnut increased with an increase in the size of land holding and the percentage of land and labor devoted to food crops decreased with an increase in the size of land holding. This suggests that small farmers give a higher priority to food production than to cash crop production. But as farmers accumulate capital and as the size of land cultivated increases, the emphasis tends to shift to commercial agriculture while maintaining a higher subsistence level of living.

In the farm budget analysis the percentage of total gross income obtained from off-farm activities decreased with an increase in the size of land holding. Net farm income per _dabada_ was highest for large farmers with an average of D3,656 and lowest for small farmers with an average of D508. Medium farmers had a _dabada_ net farm income of about D1,412. This was equal to net farm earnings per unit of family labor of D2.31 for small farmers, D4.04 for medium farmers, and D6.22 for large farmers.

Net family earnings for large farmers was more than five times that of small farmers and three times that of medium farmers. Net family earnings per person were equal to about D92, D142, and D485 for the small, medium, and large farmers. If farmers were to

obtain their minimum calorie intake from rice alone, small and medium farmers may not meet their minimum requirements, while large farmers would spend only about 30% of their income to achieve this minimum.

Policy Implications and Recommendations

The major policy issues which need to be addressed by the government of The Gambia are presented in this section. Recommendations based mostly on the results obtained in this study are also made.

Prices and Pricing Policy

The results of the study have shown a positive net enterprise income for all the rice enterprises considered. The net enterprise incomes of all the rice enterprises were generally higher than those of groundnuts and upland cereals. However, because of the high labor input in rice production, the returns to family labor and management in rice production were generally lower than those of groundnut and cereals. Prices for paddy would have to be increased by about 57% above current levels in order to make all returns per workday of family labor and management equal to the enterprise wage rates. Several recent studies on grain production and marketing in The Gambia have argued that the lack of a positive food grain pricing policy is the major obstacle to achieving food self-sufficiency. They, therefore, call for increases in the producer prices of the food grains, especially rice. This study lends support to such recommendations. However, the level to which food grain prices should be increased should be weighed against the economic benefits and political risks involved. For while increases in the price of rice might lead to

increased paddy production, the political problems associated with discontent by the politically powerful urban consumers might mitigate any production responses. Also, consideration has to be given to the effect of higher food grain prices on the real incomes and nutritional status of the urban poor.

In the long run and in terms of overall food self-sufficiency, a policy that will increase the producer price and a marketing strategy that can remove the surplus grain from the farmers should be adopted for all the food grains, including upland cereals. This may prevent the reallocation of resources from upland cereals to groundnut that has been accentuated by the introduction of animal traction.

Output Disposal

Related to agricultural price policy is the question of output disposal. There is currently a lack of an organized output collection and disposal system for rice and other food grains. Although the GPMB is charged with the responsibility of marketing locally produced rice, the profit margin is believed to be so low, if not negative, that there is no incentive for GPMB to actively participate in the collection of domestically produced rice. Even if the consumer price of rice is increased, at the existing world prices, the GPMB will still find it more profitable to deal in imported rice. The collection and disposal of rice at the village level is mostly handled by village traders. Since women are normally not allowed to sell large quantities of rice by their husbands, they are forced to sell to village traders in secret at prices that are about 15 to 25% below the open

market price. To avoid these low prices, it is recommended that a women's cooperative similar to that of men's be organized for the specific purpose of marketing any surplus rice output. This may be better organized at the village level and can also be handled by The Gambia Cooperative Union.

With a positive price policy for all the upland cereals, the collection of surpluses can be integrated with the groundnut marketing season. Farmers can sell their grain at the same time they sell their groundnut.

Women's Role in Rice Production

The study showed that women were undoubtedly the most important sources of labor for rice cultivation. Even though irrigated rice was introduced to men, women provided more than 50% of the total labor input. Both in the interest of achieving rice self-sufficiency and in improving the economic position of women, rice production, at least in the short run, should be considered the domain of women and as such women should be called upon to fully participate in the appraisal, preparation, and implementation of any development program geared toward rice cultivation. Because of the traditional family structure, this does not mean that men's role should be considered secondary; rather, it means that women should now become an integral part of these development programs.

