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ENTERPRISE CHOICE, ENTERPRISE COMBINATIONS,
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IN SIERRA LEONE

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Steven C. Franzel

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Carl K. Eicher

Major professor

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ENTERPRISE CHOICE, ENTERPRISE COMBINATIONS, AND INCOME DISTRIBUTION AMONG FARMERS IN SIERRA LEONE

By

Steven C. Franzel

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This thesis provides information on how poor rural households select and combine their activities, so that rural development planners can direct their programs towards those in greatest need. The analysis is disaggregated by income groups to explore conditions of poor households and differences in enterprise choice and factor use among income strata.

There is considerable inter-strata variation in enterprise mix. However, this variation does not contribute significantly to inter-strata income differentials. Rather, it is likely that differences in resource productivity in the principle enterprises are important in explaining disparities in incomes.

The most important production systems are modeled by identifying principle enterprise combinations. The analysis establishes the importance of peak-season labor bottlenecks and capital scarcity as constraints to increasing the incomes of the poor.

The policy recommendations arising from the analysis emphasize increasing labor productivity in upland rice production and reducing peak-season labor bottlenecks. Furthermore, farm models must be disaggregated by income strata so that programs can be specifically targeted to reach low-income households.

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CHAPTER I

INTRODUCTION

1.1 Problem Statement

Rural development planners in the Third World are becoming increasingly aware that information about the small farm system and its allocation of resources is a prerequisite for formulating successful rural development programs. The widespread failure of large-scale, capital-intensive agricultural projects and the increasing concern for a more egalitarian distribution of benefits have led to increasing emphasis on small-farmer oriented programs. The mobilization and increased productivity of underemployed resources, especially labor, in the small-scale rural sector, is seen as an important avenue to increasing output, employment, and income.

Interventions in the small-farm sector have, unfortunately, not achieved the level of success that many planners once envisaged. The limitations of the widely-heralded Green Revolution high-yielding varieties are well documented (Wharton, 1969). And even where African rural development programs have resulted in large increases in output and income, the low-income groups have rarely benefitted to the degree expected by program planners (Lele, 1975).

A large part of the problem is the poor understanding of how the small farm system works and how its resources are allocated.

Often, planners simply ignore farmers' conditions and try to impose new "innovative" systems or subsystems on the small farmer which have been proved to be effective on research stations. The result is usually failure. On the other hand, the approach used in this study, the farming systems approach, views the farm as a system and examines the effects on a given change in a component (a new crop, for example) on the overall system. The immediate goal is to modify the existing farming system to incorporate improvements, not to replace the system with a new one. The focus is on overcoming the critical constraints which the farmer faces so he can increase his output and income (Norman, 1976).

The large amount of information necessary and the location specificity of the farming systems approach are evident. The researcher must thoroughly understand the physical and biological conditions which the farmer faces, the resources at his disposal, his goals, his attitudes, and the decision-making framework which he uses to allocate resources. Knowledge about community and institutional factors and the pattern of resource use throughout the year are also crucial (Norman, 1976).

Because the distribution effects of rural development projects now receive high priority, it is no longer adequate to use the average farm in an area as a model for that area. What are needed, as was noted as early as 1925 by the Russian economist Chayonov, are farm models for low-income households so that programs can be specifically designed and targetted to meet their needs (Chayonov, 1925).

A detailed study of enterprise choice is a vital component of the farming system approach. It is important that planners understand the nature of enterprise emphasis among different income groups. This information can enhance the understanding of why the poor are poor, and thus help in designing programs to increase their incomes.

One important hypothesis to explain why the rural poor are poor is the following: low-income households have low incomes because they undertake low-returns enterprises relative to the rest of the rural population. The extent to which this hypothesis is or is not true may importantly influence the types of programs which are appropriate. If the hypothesis is true, programs targeted to help the rural poor should emphasize the introduction of new enterprises to low-income households, especially enterprises currently being undertaken by middle and high-income households in the same area. Alternatively, incomes may be increased by upgrading the technology of low-income households in the enterprises they are pursuing. This latter approach may present greater difficulties, however,because of the uncertainty about the adaptibility of such changes. Epstein, for example, found farmers in South India to be more amenable to the introduction of new crops than to adopting recommended changes on traditionally-grown crops (Epstein, 1962).

If the hypothesis is not true, that is, if the choice of enterprise is not an important cause of poverty, other factors need to be investigated. One alternative hypothesis might be that

low-income households have low incomes because of an inability to follow correct management practices due to constraints acting upon them. Another might be that differential access to resources (e.g., land) is largely responsible for income differences.

Unfortunately, the data available to confirm or reject the hypothesis that enterprise choice is a significant determinant of income status is sparse and somewhat contradictory. Studies by Betu and Upton in the middle 1960's in the savannah zone of Nigeria showed that the enterprise mix had little if any effect on gross margins per man-day (Petu and Upton, 1964). Matlon, who studied income distribution in three villages in Northern Nigeria, found similar crop mixes among different income strata and that differences in crop mix accounted for little variation in returns to labor or land. However, high-income households were able to give greater emphasis to several high-return "specialty" crops requiring high levels of purchased inputs. In addition, the percentage of income earned in the nonagricultural sector rose from 11.5 percent for the lowest-decile households to 35.4 percent for the households of the highest decile. For high-income households, the greater emphasis on nonfarm enterprises resulted in higher returns to labor (Matlon, 1977).

This study hypothesizes that enterprise choice plays a central role in determining income levels. If this hypothesis is true, the reasons why poor farmers have chosen low-returns enterprises

must be explored. Some major reasons why poor farmers might reject particular high-return enterprises include:

1. Capital constraints. Only wealthy farmers are able to meet the capital requirements necessary to pursue the enterprise. Even when cash requirements are small, they may come at a time of the year when cash is particularly scarce.

2. Risk. High-return enterprises may have high variability in returns from year to year, presenting the low-income farmer with a degree of risk which he finds unacceptable. The primary causes of variability in returns are high yield variability and high product-price variability.

3. Labor bottlenecks. Poor rural households may lack the labor necessary to meet the labor requirements of peak periods, especially when the peak period for the high-returns enterprise coincides with a peak period for the production of a food staple. Because of the cash constraint, or the unavailability of labor during the peak period, they are unable to hire laborers to meet the need for additional labor.

4. Health. Nutritional problems or disease may prevent poor households from undertaking high-return, labor-intensive enterprises, especially when crucial labor inputs are required just before the harvest period. This constraint is related to "3" above.

5. Land scarcity. If farmers give first priority to meeting their subsistence food needs, it is possible that only the residual land (if any) will be left for cultivating high-return cash crops.

6. Exogenous factors which include:

a. ecological characteristics--rainfall, soil fertility, etc. The poor may be concentrated in areas lacking the ecological conditions necessary for growing high-return crops.

b. locational characteristics--area-specificity of some enterprises, proximity to markets, etc. Many high-returns enterprises, such as fishing and mangrove swamp rice, are area-specific. Where the poorest farmers live far from marketing outlets, the cultivation of cash crops may be unprofitable due to transport problems.

c. demographic characteristics--age of farmer, family size, etc. Large families may be engaged in more labor-intensive enterprises. Older farmers may shun enterprises with heavy labor requirements.

d. education--awareness of new enterprises, contact with extension workers, etc. Farmers who can read and write and have contact with extension workers may have greater access to information concerning new high-return enterprises being introduced in the area.

The relative importance of each of these factors has an important bearing on the design of programs for increasing the incomes of poor rural households. For example, if cash constraints are an important problem, the establishment of a credit program may be specifically called for. A credit program might also aid in the solution of labor bottlenecks. If hired laborers are simply

unavailable at peak periods, however, changing the production period for one of the enterprises (by introducing an early-maturing variety, for example) or changing the enterprise combination may be necessary. Where increased risk impedes poor farmers from adopting high-return enterprises, programs which lessen risk are called for, e.g., introducing enterprises with little variability in yields or prices. Alternatively, a program may help the farmer accommodate to risk by giving him access to credit.

Although the above discussion has been based on enterprise choice as a determinant of income, the examination of enterprise combinations is also an important component of the farming systems approach. As mentioned previously, the researcher must understand how the introduction of a new enterprise (or modification of an existing enterprise) will affect the overall farm system. This can most easily be done by studying the two or three major enterprises in combination, which serve as a representation of the system. An examination of the levels and timing of factor use in enterprise combinations provides guidance for releasing constraints to increasing rural incomes. For example, the peak season labor requirement is a major constraint to increasing rural incomes in Sierra Leone (Byerlee et al., 1977). An analysis of seasonal labor use for major enterprises in combination provides guidance for adding new enterprises or technologies to a combination, or substituting new enterprises for existing ones.

In summary, information about enterprise choice, enterprise combinations, and the levels and timing of factor use for different

enterprises and combinations is vital for planning rural development programs. This information must be disaggregated by income group so that it may be used to design programs to improve income distribution and aid those in greatest need. An analysis of enterprise choice among the rural poor and factors affecting enterprise choice can help planners target their programs towards low-income households.

1.2 Objectives

The objectives of this study are the following:

a. Describe differences in enterprise choice among rural households of different areas and income groups of Sierra Leone.

The criteria for measuring enterprise emphasis include the frequency of occurrence and the contribution to total household labor and income.

b. Examine extent to which income levels are a function of enterprise choice.

The association between income levels and enterprise choice will be tested using comparative net margin analysis. Expected returns based on nationwide average enterprise returns are used to indicate the effect of enterprise emphasis on income level.

c. Present levels and timing of factor requirements and returns for major enterprises. Summarize effects of factor requirements on enterprise choice.

An examination of factor requirements may help explain why farmers of different income levels choose different enterprises. One major hypothesis is that capital constraints prevent low-income

farmers from pursuing high-returns enterprises. Whether poor households select enterprises with low capital-labor ratios and high labor-land ratios is also investigated. The description of factor requirements for individual enterprises, highlighted by an examination of seasonal labor use, provides background for meeting the objective which follows.

d. For important enterprise combinations, discuss factor requirements and returns. Examine the degree of compatibility and conflict between enterprises in combination. Summarize effects of factor requirements on choice of enterprise combination.

This section focuses on how component enterprises of major enterprise combinations fit together with respect to factor requirements. It is hypothesized that the enterprises in a combination are selected to equalize, as much as possible, the distribution of labor throughout the year. As mentioned previously, Bylerlee, et al., (1977) found that peak season labor demands in Sierra Leone constrain farm income. This study hypothesizes that the farmer seeks to overcome this constraint by choosing enterprises with complementary peak labor periods, rather than overlapping ones. The use of hired labor to release peak-period labor constraints is also examined.

e. Discuss implications of analysis for agricultural development programs and policies affecting farming systems in Sierra Leone.

A better understanding of factors affecting enterprise choice and choice of enterprise combinations can help project planners release constraints to increase production and modify farming systems to increase rural incomes. Throughout the study, we will

highlight the implications of the above analysis on rural development policies and proposals.

1.3 Source of Data

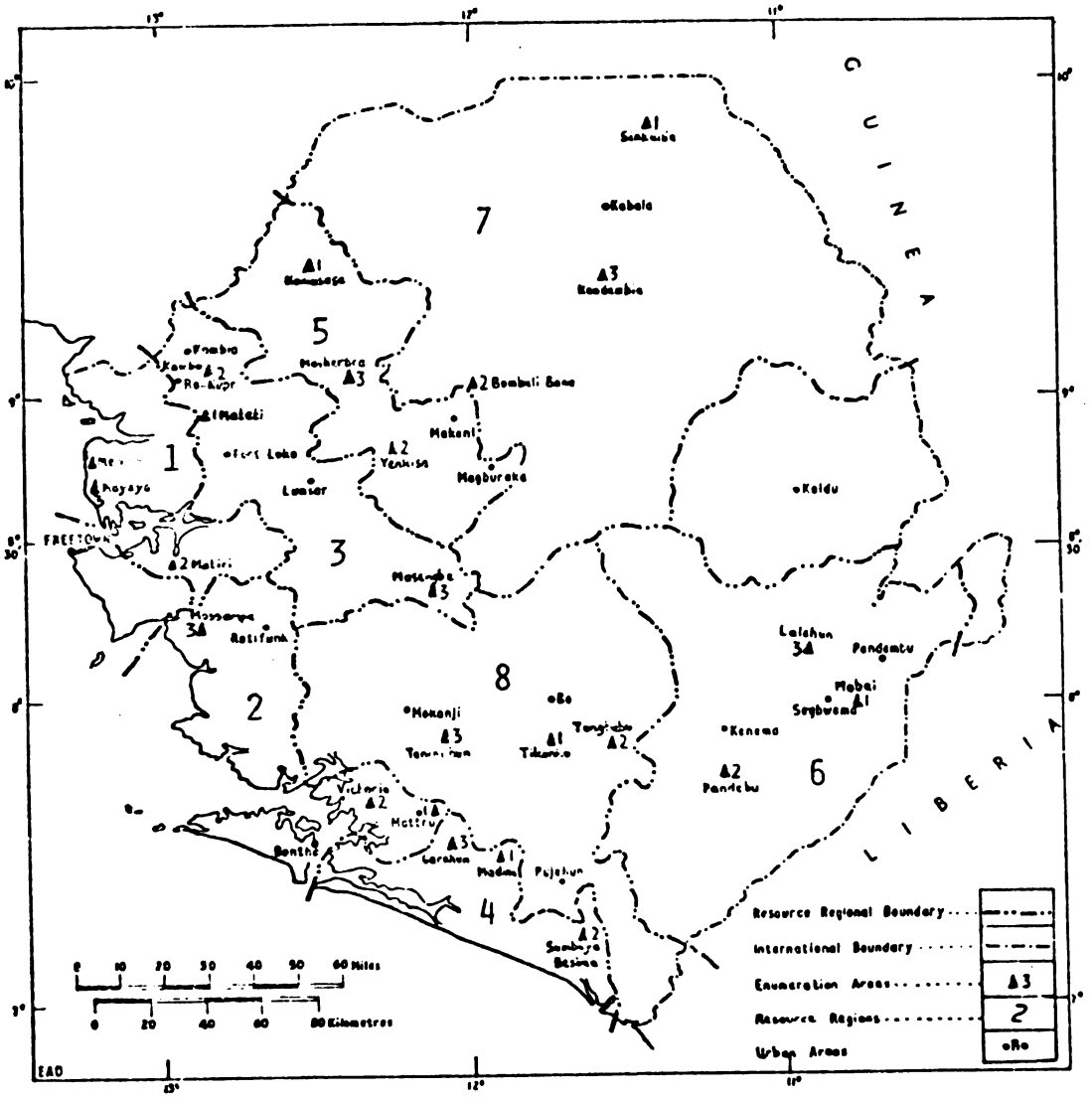
The data examined in this study were collected as part of a comprehensive study of farm households in Sierra Leone during 1974/75 (Spencer and Byerlee, 1977). The project was conducted with funding by USAID, the Rockefeller Foundation, and Njala University College, Sierra Leone.

A multi-phase stratified sampling design was used to select sample farm households for the study. The country was first divided into eight rural resource regions as shown in Figure 2.1. The ecological and demographic characteristics of each resource region are described in Table 1.1.

The eight rural resource regions were then subdivided into enumeration areas used by the Central Statistics Office and three enumeration areas were selected to represent each rural resource region. Enumeration areas average about ten square miles in area and contain about 130 farm families. Sample frames of farm households were then prepared for each selected enumeration area. From these frames, a stratified sample of twenty farm households and four nonfarm households (excluding traders) were selected at random in each enumeration area. The sample obtained is thus a regionally-balanced, representative sample of rural households.

Between March 1974 and June 1975, selected households were visited twice weekly by resident enumerators to collect the

Figure 1.1 SIERRA LEONE RURAL RESOURCE REGIONS[a]



South	North	East
Southern Coast (2)	Scarcies (1)	Moa Basin (6)
Riverain Grasslands (4)	Northern Plains (3)	
Southern Plains (8)	Boliland (5)	
	Northern Plateau (7)	

[a]Spencer, Dunstan S.C. and Byerlee, Derek. 1977. "Small Farms in West Africa: A Descriptive Analysis of Employment, Incomes and Productivity in Sierra Leone." African Rural Economy Working Paper No. 19, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.

Table 1.1 ECOLOGICAL AND DEMOGRAPHIC CHARACTERISTICS OF RURAL RESOURCE REGIONS IN SIERRA LEONE

Region	Area (km^2)	Population (1000)	Rural Population Density (Persons per km^2)	Elevation (meters above sea level)	Mean Rainfall (mm)	Vegetation	Soils	Dominant Ethnic Group	Average Household Size	Primary School Attendance[a] (percent)
SIERRA LEONE	68,878	1,824.2	26.5	0-400	-	-	-	-	6.4	24.2
North	39,104	884.3	22.6	0-400	-	-	-	-	6.8	16.2
Scarcies	2,412	156.9	65.0	15	2540-3550	Chesmapodium grass Mangrove swamps Inland swamps	Reddish to yellow brown Laterite	Temne Susu	8.7	20.2
Northern Plains	5,769	277.6	48.1	15-150	2540-3800	Lophita Grass savannah Secondary bush	Laterite	Temne	7.3	11.3
Bolilands	4,614	172.2	37.3	15-150	2400-3550	Savannah Swamp grasslands Secondary bush	Laterite	Temne Limba Loko	8.1	13.0
Northern Plateau	26,308	277.6	10.6	300-400	2000-3550	Savannah	Reddish brown Laterite	Limba Fullah Koranko	6.3	17.4
South	17,772	473.7	26.7	0-150	-	-	-	-	5.5	37.4
Southern Coast	3,420	94.9	27.7	15	2800-4060	Secondary bush Mangrove swamps Inland swamps	Laterite Lithosols Alluvial	Mende Temne	6.4	20.8
Riverain Grass-lands	2,759	56.6	20.5	15	3300-4600	Grasslands Secondary forest	Alluvial	Mende	4.7	22.5
Southern Plains	11,593	322.2	27.8	15-150	2660-3550	Secondary forest	Laterite	Mende	5.4	45.9
East (Moa Basin)	12,003	466.2	38.8	150-300	2540-3556	High Bush	Laterite	Mende	5.1	31.0

[a]Percent of children 6 to 16 years of age attending school in rural areas.

necessary information. Because of data problems, only 328 (57 percent) of the sample households were suitable for the analysis of income data.

For the purposes of this study, the eight resource regions are aggregated into three regions: North, South, and East. The rural resource regions associated with each region are shown on the left hand side of Table 1.1.

CHAPTER II

SIERRA LEONE: GENERAL CHARACTERISTICS AND THE RURAL ECONOMY

2.1 General Characteristics

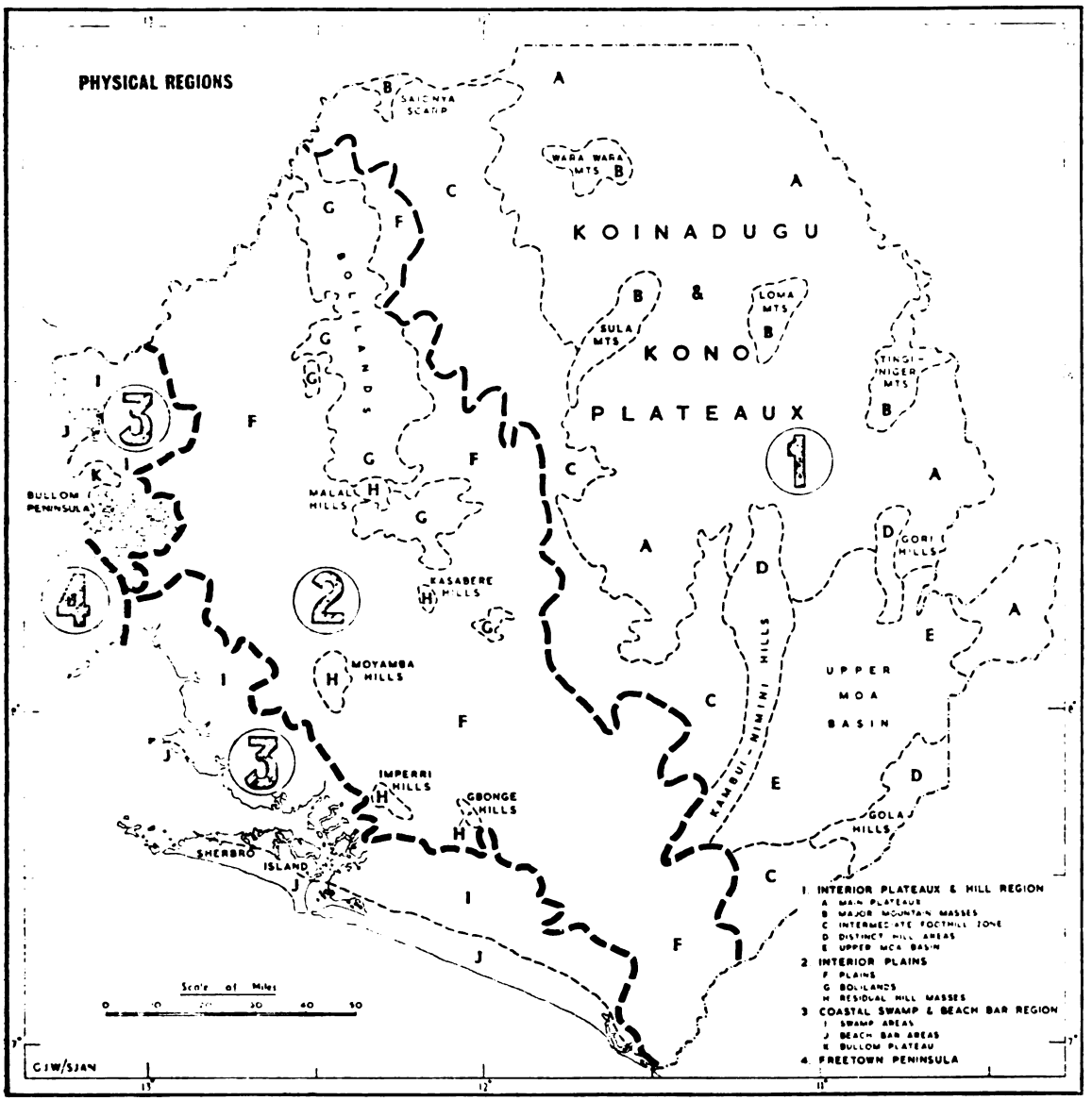
Sierra Leone is divided into four physical regions as shown in Figure 2.1:

1. Interior plateau and hills of the east (altitude of 1400-2000 feet).
2. Interior plains of west-central Sierra Leone (altitude of 100-750 feet).
3. Coastal swamplands (altitude of 0-50 feet).
4. Freetown Peninsula (altitude of 0-50 feet).

Moving from northeast to southwest, the annual mean rainfall of the country increases from less than 80 inches to about 170 inches. Annual mean rainfall nationwide is about 100 to 120 inches. The wet season generally extends from May to November but lengthens as one moves eastward from the coast (Clarke, 1966). The vegetation varies with rainfall; Savannah and grassland predominate in the north whereas secondary forest and bush are more common in the southern half of the country and coastal areas.

With a population of 3.0 million and an area of 28,000 square miles, Sierra Leone has an average population density of 107 per square mile, relatively high by African standards (World Bank, 1977). The

Figure 2.1.--Physical Regions of Sierra Leone[1]



SOURCE: Clarke (1965).

Freetown Peninsula and the northern coastal swampland are the two most densely populated areas of Sierra Leone; areas of lowest population density include the southern coastal areas and the northern quarter of the country. Sierra Leone is characterized by a high degree of ethnic diversity. The two largest ethnic groups are the Mende, concentrated in the South, and the Temne, who predominate in the west-central areas (Clarke, 1966).

2.2 Agriculture and the Rural Economy

The agriculture sector (including forestry, hunting, and fishing) employs about 75 percent of the population (Government of Sierra Leone, 1974). Agriculture's contribution to gross domestic product (GDP) is less significant and declined from 39 percent to 32 percent between 1963/64 and 1970/71. During the same period, GDP at factor cost (in constant 1963/64 prices) rose by 4.3 percent per year and the agricultural sector grew 1.6 percent per year (World Bank, 1977).

Small farmers predominate in Sierra Leone agriculture. The average family consists of 6.7 persons, 4 of whom are over 15 years of age. The average cultivated area is 6.6 acres per household and varies little between households and regions (Spencer and Byerlee, 1977). Farms are managed at very low levels of technology; capital inputs are limited to a few hand tools. Mechanical planting is undertaken in a few areas of the country, servicing 2.5 percent of total acreage in 1973 (Due and Karr, 1973). Although land is usually

owned in Sierra Leone, individual families generally manage the land at their disposal. Some nominal payment is often made to the land-controlling person or group, i.e., the family head or chief (Spencer and Byerlee, 1977).

Rice, the nation's most important crop, is grown by about 86 percent of the farmers and upland rice alone accounts for over half of total cultivated acreage. Rice accounts for between 40 and 50 percent of the total value of agricultural production and about 29 percent of the value of farm sales (Spencer, 1975b). Five major rice growing systems, are found in Sierra Leone (Spencer, 1975b).

1. Upland--Accounting for about two-thirds of all rice produced, upland rice is found throughout the country. Yields in the crop year under study, 1974/75, were 672 lbs. per acre.[1] Intercropping is common though the density of intercrops on upland rice farms is low. Upland rice is cultivated under a bush-fallow rotation with land remaining in fallow for approximately ten years at a time.

2. Inland Swamp--also found throughout the country wherever swamps are located. As in the other swamp systems, fields are usually cropped permanently and intercropping is rare. Swamp rice production is considerably more labor intensive than upland rice and yields per acre average 1,700 lbs.

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[1]These figures are about 60 percent of those reported for previous years (Spencer, 1975a and Government of Sierra Leone, 1977). Yields were lower than average in 1974 because of the lateness and short duration of the rainy season.

3. Boliland--found in the north-central area of the country in low swamp grasslands which are flooded during the rainy season. Yields range from 800 to 1,000 lbs. per acre.

4. Mangrove Swamp--found in coastal areas where flooding is induced by tidal water flows along the estuary. Yields average 2,000 lbs. per acre.

5. Riverrain--common in the southern coastal areas where rainfall is high. Flooding often requires the use of floating varieties. Yields in 1974/75 were about 1,600 lbs. per acre, but are usually much lower.

Following rice, oil palm has the highest output value of any rural enterprise in Sierra Leone. Fruit are gathered from oil palms growing wild in the bush and are sold for export or used for the production of palm oil and other palm products. Oil palm is especially important in southern and northwestern areas.

Coffee (robusta) and cocoa are Sierra Leone's two other important tree crop enterprises. They are grown primarily in south-central and southeastern areas. Levels of maintenance and yields are low relative to other countries in West Africa. Another important cash crop enterprise, vegetables (onions, peppers and tomatoes), are grown primarily in the area around Freetown, Sierra Leone's capital.

Groundnuts, cassava, and fundi (African three-fingered millet) are the most common subsistence food crops after rice. Cassava is found primarily in the south whereas fundi is grown mostly in the north. Groundnuts are cultivated throughout the country.

Nonfarm enterprises also play an important role in the rural economy.[1] The two most important enterprises in this category are labor sold out[2] and fishing. Fishing is important in coastal areas as well as inland streams and lakes. Households sell out labor throughout the country, especially in the South.

2.3 Agricultural Policy in Sierra Leone

Official concern and funding for agriculture have increased in recent years, in response to the sector's lagging performance. Agriculture's share of development expenditures rose from 4 percent in 1963/64 to 11 percent in 1970/71. During this same period, however, per-capita food production remained at a virtual standstill (Spencer and Byerlee, 1977).

The government's primary objective in the agricultural sector is to attain self-sufficiency in rice production. Between 1972 and 1976, rice imports averaged over 20,000 metric tons per year (F.A.O., 1977). To counteract this trend, the government offers price supports, subsidized mechanical plowing, fertilizer subsidies, and swampland clearing subsidies to encourage production. The

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[1] Farm enterprises are defined as those involving the production and home-processing of all crops and oil palm products. Nonfarm enterprises include all other enterprises, including labor sold out by the household.

[2] Labor sold out is defined in this study to include all labor used for enterprises not managed by the household, whether payment is made in cash or kind. It thus includes exchange labor, in which a person works in the field of a neighbor for a meal, with the understanding that the neighbor will reciprocate. Exchange labor accounts for about 40 percent of labor sold out and is especially important in the South (Spencer and Byerlee, 1977).

International Development Association (IDA) finances development projects in the east and north which employ a credit/seed/fertilizer/water control package to increase swamp rice and tree crop production. The government does not promote upland rice, citing the crop's heavy labor requirements for clearing, its contribution to soil erosion, and its lower yields and returns per acre (Due and Karr, 1973).

The price of rice is influenced by price supports and the quantities of rice imported by the Rice Corporation--a semi-governmental agency. Prices of export crops are set by the Sierra Leone Produce Marketing Board. For the period 1955-1971, agricultural export taxes and a price policy oriented towards urban consumers resulted in a transfer of 670,000 Leones (Le.)[1] per year out of the agricultural sector (Levi, 1974). In recent years this policy has been somewhat reversed as prices of rice and export crops have increased (Spencer and Byerlee, 1977).

2.4 Income Distribution in Rural Sierra Leone

Unfortunately, very little research has been conducted concerning income distribution in rural Sierra Leone. A recent study by Eponou, using data from the same data base as is used in this study, describes rural income distribution and examines possible determinants (Eponou, 1978). This section briefly reviews his findings.

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[1] 1 Leone = $1.10. 100 cents = 1 Leone.

Table 2.1 shows income per consumer equivalent (ICE) by region.[1] The national average ICE is 120 Le. The East and South have similar ICE's of 134 and 131 Le., respectively, whereas the ICE in the North is 103 Le., or 30 percent less. Low income levels in the North are associated with the region's low crop yields, which reflect scant rainfall and poor soils compared to the other regions (Spencer, 1975b).

TABLE 2.1.--Rural Incomes per Consumer Equivalent (ICE) in Regions of Sierra Leone[a]

Region	Mean ICE	Gini Ratio
South	131 Le.	.34
North	103 Le.	.40
East	134 Le.	.36
Nationwide	120 Le.	.38

SOURCE: Eponou, 1978.

[a]Regions are defined in Table 1.1. Consumer equivalents are defined in Section 3.3.

Mean ICE's of different income groups are shown in Table 2.2. Nationwide, the highest income tercile has a mean income 5.7 times that of the lowest income tercile. The highest income decile has a mean ICE 14.9 times that of the lowest income decile. The Gini

[1]Income per consumer equivalent is used instead of per capita income to account for the differences in consumption requirements of families with different age and sex compositions. Consumer equivalents are defined in detail in section 3.3. Regions refer to those defined in Table 1.1.

TABLE 2.2.--Rural Income per Consumer Equivalent (ICE) by Income Group in Sierra Leone[a]

Income Group		Mean ICE
Lowest	10%	20.1
Lowest	30%	39.3
Middle	40%	101.0
Highest	30%	225.0
Highest	10%	300.0
Nationwide		.20.0

ratio, which measures the distribution of income within an area, is shown by region in Table 2.1. The nationwide ratio is .38, which is similar to ratios calculated in other areas of tropical Africa (Eponou, 1978). The distribution of income in the North is more skewed than in the other two regions.

CHAPTER III

ENTERPRISE EMPHASIS IN RURAL SIERRA LEONE

3.1 Enterprise Emphasis--A Descriptive Analysis

Before proceeding to an analysis of enterprise choice and enterprise combinations in rural Sierra Leone, a description of enterprise emphasis is necessary. Two variables are important for determining enterprise emphasis:

1. Percentage of household income derived from an enterprise. This measures the contribution of the enterprise to total household income.

2. Percentage of total labor[1] allocated to a given enterprise by a household. Labor is by far the most important resource used by the small farmer. How the farmer allocates the labor at his disposal among different enterprises plays an important role in determining enterprise emphasis.

It would be impractical and misleading to try to combine these two variables into an "emphasis index." The first variable shows the economic performance of an enterprise, whereas the second

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[1] Includes operator labor, family labor, and labor hired and sold out by the household. Total labor thus represents all labor used by the household to generate income. Household labor, on the other hand, refers only to operator labor, family labor, and labor sold out by the household.

variable reflects the allocation of the major resource to an enterprise.

Table 3.1 presents the twenty-six most important enterprises in rural Sierra Leone. Each of these enterprises accounts for at least 1 percent of the total labor or income of more than one sample household.[1] The average farm household undertakes about seven different enterprises. The most frequently occurring enterprise is upland rice, which is cultivated by 85 percent of the sample farmers. Three other enterprises, cassava, labor sold out, and wild oil palm are undertaken by over two-thirds of all sample farmers. Inland swamp rice, groundnuts, and "other vegetables" (excluding onions, peppers, and tomatoes) are farmed by over 50 percent of the farmers. Each of these enterprises is found throughout the country, except for cassava which is grown primarily in the South. Other frequently occurring enterprises include inland and marine fishing, coffee, hunting and gathering, and fruit production.

Table 3.1 also shows the frequency of enterprise groupings. Rice is grown by 98 percent of the households, while other annuals and tree crops are farmed by 95 percent and 78 percent of the

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[1]Those enterprises which are not specifically associated with income generation are not shown here. For example, values for oil palm processing are included under oil palm.

Also, labor and income associated with intercrops in a field which is predominantly of one crop are included under that crop. However, intercropping is not common. One enterprise, construction, was excluded because of problems in valuing income for subsistance contracts.

Some enterprises listed are actually enterprise groupings: other craft work, other vegetables, etc.

Table 3.1 THE IMPORTANCE OF DIFFERENT ENTERPRISES IN LAND USE, LABOR ABSORPTION, AND INCOME GENERATION IN RURAL SIERRA LEONE

Enterprise	% Households in Which:						% Enterprise Contribution		
	Household Participates[a]	Enterprise is Important[b]				Household Specializes[c]	Labor Absorption	Income Generation	Land Use
		South	North	East	National				
ALL FARM	99.7	99.3	98.5	97.9	98.8	94.5	86.5	78.9	100.0
Rice	97.9	95.0	89.3	95.9	92.7	85.1	61.9	41.3	81.7
Upland	85.4	88.8	65.9	39.8	78.0	70.7	47.3	26.7	61.8
Inland Swamp	52.7	14.9	31.2	49.0	26.8	9.4	7.6	5.8	5.6
Mangrove	n.a.	2.8	n.a.	0	n.a.	n.a.	1.1[d]	1.4[d]	0.9[d]
Boliland (Hand & Mech.)	5.2	0	10.1	0	4.3	4.0	4.7	5.6	10.1
Riverain (Mech.)	4.3	9.2	0	0	4.0	3.0	1.2	1.8	3.3
Other Annuals	95.1	65.1	44.3	22.4	56.4	16.5	15.6	17.1	11.5
Fundi	18.9	0	26.1	0	11.0	2.1	2.1	1.3	2.1
Cassava	69.5	52.5	12.3	0	27.7	6.7	4.1	4.8	3.5
Groundnuts	52.1	20.6	24.6	22.4	22.6	2.4	5.0	3.9	4.9
Onions, Peppers, Tomatoes	16.5	1.4	18.1	2.0	8.5	6.1	3.8	4.3	1.0
Other Vegetables	49.7	12.0	11.5	2.0	10.4	0.3	0.6	2.8	-
Tree Crops	78.3	62.4	28.3	73.4	49.7	24.4	8.9	20.3	6.8
Fruits	21.0	2.4	1.4	0.7	10.2	0.3	0.3	0.8	-
Cocoa	11.3	0	0	40.8	6.1	1.5	0.6	1.7	1.9
Coffee	29.9	7.1	1.4	49.0	11.0	2.7	1.3	2.9	4.9
Oil Palm (wild)	67.4	58.1	26.1	28.6	40.2	20.1	6.2	14.9	-
Animals	3.4	0	1.4	0	0.6	0.3	0.1	0.2	-
NONFARM	93.0	56.0	50.7	36.7	50.9	17.1	13.3	21.1	-
Fishing	39.9	15.6	13.0	0	12.2	4.4	2.1	7.6	-
Hunting and Gathering	22.2	3.4	0.7	0.2	2.1	0	0.3	1.0	-
Small Industries	31.1	15.6	13.8	22.4	15.8	7.3	2.9	6.5	-
Tailoring	7.3	4.2	5.1	6.1	4.9	3.0	0.5	1.9	-
Carpentry	4.6	3.5	0.7	4.1	2.4	0.9	0.5	0.5	-
Blacksmithing	9.4	3.4	4.3	4.1	4.0	1.8	0.7	1.9	-
Spinning-Weaving	3.6	0.3	0	4.1	0.9	0	0.3	0.3	-
Other Small Industries	14.6	4.3	3.6	4.1	4.0	1.5	0.9	1.9	-
Trading	7.6	1.4	2.2	4.1	2.4	0.6	0.7	0.9	-
Labor Hired Out	69.5	31.2	24.6	12.2	25.6	5.2	7.3	5.1	-

[a]Households in which > 1% of total labor input goes to the particular enterprise.

[b]Households in which > 10% of the total labor input goes to the enterprise or > 10% of total income is generated by the enterprise.

[c]Households in which > 30% of total labor input goes to the enterprise or > 30% of total income is generated by the enterprise.

[d]An underestimate since northern mangrove swamps were not surveyed.

n.a.: not available

households respectively. Ninety-three percent of the households pursue nonfarm occupations with fishing being undertaken by 40 percent, small industries by 31 percent, and labor sold out by 69 percent of the households.

Column 5 shows the percentage of households in which an enterprise is important. An enterprise is important for a household if it contributes greater than 10 percent to total income or labor. Upland rice is important for over 75 percent of all households and wild oil palm is important for about 40 percent. Cassava, inland swamp rice, labor sold out, and groundnuts are other enterprises which are important for over 20 percent of the households.

According to Table 3.1, a household specializes in an enterprise if the enterprise accounts for more than 30 percent of total labor or income. Seventy-one percent of all households specialize in upland rice and 20 percent specialize in wild oil palm. Only four other enterprises, inland swamp rice, cassava, onions-peppers-tomatoes, and labor sold out, are specialized in by more than 5 percent of the households. The average household specializes in 1.5 enterprises.

The percentage contribution of different enterprises to total labor, income, and acreage of households is shown in the last three columns of Table 3.1. Upland rice accounts for 47 percent of total labor and 27 percent of total income, leading both categories. Inland swamp rice, wild oil palm and labor sold out each account for over 5 percent of total labor and income. In addition,

groundnuts accounts for over 5 percent of total labor and fishing accounts for over 5 percent of total income. Rice accounts for over 80 percent of total acreage cultivated; other annuals and tree crops represent 11 percent and 7 percent, respectively.

Table 3.1 also shows the contributions of nonfarm enterprises to household income and labor. About 21 percent of total household income in rural Sierra Leone comes from nonfarm sources. Nonfarm labor accounts for 13 percent of total labor used by the rural household. Two enterprises, labor sold out and fishing, account for over half of nonfarm labor and income.

3.2 Enterprise Returns

Tables 3.2 and 3.3 present net enterprise returns per household man-hour equivalent[1] and per acre, respectively, for eighteen enterprises. The returns are computed by calculating the value of output for an enterprise and subtracting actual or imputed values for variable costs (hired labor, land payments, seed, fertilizer, and mechanical services, etc.), an establishment cost factor (for tree crops), and an annual cost of capital factor (especially important for nonfarm enterprises). Net returns are then divided by the number of household man-hour equivalents or acres devoted by the household to the given enterprise to arrive at enterprise net returns per

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[1] Female and child labor hours are weighted at .75 and .50 man-hour equivalents respectively, reflecting the ratios of their hired labor wages to those for adult males. Adults are those household members 16 years and older (Spencer and Byerlee, 1975).

Table 3.2 FARM AND NON-FARM ENTERPRISES CLASSIFIED ACCORDING TO NET RETURNS PER MANHOUR[a]

Returns Category and Enterprise	Returns to Labor By Region (cents/hour)				Number of Observations
	North	South	East	National	
Low					
Fundi	5.4	-	-	5.4	33
Labor Sold Out	5.9	7.8	7.5	6.9	228
Upland rice	6.9	7.7	10.8	7.9	227
Groundnuts	12.2	5.9	-	9.9	62
Onions-peppers-tomatoes	10.0	-	-	10.0	25
Middle					
Carpentry	-	-	-	12.1	16
Inland Swamp Rice[b]	11.1	15.8	15.8	12.5	46
Coffee	-	-	16.8	16.8	27
Cassava	-	23.7	-	19.9	79
Riverain rice (mech.)	-	23.8	-	23.8	12
Oil Palm (wild)	16.0	28.1	44.8	25.4	120
High					
Blacksmithing	-	-	-	27.7	14
Mangrove rice	-	-	-	27.9	11
Tailoring	-	-	-	32.1	19
Cocoa	-	-	33.5	33.5	13
Boliland rice (mech.)	35.7	-	-	35.7	9
	36.8	-	-	36.8	13

[a]Only households for which an enterprise accounted for more than 10 per cent of total household labor or income are included in the computation of net returns for that enterprise (exception is labor sold out for which all households selling labor are included). Blanks are shown above where there were less than 10 households in the given region meeting the above criteria.

[b]Figures for the South and East have been combined due to an insufficient number of cases for each region individually.

Source: Survey Data

manhour or per acre. Returns data for an enterprise are based on households in which the enterprise contributes greater than 10 percent of total labor or income (Spencer, Byerlee, and Franzel, 1979).

Enterprises in Table 3.2 are grouped into high-returns, middle-returns, and low-returns per manhour enterprises. Inland fishing has the highest return, 64.7 cents per manhour. Marine fishing, mechanized Boliland rice, cocoa, tailoring, mangrove rice, and blacksmithing follow. The enterprise with the lowest returns is fundi, 5.4 cents per hour. Other low-returns enterprises include labor sold out, upland rice, onions-peppers-tomatoes and groundnuts. Middle-returns enterprises include wild oil palm, mechanized riverrain rice, cassava, coffee, inalnd swamp rice, and carpentry.

Table 3.2 shows the high returns associated with nonfarm enterprises. Of the six nonfarm enterprises listed, four are high-returns enterprises. Although nonfarm enterprises make up only one-third of all enterprises, they account for 57 percent of the high-returns enterprises.

An inter-regional comparison shows returns per manhour to be consistently lower in the North than in the rest of the country. The North has the lowest returns per hour of any region for upland rice, inland swamp rice, oil palm, and labor sold out, enterprises which account for over half of total income. The North's lower enterprise returns are associated with the region's poorer ecological characteristics and contribute to the lower incomes per consumer equivalent recorded in that region. For the three major enterprises which are

pursued in both the South and the East, the East has higher returns for two of them--upland rice and oil palm.

Net returns per acre for major crops are shown in Table 3.3. Onions-pepper-tomatoes have the highest returns to land, 366 Le. per acre, or about three times as high as mangrove swamp rice, the next leading crop. Fundi and upland rice have the lowest returns per acre.

TABLE 3.3.--Net Returns per Acre for Major Crops in Sierra Leone[a]

Enterprise	Net Returns Per Acre				Number of Observations
	South	North	East	Nationwide	
Rice					
Upland	35.73	34.45	54.11	37.00	227
Inland Swamp	100.68	97.26	100.68	98.52	46
Mangrove	121.78	---	---	121.78	11
Riverrain (mechanized)	55.08	---	---	55.08	12
Boliland (mechanized)	---	54.60	---	54.60	9
Other Annuals					
Fundi	---	34.55	---	34.55	33
Cassava	56.18	---	---	56.18	79
Groundnuts	40.81	68.81	---	58.73	62
Onions-Peppers-Tomatoes	---	353.04	---	353.04	25
Tree Crops					
Cocoa	---	---	65.69	65.69	13
Coffee	---	---	70.74	70.74	27

[a]Blanks indicate that less than ten observations were available for analysis. Figures for inland swamp rice in the South and East are combined due to a shortage of observations in the individual regions.

3.3 Differences in Enterprise Emphasis Among Income Groups

The households in this study are assembled into income groups according to their incomes per consumer equivalent (ICE). ICE is employed instead of per capita income to account for differences in consumption requirements among families with different sex and age structures. This is important because of the high degree of variation in the composition of households among different regions of Sierra Leone. In general, households are larger and dependency ratios higher in the North.

Family members are accorded consumption weights as shown in Table 3.4. These weights were established by the FAO for the

TABLE 3.4.--Age/Sex weights Used in Calculating Consumer Equivalents

Age/Sex	Male	Female
0-4	.2	.2
5-9	.5	.5
10-14	.75	.7
15+	1.0	.9

SOURCE: FAO, 1957.

calculation of man-equivalent calorie requirements (FAO, 1957). Since food consumption accounts for about 70 percent of total consumption in rural Sierra Leone these weights are believed to be reasonable proxies for overall consumption requirements (King and Byerlee, 1977).

The sample households are divided into income terciles with 98 households (30 percent) in the highest and lowest terciles, and 132 households (40 percent) in the middle tercile. They are also divided into income deciles with 32 to 33 households (10 percent) per decile.

The analysis of enterprise emphasis among income groups is important for designing programs to increase the incomes of the rural poor. In order to help low income farmers, we must understand which enterprises they pursue and the constraints which limit their particular production possibilities. Table 3.5 shows that enterprise emphasis changes significantly between income groups. Twelve of the 22 most important enterprises are associated with a specific income tercile, using a test of proportions and a 10 percent significance level (Clark and Schkade, 1974). Nine enterprises are significant at the 5 percent level. Boliland rice (hand and mechanized) and blacksmithing are emphasized by high-income households, whereas groundnuts, onions-peppers-tomatoes, marine fishing, and carpentry are undertaken primarily by middle-income households. Low-income farmers emphasize upland rice, fundi, other vegetables, fruits, and labor sold out more often than other income groups.

A comparison of the results of Table 3.2 and Table 3.5 show that all enterprises emphasized by high-income households have high returns to labor, and that all enterprises emphasized by low-income households have low returns to labor. The enterprises emphasized by middle-income households include low, middle, and high-returns enterprises.

TABLE 3.5.--Enterprise Emphasis Among Income Group in Rural Sierra Leone

	Percentage of Households for Which Enterprise Contributes Greater than 10% of Total Labor or Income			Number of Observations	Income Class Emphasis[a]	
	High Income	Middle Income	Low Income		Level of Significance .05	.10
FARM						
Rice						
Upland	69.4	76.5	88.8	25.6	--	L
Inland Swamp	28.6	27.3	24.5	88	--	--
Mangrove	3.1	1.0	0	4		
Boliland Rice (Hand)	7.1	4.5	1.0	14	--	H
Boliland Rice (Mech.)	6.1	2.3	0	9	H	H
Riverain (Mech.)	4.1	4.5	3.1	13	--	--
Other Annuals						
Fundi	7.1	9.8	16.3	36	L	L
Cassava	28.6	28.8	25.5	91	--	--
Groundnuts	17.3	28.8	19.4	74	M	M
Onions-Peppers-Tomatoes	8.2	12.1	4.1	28	M	M
Other vegetables	4.1	10.6	16.3	34	L	L
Tree Crops						
Fruits	0	2.3	5.1	8	L	L
Cocoa	8.2	5.3	5.1	20	--	--
Coffee	11.2	9.8	12.2	36	--	--
Oil Palm (wild)	36.7	40.1	43.9	132	--	--
Animals	0	0	2.0	2		
NONFARM						
Fishing						
Marine Fishing	6.1	8.3	2.0	19	--	M
Inland Fishing	7.0	8.3	3.1	21	--	--
Hunting and Gathering	2.0	2.3	2.0	7		
Small-Scale Industries						
Tailoring	6.1	4.5	4.1	16	--	--
Carpentry	0	4.5	2.1	8	M	M
Blacksmithing	8.2	3.8	0	13	H	H
Spinning-Weaving	1.0	1.5	0	3		
Other small industries	3.0	3.8	5.1	13	--	--
Trading	2.0	3.8	1.0	8	--	--
Labor Sold Out	18.4	20.5	39.8	84	L	L

[a]Using Test of Proportions (Clark and Schkade, 1974). Only those enterprises with over eight cases are tested. H = High; M = Middle; L = Low.

Therefore, it is likely that enterprise choice is an important factor in determining rural income levels. Since poor rural households pursue low-returns enterprises, they obtain low levels of income.

Table 3.6 compares enterprise emphasis among the high decile and low-decile households. The table shows the heavy emphasis which the poorest households give to upland rice. Upland rice labor accounts for 67 percent of total labor inputs for low-decile households but only 30 percent for high-decile households. Households in the high-decile group devote a greater proportion of their labor to virtually all other enterprises (exception being fundi and carpentry) than do the poorest households.

The differences in enterprise emphasis between high and low-decile groups is somewhat different than the differences between high and low-tercile groups. Upland rice, fundi, and "other vegetables" are emphasized by low-decile households. Inland swamp rice, cassava, onions-peppers-tomatoes, fishing, and tailoring are undertaken primarily by high-decile households. Three less prevalent enterprises, mechanized riverain rice, mangrove swamp rice, and cocoa also make important contributions to the incomes of high-decile households.

3.4 Comparative Expected Net Margin Analysis: Returns to Labor and Land

The preceding analysis shows that enterprise choice varies among income groups. Next, expected net margin analysis[1] is used

[1] Upton refers to this method as potential net margin analysis.

TABLE 3.6.--Enterprise Emphasis Among the Highest and Lowest Decile Income Groups in Rural Sierra Leone[a]

	Percentage of Households Undertaking Enterprise[b]		Percentage of Households for which Enterprise is Important[c]		Percent of Total Household Labor		Percent of Total Household Income[d]	
	High 10	Low 10	High 10	Low 10	High 10	Low 10	High 10	Low 10
FARM								
Rice								
Upland	66	91**	14	28	30.4	66.7	18.7	32.8
Inland Swamp	53**	37	19	9	9.8	8.0	11.9	4.1
Mangrove	3	0	3	0	3.0	0	3.4	0
Boliland (hand)	9	3	3	0	0	0	0.1	0
Boliland (mech.)	6	0	3	0	2.5	0	6.3+	0
Riverrain (mech.)	9	3	9	3	3	1.2	7.1++	0
Other Annuals								
Fundi	6	31**	3	3	1.4	4.6	0.4	2.0
Cassava	75**	41	3	6	4.9	1.9	3.1	7.2
Groundnuts	47	47	6	0	5.1	2.8	2.9	4.3
Onions-Peppers-Tomatoes	22**	6	9	3	6.3	0.7	4.9	5.1
Other Vegetables	34	53**	0	0	0.6	0.6	0.2	0.7
Tree Crops								
Fruits	19	9	0	3	0.6	0.2	--	--
Cocoa	19	9	3	0	1.4	0.2	4.8++	0
Coffee	25	16	3	0	1.8	1.0	4.4	2.0
Oil Palm (Wild)	59	66	16	25	5.6	3.4	6.1	16.7+
Animals	3	6	0	3	0.1	0.2	0.1	1.0
NONFARM								
Fishing	50**	16	9	0	4.3	0.3	16.5++	0
Hunting-Gathering	22	22	0	0	0.3	0.2	0.5	1.6
Small Scale Industries								
Tailoring	22**	3	9	3	2.6	0.2	4.6	3.0
Carpentry	3	6	0	3	0.2	0.9	0	0.5
Blacksmithing	6	12	3	0	0.3	0	0.8	0
Spinning-Weaving	9	3	0	0	0.3	0.1	0.5	0
Other Small Industries	12	2	0	3	2.3	0.1	1.4	0
Trading	6	6	0	3	0.2	0.2	0.3	1.6
Labor Sold Out	72	72	0	9	5.8	5.3	2.4+	17.1++
TOTALS					100.0	100.0	100.0	100.0

[a] * and ** means significant at the 10% and 5% level respectively under a binomial distribution test for small sample sizes.
+ and ++ mean significant at the 10% and 5% levels respectively, under a Chi-square test.

[b] Enterprise contributes greater than 1% of total household labor or income.

[c] Enterprise contributes greater than 10% of total household labor or income.

[d] Where returns to an enterprise are negative, zero is substituted for a negative percentage.

to measure the effect of enterprise choice on labor productivity and land productivity (Upton, 1973). Since labor is the chief resource constraint to increasing incomes in rural areas, labor productivity, as measured by the returns to labor, is emphasized (Spencer and Byerlee,1977).

The expected net margin per hour for an enterprise is the average returns per hour for that enterprise for all farmers undertaking it. The expected net margin, thus, gives an expected value of returns based on the performance of all farmers engaged in the enterprise. The overall household expected net margin per hour weights the various expected net enterprise margins per hour by the amount of labor expended for each enterprise. It thus represents the returns to labor based solely on the choice of enterprises and not on the actual performance of the particular household.

A numerical example is provided for further clarification. Assume that two farmers grow only two crops each--groundnuts and cassava. Farmer A devotes 80 percent of his labor to groundnuts and 20 percent to cassava while Farmer B devotes 50 percent of his labor to each crop.

Looking back at Table 3.2 we see that the nationwide net returns per manhour for groundnuts and cassava are about 10 cents and 20 cents per hour. The farmers' individual expected net margins per hour are then weighted by percentage of total labor expended:

Farmer A: (.8 x 10) + (.2 x 20) = 12 cents/manhour

Farmer B: (.5 x 10) + (.5 x 10) = 10 cents/manhour

We thus conclude that Farmer A pursues an enterprise mix which gives him a higher expected net margin per hour than Farmer B.

Expected net margins to land are calculated in a similar manner. But whereas expected net margins per hour are weighted by the enterprise's percentage of total labor, expected net margins per acre are weighted by the enterprise's percentage of total household land. Net margins per acre are obtained from Table 3.3.

As stated previously, studies by Petu and Upton (1964) and Matlon (1977) showed that the crop mix accounted for very little variation in productivity. Matlon, however, found a greater emphasis on nonfarm enterprises among high-income households which did result in higher overall returns to labor.

In the following analysis, expected net margins per hour are shown for both farm enterprises and all enterprises undertaken by the households. A comparison of expected net margins per manhour for farm enterprises of different regions is shown in Table 3.7. In column 1, expected enterprise net margins per manhour are based on the regional averages of enterprise net margins from Table 3.2. In column 2, net margins per manhour are computed using nationwide averages. When general averages are used, the net margin per hour takes into account differing productivity between acres for a particular enterprise. National averages, on the other hand, gloss over regional differences in productivity. In both cases, the differences between mean expected net margins of different regions are significant at the 1 percent level, using an analysis of variance test.

TABLE 3.7.--Expected Household Net Margins to Labor and Land Among Regions of Rural Sierra Leone[a]

	Returns to Labor Mean Expected Household Net Margin/Manhour (cents)		Returns to Land Mean Expected Household Net Margin/Acre (Le.) Using Regionwide Enterprise Returns
	Using regional Enterprise Returns	Using Nationwide Enterprise returns	
Farm Enterprises Only			
South	12.96**	13.63**	45.04
North	9.93**	10.69**	79.31
East	14.91**	12.33**	68.77
National	11.91	12.20	62.56
All Enterprises			
South	13.44**	13.97**	--
North	11.01**	11.77**	--
East	15.21**	12.80**	--
National	12.69	12.87	--

[a]Expected household net margins are defined in Section 3.4. Enterprise returns to land and labor are obtained from Tables 3.3 and 3.4 respectively. Where there were less than ten cases of an enterprise in a region, nationwide net margins for the enterprise were used.

*Differences between regions are significant at the 5 percent level using a test of analysis of variance.

**Differences between regions is significant at the 1 percent level, using a test of analysis of variance.

Using nationwide average returns, the South has the highest expected net margin per manhour, 13.7 cents, whereas the North has the lowest 10.7 cents per manhour. The predominance of high-returns enterprises in the South, e.g., mangrove rice, mechanized riverain rice, and inland fishing, explains the South's high ranking. Crops found in the North, e.g., fundi, groundnuts, and onions-peppers-tomatoes, tend to give low returns.

Assigning regional averages for net margins per manhour to households within each region (column 3) results in a different ranking. The East is highest at 14.9 cents per hour, since returns to labor for major enterprises are higher in the East than in other regions. Both the crop mix and differing returns of major enterprises between regions leads to inter-regional differences in labor productivity and income.

Table 3.8, column 1, presents the expected farm net margin per manhour for different income groups. Nationwide, the high-decile group has an expected net margin 40 percent higher than the low-decile group and this difference is significant at the 5 percent level. Differences between the terciles were not significant. Nevertheless, from the highest income group through the lowest income group in Table 3.8, there is a consistent trend of decreasing expected household net margins per hour for farm enterprises. Therefore, there is some degree of association between crop mix and income level.

TABLE 3.8.--Expected Household Net Margins to Labor and Land by Region and Income Group in Rural Sierra Leone[a]

Income Group	Returns to Labor Mean Expected Household Net Margin/manhour (cents)		Returns to Land Mean Expected Household Net Margin/Manhour (Le.)
	Farm Enterprises	All Enterprises	
South	12.96	13.44*	45.04
Lowest 10%	13.61	12.20**	--
Lowest 30%	12.80	12.89*	41.72
Middle 40%	12.28	12.71*	48.12
Highest 30%	14.05	15.00*	--
Highest 10%	19.34	18.52**	44.17
North	9.93	11.01	79.31
Lowest 10%	9.64	8.25*	--
Lowest 30%	8.71	8.72**	76.83
Middle 40%	11.01	11.36**	80.18
Highest 30%	9.70	12.83**	80.59
Highest 10%	10.30	12.47*	--
East	14.91	15.21	68.77
Lowest 30%	14.84	15.23	47.50
Middle 40%	14.77	14.96	89.04
Highest 30%	15.17	15.50	64.56
Nationwide	12.20	12.87**	62.56
Lowest 10%	10.73*	10.80**	--
Lowest 30%	11.34	11.35**	61.60
Middle 40%	12.45	13.24**	63.51
Highest 30%	12.71	13.90**	62.26
Highest 10%	15.06*	16.51**	--

[a]Expected household net margins are defined in Section 3.4. Enterprise returns to land and labor are obtained from Tables 3.3 and 3.4 respectively. Where there were less than ten cases of an enterprise in a region, nationwide net margins were used.

Decile data are not shown for the East because deciles in the East consisted of less than ten households.

*Difference between regions is significant at 5 percent level using a test of analysis of variance.

**Difference between regions is significant at the 1 percent level, using a test of analysis of variance.

Table 3.8, column 1, also presents a breakdown by income group for each region. In this analysis, there is less indication of an important association between income levels and expected farm net margin per hour. At a 5 percent level of significance under a test of analysis of variance, there were no significant differences in expected farm net margin per hour between either tercile groups or high- and low-decile groups in any of the regions. Nor in any region did expected net margins follow a consistent declining trend from high-income groups to low-income groups.

Tables 3.8 also shows expected net margins per hour for all enterprises, that is, both farm and nonfarm activities. The results are nearly identical to those in the analysis of farm enterprises, with differences between regions significant at the 1 percent level. Therefore, the enterprise mix is important in generating differences in productivity between regions.

Table 3.8, column 2, presents all-enterprise expected net margins per hour for different income groups. The high-tercile households have an expected net margin per hour 5 percent higher than that of the middle-tercile and 22 percent higher than that of the low-tercile households. Moreover, the differences between income groups are significant at the 1 percent level. Thus, a strong association exists between income level and expected household net margin per hour. This supports the hypothesis that enterprise emphasis has a significant effect on income distribution.