Individual Rice Enterprises

The results of the economic analysis showed that mangrove rice, upland rice, and bafaro rice are more economically profitable

than irrigated rice. However, in the past these systems of rice cultivation have received lesser attention than that given to irrigated rice. It is recommended that policy makers regard mangrove rice, upland rice, and bafaro rice as other potential alternative systems for achieving rice self-sufficiency. Among these three, mangrove rice probably shows a greater potential because of the extensive, yet untapped, mangrove lands in the lower river. Specifically, it is recommended that the government undertake to build extensive causeways on the mangrove swamps to reduce walking time between fields and to and from the village. The bonds of the causeways could be designed in such a way as to achieve some amount of water control on the fields. It is also recommended that farmers cultivating these systems be exposed to the same level of input delivery systems, such as improved seed, supervision, and other facilities that are made available to irrigated rice farmers.

The results have shown that irrigated rice is more expensive to produce than the other systems of rice cultivation. However, because of weather uncertainties and the need to reduce dependency on the outside world, irrigated rice cultivation may offer a greater benefit to the country than is reflected in the economic analysis. Given that the government is committed to pursuing rice self-sufficiency through an expansion of irrigated rice production, there are certain issues that need to be addressed. There is a need for the government to balance the economic costs of greater self-sufficiency against the gains in terms of security and a sense of reduced dependence. A simple analysis in this study showed that a policy designed to achieve

self-sufficiency in rice through an expansion of irrigated rice production will reduce the gross national product over a wide range of rice and groundnut world prices.

The Gambia has yet to learn from its experience of about 30 years of irrigated rice production. It appears as if most of the mistakes in past projects are being repeated in succeeding irrigation projects. It is suggested that all aspects of past irrigation projects be carefully studied with a view to identifying key factors that caused their failures and that an attempt should be made to eliminate such factors in succeeding projects. This is especially important for the proposed extensive irrigation projects. Farmers, male and female, and extension workers should be thoroughly trained in irrigated rice production method and management. This may require a period of about five to ten years.

In the existing irrigation perimeters, farmers should be encouraged to use their fields for both the wet and dry season crops. This will at least help in maintaining the fields and channels in good order and so avoid the possibility of abandonment. Although the emphasis in using the irrigated perimeters will be on rice cultivation, farmers who find it impossible to use their fields because of labor shortages should be encouraged to grow other upland cereals on these perimeters. Farmers should also be encouraged to employ animal traction in the plowing of irrigated rice fields as is done in other countries such as Senegal and Mali. This will reduce the need for power fillers.

Input Delivery

The use of fertilizer during the year of the survey was very low. Farmers complained about the lack of fertilizer and improved seed for use in both rice cultivation and upland crops. Steps should be taken to ensure that the intensification of rice production is pursued concurrently with an organized timely input delivery system. The possibility of the use of transport trucks during the groundnut trading season for fertilizer transportation should be investigated. Empty trucks from the depot areas could easily be used to transport fertilizers to the buying centers at little extra cost. The author believes that farmers are more likely to buy fertilizer at this time of the year because farmers have money at this time to pay for fertilizer in cash.

As rice production increases, there is an urgent need for processing facilities, especially for milling. The government should either encourage private entrepreneurs to locate small rice milling machines in strategic locations around the country or it should encourage the village cooperative societies to buy and install small rice mills.

Agricultural Credit

Although an Agricultural Development Bank has been opened in Banjul, its impact on the rural population in the short run will be minimal. The rural population can be better reached through the current cooperative credit system. However, the credit currently provided by the cooperatives is of a subsistence nature. Cooperative

members receive D200 or one-third of their groundnut sale, whichever is smaller, as subsistence credit to be used during the hungry season. This system of giving credit doesn't take cognizance of need and is biased in favor of large farmers. It is recommended that the subsistence credit be phased out and be replaced by a production credit which can be disbursed on the basis of need. Emphasis should be placed on giving credit in kind in the form of needed inputs.