Similar results are obtained at the regional level. In both the South and the North differences between high- and low-decile groups are significant at the 5 percent level, under a test of analysis of variance. In the North, differences between terciles are significant at the 1 percent level and follow a consistently decreasing trend. Although the low-tercile group has a slightly higher expected net margin per hour than the middle-tercile group in the Southn, when they are grouped together they are significantly lower than the high-tercile at the 1 percent level. In the East, differences between income groups are not signficant.

Several important points can be made by comparing the all-enterprise figures with those for farm enterprises only. Using nationwide net margins per hour, the nationwide expected net margin per hour for all enterprises is 12.9 cents, 6 percent higher than that for farm enterprises. Furthermore, Table 3.7 shows that the disparity between the high-returns region and the low-returns region is 25 percent greater in the farm-enterprises analysis. Thus, non-farm enterprises both increase the net margins per hour and contribute to equalizing the expected net margins per hour between different regions.

Nonfarm enterprises, however, appear to skew the nationwide distribution of income. The range in expected net margins per hour between terciles is 12 percent for farm enterprises and 22 percent for all enterprises. Corresponding figures for the ranges between high- and low-deciles are 22 percent and 53 percent respectively.

Nevertheless, differences in expected household net margins among both regions and income groups are small when compared with actual differences in incomes per consumer equivalent. ICE differences between the East (the region with the highest ICE) and the North (the region with the lowest ICE) were 30 percent whereas expected net margins differed by only 19 percent. Differences in expected net margins play an even smaller role in determining income differences between income groups. The high-tercile group's ICE is 5.7 times that of the low-tercile group whereas its expected net margin per hour is only 22 percent higher. ICEs in the high-decile group are 14.9 times those of the low-decile group; expected net margins per hour differ by only 53 percent.

In conclusion, significant differences exist between the expected net margins per hour of income groups and regions, and nonfarm enterprises are especially important in determining these differences. However, the differences in expected net margins between income groups are small when compared to actual differences in income levels. Thus, enterprise choice has a limited role in determining the distribution of income.

Tables 3.7 and 3.8 also explore the relationship between enterprise choice and retuns to land. Table 3.7, column 3, shows expected net margins per acre by region. The differences between the regions are not significant at the 5 percent level. Nor is there a significant relationship between expected net margins per acre and income levels at the nationwide and regionwide levels (Table 3.8,

column 3). Nationwide, the expected net margin per acre differs by only 3 percent between the income terciles with the highest and lowest values. Thus there is no tendency for high-income farmers to choose crops which have higher overall returns per acre. This finding supports the hypothesis that access to land is not a major constraint to increasing incomes.

3.5 Enterprise Combinations

A study of enterprises in combination with their respective factor requirements can provide a better understanding of the farm system. For the purposes of this study, an enterprise combination consists of two enterprises which account for at least 60 percent of a household's total labor and which individually account for at least 10 percent of total household income or labor.[1] An enterprise combination serves as a simplified approximation of an overall farm system. Nine enterprise combinations, each representing at least ten households, are shown in Table 3.9. All combinations include upland rice as one of their component enterprises. Each of the nine enterprise

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[1] According to this definition, one household may have more than one enterprise combination. In the initial stages of this study, it was decided that enterprise combinations would be defined in terms of households, i.e., one enterprise combination per household. A household's enterprise combination was defined as all enterprises contributing greater than 10 percent of total household labor and/or income. However, because of the great diversity in enterprises and enterprise combinations, few households had the same combination. Using a sample of 328 households, there were only two enterprise combinations (upland rice alone and upland rice-wild oil palm) which represented over 12 households. Different values of the percentage contribution to total labor and income were tried, to no avail.

TABLE 3.9.--Major Enterprise Combinations of Rural Households in Sierra Leone[a]

	Cases	Mean % Contribution to Total Labor	Mean % Contribution to House-hold Labor	No. of Cases Per Region			No. of Cases Per Income Group			Income Tercile Emphasis[b]
				South	North	East	High (30%)	Middle (40%)	Low (30%)	
Upland Rice--Wild Oil Palm[c]	69	78.4	70.9	53	11	5	17 (24%)	25 (36%)	27 (40%)	Low
Upland Rice--Labor Sold Out	48	77.6	54.3	33	12	3	10 (21%)	12 (25%)	26 (54%)	Low
Upland Rice--Groundnuts	44	73.6	45.6	20	18	6	8 (18%)	22 (50%)	14 (32%)	Middle-Low
Upland Rice--Cassava	43	73.8	50.9	42	1	0	12 (28%)	16 (37%)	15 (35%)	--
Upland Rice--Inland Swamp Rice	40	73.8	56.2	11	11	18	15 (37%)	14 (35%)	11 (27%)	--
Upland Rice--Coffee	18	72.9	53.6	5	2	11	6 (33%)	6 (33%)	6 (33%)	--
Upland Rice--Fishing[d]	17	77.3	55.0	16	1	0	5 (29%)	8 (47%)	4 (23%)	--
Upland--Fundi	14	72.2	54.3	0	14	0	0	2 (14%)	12 (86%)	
Upland Rice--Tailoring-- or Carpentry	10	78.9	66.6	4	3	3	0	5 (50%)	5 (50%)	Middle-Low

[a]Enterprise combinations are defined in Section 3.5.

[b]According to tests of proportions, level of significance = 10%.

[c]Oil Palm enterprises in two enumeration areas in the North are excluded, due to the unreliability of measuring palm wine output.

[d]Includes 15 inland and two marine-fishing enterprises.

combinations accounts for over 70 percent of total labor in their respective households; all but one combination accounts for over 50 percent of total income. Five of the combinations--upland rice with inland swamp rice, with groundnuts, with tailoring-or-carpentry with wild oil palm, and with labor sold out--are well distributed throughout the country. Upland rice in combination with fundi, with cassava, with fishing, and with coffee are relatively region-specific.

In Table 3.9, column 10, a test of proportions (level of significance of 10 percent) is used to measure the association between choice of enterprise combination and income group (Clark and Schkade, 1974). Five of the nine combinations are associated with particular income groups. Upland rice-wild oil palm, upland rice-labor sold out, and upland rice-fundi are more frequently found among low-income households. Upland rice-tailoring-or-carpentry and upland rice-groundnuts are emphasized by middle and low income households. The other four combinations are not associated with any particular income group.

Two of the three combinations emphasized by the low income group, include only low returns enterprises. One, upland rice-wild oil palm, includes a middle-returns enterprise. Upland rice-groundnuts, a combination of two low-returns enterprises, is one of two combinations emphasized by middle and low income households.

Table 3.10 shows the contribution of enterprises in enterprise combinations to the total labor and income of households.

TABLE 3.10.--Contributions of Component Enterprises in Enterprise Combinations to Total House-Hold Labor and Income in Rural Sierra Leone[a]

	Combination Mean % Contribution to Total Labor	Combination Mean % Contribution to Household Income	Upland Rice Mean % Contribution to Total Labor	2nd Enterprise Mean % Contribution to Total Labor	Upland Rice Mean % Contribution to Total Household Income	2nd Enterprise Mean % Contribution to Total Household Income
Upland Rice Oil Palm[b]	78.4	70.9	65.1	13.4	30.1	40.8
Upland Rice Labor Sold Out	77.6	53.4	63.3	14.2	34.4	19.0
Upland Rice Groundnuts	73.6	45.6	60.0	13.7	49.4	10.7
Upland Rice Cassava	73.8	50.9	68.0	5.9	25.4	25.5
Upland Rice Inland Swamp Rice	73.8	56.2	54.0	19.8	38.8	17.4
Upland Rice Coffee	72.9	53.6	61.1	11.7	35.0	18.6
Upland Rice Fishing[c]	77.3	55.0	74.6	2.7	35.4	19.7
Upland Rice Fundi	72.2	54.0	58.0	14.1	40.7	13.6
Upland Rice Tailoring-or-Carpentry	78.9	66.6	70.7	8.2	41.6	25.0

[a]Enterprise combinations are defined in Section 3.5.

[b]Upland rice-oil palm combinations in two enumeration areas in the North have been excluded due to unreliability of measuring palm wine output.

[c]Includes 15 inland and 2 marine-fishing enterprises.

Upland rice accounts for over half of total labor for all combinations. The contributions of the second enterprise to total labor range from 3 percent (fishing) to 20 percent (inland swamp rice). Contributions of upland rice returns to total income range from 25 percent (in combination with cassava) to 49 percent (in combination with groundnuts). Second-enterprise contributions range from 10 percent (groundnuts) to 41 percent (wild oil palm). In two enterprise combinations, upland rice with cassava and with wild oil palm, upland rice contributes less than the second enterprise to total income.

The association between enterprise combinations and income levels for different regions is explored in Table 3.11. The South and the East, which have similar physical characteristics, are considered to be a single region in this analysis. Upland rice-wild oil palm, is emphasized by low-income farmers in the North but shows no marked association with any income group in the East-South. In the nationwide analysis (Table 3.9) it is associated with low-income households. Upland rice-inland swamp rice, which is not associated with a particular income group in the nationwide analysis, is clearly associated with low-income farmers in the North and with high- and middle-income farmers in the East-South. Upland rice-labor sold out is most commonly found among low income farmers in both regions, which mirrors the results of the nationwide analysis. Upland rice--groundnuts, which is emphasized by middle-low income groups in the nationwide analysis, is not associated with any income group in either

TABLE 3.11.--Enterprise Combinations and Income Levels of Rural Households in Regions of Sierra Leone[a]

Enterprise Combination	Region	Cases	No. of Cases Per Income Group			Income Level[b]
			High (30%)	Middle (40%)	Low (30%)	
Upland Rice--Wild Oil Palm[c]	N	11	0	2 (18%)	9 (82%)	Low
Upland Rice--Wild Oil Palm	E-S	58	14 (24%)	25 (43%)	19 (33%)	--
Upland Rice--Labor Sold Out	N	12	1 (8%)	2 (17%)	9 (75%)	Low
Upland Rice--Labor Sold Out	E-S	36	8 (22%)	13 (36%)	15 (42%)	Low
Upland Rice--Inland Swamp Rice	N	11	2 (18%)	2 (18%)	7 (64%)	Low
Upland Rice--Inland Swamp Rice	E-S	29	12 (41%)	12 (41%)	5 (17%)	High-Middle
Upland Rice--Ground-Nuts	N	18	4 (23%)	9 (50%)	5 (28%)	--
Upland Rice--Ground-Nuts	E-S	26	5 (19%)	13 (50%)	8 (31%)	—

[a]Enterprise combinations are defined in Section 3.5. Only those enterprise combinations with more than ten cases in the East-South and North are included.

[b]According to test of proportions ($\alpha = .10$).

[c]Oil palm enterprises in two enumeration areas in the north have been excluded, due to the unreliability of measuring palm output.

region. This analysis thus shows that relationships between enterprise combinations and income groups which occur nationwide do not necessarily hold at the regional level.

Both the upland rice-wild oil palm and the upland rice-inland swamp rice combinations are associated with poorer farmers in the North than in the East-South. This result can largely be attributed to the lower returns per man-hour for each of the three crops in the North as compared to the other two regions. This, in turn, reflects the poorer physical characteristics of the North. The association between enterprise combinations and income levels will be further examined in Section 5.

CHAPTER IV

FACTOR USE AND ENTERPRISE EMPHASIS

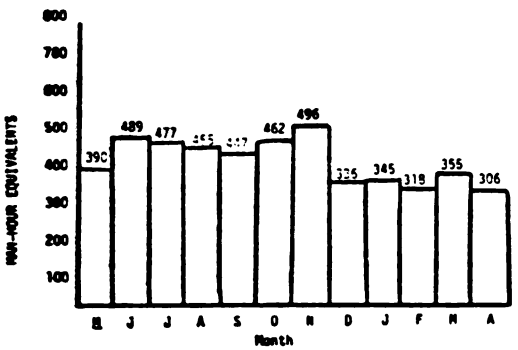
This chapter examines the levels and timing of factor use and the relationship between factor use and enterprise choice. Emphasis is given to the use of labor and capital, the two most severely limiting factors in rural Sierra Leone. The complimentarity of upland rice and inland swamp rice with other enterprises is also examined. The analysis in this chapter provides background for the examination of factor use in enterprise combinations in Chapter V.

4.1 Seasonal Labor Use Among Regions

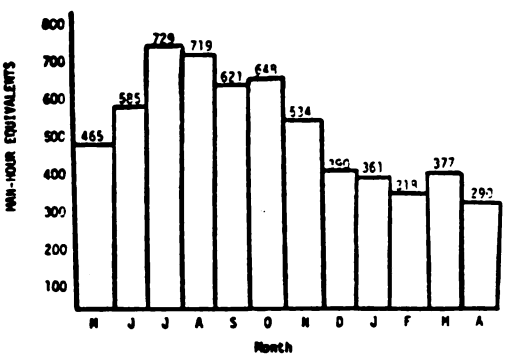
The monthly distribution of labor used by households of different regions is shown in Figure 4.1. Peak periods and slack periods in the South are relatively uniform, with the former extending from June through November and the latter from December through May. These periods correspond rather closely to the rainy season and dry season, respectively. The low coefficient of variation, 17.6, reflects the relative smoothness in labor use from month to month. Labor use in the north, on the other hand, is characterized by much sharper peak and trough periods. Peak months are July and August and the slack period is December through April. The coefficient of variation between months is 31.1, almost double that of the South. The East's peak

Figure 4.1
Monthly Distribution of Labor Used Per Household By Region in Rural Sierra Leone, May 1974-April, 1975

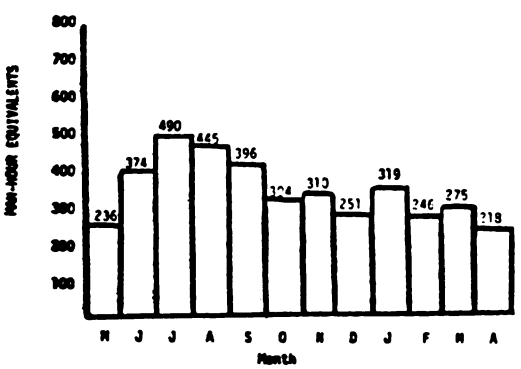
A. SOUTH



B. NORTH



C. EAST



D. NATIONAL

labor period is June to September with a relatively uniform slack period extending through the rest of the year. The region's high monthly coefficient of variation, 27.0, is probably related to the high degree of homogeneity of cropping systems in the East.[1] The more seasonal nature of labor use in the North is related to its shorter rainy season and lower levels of rainfall.

4.2 Seasonal Labor Use for Individual Enterprises

The monthly distribution of labor used for major enterprises is shown in Figures 4.2 to 4.10. Monthly labor profiles are on a per-acre basis for farm enterprises and a per-case basis for nonfarm enterprises. The analysis includes only those cases in which the enterprise contributes greater than 10 percent of total household labor or income. The peak periods and slack periods of individual enterprises are shown in Table 4.1.

Labor profiles for upland rice are shown in Figure 4.2. Peak periods are June to November in the South, June to October in the North, and June to July in the East. In the North and the South, these periods correspond roughly with the rainy season. In the South and the East, the peak month for labor use is July, when weeding takes place. In the North, October, the month of harvesting, is the busiest month although labor use is high in July as well.

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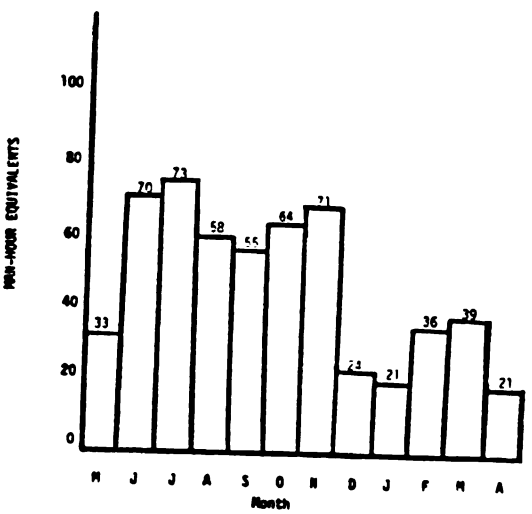
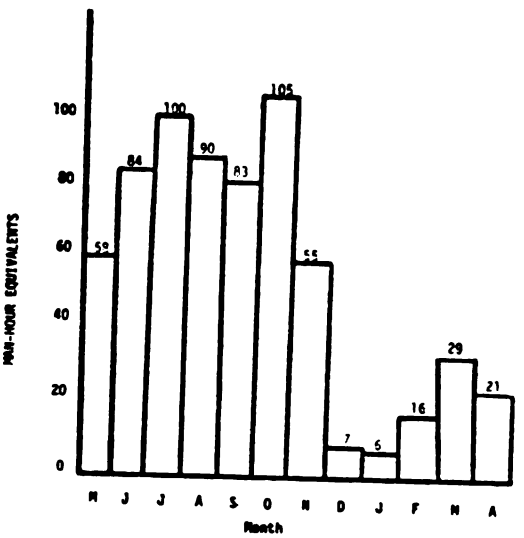
[1] It is recalled that the South and North consist of three and four resource regions, respectively, whereas the East consists of only one. A higher degree of variation in physical resources brings about more crop diversity and a consequent lower coefficient of variation for seasonal labor use.

Figure 4.2
Monthly Distribution of Labor Used for the Production
of An Acre of Upland Rice in Sierra Leone
May 1974-April 1975

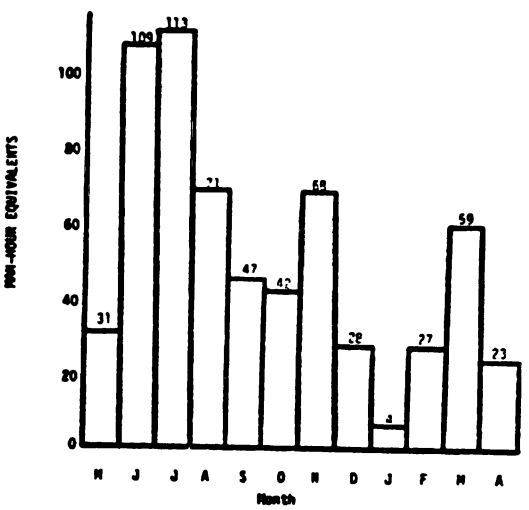
A. SOUTH



B. NORTH



C. EAST



D. NATIONAL

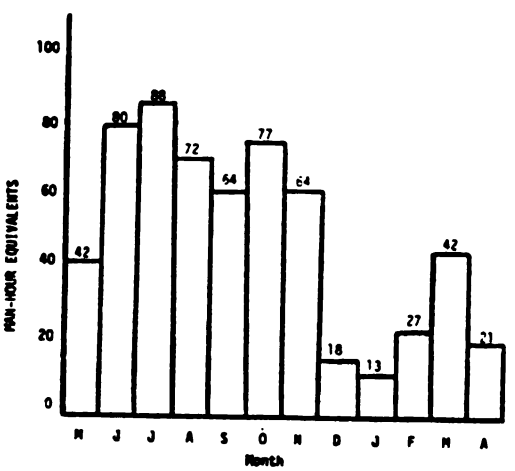
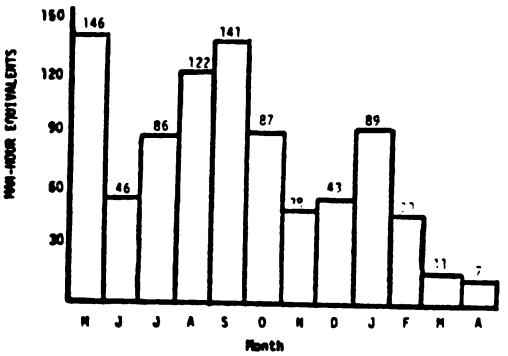
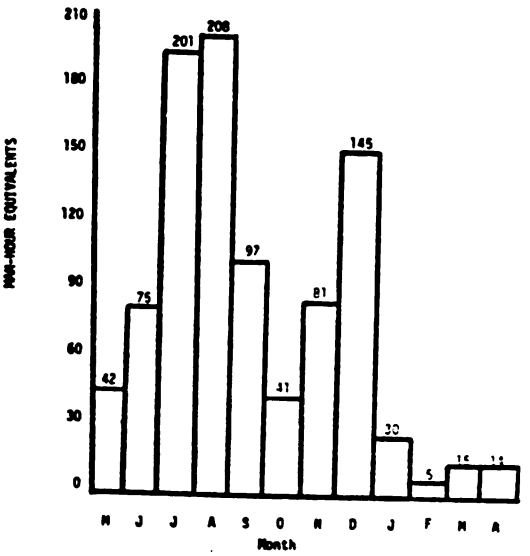


Figure 4.3
Monthly Distribution of Labor Used for the Production of an Acre of Inland Valley Swamp Rice and an Acre of Mangrove Swamp Rice in Sierra Leone, May 1974-April 1975

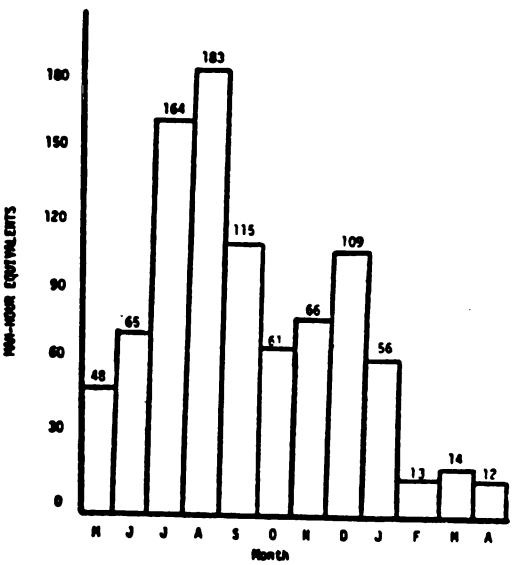
A. INLAND SWAMPS: SOUTH & EAST



B. INLAND SWAMPS: NORTH



C. INLAND SWAMPS: NATIONAL



D. MANGROVE SWAMPS: SOUTH

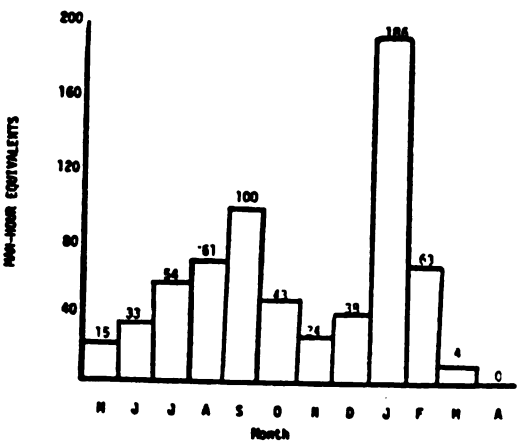
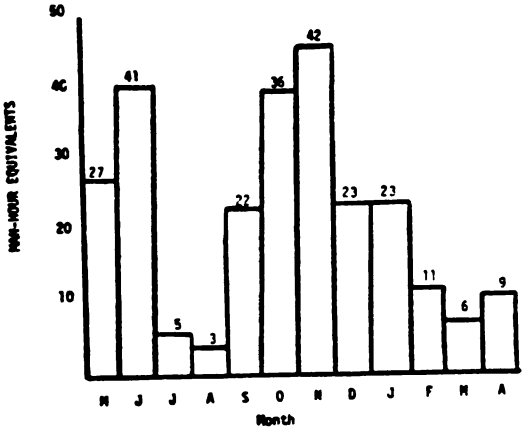
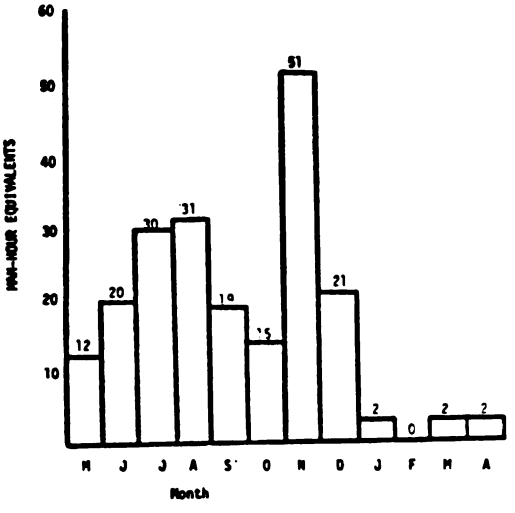


Figure 4.4
Monthly Distribution of Labor Used for the Production of an Acre of Riverain Rice and an Acre of Boliland Rice in Sierra Leone, May 1974-April 1975

A. RIVERAIN-MECHANIZED



B. BOLILAND-MECHANIZED



C. BOLILAND-HAND

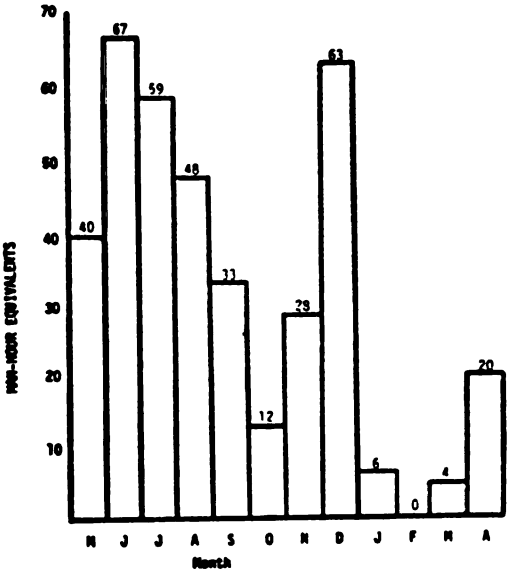
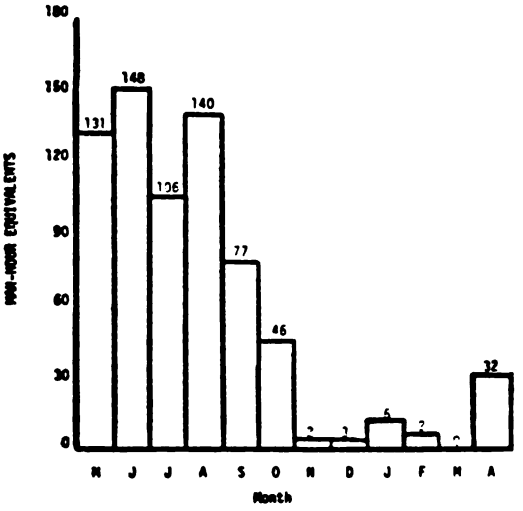
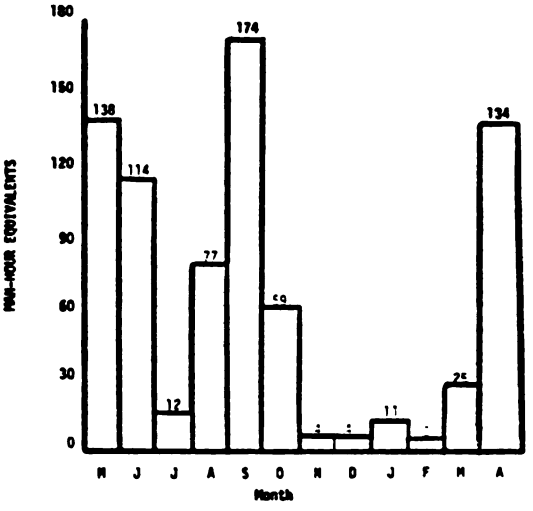


Figure 4.5
Monthly Distribution of Labor Used for the Production of an Acre of Fundi and an Acre of Groundnuts in Sierra Leone, May 1974-April 1975

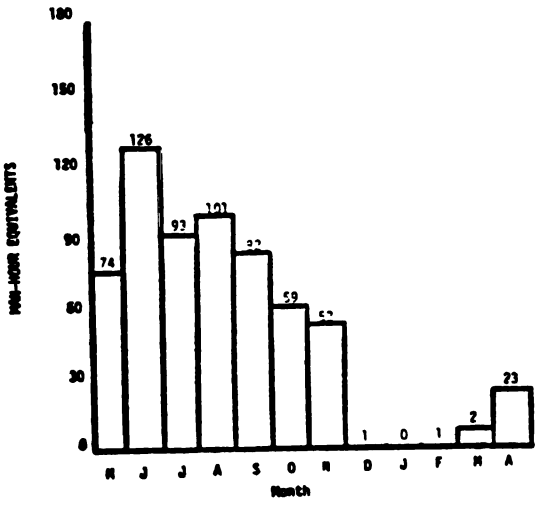
A. FUNDI



B. GROUNDNUTS: SOUTH



C. GROUNDNUTS: NORTH



D. GROUNDNUTS: NATIONAL

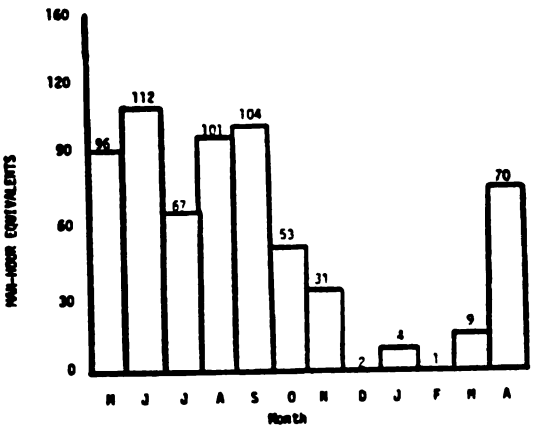
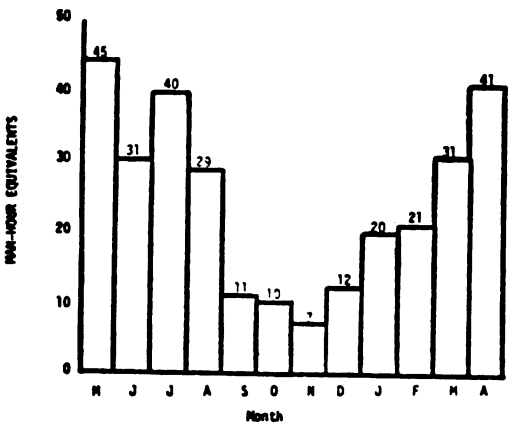


Figure 4.6
Monthly Distribution of Labor Used for the Production of an Acre of Cassava and an Acre of Onions, Peppers, and Tomatoes (OPT) in Sierra Leone, May 1974-April 1975

A. CASSAVA: SOUTH



B. ONIONS, PEPPERS AND TOMATOES: NORTH

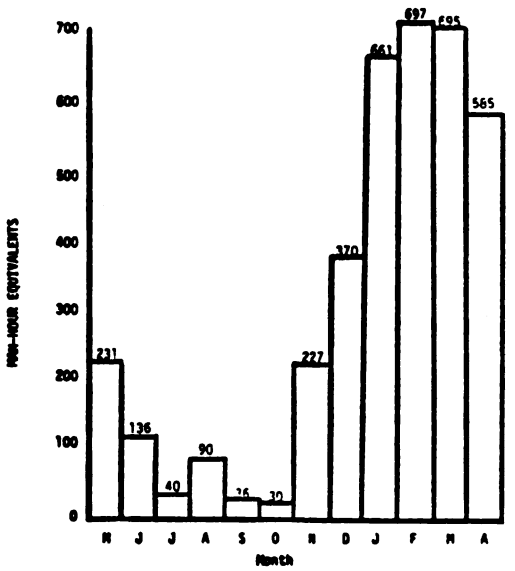
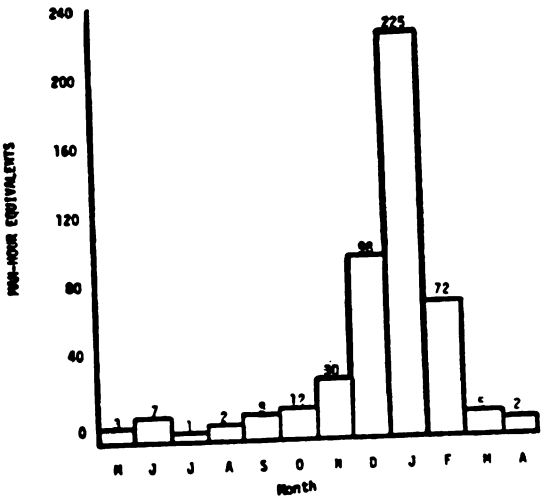


Figure 4.7
Monthly Distribution of Labor Used for the Production of an Acre of Coffee and an Acre of Cocoa in Eastern Sierra Leone, May 1974-April 1975

A. COFFEE



B. COCOA

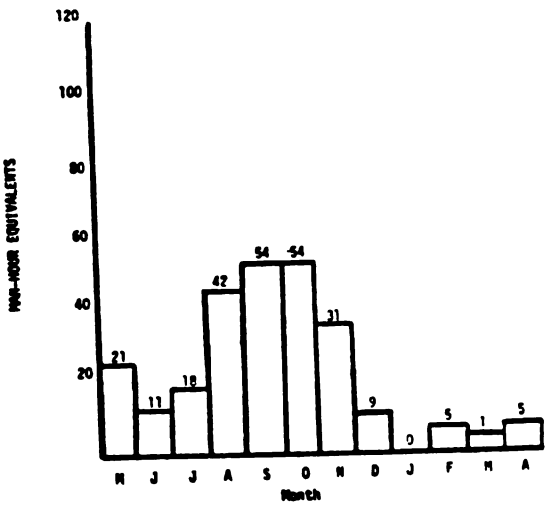
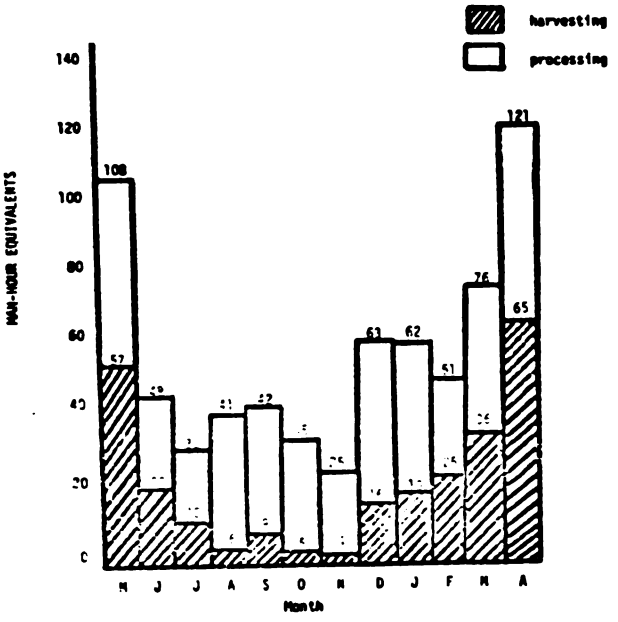
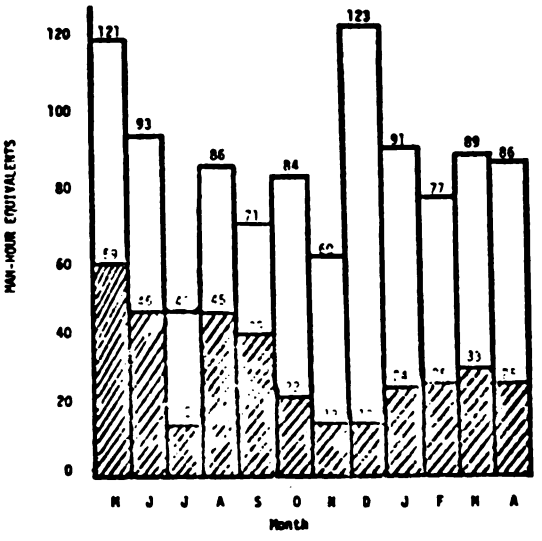


Figure 4.8
Monthly Distribution of Labor Used for the
Production and Processing of Wild
Oil Palm Products in Sierra Leone
May 1974-April 1975

A. SOUTH



B. NORTH



C. NATIONAL

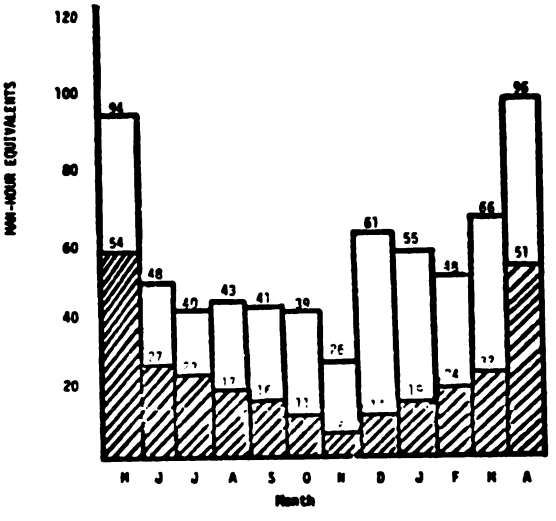
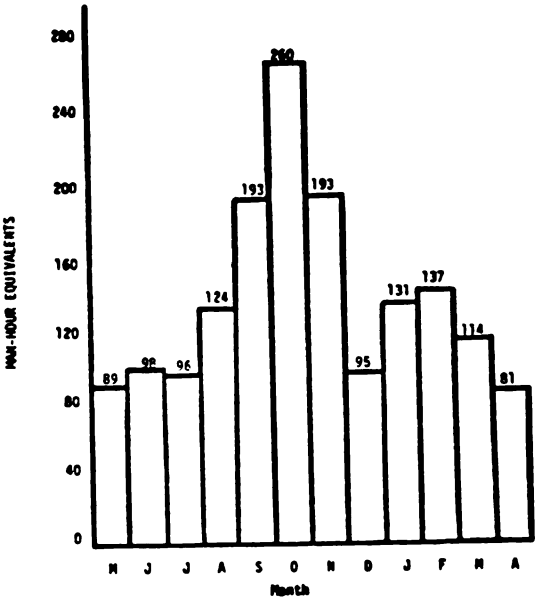


Figure 4.9
Monthly Distribution of Labor Use Per Household in Small-Scale Fishing and Processing Production in Sierra Leone, May 1974-April 1975

A. MARINE FISHING: NORTH



B. INLAND FISHING

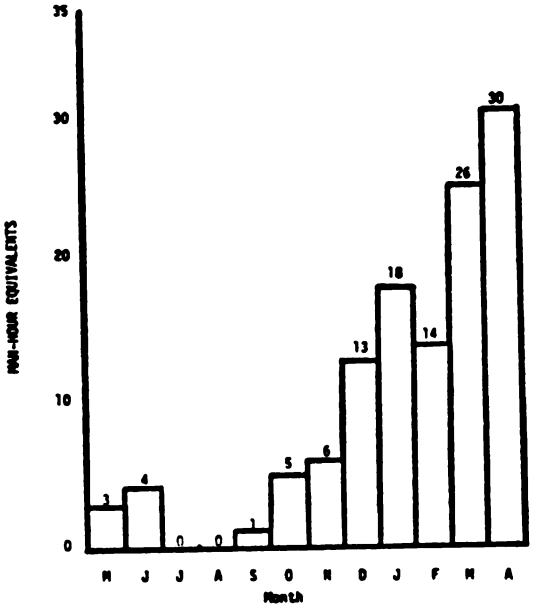
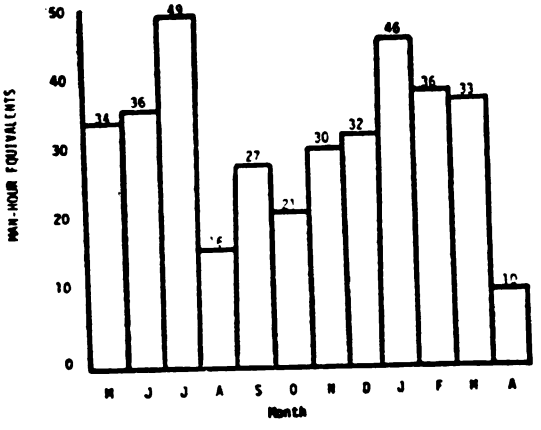
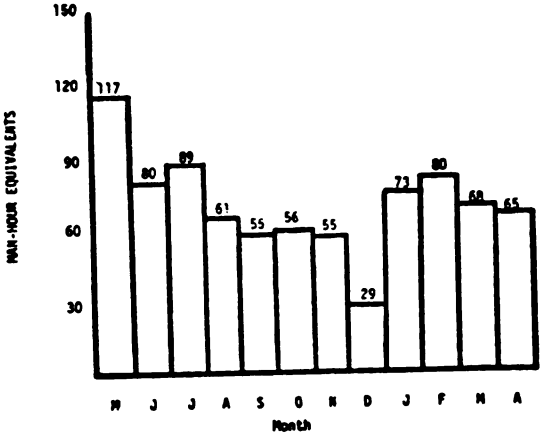


Figure 4.10
Monthly Distribution of Labor Use for Small-Scale Industrial Firms in Rural Sierra Leone, May 1974-April 1975

A. CARPENTRY



B. BLACKSMITHING



C. TAILORING

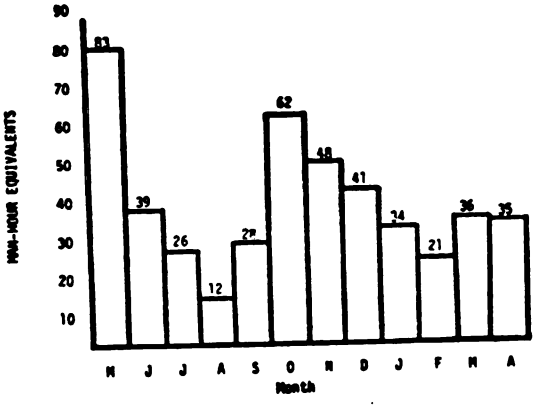


TABLE 4.1.--Peak Periods and Slack Periods for Selected Enterprise in Rural Sierra Leone

	Region	Peak Month	Peak Period	Tasks	Slack Period
FARM					
Rice					
Upland Rice	S	July	June-Nov.	Plant, Weed, Harvest	Dec-March
	N	Oct	June-Oct	Plant, Weed, Harvest	Dec-April
	E	July	June-July	Plant	Sept-Oct, Nov-Feb, Apr-May
Inland Swamp	E-S	May	May, July-Oct Jan	Land prep, plant, transpe, weed, harvest	June, Nov-Dec Feb-Apr.
	N	Aug	July-Aug, Dec	Plant, Transpe Harvest	Oct, Jan-May
Mangrove	S	Jan	Sept, Jan	Transpl, harvest	March-May, Nov
Riverrain (Mech.)	S	Nov	Jn, Oct-Nov	Plant, Birdscaring harvest	Feb-Apr July-Aug
Boliland (Mech.)	N	Nov	July-Aug, Nov.	Plant, harvest	Jan-Apr
Boliland (Hard)	N	Dec	May-Aug, Dec.	Land Prep, Plant, harvest	Oct, Jan-March
Other Annuals					
Fundi	N	June	May-Aug	Land prep, plant, weed, harvest	Nov-March
Groundnuts	S	Sept	Apr-May, Sept	Land prep, plant, harvest	Nov-March, Jul.
Groundnuts	N	June	May-Sept	Plant, Weed, Harvest	Dec-Apr.
Cassava	S	May	March-Aug	Plant, Weed, Harvest	Sept-Dec
Onions-Peppers-Tomatoes	N	Feb	Jan-Apr	Plant, Weed, Harvest	June-Oct
Tree Crops					
Cocoa	E	Sept	Aug-Oct	Underbrushing, harvest	Dec-July
Coffee	E	Jan	Dec-Feb	Underbrushing, harvest	March-Oct
Oil Palm	S	Apr	March-May	Harvesting, processing	July-Nov.
Oil Palm	N	Dec	May-Dec	Harvest, processing,	July, Nov.
NONFARM					
Fishing					
Marine	Nat	Oct	Sept-Nov		Apr-July, Dec.
Inland	Nat	Apr	March-Apr		May-Nov
Small Industries					
Carpentry	Nat	July	Nov-March, May-July		Aug, Oct, Apr
Blacksmithing	Nat	May	Feb, May-July	Tool Repair	Dec
Tailoring	Nat	May	May, Oct		July-Sept, Feb
Labor Sold Out	S	Nov	Nov-Jan		Apr-July
	N	July	July-Aug, Nov-Jan, March		Feb, Apr-June

Inland swamp rice, shown in Figure 4.3, is characterized by sharper peak and slack labor periods than is upland rice. In the South and East, peak periods are in May (land preparation), July through October (planting, transplanting and weeding), and January (harvesting). The peak period in the North is for land preparation and planting in July and August; peak periods are more acute in the North than in other regions.

The other four rice systems are characterized by two peaks--one for planting and the other for harvesting. Fundi and groundnuts are generally planted one to two months before upland rice and harvested one to two months before upland rice. Cassava,like fundi and groundnuts, is a subsistence crop. Cassava'a particular advantage is that it can be stored in the ground for long periods of time.

Three farm enterprises--onions-peppers-tomatoes, coffee and wild oil palm--are undertaken in the dry season. The first two are cash enterprises while the latter is both a subsistance and a cash enterprise. The peak period of cocoa, also a cash crop, is during harvesting (August to October).

Most of the nonfarm enterprises have peak periods between December and May, the period of low agricultural activity (Figures 4.9 and 4.10). Labor use for inland fishing peaks in March and April. Tailoring labor is highest in May, the month of an important Moslem festival. Labor use in blacksmithing is heavy in May when tools are made and repaired for the planting season. Labor sold out

peaks in November and January for the South and East respectively. Other nonfarm enterprises are pursued most actively during the cropping season: marine fishing peaks in October, carpentry in July, and labor sold out in the North in July.

Seasonal labor profiles for individual crops are important in explaining enterprise emphasis. In the East, for example, coffee and cocoa are important cash crops and upland rice and inland swamp rice are important subsistance crops. Coffee and cocoa have similar variable and capital costs. Although coffee has returns per manhour about half those of cocoa, it is farmed by almost three times as many households and specialized in by almost twice as many. Coffee's dry-season peak labor period complements the rainy-season peaks of inland swamp rice and upland rice, whereas cocoa's peak period conflicts with those of the rice enterprises. High-decile farmers, who can better afford to divert scarce labor from food staple production during the peak season labor periods, devote seven times more labor to cocoa than low-decile farmers (Table 3.6). The ratio for coffee, on the other hand, is only 1.8. Poor farmers, having fewer resources to fall back on in the case of staple-crop failure, are reluctant to pursue enterprises which conflict with production of rice, the food staple. Moreover, they lack the means to hire the peak season labor necessary to harvest cocoa. High-income farmers, on the other hand, have sufficient resources to farm cocoa, the most profitable tree crop.

The analysis of seasonal labor profiles is also useful in explaining the importance of the onions-peppers-tomatoes enterprise. In Chapter III, it was noted that onions-peppers-tomatoes is a low returns enterprise which is emphasized by middle-income households. Onions-peppers-tomatoes are grown primarily in the Freetown area, where a ready demand for vegetables exists. The two other principal enterprises in this area are upland rice and marine fishing (Spencer and Byerlee, 1977). Onions-peppers-tomatoes' peak period is during the dry season, January to April, whereas peak periods for marine fishing and upland rice are during the rainy season. Thus, although onions-peppers-tomatoes is a low-return enterprise, it provides an important supplement to household income during periods when the opportunity cost of labor is relatively low. Furthermore, in the Freetown area, land for cultivation is scarce. Hence, another reason for onions-peppers-tomatoes' importance is its high returns to land, as shown in Table 3.4.

Enterprise returns, as computed in Table 3.3, may not correctly measure the profitability of an enterprise. If peak season labor is indeed a major constraining factor to increasing income, then the opportunity cost of labor varies between peak and slack seasons. Therefore, it is incorrect to value a manhour of peak season labor at the same value as a manhour of slack season labor. In Table 4.2 returns to peak season labor are compared with conventional enterprise returns to labor. The returns to peak season labor for a given enterprise are computed in the following manner:

TABLE 4.2.--Conventional Returns to Labor and Returns to Peak Season Labor for Major Enterprises in Rural Sierra Leone

Enterprise	Region[a]	Conventional Net Returns to Labor (cents per manhour)	Net Returns to Peak Season Labor (cents per manhour)[b]
FARM			
Rice			
Upland Rice	S	7.7	3.0
Upland Rice	N	6.9	3.2
Upland Rice	E	10.8	3.0
Inland Swamp	E-S	15.8	24.0
Inland Swamp	N	11.1	13.4
Mangrove	S	15.8	24.0
Riverrain rice (mech.)	S	23.8	30.6
Boliland rice (mech.)	N	35.7	72.9
Other Annuals			
Fundi	N	5.4	0.9
Groundnuts	S	5.9	1.6
Groundnuts	N	12.2	18.6
Cassava	S	23.7	43.8
Onions-Peppers-Tomatoes	N	10.0	n.a.[b]
Tree Crops			
Cocoa	E	33.5	51.9
Coffee	E	16.8	n.a.[b]
Oil Palm	S	28.1	111.7
Oil Palm	N	16.0	25.7
NONFARM			
Fishing			
Marine	Nat.	36.8	44.7
Inland	Nat.	64.7	66.5
Small Industries	Nat.		
Carpentry	Nat.	12.1	40.0
Blacksmithing	Nat.	27.7	--
Tailoring	Nat.	32.1	--

[a]Regions: S = South; N = North; E = East; Nat. = Nationwide

[b]For definition see text: Peak seasons are subjectively determined from Figure 4.1:Nationwide = June to November; North: July to August; South: June to November; East: June to September.

N.A.: Not available. For these enterprises the values are infinite since no peak season labor is used.

$$\text{Returns to peak season labor} = \frac{\text{Net returns to labor} - (\text{nonpeak season labor hours} \times \text{wage rate})}{\text{Peak season labor hours}}$$

All-household peak seasons were delineated for each region. In the formula above, the higher the percentage of labor devoted to nonpeak labor hours, the greater are peak season returns. But this measure has several weaknesses. First, precise delineation of a peak period is somewhat arbitrary. Second, this formula assumes that peak season labor is the major constraint to increasing returns for all enterprises. Third, the measure is meaningless for enterprises which are not pursued at all during peak seasons. And last, the assumption that all nonpeak labor hours can be valued at the average annual enterprise wage is not tenable; this leads to an underestimation of the returns to peak season labor.

In spite of these problems, however, the measure is useful when interpreted ordinally. The return to peak season labor serves to compliment the conventional enterprise return by taking into account seasonal labor constraints. Onions-peppers-tomatoes and coffee are low-and middle-return enterprises according to conventional returns analysis (Table 4.2). However, they have no peak labor requirements; therefore, their returns to peak labor are theoretically infinite. Other enterprises with high values include wild oil palm (South), mechanized boliland rice, and inland fishing. Upland rice, fundi, and groundnuts (South) have the lowest returns to peak labor since peak season labor requirements for these crops coincide with household peak-labor periods.

The relationship between seasonal labor inputs and enterprise choice will be further examined in Section 4, which concerns enterprise combinations. The examples in this section have emphasized the importance of labor conflicts and complimentaries between rice, Sierra Leone's staple crop, and other enterprises. The peak periods for upland rice and inland swamp rice are during the rainy season. Fundi, groundnuts, tailoring, and labor sold out (in the North and East) have peak labor periods which conflict with the two major rice systems. Cassava, cocoa, marine fishing, blacksmithing, and carpentry have somewhat overlapping peak periods with rice. Onions-peppers-tomatoes, coffee, wild oil palm, inland fishing, and labor sold out (in the South), have peak periods which complement those of the rice systems.

Since the government promotes inland swamp rice at the expense of upland rice, it is useful to examine the degree of conflict between peak seasons for each of these two crops and those of other enterprises. Table 4.3 shows that in the South, peak-period conflicts increase for three of four supplementary enterprises if a change from upland rice to inland swamp rice takes place. This is most striking in the case of cassava, which has the same peak month as inland swamp rice. In the East conflicts increase significantly with a changeover from upland rice to inland swamp rice because the peak months for coffee and cocoa conflict with the peak period of inland swamp rice. Conflicts also increase for two of five enterprises examined in the North. Thus, in general, the seasonal labor

TABLE 4.3.--Months of Peak Season Labor Conflicts Between Rice and Selected Enterprises in Rural Sierra Leone

	Number of Months of Conflict					
	South		North		East	
	Upland Rice	Swamp Rice	Upland Rice	Swamp Rice	Upland Rice	Swamp Rice
Groundnuts	1*	2*	4*	2*	--	--
Cassava	3	3***	--	--	--	--
Fundi	--	--	3*	2*	--	--
Onions-Peppers-Tomatoes	--	--	0	0	--	--
Oil Palm	0	1*	0	1*	--	--
Coffee	--	--	--	--	0	1*
Cocoa	--	--	--	--	0	3*
Labor Sold Out	1*	1	2*	3**	--	--

NOTE: Computed from Table 4.1.

*Peak month of one enterprise occurs during peak period of other enterprise.

**Peak month of each enterprise occurs during peak period of other enterprise.

***Peak month for one enterprise coincides with peak month of other enterprise.

requirements for upland rice are more compatible with the existing farm system than are those of inland swamp rice.

This conclusion must be accepted, however, with two reservations. First, it might be argued that the household's selection of nonrice enterprises is subsidiary to the selection of rice enterprises. If this is true, then conflicts between rice and nonrice enterprises are less important. However, since nonrice enterprises account for about 40 percent of total labor and 60 percent of income it is doubtful that their importance can be dismissed easily. Second, it might be argued that there is nothing immutable about the peak labor periods of individual enterprises and that changes in peak periods caused by the introduction of inland swamp rice may even be desirable. Although this is indeed possible, it is doubtful that the traditional agricultural system, based on upland rice production, would be characterized by sub-optimal timing patterns for the carrying out of important tasks.

4.3 Enterprise Variable Costs and Capital Costs

The lack of capital to purchase technological inputs is a well-known constraint to increasing the productivity and incomes of poor rural households. This condition is one of the major reasons cited to support the introduction of credit facilities in rural areas (Tinnermeier, 1976).

A related hypothesis is that the capital constraint prevents poor farmers from adopting high returns enterprises. Matlon, in his study of three villages in Northern Nigeria, found that the cost of

purchased inputs constrained low income farmers from producing some of the highest-returns crops. He also found a higher frequency of nonfarm occupations requiring high inputs of working capital among the higher-income groups (Matlon, 1977).

In the analysis which follows, four cost components are presented to examine the capital constraint: annual capital costs, annual variable costs, the value of capital stock, and annual cash variable costs. These cost components, along with expected labor-land and capital-labor ratios, are used to analyze the effect of the capital constraint on enterprise choice.

4.3.1 Annual Capital and Variable Costs

Annual capital costs and variable costs per acre for major crops in Sierra Leone are shown in Table 4.4. Annual capital costs are computed using the capital recovery formula (Liedholm and Chuta, 1976):

$$R = \frac{rV}{1 - (1 + r)^{-n}}$$

where:

R is the constant annual capital cost

V is the original (undepreciated) market value of the asset

r is the discount rate (10 percent)

n is the expected life of the asset.

This formula converts capital stock data into an annual capital cost flow reflecting both depreciation and the opportunity cost of capital.

TABLE 4.4.--Annual Variable Costs and Capital Costs per Acre for Major Farm Enterprises in Rural Sierra Leone[a]

Farm	Costs Per Acre		
	Variable Cost[b]	Annual Cost of Capital[c]	Total
Rice			
Upland	15.63	0.32	15.95
Inland Swamp	23.51	1.51	25.02
Mangrove	25.77	1.26	27.03
Boliland (hand)	9.10	0.50	9.60
Boliland (mech.)	17.00	0.50	17.50
Riverrain (mech.)	11.77	0.40	12.17
Other Annuals			
Fundi	7.29	0.28	7.57
Cassava	2.07	0.25	2.32
Groundnuts	10.96	0.38	11.34
Onions-Peppers-Tomatoes	44.27	1.19	45.46
Tree Crops			
Cocoa	2.38	9.53	11.91
Coffee	2.71	9.53	12.24
Wild Oil Palm	--	--	--

[a]Average figures for cases in which enterprise contributed more than 10 percent of total household income or labor.

[b]Includes costs of seed, fertilizer, land payments, hired labor, mechanical services and other inputs.

[c]Computed using the capital recovery formula shown in text. For cocoa and coffee, the annual cost of capital includes an established cost factor which is comprised of a depreciation and an interest component. For other enterprises, the annual cost of capital refers to the annual costs associated with the use of tools and equipment.

Tools, equipment, and the establishment of tree crop orchards are the most important capital costs. Annual variable costs include both actual and imputed costs for seed, land payments, fertilizer, hired labor, and tractor rent.

The crop with the highest variable costs per acre is onions-peppers-tomatoes, 44 Le. per acre, reflecting high rental payments and seed costs. Inland swamp rice and mangrove swamp rice also have high variable costs reflecting the extensive use of hired labor. Coffee, cocoa, cassava, and fundi have the lowest variable costs per acre, all under 10 Le.

Annual capital costs per acre are highest for cocoa and coffee, 9.53 Le. per acre, because of high establishment costs. Annual capital costs are low for other crops, reflecting the relatively minor importance of tools and equipment in traditional agriculture.

In Table 4.5, capital costs are computed on a per-manhour basis, leading to somewhat different results. This method takes into account the differing levels of labor intensity of different enterprises. For example, although onions-peppers-tomatoes has the highest per acre costs, an acre of onions-peppers-tomatoes absorbs six times as much labor as does an acre of upland rice, and still generates higher net returns per manhour. The enterprise with the highest variable costs per manhour is marine fishing, 13.6 cents, followed by mechanized boliland rice and mangrove swamp rice. Annual capital costs per manhour are high for marine fishing, the small-scale industries, cocoa, and coffee.

TABLE 4.5.--Annual Variable Costs and Capital Costs Per Manhour for Major Enterprises in Rural Sierra Leone (Cents/Manhour)[a]

	South			North			East			National		
	Variable Costs	Annual Capital Costs	Total	Variable Costs	Annual Capital Costs	Total	Variable Costs	Annual Capital Costs	Total	Variable Costs	Annual Capital Costs	Total
FARM												
Rice												
Upland	2.9	0.1	3.0	2.2	0	2.2	2.4	0	2.4	2.5	0.1	2.6
Inland Swamp	2.9	0.1	3.0	2.4	0.1	2.5	2.9	0.1	3.0	2.8	0.1	2.9
Mangrove	4.1	0.1	4.2	--	--	--	--	--	--	4.1	0.1	4.2
Boliland (hand)	--	--	--	2.9	0.2	3.1	--	--	--	2.9	0.2	3.1
Boliland (mech.)	--	--	--	8.8	0.2	9.0	--	--	--	8.8	0.2	9.0
Riverrain (mech.)	4.5	0.1	4.6	--	--	--	--	--	--	4.5	0.1	4.6
Other Annuals												
Fundi	--	--	--	1.1	0	1.1	--	--	--	1.1	0	1.1
Cassava	0.8	0.1	0.9	--	--	--	--	--	--	0.8	0.1	0.9
Groundnuts	2.0	0.1	2.1	1.6	0.1	1.7	--	--	--	1.8	0.1	1.9
Onions-Peppers-Tomatoes	--	--	--	1.2	0	1.2	--	--	--	1.2	0	1.2
Tree Crops												
Cocoa	--	--	--	--	--	--	0.9	3.7	4.6	0.9	3.7	4.6
Coffee	--	--	--	--	--	--	0.6	2.1	2.7	0.6	2.1	2.7
Wild Oil Palm	0.8	0.1	0.9	0.4	0	0.4	1.4	0	1.4	0.8	0	0.8
NONFARM												
Fishing												
Marine	--	--	--	13.6	9.2	22.8	--	--	--	13.6	9.2	22.8
Inland	--	--	--	--	--	--	--	--	--	0	0	0
Small Industries												
Tailoring	--	--	--	--	--	--	--	--	--	1.5	3.3	4.8
Carpeting	--	--	--	--	--	--	--	--	--	1.8	2.5	4.4
Blacksmithing	--	--	--	--	--	--	--	--	--	1.5	1.1	2.6

[a]See notes for Table 4.2.