Upland Cereals Improvement

Development programs designed to improve the cultivation of upland cereals should not put emphasis on one cereal alone. The results of this study showed that there was a tendency for certain regions of the country to concentrate on one upland cereal cultivation. It is, therefore, recommended that upland cereal development efforts be region specific in order to avoid regional imbalances.

Areas for Further Research

This study was limited in scope in that it concentrated on rice farmers. It was, however, successful in generating a data base on the economics of rice production, groundnuts, and upland cereals cultivation. There is now a need for a more broadly based study that will investigate the total farming system, including the aspect of crop and livestock integration. Data currently being collected by the Mixed Farming Center in Abuko, The Gambia, will shed some light on this broader aspect. Specifically, studies are needed on:

a. the role of women in the household economy and the impact of technological change on the structure of

the family and the allocation of male and female labor

b. the social, economic, and environment impact of the proposed bridge-barrage at Yelitenda

c. the effect of alternative development strategies on income distribution and migration among the rural population

d. the effect of increasing grain prices on the urban consumers and on

e. the economics of livestock production and crop and livestock diversification

With the intensification of rice production, agronomic studies designed to investigate the effects of changing cultural practices should be carried out. For example, experiments should be designed to study the effect of plant population density and fertilizer combination on the yield of all rice systems using different rice varieties. Since improved varieties are often unavailable, a national program designed to select high yielding local varieties should be carried out.

It is necessary to carry out a post-harvest crop loss study to determine the extent of food grain loss after harvest and to make recommendations on food storage and processing in The Gambia.

Finally, there is an urgent need for an operational method of valuing family labor in both the financial and economic analysis of peasant agriculture. Current methods that are available are

either too theoretically complex to be of practical use or assume certain conditions that are not applicable to third world countries or require data that are impossible to obtain accurately.

APPENDICES

APPENDIX A

INPUT/OUTPUT DATA ON COTTON

TABLE A-1.--Cotten Enterprise Budget per Hectare

	Amount	Price/Unit Dalasis	Value (Dalasis)
A. Enterprise Characteristics			
1. No. of Households	4	--	--
2. Average Holdings	0.38 ha	--	--
B. Income and Expenditure			
1. Value of output	1182 kgs	0.53	626.46
2. Variable Costs			
Seed[a]			
Fertilizer[a]			
Insecticide[a]			
Contract labor	14.1 wds	1.97	27.78
Hired Ox-equipment			
TOTAL Variable Costs			27.78
3. Gross Margins			598.68
4. Fixed Costs			
Strange Farmer	93.8 wds	4.80	450.24
Depreciation[b]	27 hrs	0.66	17.82
5. Returns to land, family labor, and management			130.62
6. Opportunity cost of capital (15%)	27.28		4.09
7. Net returns to land, family labor, and management			126.53
8. Opportunity cost of land	1 ha	0.00	0.00
9. Net return to family labor and management			126.53
10. Return per workday to family labor and management	134 Wd		0.94

Source: Survey Data

[a]These inputs are supplied free. It was estimated that at current subsidized prices farmers would have paid about D270.00 for these inputs. Quantities applied of these inputs were difficult to verify.

[b]Animal/ox-equipment depreciation. Depreciation for hand tools has been assumed to be negligible.

TABLE A.2.--Labor Distribution in Cotton Cultivation by Type of Labor and Activity

	Land Preparation		Planting		Care Cultivation		Harvesting		Total	
	Workdays	%	Workdays	%	Workdays	%	Workdays	%	Workdays	%
Family										
a. Males 16-60 yrs	9.9		9.0		62.3		16.2		97.4	
10-15 yrs					3.6		3.2		6.8	
0-9 yrs										
Total Males	9.9	66.0	9.0	76.9	65.9	57.6	19.4	19.3	104.2	43.1
b. Females 16-60 yrs					0.3		13.1		13.4	
10-15 yrs					1.3		3.3		4.6	
0-9 yrs										
Over 60 yrs										
Total Females					1.6	1.4	16.4	16.3	18.0	7.4
c. Other Family					2.5	2.2			2.5	1.0
Total Family Labor Input	9.9	66.0	9.0	76.9	70.0	61.2	35.8	35.6	124.7	51.5
Strange Farmer	5.1	34.0	2.7	23.1	30.4	26.6	55.6	55.2	93.8	38.8
Hired Exchange Males							9.3		9.3	
Exchange Females										
Contract Males					14.1				14.1	
Contract Females										
Total Hired Labor					14.1	12.2	9.3	9.2	23.4	9.7
TOTAL LABOR INPUT	15.0	100.0	11.7	100.0	114.5	100.0	100.7	100.0	241.9	100.0