By summing the annual capital and varible costs, we arrive at total enterprise costs. Total costs per manhour are highest for marine fishing, mechanized Boliland rice, tailoring, cocoa and mechanized riverrain rice. Costs are lowest for inland fishing, wild oil palm, cassava, fundi, and onions-peppers-tomatoes. For the major crops, costs are highest in the South and East and lowest in the North.

4.3.2 Value of Capital Stock

The value of capital stock per manhour, the enterprise capital-labor ratio, represents the value of capital stock necessary to pursue an enterprise relative to the amount of labor which is absorbed by the enterprise annually. Capital stock generally refers to tools and equipment though in some cases, e.g., establishment of tree crop plantations, capital is the embodiment of labor. The value of the capital stock can thus be used to measure the relative barrier to entry caused by capital requirements. Although a farmer may be able to "afford" the annual capital cost associated with a given enterprise, the initial outlay required to purchase the capital input may be prohibiting. The imperfections in rural financial markets and the scarcity of financial capital in general limit the chances of obtaining credit for the purchase of capital inputs.

Table 4.6 presents capital-labor ratios for major enterprises among different regions. Nonfarm enterprises are generally much more capital intensive than farm enterprises. Marine fishing has the highest captal-labor ratio, 44.60 cents per manhour, and the

TABLE 4.6.--Capital-Labor-Ratios for Major Enterprises in Rural Sierra Leone[a]

	Capital-Labor-Ratios			
	South	North	East	National
FARM				
Rice				
Upland	.26	.19	.23	.23
Inland Swamp	.22	.20	.21	.21
Mangrove	.18	--	--	.18
Boliland (hand)	--	.21	--	.21
Boliland (mech.)	--	.21	--	.21
Riverrain (mech.)	.42	--	--	.42
Other Annuals				
Fundi	--	.23	--	.23
Cassava	.27	.22	.24	.25
Groundnuts	.26	.21	.23	.23
Onions-Peppers-Tomatoes	--	.17	--	.17
Tree Crops				
Cocoa	--	--	.22	.22
Coffee	--	--	.24	.24
Wild Oil Palm	.27	.17	.22	.23
NONFARM				
Fishing				
Marine	--	44.60	--	44.60
Inland	--	--	--	--
Small Industries				
Tailoring	--	--	--	22.79
Carpentry	--	--	--	16.60
Blacksmithing	--	--	--	7.50

[a]Capital-labor ratio is the total value of capital stock (cents) per manhour of labor absorbed by the enterprise annually. See notes to Table 4.4.

small-scale industries average 15.63 cents per manhour. Farm enterprises, on the other hand, range from .17 cents per manhour (onions-peppers-tomatoes) to .45 cents per manhour (mechanized riverrain rice). These patterns are found in all three regions. For the five enterprises for which regional comparisons can be made, the South invariably has the highest ratio while the North has the lowest ratio.

4.3.3 Annual Cash Variable Costs

A comparison of flows of cash into and out of the enterprise (and indeed the household) would be of great use in determining the liquidity constraint. Unfortunately, such data is not available. Table 4.7 shows the proportions of variable costs which are paid for in cash and the cash spent per manhour of enterprise labor. These measures give some indication of the liquidity constraint. Although individuals of all income groups may experience cash shortages, it is reasonable to assume that lack of cash is an especially important factor excluding low income households from cash-intensive enterprises.

The small-scale industries, marine fishing, and mechanized rice cultivation have the highest cash percentage of total variable costs, ranging from 89 to 100 percent. Fundi, cassava and groundnuts, on the other hand, each had percentages less than 10 percent. The rankings are similar for variable cash costs per manhour. Marine fishing, the small industries, and the mechanized rice enterprises range from 1.4 cents to 12.1 cents per manhour. Fundi, cassava, and groundnuts have cash costs of about 0.1 cents per manhour.

TABLE 4.7.--Cash Variable Costs per Manhour for Major Enterprises in Rural Sierra Leone (Cents/Manhour)[a]

	South			North			East			Nationwide		
	Variable Costs/ Manhour	% Cash	Cash Variable Cost per Manhour	Variable Costs/ Manhour	% Cash	Cash Variable Cost per Manhour	Variable Costs/ Manhour	% Cash	Cash Variable Cost per Manhour	Variable Costs/ Manhour	% Cash	Cash Variable Cost per Manhour
FARM												
Rice												
Upland	2.9	15	0.4	2.2	23	0.5	2.4	11	0.3	2.5	14	0.4
Inland Swamp	2.9	15	0.4	2.4	19	0.5	2.9	15	0.4	2.8	17	0.5
Mangrove	4.1	18	0.7							4.1	18	0.7
Boliland (hand)				2.9	10	0.3				2.9	10	0.3
Boliland (mech.)				8.8	60	5.3				8.8	60	5.3
Riverrain (mech.)	4.5	67	3.0							4.5	67	3.0
Other Annuals												
Fundi				1.1	9	0.1				1.1	96	0.1
Cassava	0.8	9	0.1							0.8	9	0.1
Groundnuts	2.0	7	0.1	1.6	6	0.1				1.8	6	0.1
Onions-Peppers-Tomatoes				1.2	46	0.6				1.2	46	0.6
Tree Crops												
Cocoa							0.9	62	0.6	0.9	62	0.6
Coffee							0.6	33	0.2	0.6	33	0.2
Oil Palm	0.8	39	0.3	0.4	50	0.2	1.4	28	0.4	0.8	43	0.3
NONFARM												
Fishing												
Marine				13.6	89					13.6	89	12.1
Inland				0	0					0		0
Small Industries												
Tailoring										1.5	100	1.5
Blacksmithing										1.5	91	1.4

[a]Cash components of Variable Costs include: (1) hired labor--data was collected concerning the cash component of hired labor, by far the most important component of variable costs. This data is from Jarrett (1978); (2) All seed costs with the exception of onions-peppers-tomatoes, was assumed to have a subcash component. Some seed purchases, however, do take place. All sales for onions-peppers-tomatoes are purchased; (3) fertilizer--all fertilizer is paid for in cash; (4) mechanical services--all mechanical services are paid for in cash; (5) land payments--all land payments are assumed to have zero cash components although some cash payments do undoubtedly take place; (6) all inputs for nonfarm enterprises are assumed to be paid for in cash.

Blanks indicate that less than 10 households were available for analysis

4.3.4 Summary

Data in this section show the high degree of association between enterprise costs (annual capital costs, value of capital stock, variable costs, and cash variable costs) and enterprise returns. Five of the seven high-return enterprises--marine fishing, tailoring, blacksmithing, cocoa, and mechanized boliland rice--ranked high (were among the top seven enterprises) in at least three of the four cost categories. One other, mangrove swamp rice, had high variable costs and high cash variable costs. Moreover, these same high-returns enterprises are generally associated with the highest income groups. The two fishing enterprises, tailoring, mechanized Boililand rice and cocoa are associated with the highest decile group when compared to the lowest decile group (Table 3.6). Blacksmithing and mechanized Boliland rice are associated with the highest tercile group (Table 3.5). Marine fishing is the only high-returns enterprise in Tables 3.5 and 3.6 associated with an income group other than the highest. In Table 3.5, marine fishing is associated with middle-income households. This probably reflects the fact that marine fishing can be pursued with relatively low levels of capital and variable costs (Linsenmeyer, 1976).

The strong association between high-cost enterprises, high returns enterprises and high-income households supports the hypothesis that the capital constraint is an important factor excluding poor households from pursuing high-returns enterprises. Inland fishing

is the only high-returns enterprise with low capital and variable costs. However, the expansion of inland fishing is severely constrained by the existing fish population and the location-specificity of inland fishing opportunities.

4.4 Comparative Expected Labor-Land and Capital-labor Ratios

In a study concerning factor productivity and enterprise profitability in Sierra Leone, Jarret found that low-income farmers had higher labor-land ratios and lower capital-labor ratios than high-income farmers for upland rice and inland swamp rice (Jarrett, 1978). In this section, it is hypothesized that low-income farmers choose enterprises with higher labor-land ratios and lower capital-labor ratios than high income farmers. If low-income farmers face a more serious land constraint than high-income farmers, they can be expected to choose enterprises which are more labor intensive per unit of land, in an attempt to maximize total returns. If they face a more limiting capital constraint than high income farmers, they will choose enterprises which require a lower capital-labor ratio. In addition, the capital constraint may cause low-income farmers to use labor in situations where high-income farmers use capital, contributing to a higher labor-land ratio for low-income farmers.

The methodology in this section is similar to that used in Section 3.4 for comparative expected net margin analysis. There we were concerned with the effect of enterprise choice on net returns. In this analysis, we examine the effect of enterprise choice on labor-land and capital-labor ratios.

The expected enterprise labor-land ratio is the average enterprise labor-land ratio for that enterprise for all farmers undertaking it. The ratio thus gives us an expected value of the labor-land ratio based on the performance of all farmers engaged in that enterprise. The overall household labor-land ratio weights the various labor-land ratios by the area of household land cultivated for that enterprise. This ratio, then, is based solely on the choice of enterprises and not on the actual performance of the household.

A numerical example will further clarify the meaning of the expected labor-land ratio. Let us assume that two farmers grow the same two crops--upland rice and cassava. Upland rice has a labor-land ratio of about 600 manhours per acre while that of cassava is about 300. Let us further assume that the first farmer, Farmer A, has 80 percent of his land area in upland rice and 20 percent in cassava. The second farmer, Farmer B, has 50 percent of his land in each of the crops. Expected household labor-land ratios are then computed in the following manner:

Farmer A: $(.80 \times 600) + (.20 \times 300) = 540$

Farmer B: $(.50 \times 600) + (.50 \times 300) = 450$

The logic is essentially the same for capital-labor ratios though expected capital-labor ratios are weighted by the amount of household labor an enterprise accounts for, not the land area as is done for expected labor-land ratios. In this analysis, capital is defined as the total value of capital stock.

4.4.1 Comparative Expected Labor-Land Ratios

Regional and national enterprise labor-land ratios are shown in Table 4.8. Onions-pepper-tomatoes has the highest labor-land ratio, 3,619 manhours per acre, three times that of any other enterprise. Enterprises with the lowest ratios are mechanized Boliland rice, cocoa, mechanized riverain rice, and cassava. The North has the highest labor-land ratio for two of the three enterprises for which inter-regional comparisons can be made.

In Table 4.9, mean expected household labor-land ratios are compared among different regions. In column 1, nationwide means from Table 4.8 are used to standardize enterprise labor-land ratios whereas in column 2, regional means are used. In both cases differences between the regions are signficant at the 1 percent level. The expected labor-land ratio is highest in the North, where the three enterprises with the highest labor-land ratios predominate. Differences are next highest in the South and lowest in the East. Using regional means, the gap between the North and other regions increases since enterprises found nationwide are most labor intensive in the North. The East surpasses the South using regionwide ratios because upland rice is farmed with greater labor intensivity in the East than in the South.

In Table 4.10 expected labor-land ratios are shown for income groups by region. Nationwide, there are no significant differences between either tercile groups or between the highest and

TABLE 4.8.--Labor-Land Ratios for Major Farm Enterprises in Sierra Leone[a]

	Labor/Land Ratios (manhour equivalents/acre)			
	South	North	East	National
FARM				
Rice				
Upland	563	676	624	614
Inland swamp	776[b]	1009	776[b]	923
Mangrove	625	--	--	625
Boliland (hand)	--	317	--	317
Boliland (mech.)	--	193	--	193
Riverrain (mech.)	259	--	--	259
Other Annuals				
Fundi	--	678	--	678
Cassava	247	--	--	291
Groundnuts	788	589	--	646
Onions-peppers-tomatoes	--	3619	--	3619
Tree Crops				
Cocoa	--	--	255	255
Coffee	--	--	457	457

[a]Blanks indicate that less than ten cases were available for an enterprise in a given region. These cases are included, however, in calculating a nationwide enterprise labor/land ratio.

[b]Average of figures for South and East.

TABLE 4.9.--Expected Labor-Land and Capital-Labor Ratios by Region in Rural Sierra Leone[a]

	Expected Labor-Land Ratio (MHE[b]/acre)		Expected Capital-Labor Ratios (cents/MHE[b])[c]	
	Using Nationwide labor-land ratios	Using Regionwide labor-land ratios	Using Nationwide capital-labor ratios	Using regionwide capital-labor ratios
Farm Enterprises Only				
South	566**	533**	.21**	.24**
North	772**	801**	.19**	.17**
East	526**	549**	.20**	.21**
National	642	642	.20	.20
All Enterprises				
South	--	--	.76*	.79*
North	--	--	1.85*	1.83*
East	--	--	.82*	.82*
National	--	--	1.23	1.23

[a]Expected labor-land and capital-labor ratios is defined in Section 4.4. Enterprise labor-land and capital-labor ratios is obtained from Tables 4.8 and 4.6 respectively.

[b]MHE = manhour equivalent.

[c]"Capital" refers to the total values of capital stock.

*Difference between regions are significant at the 5 percent level using a test of analysis of variance.

**Difference between regions are significant at the 1 percent level using a test of analysis of variance.

TABLE 4.10.--Expected Labor-Land and Capital-Labor Ratios by Income Group in Rural Sierra Leone[a]

Income Group	Mean Expected Labor-land Ratio (MHE/acre[b])	Mean Expected Capital-Labor Ratio[c]	
		Farm enterprises only (cents/MHE[b])	All enterprises (cents/MHE[b])
South	533	.24	.79
Lowest 10%	511	.24	.52
Lowest 30%	530	.24	.48
Middle 40%	544	.24	.64
Highest 30%	519	.23	1.30
Highest 10%	442	.23	2.91
North	801	.17	1.83
Lowest 10%	698	.19**	.35*
Lowest 30%	700	.19**	.44*
Middle 40%	876	.18**	1.70*
Highest 30%	804	.14**	3.40*
Highest 10%	923	.12**	3.62*
East	549	.21	.82
Lowest 10%	--	--	--
Lowest 30%	549	.19	1.40*
Middle 40%	545	.21	.72*
Highest 30%	554	.22	.36*
Highest 10%	--	--	--
Nationwide	647	.20	1.18
Lowest 10%	620	.22	.55**
Lowest 30%	643	.21*	.53*
Middle 40%	683	.20*	1.48*
Highest 30%	606	.19*	1.45*
Highest 10%	634	.19	2.69**

[a]Expected labor-land and capital-labor ratios are defined in Section 4.4. Enterprise labor-land and capital-labor ratios are obtained from Tables 4.8 and 4.6 respectively.

[b]MHE = manhour equivalent.

[c]Capital refers to the total value of capital stock (see Section 4.3).

*Difference between income groups significant at 5 percent level using a test of analysis of variance. Tests were run for terciles and for the highest and lowest deciles.

**Difference between income groups significant at 1 percent leel using a test of analysis of variance. Tests were run for terciles and for the highest and lowest deciles.

lowest decile groups. Nor is there a consistent trend from the highest income group to the lowest income group. The results are similar for regionwide analysis.

In conclusion, there is no association between the choice of enterprise and the labor-land ratio for households of different income groups. This finding has two implications. First, it supports the earlier assertion that access to land is not a constraining factor on poor rural households; the poor are not choosing farm enterprises which are more labor-intensive per acre than those chosen by high-income households. Second, the tendency for low-income households to farm more labor-intensively is not because they pursue more labor-intensive enterprises than high-income farmers; most likely, it is because they manage their farms differently than high-income farmers. The conditions which generate these differences in management are discussed by Jarrett (1978).

4.4.2 Comparative Expected Capital-Labor Ratios

Mean enterprise capital-labor ratios are shown in Table 4.5. It is recalled that capital-labor ratios were 30 to 180 times higher for marine fishing and the small-scale industries than for rice, tree crops, and annual crops. For enterprises which could be compared between regions, ratios were highest in the South and lowest in the North.

Household expected capital-labor ratios are shown for farm enterprises only and for all enterprises in Tables 4.9 and 4.10

respectively. For farm enterprises only, Table 4.9 shows that differences in expected capital-labor ratios between regions are significant at the 1 percent level, whether regional or nationwide capital-labor ratios are used. In both cases the South is highest and the North is lowest. This shows that individual farm enterprises pursued nationwide have higher capital-labor ratios in the South and that the crop mix in the South is more capital intensive than that of crop mixes elsewhere.

In Table 4.10, column 2, expected capital-labor ratios for farm enterprises are shown for different income groups. Nationwide, differences between terciles are significant at the 5 percent level, but surprisingly, low-tercile households have ratios 12 percent higher than those of the high-tercile households. Differences between the highest and lowest deciles are not significant. Differences between income groups are not significant in the South and East at the 10 percent level, but are significant in the North at the 1 percent level, where the expected capital-labor ratio of the lowest decile group is 1.6 times that of the highest group. Although these trends are somewhat surprising, a comparison of Tables 4.5 and 3.3 show that for farm enterprises, there is no association between high returns to labor and high capital-labor ratios. The capital constraint, therefore, does not appear to cause low-income farmers to pursue a different crop mix than high income farmers.

However, this relationship does not hold when all enterprises--both farm and nonfarm--are considered, as shown in Table 4.10,

column 3. The expected capital-labor ratio of the highest decile group nationwide is five times that of the lowest decile group and the difference is significant at the 1 percent level. Differences between the terciles are significant at the 5 percent level, but this is due mainly to differences between the two highest terciles and the lowest, which differ by almost three times. The expected capital-labor ratio of the middle-income group is actually higher than that of the hign-income group. This reflects the earlier finding that two of the four enterprises with the highest capital-labor ratio--marine fishing and carpentry--are emphasized by middle labor groups.

On a regional basis, differences between income groups are not significant in the South although ratios do follow a consistent pattern downward from the highest income group to the lowest. Differences in the North also follow a consistent pattern with ratios over ten times higher for the highest decile group than for the lowest. Differences for both terciles and deciles are significant at the 5 percent level. Expected capital-labor ratios in the East, however, follow an opposite trend; the ratios of the lowest income group is three times higher than that of the highest income group. This reflects Eponou's finding that small-scale industries, which have high capital-labor ratios, contribute 78 percent more to the incomes of the lower tercile households in the East than to the higher tercile households (Eponou, 1978). In the North and South, however, small-scale industries are more important among high-income households.

Table 4.9 shows that differences between regions are significant at the 5 percent level; the capital-labor ratio of the North is more than double that of the other regions. This is due to the extremely high capital-labor ratio of the marine fishing enterprise, which is found only in the North sample.

In conclusion, when only farm enterprises are considered, different income groups do not select activities with different capital-labor ratios. However, when all enterprises are considered, high-income households select enterprises which have higher capital-labor ratios than those of low-income groups. This reflects the high capital-labor ratios of marine fishing and small-scale industries which are emphasized by high-income groups relative to low-income groups. Thus, although the capital constraint does not appear to cause low-income households to choose different farm enterprises then high-income households, it does appear to be important in prohibiting low-income households from actively participating in high-returns, nonfarm enterprises.

CHAPTER V

FACTOR USE AND ENTERPRISE COMBINATIONS

In this chapter, previous findings are used to examine and explain the choice of enterprise combinations in rural Sierra Leone. In Chapter III, enterprise emphasis was discussed and some association was found between enterprise emphasis and income group. Nine major enterprise combinations, all of them involving upland rice, were introduced and briefly discussed at the close of the chapter. In Chapter IV, factor requirements of individual enterprises were analyzed and peak and trough labor periods for individual enterprises were shown. The role of capital constraints in enterprise choice was also examined.

This chapter focuses on how factor requirements affect the choice of enterprise combination. In addition, the association of individual enterprise combinations with income groups is also examined. First, some general comments about the complementarity and conflict of seasonal labor use for enterprises in combination will be presented. Next, selected enterprise combinations will be examined. Finally, we will discuss the use of hired labor during peak periods.

5.1 Seasonal Labor Use and Enterprise Combinations

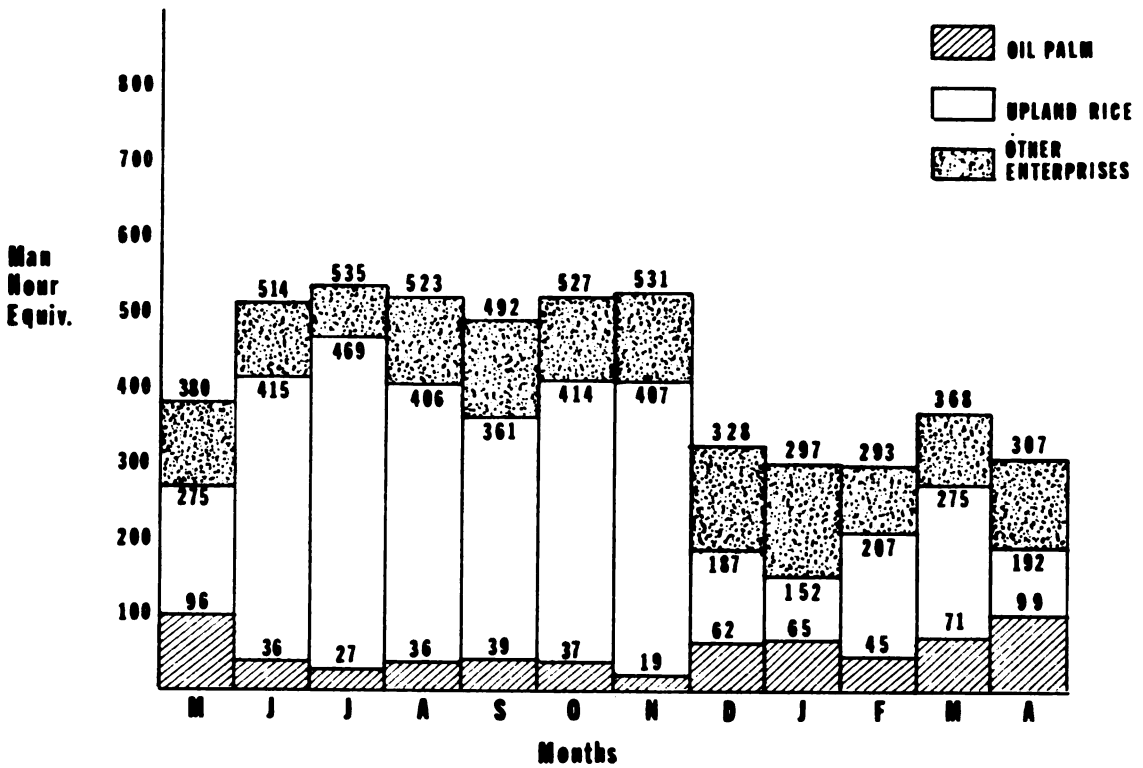
The monthly distribution of labor used for nine principal enterprise combinations is shown in Figure 5.1. Columns of total monthly labor are divided between upland rice, the second enterprise in the combination, and all other enterprises. Data from these figures are summarized in Table 5.1, which shows peak and slack periods for the enterprise combinations and for their individual component enterprises.

In all combinations, the peak months for each of the two enterprises in combination are different. In all combinations except one, upland-rice-inland swamp rice, the peak month of the enterprise combination is the same as the peak month for upland rice. In seven of the nine cases, this same month is the peak month for total household labor for households pursuing the enterprise combination. This demonstrates the predominant role of the upland rice enterprise in the rural household.

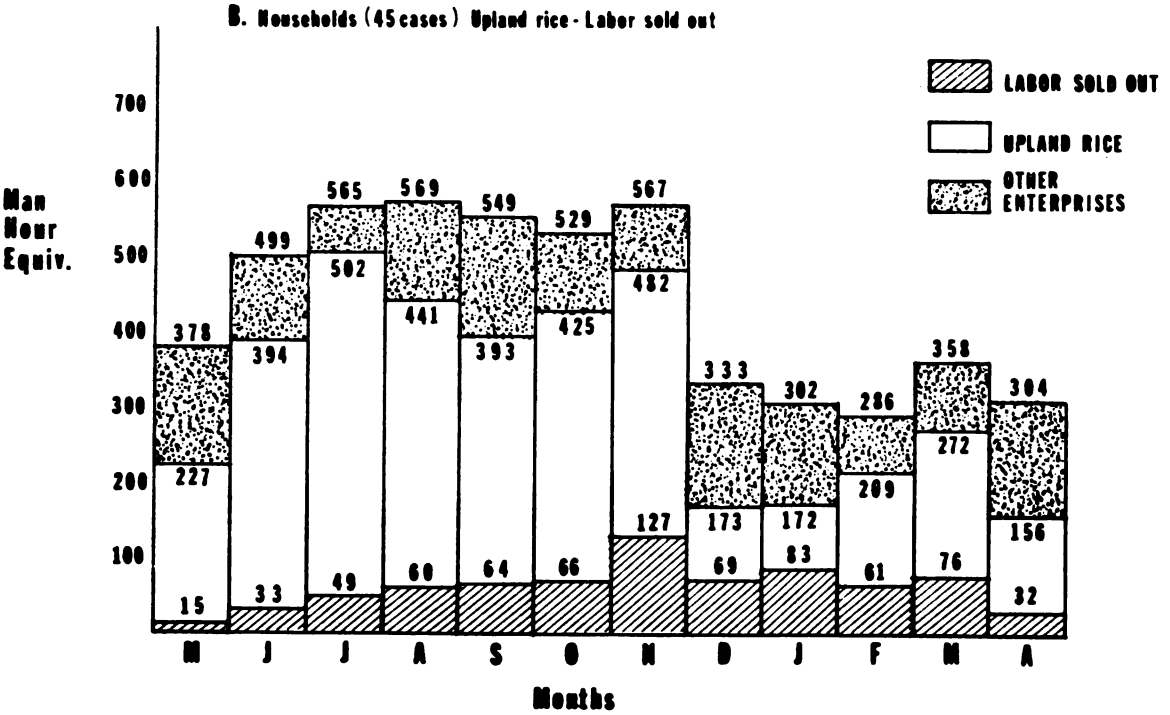
Peak periods are determined subjectively, and represent periods of high labor use relative to other periods of the year. The length of peak period ranges from one to five months per combination and averages 3.3 months. In six of the nine cases, there is no conflict between the peak periods of the two enterprises in combination. Conflicts are limited to one month for the three other combinations--upland rice with labor sold out, with cassava, and with inland swamp rice.

FIGURE 5.1 Monthly distribution of labor among households of selected enterprise combinations in rural Sierra Leone.

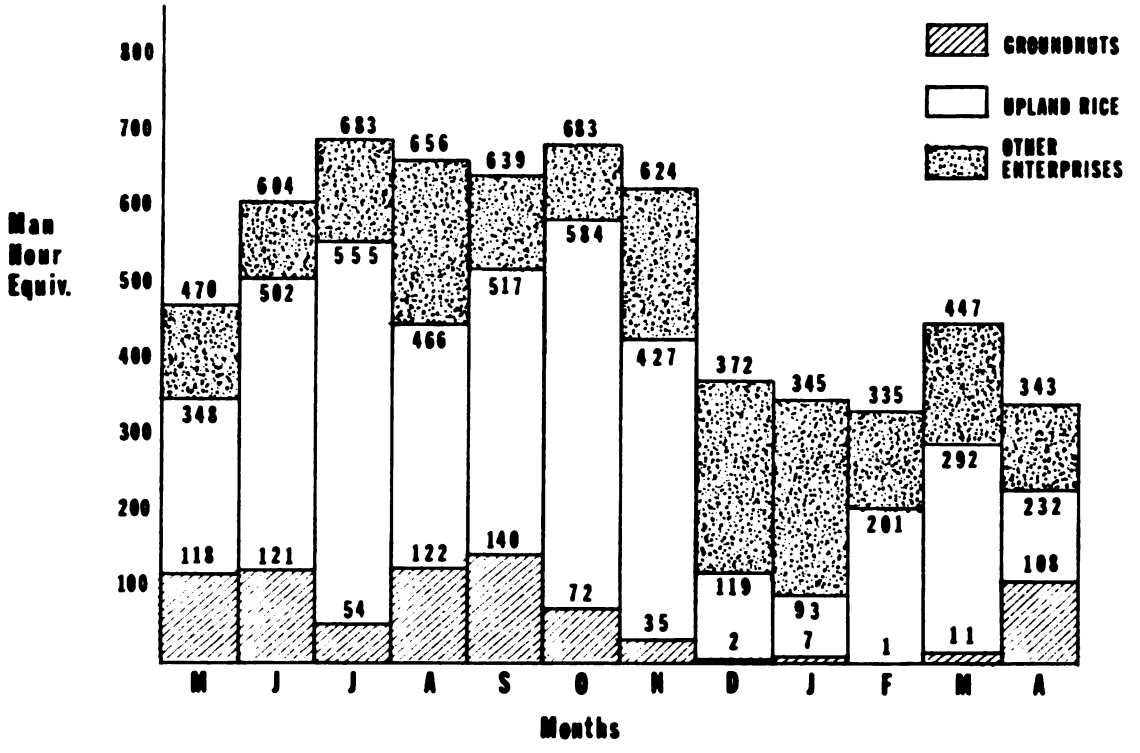
A. Households (67 cases) Upland rice - Oil palm.



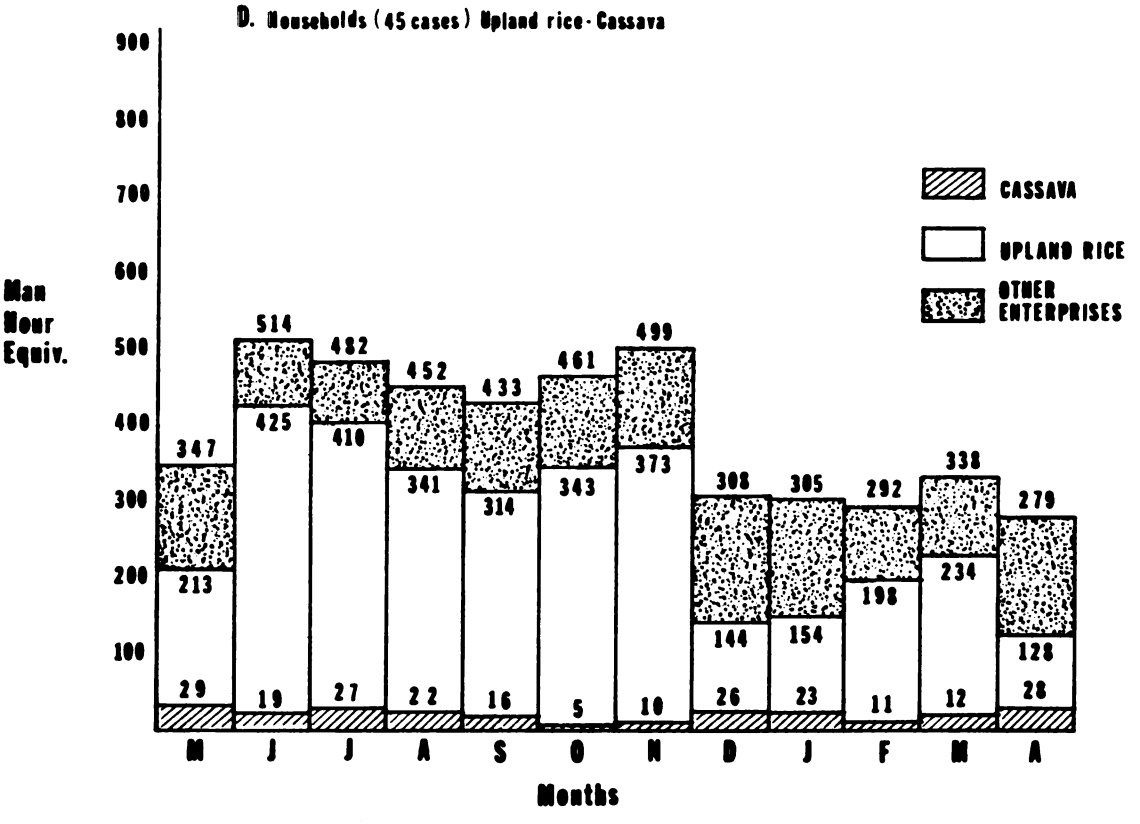
B. Households (45 cases) Upland rice - Labor sold out



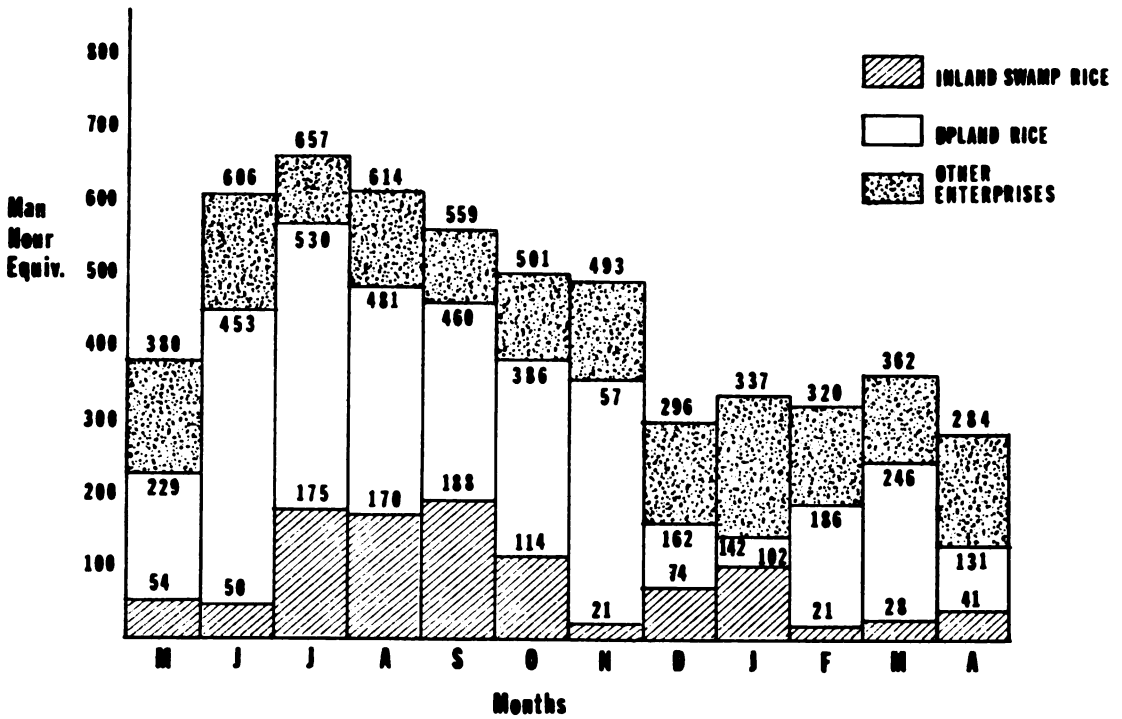
C. Households (40 cases) Upland rice - Groundnuts



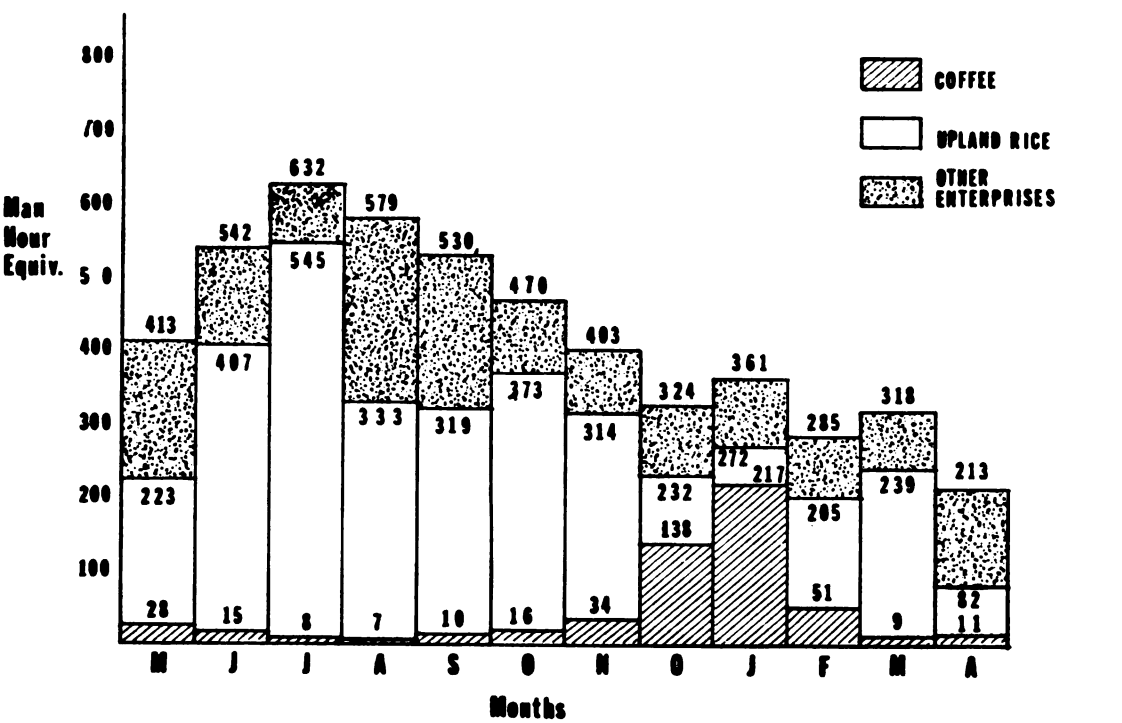
D. Households (45 cases) Upland rice - Cassava



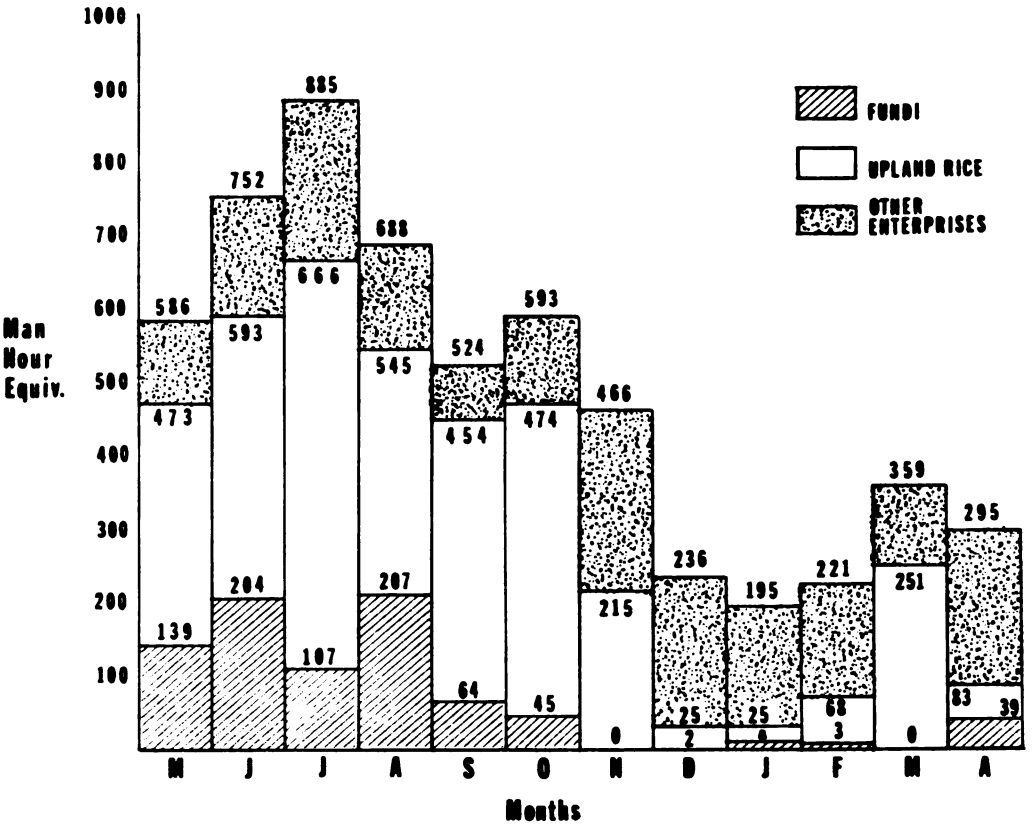
E. Households (36 cases) Upland rice-Inland swamp rice



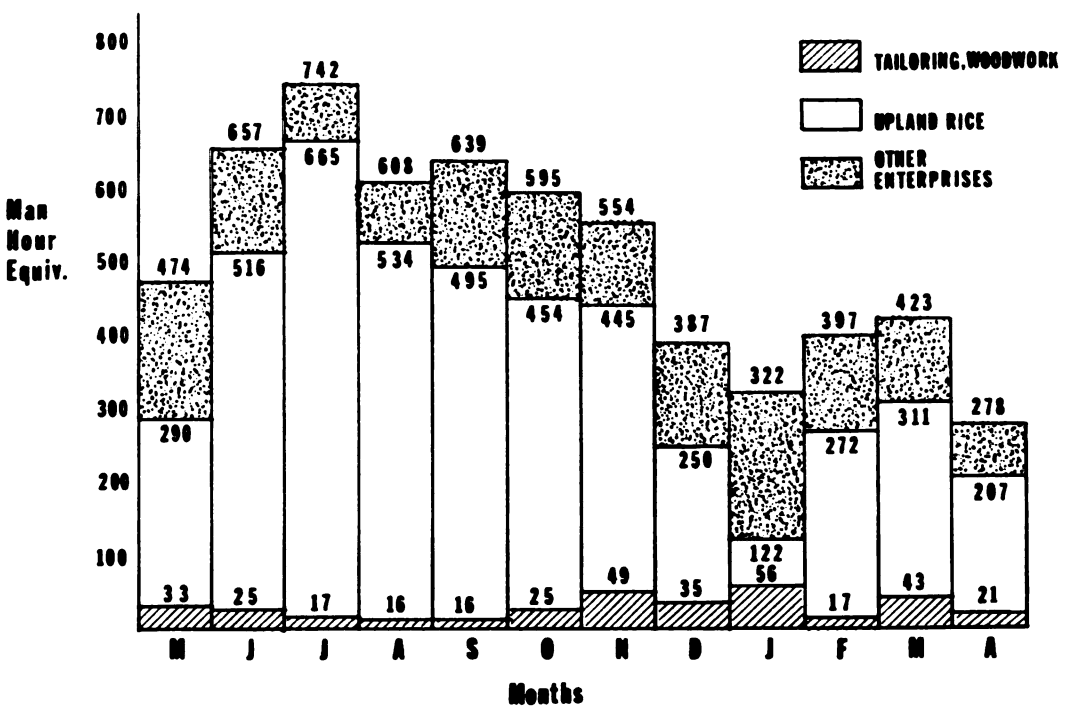
F. Households (18 cases) Upland rice-Coffee



G. Households (13cases) Upland rice-Fundi



H. Households (10cases) Upland rice-Tailoring, Carpentry



I. Household (17cases) Upland rice · Fishing

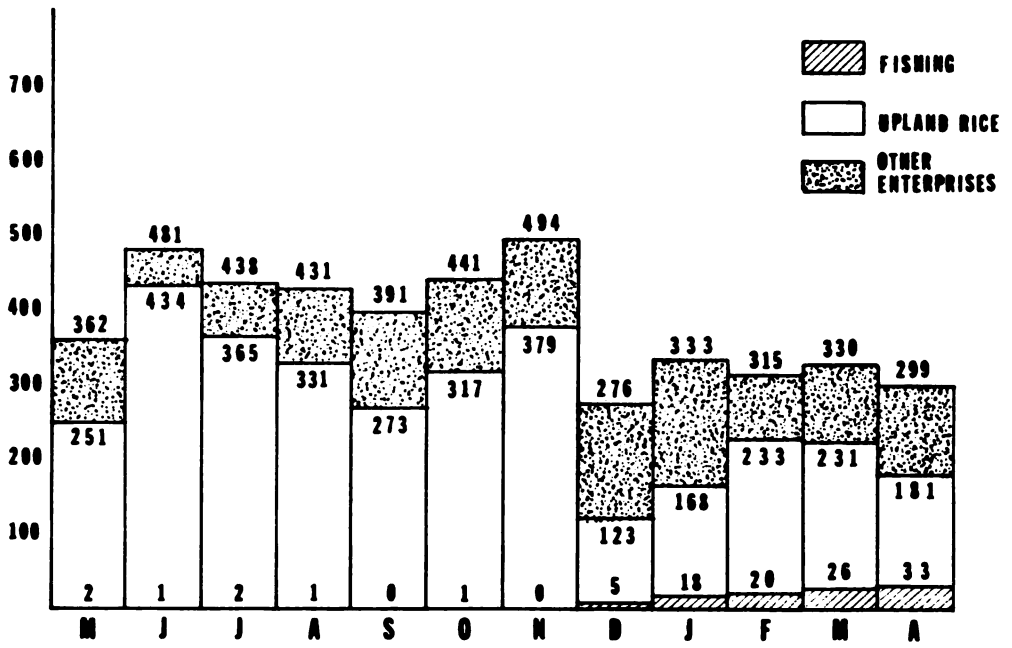


TABLE 5.1.--Slack and Peak Periods of Labor Use for Major Enterprise Combinations in Rural Sierra Leone

	Peak Month	Peak Period	Slack Period	Coefficient of Variation	Cases
1. Upland Rice-Wild Oil Palm					67
A. Upland Rice	July	June-Aug Oct-Nov	Dec-May	50.2	
B. Wild Oil Palm	Apr	Apr-May	June-Nov	49.3	
C. Upland Rice-Wild Oil Palm	July	June-Aug Oct-Nov	Dec-May	35.4	
D. Household Total	July	June-Nov	Dec-May	24.4	
2. Upland Rice-Labor Sold Out					45
A. Upland Rice	July	June-Aug Oct-Nov	Dec-May	48.8	
B. Labor Sold Out	Nov	Nov-Jan,Mch	Apr-June	46.8	
C. Upland Rice-Labor Sold Out	July	July-Aug Oct-Nov	Dec-May	41.0	
D. Household Total	Aug	July-Nov	Dec-May	27.2	
3. Upland Rice-Groundnuts					40
A. Upland Rice	Oct	July, Oct	Dec-Feb;Apr-May	49.3	
B. Groundnuts	Sept	Apr-June Aug-Sept	July Nov-March	81.9	
C. Upland Rice-Groundnuts	Oct	July, Oct	Dec-Feb,Apr	47.5	
D. Household Total	July-Oct	June-Nov	Dec-Feb,Apr	27.9	
4. Upland Rice-Cassava					
A. Upland Rice	June	June-July Oct-Nov.	Dec-May	43.2	43
B. Cassava	May	Apr-May July,Dec	Sept-Nov Feb-Mch, Jne	40.2	
C. Upland Rice-Cassava	June	June-July	Dec-May	39.1	
D. Household Total	June	June-July, Nov	Dec-May	22.6	

TABLE 5.1.--Continued.

	Peak Month	Peak Period	Slack Period	Coefficient of Variation	Cases
5. Upland Rice-Inland Swamp Rice					36
A. Upland Rice	June	Jn-Jly,Nov	Dec-Feb,Ap-May	52.5	
B. Inland Swamp Rice	Sept	July-Sept	Nov,Feb-June	72.0	
C. Upland Rice-Inland Swamp Rice	July	July	Dec-May	48.1	
D. Household Total	July	June-Aug	Dec-May	30.2	
6. Upland Rice-Coffee					
A. Upland Rice	July	July	Dec-Feb,Apr	58.1	
B. Coffee	Jan	Dec-Jan	March-Nov	144.1	
C. Upland Rice-Coffee	July	July	Dec-May	39.5	
D. Household Total	July	July-Aug	Dec-Apr	30.6	
7. Upland Rice--Fishing					17
A. Upland Rice	June	June-Aug Oct-Nov	Dec-Apr	38.3	
B. Fishing	April	Jan-Apr	May-Dec	129.8	
C. Upland Rice--Fishing	June	June-Aug Oct-Nov	Dec-May	34.2	
D. Household Total	Nov	June, Nov	Dec-May	19.2	
8. Upland Rice--Fundi					13
A. Upland Rice	July	July	Nov-Apr	65.8	
B. Fundi	Aug	June,Aug	Sept-Apr	115.6	
C. Upland Rice-Fundi	July	June-Aug	Nov-Apr	69.4	
D. Household Total	July	June-Aug	Nov-Apr	46.8	
9. Upland Rice-Tailoring-Carpentry					10
A. Upland Rice	July	June-Sept.	Dec-May	48.1	
B. Tailoring, Carpentry	March	Nov,Jan,Mch	Jne-Oct,Fb,Apr	46.9	
C. Up. Rice,Tail.,Carp.	July	June-Sept	Dec-May	42.3	
D. Household Total	July	July	Dec-May	29.0	

Slack periods, which were also defined subjectively, are almost twice as long as peak periods for individual crops. Upland rice has an average slack period of five months among the different combinations, while the slack period for the second enterprise averages seven months. As may be expected then, there is more overlap between slack seasons of enterprises in combination than between peak seasons. In only two cases, upland rice with wild oil palm and coffee, is there one or less months of overlap in slack periods. In five cases the overlap is two to three months. In the case of upland rice-fundi, there are six months of overlap.

In six of the nine combinations, July is the peak month for labor use. October, June, November, and August are peak months for other combinations. December through May is the slack season for six of the combinations. Slack periods for the other combinations cover similar lengths of time also extending through the dry season.

Coefficients of variation, which show the degree of variation in labor use during the year, are also shown in Table 5.1.[1] In all but one case (upland rice-fundi) the two enterprises in combination have a lower coefficient of variation than each of the enterprises individually. Thus, there is a high degree of seasonal complimentarity of labor inputs among enterprises in combination.

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[1]The coefficient of variation is the average percentage standard deviation from the mean labor input per month.

5.1.1 Upland Rice-Wild Oil Palm

Upland rice-wild oil palm, the most common enterprise combination, is pursued by over one-quarter of the sample households. The frequency of this combination is especially striking because the combination is location-specific--the households must be located near wild oil palms--and because of the heavy physical labor, climbing of trees, which is usually required.

Previous findings in this study help explain both the popularity of wild oil palm and its particular compatibility with upland rice. First, wild oil palm is a high-returns enterprise in the South and the East. In the North, where returns are generally lower, it is a middle-returns enterprise. Second, wild oil palm has very low costs. For annual capital costs, value of capital stock, variable costs, and cash variable costs, wild oil palm ranks among the lowest of all enterprises. Third, the seasonal labor requirements of wild oil palm compliment those of upland rice. Wild oil palm is primarily a dry season activity whereas upland rice is cultivated during the rainy season. The six months of peak and intermediate labor activity for upland rice are June through November, whereas oil palm is important from December to May. The coefficient of variation for the two enterprises in combination is the lowest for any combination except upland rice-fishing.

The above considerations help explain why upland rice-wild oil palm is an important enterprise combination for all income groups throughout Sierra Leone. In many cases, the distance of wild oil

palm trees from the home constrains households from expanding their oil palm enterprise (Levi, 1974).

5.1.2 Upland Rice-Labor Sold Out

Labor sold out is a low-returns enterprise and is an important activity for low-income groups. Upland rice-labor sold out, the second most frequently found enterprise combination, is also pursued primarily by low-income households.

Over two-thirds of the upland rice-labor sold out households are in the South, the only region in which these two enterprises have complimentary peak labor periods.

Table 5.1 shows that the peak periods for upland rice and labor sold out in combination have only one month of overlap--November. During this month, low-income farmers harvest their own upland rice and hire themselves out to harvest the farms of others. The low level of variable costs and capital costs (limited only to a few hand tools) make this enterprise combination especially attractive to low income households. Because exchange labor is a social institution as well as an economic undertaking (see Section 2.2), high and middle income households also sell out some labor.

5.1.3 Upland Rice--Groundnuts

The upland rice--groundnuts combination is found in all three regions of Sierra Leone and is associated with middle and low-income households. Because of higher yields, returns per manhour for groundnuts are higher in the North than in the South. The capital costs of

groundnut cultivation are low relative to other enterprises. Variable costs are average whereas cash requirements are low.

There is no conflict between the peak periods of upland rice and groundnuts (Table 5.1). Groundnuts are planted and weeded April through June and harvested August through September; peak periods for upland rice are planting and weeding in July and harvesting in October.

The complimentarity of these two crops is further demonstrated by examining sexual roles in the cultivation of each of the crops. Gunther (1978) showed that while males brush, clear, and till upland rice fields from April through June, females plant and weed groundnuts. Since groundnuts are cultivated on fields which have been used for upland rice during the previous year, little clearing or land preparation is necessary. Upland rice is harvested primarily by males while the females contribute most of the harvesting labor for groundnuts.

5.1.4 Upland Rice-Cassava

Upland rice-cassava is found primarily in the South where it is undertaken by 30 percent of the sample households. Peak labor months for cassava cultivation are April and May whereas those for upland rice are June and July. Secondary peak periods for cassava are July and December while those for upland rice are October and November. Seasonal labor inputs, then, are fairly complementary. Along with fundi, cassava has the lowest variable costs, capital costs, and cash costs of all enterprises examined. Furthermore,

cassava has a relatively high enterprise return per manhour and is important as a food reserve. These factors make it an important enterprise for all income groups (Table 3.9).

5.1.5 Upland Rice--Inland Swamp Rice

Upland rice-inland swamp rice, the only major combination consisting of two rice enterprises, is common in the East and North. The frequency of this combination depends on the accessibility of swamp areas suitable for swamp rice cultivation.

Nationwide, this combination shows no association with income groups. In the South and East, however, it is associated with high and middle income groups and in the North with low income groups. Returns to labor in the South and East are 43 percent higher than in the North.

Nationwide, the peak month for the combination is July, the only month in which peak periods for the two crops overlap. In July, farmers weed upland rice and plant and transplant swamp rice. Other peak periods for the two crops in combination are November (upland rice harvesting), August (inland swamp rice weeding), and January (inland swamp rice harvesting).

The peak periods for upland rice and inland swamp rice differ among the three regions of Sierra Leone. Table 4.1 shows the two enterprises have one month of conflict in the East, two months in the North, and four months in the South. Thus labor inputs for the two crops are most complimentary in the East, the region where the

combination is most common, and least complimentary in the South, the region where it is least common.

Variable costs and cash costs for inland swamp rice are average whereas capital costs, as for all farm enterprises, are low. Variable costs and capital costs are slightly higher in the South and East than in the North.

5.1.6 Upland Rice--Coffee

The high degree of complimentarity of upland rice and coffee in combination is discussed in Section 4.2. Coffee is a dry season crop with a peak period in December and January whereas upland rice's peak period is in July. Since coffee requires a long rainy season, production is restricted to the East and those areas close to it. Variable costs are average but capital costs are high because of the high cost of establishing a coffee farm.

Upland rice--coffee is not associated with any particular income group. In Section 4.2, it was noted that in general upland rice-coffee is a lower-return combination than upland rice-cocoa, another enterprise combination found exclusively in the East. Upland rice--coffee, however, is undertaken more often because there is no conflict between the peak labor periods of the component enterprises.

5.1.7 Upland Rice--Fishing

Upland rice--fishing, like upland rice--coffee, consists of one rainy-season enterprise and one dry-season enterprise. Of 17 cases, 15 are inland, fresh-water fishing, and two are marine fishing.

Fishing is undertaken primarily between January and April whereas upland rice's peak periods are June through August and October through November.

There is no association between the upland rice-fishing combination and income group, even though fishing has higher returns than any other enterprise. This is understandable since fishing plays a relatively minor role in upland rice-fishing households (Table 3.10).

The combination is undertaken by only 5 percent of the sample households, even though capital and varible costs are low and seasonal labor inputs for upland rice and fishing are highly complimentary. This is certainly due to lack of accessibility to streams and lakes. The low level of fishing labor among fishing households is probably due to the limited capacity of lakes and streams to absorb substantial inputs of labor at high returns.

5.1.8 Fundi--Upland Rice

Fundi, the lowest-returns enterprise in Sierra Leone, is the most important enterprise in the North following upland rice. Although one-quarter of the region's farmers cultivate fundi, less than 5 percent specialize (devote more than 30 percent of their labor or receive more than 30 percent of their income) in fundi cultivation. About 10 percent of the households in the North pursue the upland rice-fundi enterprise combination.

Upland rice-fundi is undertaken almost exclusively by low-income farmers. Variable costs and cash costs are among the lowest

for any enterprise. However, seasonal labor requirements conflict rather seriously with those for upland rice; upland rice-fundi is the only enterprise combination which has a coefficient of variation for monthly labor higher than the coefficients for each of the component enterprises (Table 5.1). In the analysis of individual enterprises in the North, peak periods for fundi are May through August whereas peak periods for upland rice are June through October (Table 4.1). In the analysis of enterprise combinations, however, peak periods for fundi are June and August (planting and harvesting respectively) whereas upland rice's peak period is July (weeding). These patterns may indicate a departure from the optimal timing of cultural practice to accommodate the cultivation of two crops with competing labor requirements.

One might ask why low-income farmers are willing to cultivate a crop whose peak period conflicts with the peak period of the food staple. This is especially curious because fundi is the lowest-returns enterprise studied. The reason behind these findings is the crucial role fundi plays as a "hungry season" food; fundi is harvested in August approximately two months before the upland rice harvest. Since low-income farmers are unable to maintain food stocks or cash reserves throughout the year, they rely on fundi for food during the months before rice becomes available.

5.1.9 Upland Rice--Tailoring-or-Carpentry

Upland rice-tailoring-or-carpentry, undertaken by ten (3 percent) of the sample households is pursued exclusively by low and

middle-income households. This is somewhat surprising since tailoring is a high-returns enterprise and carpentry is a middle-returns enterprise. Table 3.14, however, shows that tailoring and carpentry play a very limited role in the households of this enterprise combination, accounting for only 8 percent of total labor.

Tailoring has high variable costs, capital costs, and cash costs and carpentry has high capital costs. Capital stock values for both enterprises are highly variable, reflected by coefficients of variation of over 60 percent. Low and middle-income households are thus able to undertake these enterprises on a very small scale employing low levels of capital inputs.

Table 4.1 shows that there is some conflict between the seasonal labor requirements for tailoring and carpentry and those for upland rice. For those households pursuing the upland rice-tailoring-or-carpentry combination, however, the latter two enterprises account for less than 10 percent of total labor used during any of the peak months (Figure 5.1). Therefore, it is not likely that seasonal labor requirements are an important constraint limiting expansion of this enterprise combination. However, demand constraints may limit the expansion of tailoring and carpentry. Moreover, high capital constraints may be a barrier to entry prohibiting low and middle-income households from expanding their carpentry and tailoring enterprises.