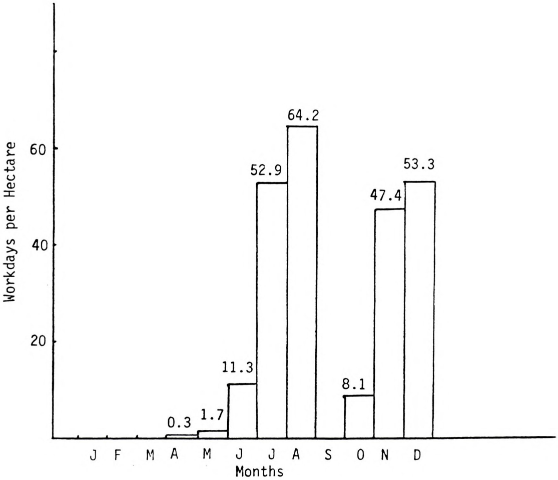

Figure A-1.--Monthly Labor Distribution in Cotton Cultivation.

APPENDIX B

MONTHLY LABOR INPUTS BY TYPE OF FARMING SYSTEM

TABLE B.1 .--Monthly Labor Input by Region and Activity (In Workdays) Per Dabada

Months	Mangrove Rice Region				Bafaro Rice Region				Irrigated Rice Region			
	Crops	General Farm	Off-Farm	Total	Crops	General Farm	Off-Farm	Total	Crops	General Farm	Off-Farm	Total
January	47	2	15	64	13	2	18	33	2	1	17	20
February	39	3	8	50	1	--	16	17	--	3	18	21
March	--	4	7	11	5	--	17	22	10	3	20	33
April	--	4	5	9	5	--	17	22	18	3	17	38
May	16	6	5	27	5	1	21	27	14	3	17	34
June	35	5	4	44	38	1	13	52	28	4	11	43
July	57	2	2	61	53	1	4	58	57	3	10	70
August	54	--	1	55	57	--	7	64	63	1	12	76
September	99	1	7	107	42	--	9	51	57	1	15	73
October	64	1	6	71	11	--	13	24	31	1	20	52
November	44	2	6	52	22	--	13	35	49	1	15	65
December	34	2	9	45	40	1	11	52	22	1	13	36
Total	491	35	76	602	292	5	162	459	352	25	188	565

Source: Survey Data.

Note: The sum of the monthly labor inputs may not equal totals because of rounding errors.

TABLE B.2.--Monthly Labor Input by Size of Land Holding and Activity (in Workdays) Per Dabada

Month	Small				Medium				Large			
	Crops	General Farm	Off-Farm	Total	Crops	General Farm	Off-Farm	Total	Crops	General Farm	Off-Farm	Total
January	6	1	19	26	18	2	15	35	53	1	21	75
February	1	2	20	23	8	2	12	22	53	4	19	76
March	6	3	18	27	5	2	14	21	2	4	13	19
April	8	2	20	30	7	2	12	21	6	6	11	23
May	10	1	24	35	9	3	14	26	22	6	13	41
June	28	2	11	41	35	3	9	47	37	7	8	52
July	34	3	5	42	56	2	5	63	75	1	7	83
August	34	1	10	45	62	--	6	68	63	--	7	70
September	28	1	12	41	62	1	9	72	117	--	16	133
October	19	1	15	35	32	--	12	44	55	1	15	71
November	19	--	14	33	36	1	10	47	64	2	16	82
December	17	--	13	30	31	1	9	41	61	2	17	80
Total	210	17	184	411	362	18	129	509	608	36	165	809

Source: Survey Data

[a]The sum of the monthly labor inputs may not equal total because of rounding errors.

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