5.1.10 Conclusion

The pattern of factor requirements--capital and variable costs and labor inputs--is important in explaining the incidence of enterprise combinations and understanding why they are undertaken by different income groups. There is a high degree of complimentarity between the seasonal labor requirements of component enterprises in enterprise combinations. The findings do not show that capital and variable costs play an important role in excluding low-income households from middle and high-returns enterprise combinations. However, the enterprise combinations with low variable and capital cost requirements are pursued more frequently by low-income households than middle and high-income households. These enterprise combinations generally have relatively low returns to labor.

5.2 Enterprise Combinations and the Use of Hired Labor

In the previous section the coefficient of variation was used to measure the degree of conflict between the seasonal labor requirements of selected enterprises. However, this analysis ignored the possibility that households may employ hired labor[1] to increase their use of peak season labor and thus further skew the seasonal labor

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[1]It is recalled that hired labor includes both (1) labor contracted for a wage paid for in cash or kind and (2) exchange labor, in which a person works in the field of a neighbor for a meal with the understanding that the neighbor will reciprocate. Exchange labor accounts for about 40 percent of total hired labor.

profile, increasing the monthly-labor coefficient of variation. Since peak season labor bottlenecks are an important constraint to increasing output, it might be expected that households hire most of their labor during peak seasons. This hypothesis, as well as the use of hired labor in major enterprise combinations, is examined in this section.

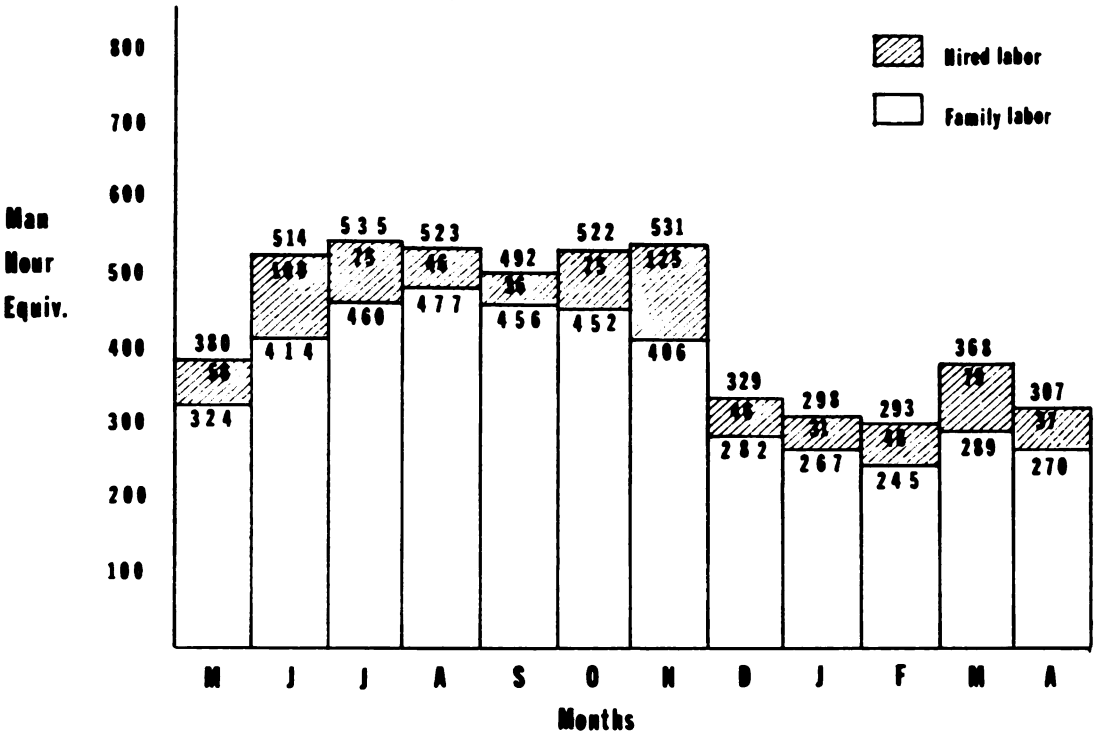
Figure 5.2 shows the monthly distribution of family labor and hired labor for households of selected enterprise combinations. Table 5.2 summarizes some of the important data from these figures. Hired labor accounts for between 11.6 and 18 percent of the total labor of different enterprise combinations. There does not appear to be a relationship between the level of hired labor used and the degree of conflict between peak periods of enterprises in combination. However, there is a strong relationship between the income group associated with an enterprise combination and use of hired labor. The three enterprise combinations emphasized by low-income households were first, second, and fourth in least hired labor used.

Table 5.2, column 2, shows that most hired labor, 73 to 92 percent, is used on upland rice fields; only 54 to 74 percent of total labor--hired and family--is used for upland rice (Table 3.10). The use of hired labor for the second enterprise in combination with upland rice is substantially less, ranging from zero for fishing and tailoring-carpentry to 16 percent for inland swamp rice.

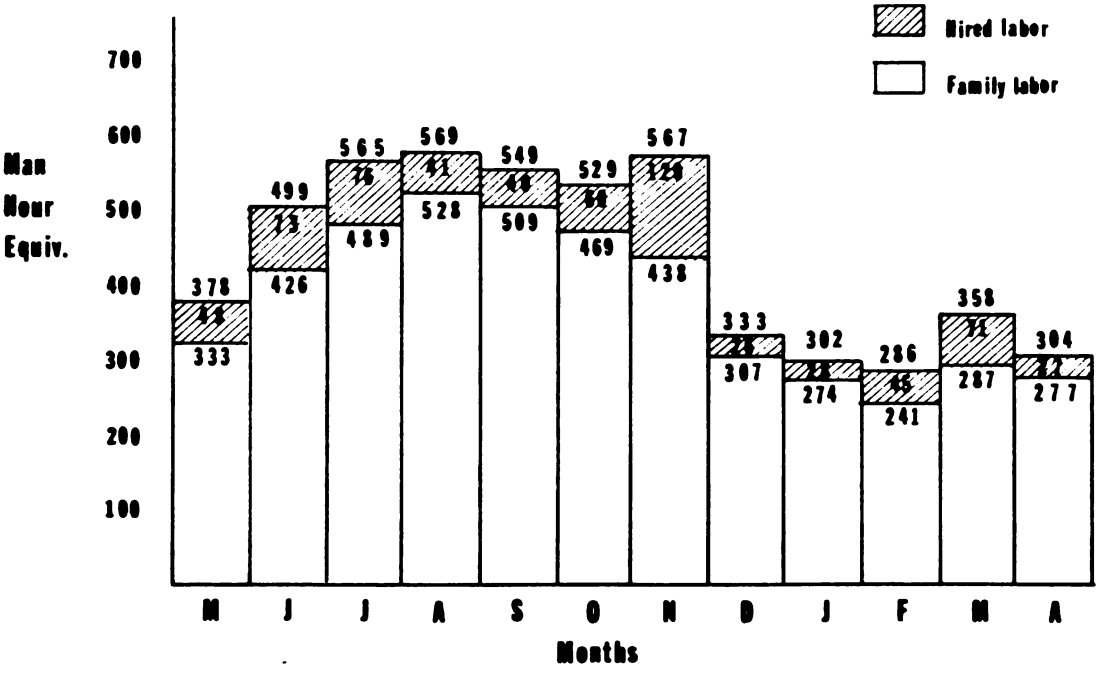
Columns 4 and 5 show the coefficients of variation for monthly family labor and monthly total labor respectively. When the

FIGURE 5.2 Monthly distribution of family labor and hired labor use among households for major enterprise combinations of rural Sierra Leone

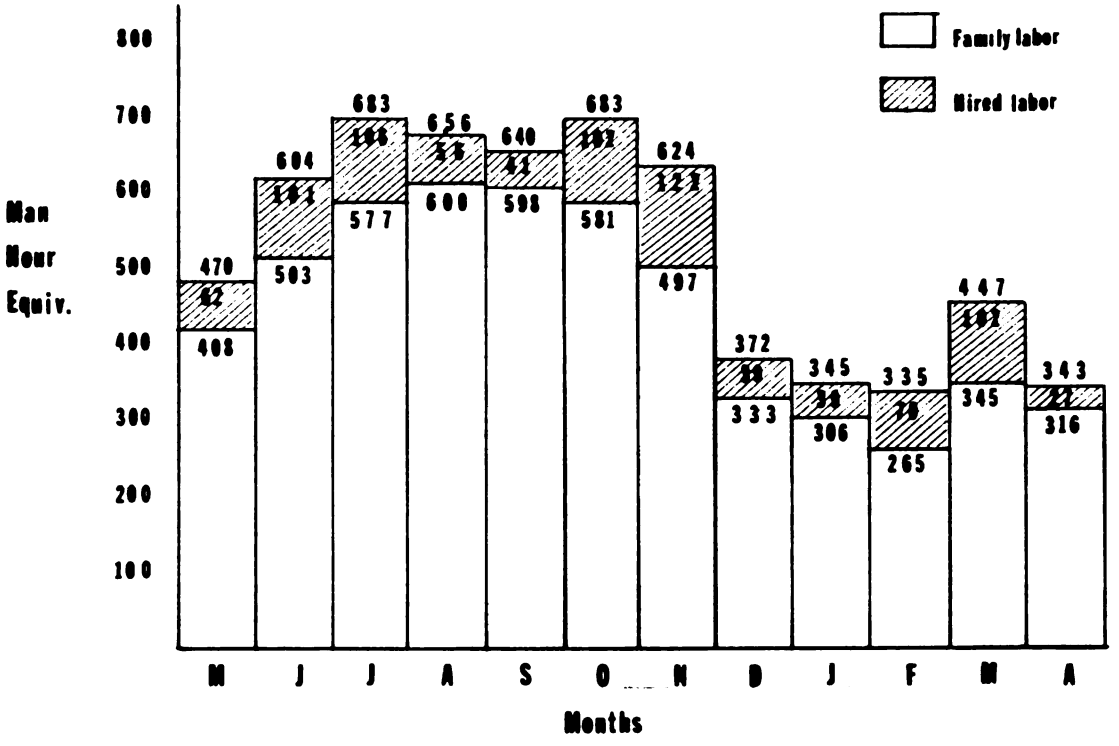
A. Upland rice - Oil palm households (67cases)



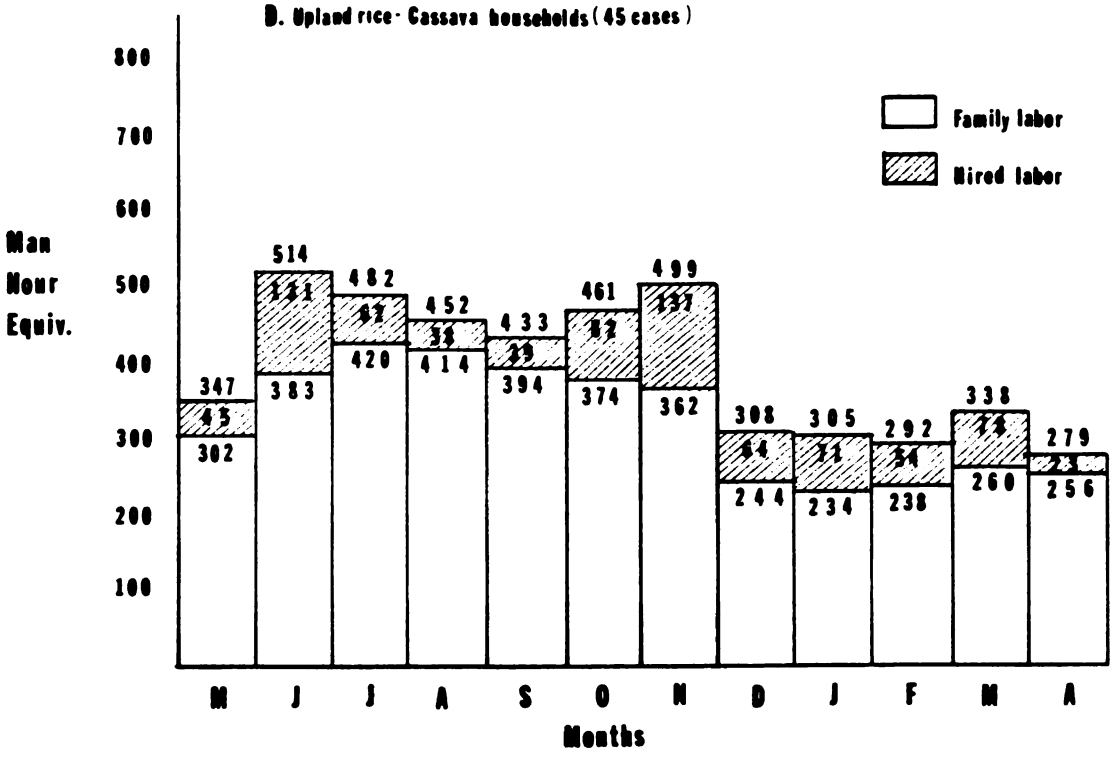
B. Upland rice - Labor sold out household (45 cases)



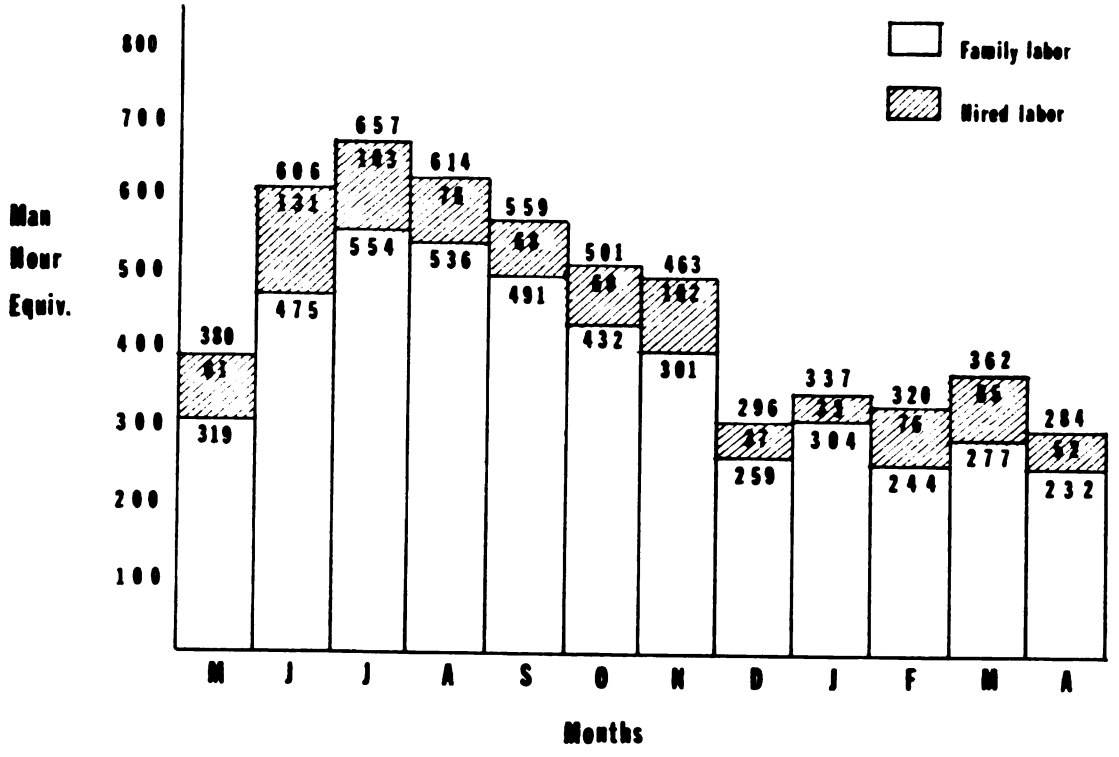
C. Upland rice - Groundnuts households (40 cases)



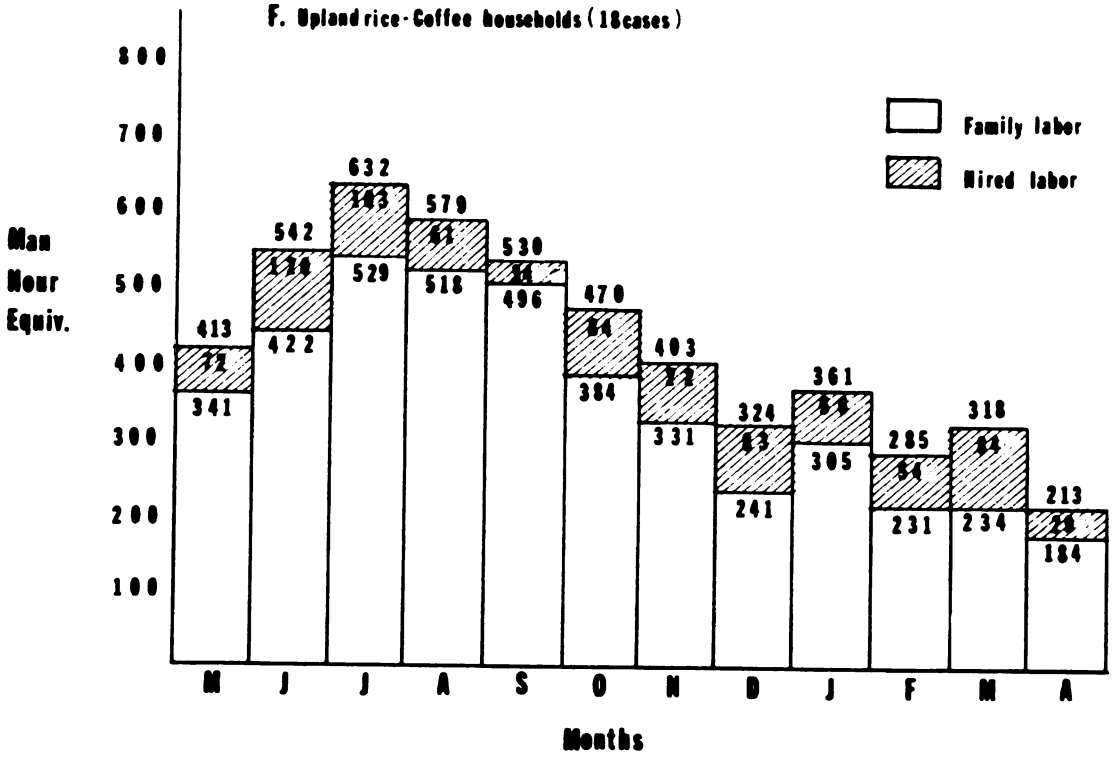
D. Upland rice - Cassava households (45 cases)

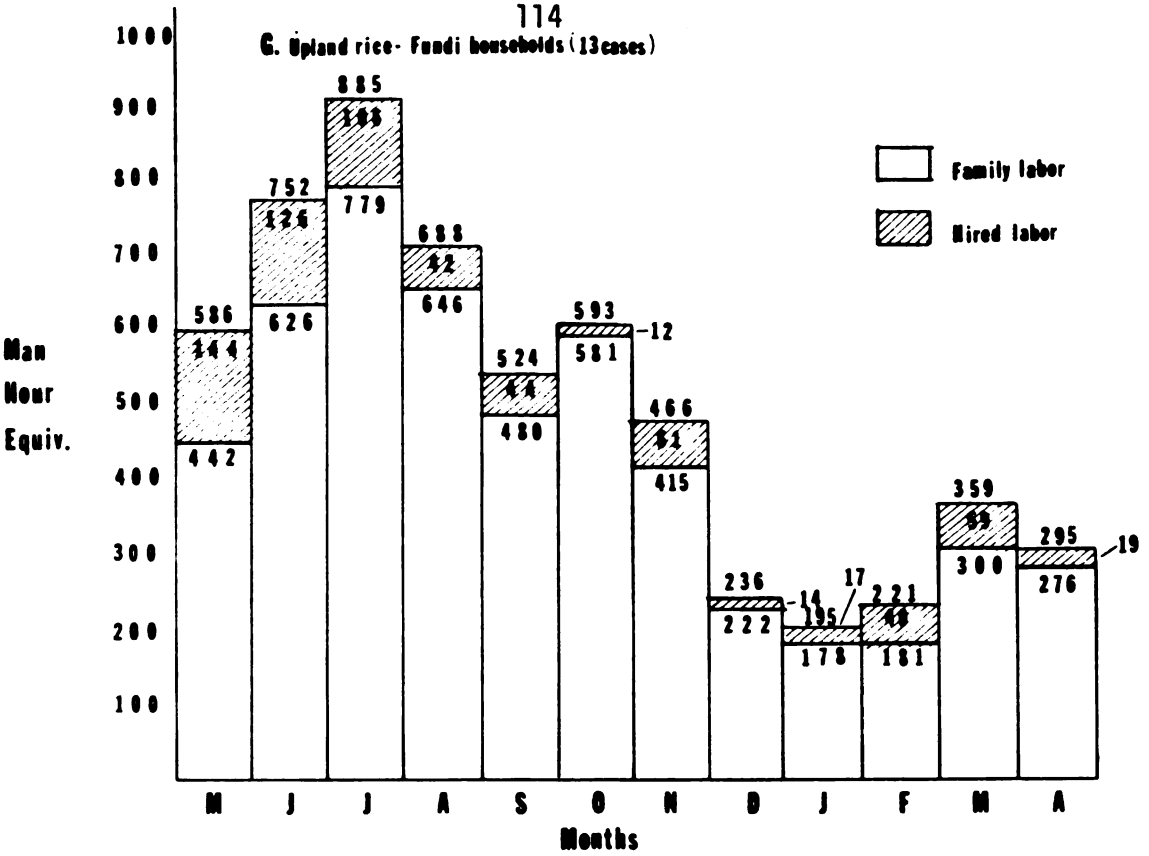


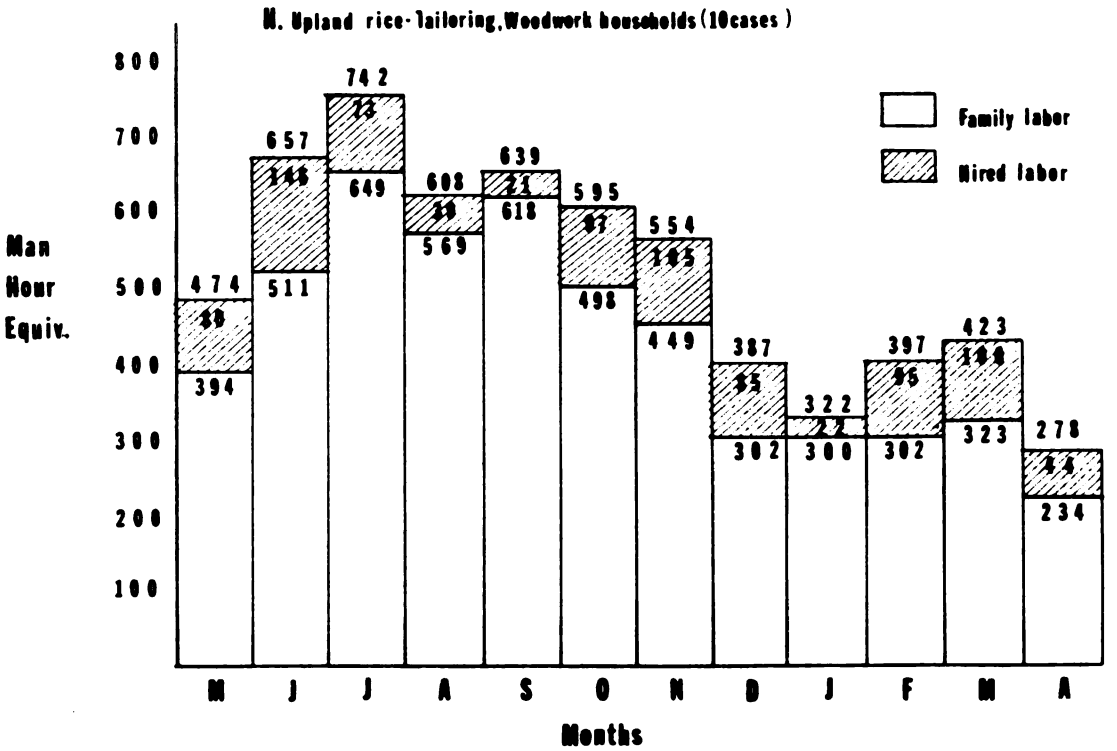
E. Upland rice - Inland swamp rice households (36 cases)



F. Upland rice - Coffee households (18 cases)




G. Upland rice- Fundi households (13cases)
Man Hour Equiv.
1000
900
800
700
600
500
400
300
200
100
Family labor
Hired labor
586
144
442
752
126
626
885
106
779
688
42
646
524
44
480
593
12
581
466
51
415
236
14
222
195
17
178
221
40
181
359
59
300
295
19
276
M J J A S O N D J F M A
Months


H. Upland rice-Tailoring, Woodwork households (10cases)
Man Hour Equiv.
800
700
600
500
400
300
200
100
Family labor
Hired labor
474
80
394
657
146
511
742
93
649
608
39
569
639
21
618
595
97
498
554
105
449
387
85
302
322
22
300
397
95
302
423
100
323
278
44
234
M J J A S O N D J F M A
Months

I. Upland rice- Fishing households (17cases)

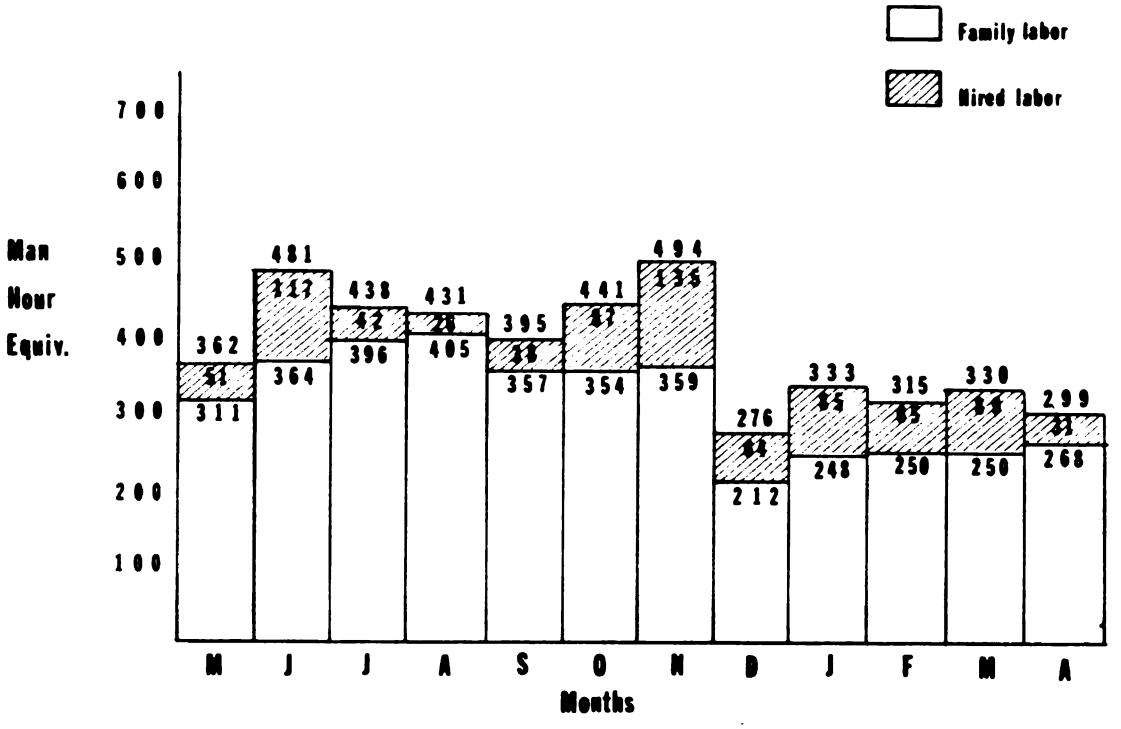


TABLE 5.2.--Hired Labor Use in Major Enterprise Combinations in Rural Sierra Leone

Enterprise Combination	1 Hired Labor as Percentage of Total Labor	2 Upland Rice Hired Labor as Percentage of Total Hired Labor	3 2nd-Enterprise Hired Labor as Percentage of Total Hired Labor	4 Coefficient of Variation: Family Labor[a]	5 Coefficient of Variation: Total Labor[a]	6 Peak Month for Family Labor	Peak Month for Hired Labor
Upland Rice--Wild Oil Palm	14.8	85	3	24.8%	24.4	Aug.	Nov.
Upland Rice--Labor Sold Out	12.7	92	--	27.6%	27.2	Aug.	Nov.
Upland Rice--Groundnuts	14.1	80	7	28.9%	27.9	Aug.	Nov.
Upland Rice--Cassava	17.6	87	1	23.0%	22.6	July	Nov.
Upland Rice--Inland Swamp Rice	16.7	71	16	31.6%	30.2	July	June
Upland Rice--Coffee	16.8	73	6	34.0%	30.6	July	June
Upland Rice--Fishing	18.0	83	0	20.9%	19.2	Aug.	Nov.
Upland Rice--Fundi	11.6	8	2	46.9%	46.8	July	May
Upland Rice--Tailoring--Carpentry	15.2	90	0	32.6%	29.0	July	June

[a]Coefficient of variation = $\frac{\text{standard deviation}}{\text{mean}} \times 100$.

coefficient for total labor is greater than that for family labor, the use of hired labor has caused an increase in the average percentage deviation from the mean monthly labor input. In other words, when the coefficient for total labor is greater than that for family labor, hired labor has been used to increase the relative quantity of labor used during the peak period. For all nine enterprise combinations, the coefficient of variation for total labor is less than that for family labor, i.e., the use of hired labor is more important during slack and intermediate periods than during peak periods.

Table 5.2 also shows the months of peak hired labor and peak family labor for the enterprise combinations. Family labor tends to peak in July or August whereas hired labor peaks in November or June. In none of the nine enterprise combinations does the month of greatest use of hired labor coincide with any of the three most important months of family labor use. In all combinations, the use of hired labor is greatest during the fourth, fifth or sixth highest month of family labor use. This further demonstrates that hired labor is used mostly during intermediate periods as opposed to peak or slack periods. The charts in Figure 5.2 also suggest this result.

The low level of hired labor used during peak seasons is not attributable to inefficiencies in the labor market. Spencer and Byerlee found the rural labor market in Sierra Leone to be well established and generally efficient, with wages highest during the peak season (Spencer and Byerlee, 1977). Rather, the low level of hired labor used during peak seasons can be explained by the absence of a landless laborer class in rural Sierra Leone. Hired labor is

generally much less available during peak periods because all family labor is engaged in domestic activities. Household labor is available for hire by other households primarily during months outside the peak period.

Figure 5.3 and Table 5.3 present the monthly use of hired labor and family labor by households of different income terciles for three enterprise combinations: upland rice-wild oil palm, upland rice-groundnuts, and upland rice-cassava.[1] It is not possible to generalize about the relative use of hired labor by households of different income groups pursuing the same enterprise combination. For two of the combinations, the middle-income group uses the highest proportion of hired labor, whereas in the remaining combination, it uses the lowest proportion. There is no significant difference in the relative use of hired labor between low-income and high-income households. This finding is quite unexpected. It is caused, perhaps, by the predominance of the system of exchange labor. If the degree of participation in this system is not associated with income level, one could expect to find all income groups using similar levels of hired labor.

Table 5.3 shows coefficients of variation[2] for family labor and total labor. There does not appear to be any association between

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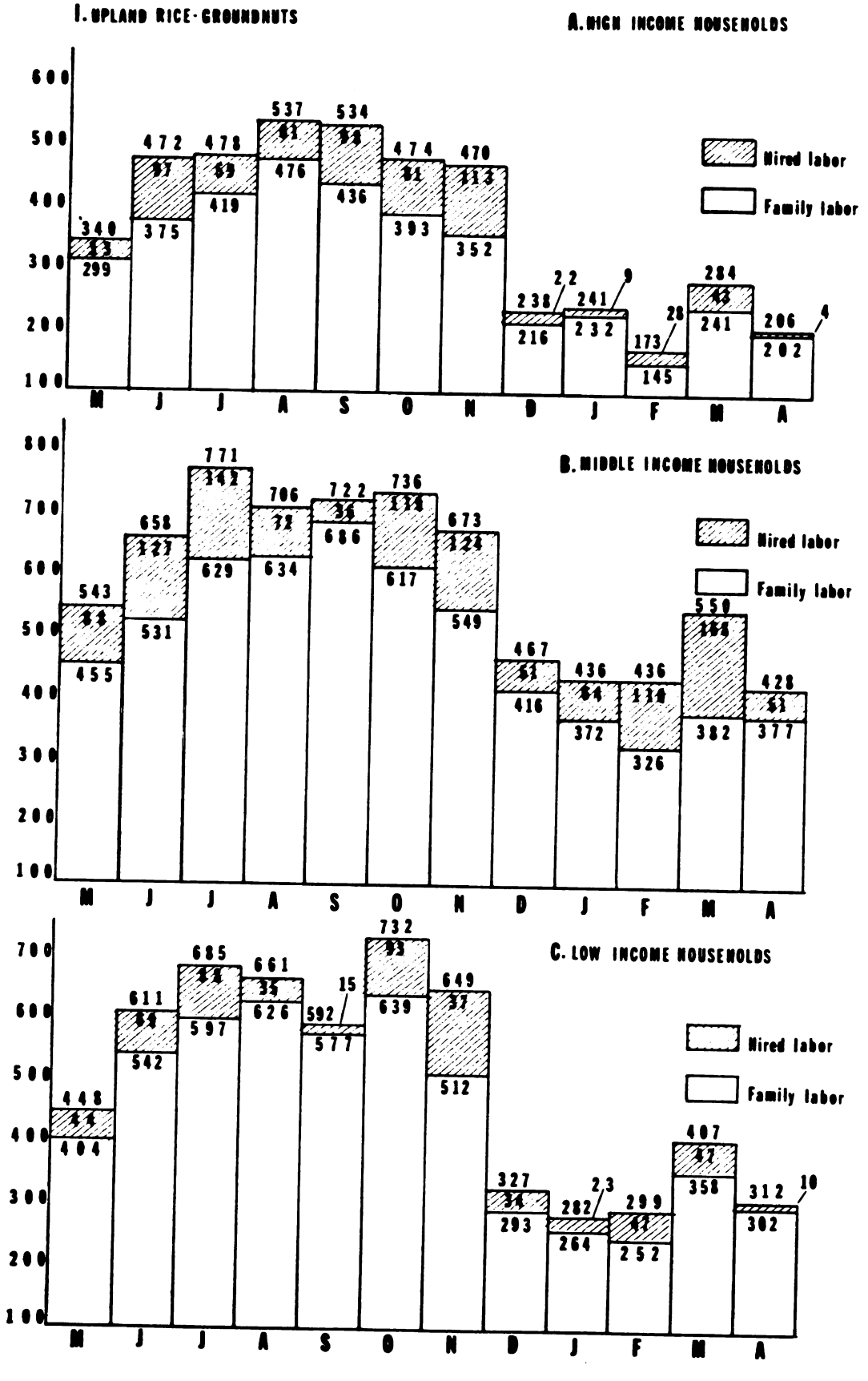
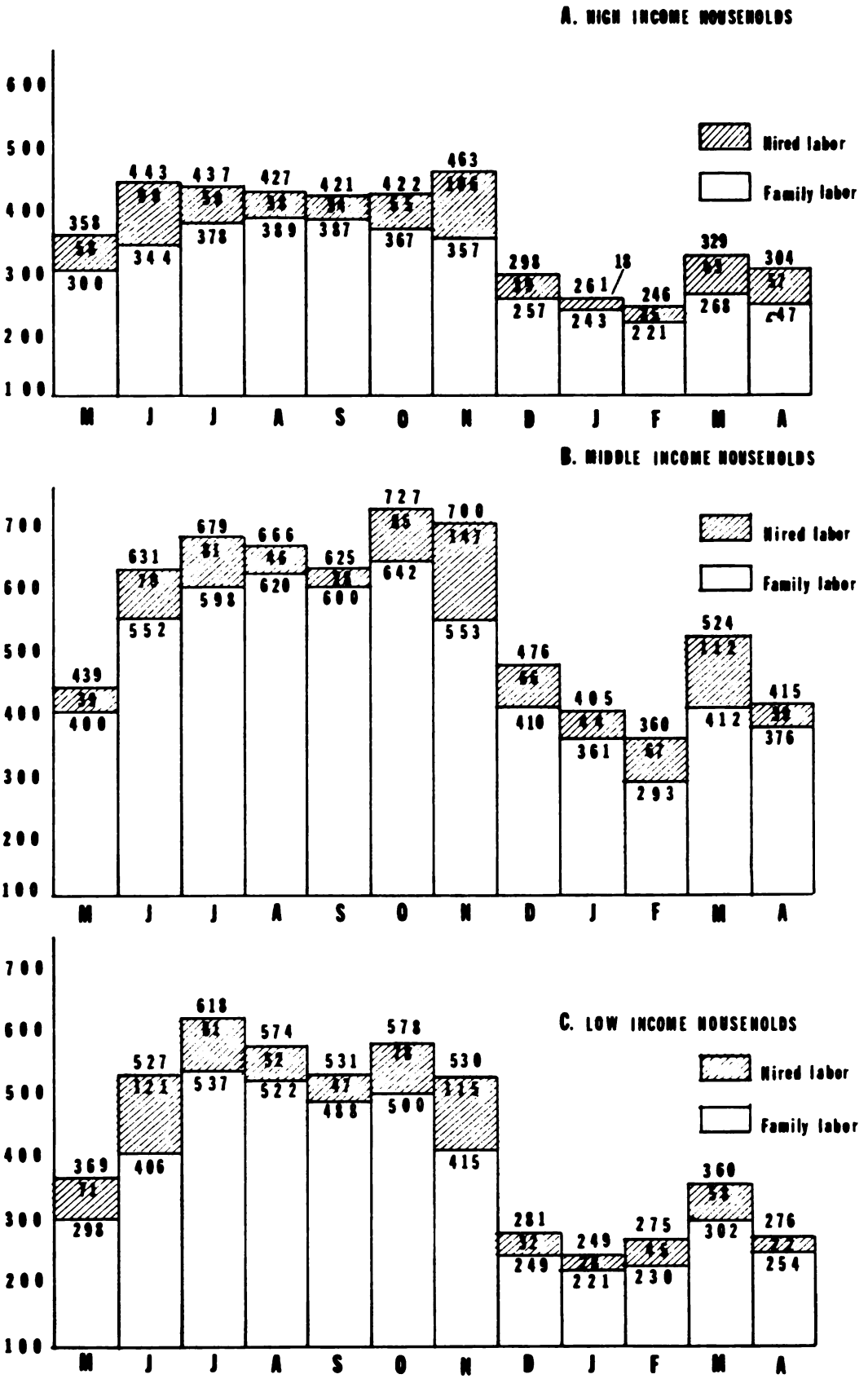
[1]Only one other enterprise combination, upland rice-inland swamp rice, had a sufficient number of cases for analysis by income group. It was excluded, however, because income differences largely reflect regional differences (see Table 3.11).

[2]From the mean monthly labor input.

FIGURE 5.3 Monthly distribution of hired and family labor used by households of different income groups for selected erterprise combinations



II. Upland rice - Oil palm (wild)



III. Upland rice-Cassava

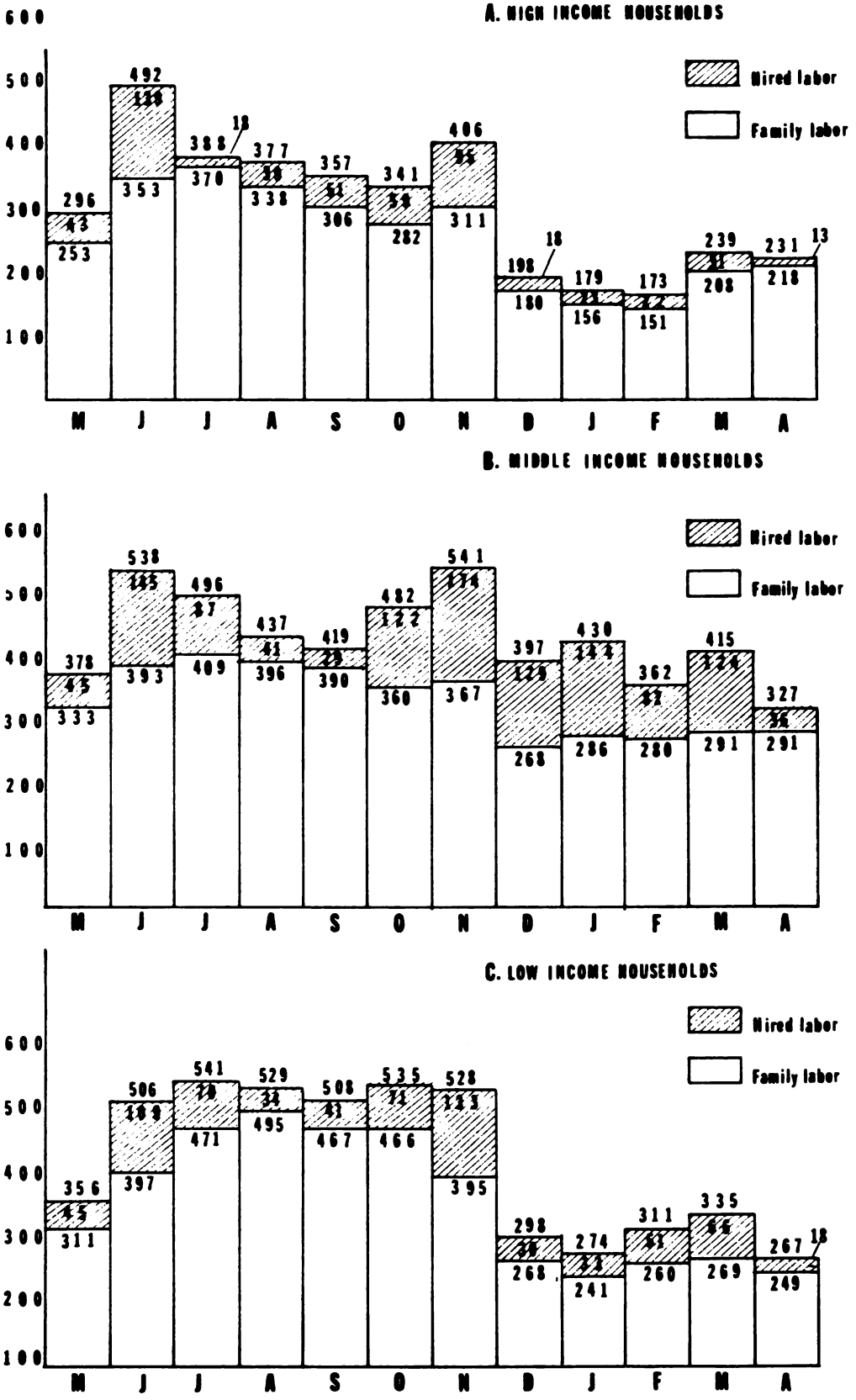


TABLE 5.3.--Hired Labor Use by Income Group for Selected Enterprise Combinations in Rural Sierra Leone

Income Group	Hired Labor as Percentage of Total Labor	Coefficient of Variation: Family Labor[a]	Coefficient of Variation: Total Labor[a]	Peak Month: Family Labor	Peak Month: Hired Labor
Upland Rice--Oil Palm (wild)					
Highest 30%	14.7	20.2	21.0	Aug.	Oct.
Middle 40%	12.5	24.9	23.7	Oct.	Nov.
Lowest 30%	14.4	33.2	32.8	July	June
Upland Rice--Groundnuts					
Highest 30%	14.3	33.4	36.9	Aug.	Nov.
Middle 40%	16.2	25.0	22.1	July	Sept.
Lowest 30%	10.7	33.5	34.0	Nov.	Oct.
Upland Rice--Cassava					
Highest 30%	15.0	29.6	33.5	July	June
Middle 40%	22.2	15.6	15.5	July	Nov.
Lowest 30%	14.0	28.2	28.0	Aug.	Nov.

[a]Coefficient of variation = $\frac{\text{standard deviation}}{\text{mean monthly labor input}} \times 100$.

Family labor refers to labor of all family members.

Total labor refers to labor of all family members and hired laborers.

these coefficients and income level for households pursuing the three selected enterprise combinations. This is not surprising because various factors affect the coefficient of variation, e.g., a high coefficient could reflect a lack of opportunities during the slack season on the one hand or the willingness of households to work extra-normal hours during peak periods.

For the high-income group, however, the coefficient for total labor is greater than the coefficient for family labor in all three selected enterprise combinations. For the middle-income and low-income groups, on the other hand, the coefficient for family labor is greater in five out of six cases. These data demonstrate that only the high-income households are able to use hired labor to increase relative household labor levels during peak periods, thus further skewing the monthly labor distribution. The use of hired labor increased the coefficients of variation of the rich by 9 percent for the three selected enterprise combinations. This is very high given that hired labor accounts for only 14.7 percent of total labor for these enterprise combinations. High-income households on average make their greatest use of hired labor during their fourth highest month of family labor use; the greatest use of hired labor for middle and low-income households occurs during the sixth highest month of family labor use.

Thus during peak labor periods, there is relatively little use of hired labor, as all persons are fully occupied on their own farms. Moving away from peak periods of labor use, however, it is

the high-income households who first make use of increasingly available hired laborers. Hired labor use among the low and middle-income groups, on the other hand, is concentrated more during the intermediate and slack periods. These findings are probably related to the greater ability of high-income households to pay higher wages, either in cash or in kind. If there is a strong association between income and social status, which seems to be a reasonable assumption, then high-income households may also be in a better position to make more use of exchange labor during peak and intermediate periods.

In conclusion, although there is little tendency for households to employ hired labor during peak seasons, there is a more marked tendency for high-income households to do so. Since peak season labor bottlenecks are a major constraint to increasing output and incomes, the ability of high-income households to employ more of their hired labor during peak periods permits them to overcome this constraint and consequently increase their incomes.

5.3 Peak Periods for Different Income Groups

Table 5.4 shows that for each of the three enterprise combinations analyzed, each income group has a different peak labor month. Furthermore, peak periods vary considerably among income groups pursuing the same enterprise combination. For upland rice-groundnuts, the peak period is August and September for the high income group. This corresponds to the period of rice weeding and groundnut harvesting. For the middle-income group, the peak period is longer, extending from July to October and thus encompassing the

TABLE 5.4.--Variations in Peak Labor Periods by Income Group and Enterprise Combination in Rural Sierra Leone

	Peak Month	Peak Period
I. Upland Rice--Groundnuts		
Highest 30%	Aug.	Aug.-Sept.
Middle 40%	July	July-Oct.
Lowest 30%	Oct.	Oct.
All Households	July, Oct.	July-Nov.
II. Upland Rice--Oil Palm (Wild)		
Highest 30%	Nov.	June-Nov.
Middle 40%	Oct.	Oct.-Nov.
Lowest 30%	July	July
All Households	July	June-July, Nov.
III. Upland Rice--Cassava		
Highest 30%	June	June
Middle 40%	Nov.	June, Nov.
Lowest 30%	July	July-Aug. Oct.-Nov.
All Households	June	June, July, Nov.

weeding of groundnuts and some rice harvesting. For low income households, the peak period is October, the end of the groundnut harvest and the beginning of the rice harvest.

Peak periods vary between income groups of the other two enterprise combinations as well. There is no association between either the duration of the peak period and income level, or between the particular peak months and income level. Therefore, it is not possible to generalize about the peak periods of specific income groups involved in upland rice enterprise combinations. The above analysis demonstrates, however, the importance of examining labor profiles for different income groups since the constraints each group faces may be different.

CHAPTER VI

SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

6.1 Summary of Findings

Rural development programs and policies often fail to help the poor because planners have an inadequate understanding of the economics of rural households and the production constraints they face. The farming systems approach seeks to understand how the rural household allocates resources to meet its priorities. This approach is useful for obtaining information concerning rural households crucial for the design of programs and policies.

This thesis uses the farming systems approach to examine enterprise choice and enterprise combinations in rural Sierra Leone, based on data collected by Spencer and Byerlee in a comprehensive survey of rural households in 1974-75. The goal of the study is to provide information on how rural households select and combine their activities, so that rural development planners can direct their programs towards those in greatest need. Microeconomic studies often focus on the average farm, overlooking differences which exist among income strata. By disaggregating the analysis by income terciles and deciles, we explore conditions of poor households and differences in enterprise choice and factor use among income strata.

The analysis begins with an examination of enterprise choice in rural Sierra Leone. Differences in enterprise choice among income

groups are highlighted and major enterprise combinations are identified. Finally, we examine the role of land, labor, and capital resources in the selection of enterprises and enterprise combinations.

Over 85 percent of the rural households in Sierra Leone specialize (devote greater than 30 percent of their labor or obtain greater than 30 percent of their income) in producing rice, the major food staple. Upland rice is by far the most important rice enterprise, accounting for over half of the nation's cultivated area. Other important enterprises in Sierra Leone include wild oil palm, inland swamp rice, cassava, labor sold out, and groundnuts.

One important hypothesis to explain why the poor are poor is the following: low-income households have low incomes because they undertake low-return enterprises relative to the rest of the rural population. This hypothesis may be divided into three parts: (1) the poor select a different mix of enterprises than the rich, (2) enterprises associated with high-income households have high returns; those of low-income households have low returns, and (3) differences in enterprise choice cause the disparity in income levels among income strata.

The analysis shows that there is an association between enterprise choice and income level. Of the 22 enterprises examined, 12 are associated with a specific income tercile. Five enterprises--upland rice, labor sold out, fundi, fruit, and "other vegetables"--are associated with high-income households. Three enterprises--

blacksmithing and hand and mechanized Boliland rice--are associated with low-income households. Furthermore, all enterprises associated with the high-income tercile have high returns and all associated with low-income terciles have low returns. Thus, the analysis supports the first two parts of the above hypothesis.

However, the third part of the hypothesis, that enterprise choice causes differences in income levels, is refuted by the results of expected net returns analysis. The household expected net return isolates the effect of enterprise choice on enterprise returns. For farm enterprises only, no significant difference exists between the expected returns to labor among income strata, indicating that the inter-strata variation in enterprise mix does not generate differences in household returns to labor. When non-farm enterprises are included, inter-strata differences in expected net returns to labor are significant, indicating that variation in enterprise choice between income groups leads to differences in returns to labor. However, the income differentials attributable to enterprise choice are small when compared to the actual income disparities between income groups. Therefore, the hypothesis that the poor are poor because they undertake low-returns enterprises is not supported.

Another possible hypothesis to explain income differentials is that the rich have higher labor productivity within major enterprises than the poor. Evidence supporting this hypothesis is presented in Matlon, et al., 1979.

Next, we examine the influence of the use of factors of production--labor, capital, and land--on enterprise choice. Although labor is an abundant resource in rural Sierra Leone, peak season labor bottlenecks are a major constraint to increasing income (Spencer and Byerlee, 1977). In this study, we present seasonal labor profiles for individual enterprises and measure their degree of complimentarity with those of the two principle staple crop enterprises: upland rice and inland swamp rice. The analysis shows that supplementary enterprises have a much higher degree of peak-season labor conflict with inland swamp rice than with upland rice.

The examination of seasonal labor use is also important for explaining the association of specific enterprises with income groups. For example, coffee and cocoa are two important cash crops in the East. Although cocoa has much higher returns, coffee production is a more common crop and is associated with low-income households. Cocoa's peak period for labor use conflicts with those of the rice staples. Since low-income farmers lack the funds necessary for hiring peak-season labor, they are unable to cultivate cocoa. Furthermore, low-income farmers have low levels of productivity in rice production (Matlon et al., 1979) and are thus unwilling to allocate resources toan enterprise which diverts scarce peak-season labor from production of the food staple.

In fact, the analysis indicates that the seasonal labor profile may be as important a consideration as the enterprise return to labor in understanding how the household selects enterprises. If the

scarcity of peak-period labor is a constraint to increasing production, the enterprise return to labor is a misleading measure of enterprise profitability because it assumes that all manhours have the same opportunity costs. The enterprise return to peak season labor, a measure introduced in this study, accounts for both the returns to labor and the variation in the opportunity cost of labor between seasons. However, this statistic is useful only as an ordinal measure, because of problems with the underlying assumptions.

The capital constraint is also an important factor affecting enterprise choice. Low-income households emphasize enterprise combinations with low capital and variable costs, combinations which also have low returns. Six of seven high-returns enterprises have high variable and capital costs, and these enterprises are generally associated with high-income households. Furthermore, the poor pursue enterprises with lower capital-labor ratios than high and middle-income groups. Thus, capital constraints exclude the poor from specializing in high-cost, high-returns enterprises such as marine fishing and the small-scale industries. However, a substantial number of poor households participate in these enterprises, albeit at low levels of intensity. The most important factors limiting the involvement of the poor in high-returns enterprises are probably capital scarcity and demand constraints.

In contrast, the size of land-holding does not appear to be an important factor affecting enterprise choice. The poor do not select crops which have higher labor-land ratios or higher expected

returns to land than those selected by high-income households. Since land is not generally a scarce resource in Sierra Leone, these results are expected.

Thus far, the analysis has highlighted the importance of two constraints--peak-season labor and capital--to increasing income Next, the most important production systems in rural Sierra Leone are modeled by identifying principle enterprise combinations. An enterprise combination consists of two enterprises which account for greater than 60 percent of a household's total labor and which individually account for greater than 10 percent of household labor or income. There are nine principle combinations, each including upland rice, which are individually pursued by more than ten (3 percent) of the 328 sample households. Five of these combinations, upland rice with wild oil palm, with labor sold out, with groundnuts, with cassava, or with inland swamp rice, are each undertaken by more than 10 percent of the sample households.

The analysis of enterprise choice and factor use is used to explain why each enterprise combination is selected, and to explore the association between individual combinations and income strata. Other aspects, e.g., the sexual division of labor, seasonal consumption requirements and the location-specificity of certain combinations, provide further insight into the choice of enterprise combination.

Five of the nine combinations are associated with particular income groups. Three combinations--upland rice-oil palm, upland

rice-labor sold out and upland rice-fundi--are associated with low-income households. The upland rice--groundnuts and upland rice--tailoring-or-carpentry combinations are associated with middle and low-income households.

Seasonal labor use is a primary consideration in the choice of enterprise combinations. For each enterprise combination, the monthly distributions of labor for the individual enterprises compliment each other. For six of the nine combinations examined, there is no peak-season labor conflict between upland rice and the second enterprise in the combination. For the three remaining combinations, the overlap in peak periods is confined to a single month. Moreover, in eight of the nine enterprise combinations, the coefficient of variation from mean monthly labor use is lower for the enterprise combination than for each of the individual enterprises. For all combinations, coefficients of variation are lower when all enterprises pursued by the households are considered than when only the two enterprises in the combination are examined. Thus, the enterprises chosen to supplement the staple-food enterprise tend to equalize the distribution of labor between months.

The role of hired labor in releasing peak season labor bottlenecks is also examined. No association exists between the ratio of hired labor to household labor and income level. In general, hired labor is not used primarily during the peak periods of household labor use. Since no landless laborer class exists in Sierra Leone, few individuals are willing to sell labor services during

peak periods. However, a disaggregation of the analysis by income strata reveals that high-income households do use hired labor to release labor bottlenecks during peak periods. As hired labor becomes available between the peak month for labor use and periods of intermediate labor use, it is used primarily by high-income households. Middle and low-income households use relatively more hired labor during intermediate and slack periods.

Last, inter-strata variations in peak periods for three individual enterprise combinations are explored. For each combination, there are important variations in the peak months and peak periods of labor use for different income terciles. It is not possible to generalize about the timing or duration of peak periods for any individual income group.

6.2 Policy Implications

Several important policy implications emerge for the above analysis. First, there is little scope for increasing the incomes of poor rural households by changing their crop mixes to mirror those of high-income households, given present technology. Rather, an understanding of the critical factors contributing to disparities in inter-strata resource productivity for the major enterprises is necessary. If the constraints limiting the farm productivity of poor households can be identified and removed, their productivity and incomes can be increased.

A principal strategy to increase the incomes of the rural poor is to improve the productivity of their upland rice farms. Significant variation exists in the returns to labor for upland rice among income strata (Matlon et al., 1979). Poor rural households devote over half of their labor to upland rice; thus, even small improvements in the productivity of this labor could generate important increases in income through increased rice production or by permitting households to divert resources to other enterprises. A policy targeted at upland rice could help equalize the distribution of income, since the upland rice enterprise is associated with low-income households.

Spencer (1975) also proposes a policy which emphasizes improving the productivity of upland rice. He claims that poor upland rice farmers can benefit greatly from an extension program promoting improved seed and fertilizer, even without input subsidies. In contrast, the government of Sierra Leone uses input and land-clearing subsidies to promote a transfer of resources from upland rice production to swamp rice production. This policy has high costs, is location-specific, and may skew the distribution of income because of its relatively narrow focus. Moreover, the more severe labor bottlenecks in production systems emphasizing swamp rice may discourage farmers from undertaking swamp rice production and decrease the incomes of those who do.

New techniques and enterprises will be acceptable to the rural poor only if they reduce, or do not exacerbate, peak season labor bottlenecks. The peak periods of labor use are generally during land preparation, planting, and harvesting of upland rice. Two approaches can be taken to reduce these peak season bottlenecks:

1. Labor-saving technologies may be introduced to reduce labor bottlenecks during peak periods in upland rice cultivation. Since large-scale, mechanized projects have a poor performance record in Sierra Leone, intermediate technologies for land preparation would be more appropriate (Spencer and Byerlee, 1977; Spencer, Byerlee, and Franzel, 1979).

2. New crop varieties are needed which require sequences of activities complimentary to those of the major rice systems. Most of the annual crops have overlapping peak periods with upland rice. In some cases, it may be desirable to alter the growing season of the rice enterprises. For example, in the North poor farmers plant fundi because it can be harvested during a period of low food availability, one to two months before the upland rice harvest. However, fundi has low returns, overlapping peak periods with upland rice, and is a less-preferred food than rice. A short-season upland rice variety could release peak-season labor bottlenecks and permit low-income farmers to cultivate a higher-return and more preferred staple crop.

There is some scope for increasing the incomes of the rural poor by introducing nonfarm enterprises, even at current levels of

technology. These enterprises, which include fishing, carpentry, tailoring, and blacksmithing, contribute to inter-strata income differentials. Incomes may also be increased by helping poor households to expand and improve productivity in their present, though minor, nonfarm activities. The capital constraint, however, is an important factor limiting the introduction and expansion of high-return, nonfarm enterprises. Unless access to credit is substantially increased for poor rural households, or entry costs substantially reduced, it is not likely that policies promoting nonfarm enterprises would greatly help the rural poor.

A final recommendation offered in this study has implications for both rural development policy and farm-level research methodology. The study establishes that important differences exist in the choice of enterprises, the choice of enterprise combinations, and factor use among income strata. Because of these inter-strata differences, farm models must be disaggregated by income group so that programs can be specifically targetted to reach low-income households.

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