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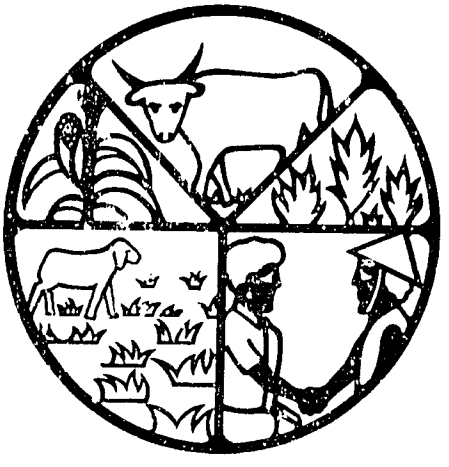
Mixed Farming Technical Report



LABOR UTILIZATION IN GAMBIAN CROPPING SYSTEMS:

TWO CASE STUDIES

by

Paul Jakus

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GAMBIAN MIXED FARMING AND RESOURCE MANAGEMENT PROJECT

Ministry of Agriculture and
Natural Resources
Government of The Gambia

Consortium for International Development

Colorado State University

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MIXED FARMING PROJECT

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Labor Utilization in Gambian Cropping Systems:

Two Case Studies

During the 1985/86 agricultural season, the Mixed Farming and Resource Management Project implemented an intensive study of 24 compounds at two sites. The purposes of the study were many, among them to evaluate the adoption of MFP interventions and to field test the Gambian Agricultural Data System (GADS).

Specifically designed to examine a farm's allocation of resources, the GADS generates data on labor utilization in detail. This report will map chronologically a farm's allocation of labor across all crop enterprises and all activities comprising each enterprise, by type of labor. This information will be useful when planning agricultural policy or interventions.

An overview of The Gambia and its farming systems is presented first followed by the methodology used in the data collection. A brief description of the villages in which the study was conducted is given. The representativeness of the sample is discussed followed by a presentation of per hectare labor utilization tables for the four major crops at each of the two study sites. Differences in labor utilization between the two study areas are then discussed. Conclusions appear in a summary. Data summarizing per hectare labor in "month by activity" and "activity by labor type" appear in a statistical appendix, although observations based upon data in these tables are raised in the text.

The Gambia and Its Farming Systems

The Gambia consists of a land area of about 11,000 square kilometers straddling the Gambia River for nearly 350 km east to west. Rainfall in The Gambia occurs in a short season usually beginning in mid-June and ending in mid-October. The rest of the year has little to no rainfall. Historically about 1000-1200 mm of rainfall could be expected, but in recent years average rainfall has been in the range of 600-800 mm.

The basic unit in Gambian agriculture is the compound. A compound generally consists of family members related by blood or marriage. While most compound members will belong to the family, it is not uncommon to find persons in the compound who are not family members. These "strange farmers" provide labor for the compound in return for food, lodging and use rights to a piece of land. Compound members usually live, eat and work together, although large compounds will often be partitioned into more than one work unit. In Gambian society, the head of the compound will

almost always be the oldest male, and it is he who stands at the top of the compound's decision making process. Since the compound constitutes the basic agricultural production unit in The Gambia, this report uses the terms "compound" and "farm" inter-changeably.

Almost all Gambian farms engage in a mix of crop and livestock enterprises. A baseline survey conducted by MFP found that more than 90% of rural Gambian compounds owned some livestock (Haydu, et al, 1986). The primary staple crops grown are millet and rice, with some maize, while the primary cash crop is groundnut. Traditional rainfed cultivation methods are followed for all crops, with the exception of those farmers participating in a major irrigated rice scheme and rice irrigated by tidal flows or ponded runoff. Very little motorized machinery is used but the use of draft animals can be characterized as extensive. Even those not owning draft animals utilize draft power. A market price and borrowing network for draft animals and machinery is well-established. Despite the widespread use of draft, farming remains a relatively labor intensive affair given the average farmer's limited access to draft power and cultivation equipment.

Livestock enterprises on most farms are managed in a relatively non-complementary manner with crop enterprises. Some farmers retain groundnut hay to feed draft animals at the end of the dry season. (A major goal of MFP was to extend this practice to other livestock and to encourage the feeding of maize stover as well as groundnut hay.) Cattle are sometimes tethered in farmers' fields, thus allowing the field to benefit from the deposited manure and urea. Cattle from many owners are pooled into a large herd and turned over to a contract herder for the duration of the crop season. At the end of the crop season the herder may be retained or the cattle turned back to their owners. During the dry season cattle are allowed to graze freely on village lands. If labor is expended, it is generally to herd cattle back to the village at day's end and to milk the lactating females.

Sheep and goats are strictly herded close to the village during the crop season; usually they are tethered for most of the day to prevent crop destruction. At the close of the season small stock are permitted to graze freely during the day but are brought back to the compound in the evening.

Methodology

Villages selected for the implementation of the Gambian Agricultural Data System were taken from those participating in two previous MFP data collection efforts. The 24 respondent compound heads were selected on the basis of their cooperation in the previous studies and their representativeness. While these farmers were originally selected as part of a random sample in the MFP Baseline study, their inclusion in the GADS effort was purposive. Respondents were known to be cooperative and to provide quality data. MFP personnel were familiar with each village and a reservoir of good will existed between MFP staff and respondent farmers. Due to the nature of the data to be collected and the "newness" of GADS, it was deemed desirable to work with compounds already familiar with MFP and the data collection process.

Farm management data were collected by field enumerators posted in each village from June 1, 1985 through March 31, 1986. Each enumerator lived in his assigned village thus allowing observation of respondent activities and establishment of a better rapport with respondents. An enumerator collected information from each of his six informants every two to three days on a regular basis. All input-output activities relating to fields and livestock owned or controlled by compound members were recorded.[1]

Given the frequent interview technique, farmer recall error was minimized. Enumerator bias was also limited because each of the four enumerators had at least four years of data collection experience. Based on the quality of their work in previous MFP efforts, these four enumerators were retained as the best of an original pool of 25 enumerators. Enumerators were expected to know their work units well: their fields, livestock, machinery and people.

Field enumerators were visited fortnightly by a Gambian supervisor. An entire day was spent with each enumerator reviewing all data collected since the last supervisory visit. Having worked in all four villages before, the field supervisor was familiar with all compounds involved in the study. The expatriate principal investigator and the field supervisor made a joint trek monthly. A similar editing scenario was followed, with both supervisors reviewing all data collected during the intervening period.

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[1] A notable exception is some cattle herding information. Because most cattle were herded contractually and grazed far from the village, data on this input was impossible to obtain.

Completed data forms were brought to project headquarters at Abuko at the end of each month. Data were entered and verified utilizing project microcomputers and programs designed for GADS. GADS is a series of BASIC programs designed to allow data entry directly from field data collection forms. Data error "traps" built into the system prevented many clerical errors while "cross-check" programs assured that a complete range of cultivation activities was recorded for each field. Should any questions be raised, consultations were held with the field supervisor and, if necessary, field enumerators.

Data were intensively managed from field to final analysis. The multi-tiered data verification process - from enumerator to field supervisor, then to principal investigator, on to computerized verification and then all the way back to the field enumerator if necessary - minimized the introduction of non-sampling error. While it is impossible to eliminate this type of error, all attempts were made to limit it.

Readers interested in more detailed discussion of the scope and structure of the data collection activities as well as codes and computer programs used are referred to the Gambian Agricultural Data System Users' Manual (Patrick, et al, 1986).

Description and Representativeness of Sample Villages

Field data collection was conducted in the villages of Piniai, Choya, Boiram and Njoben. All are located on the southern bank of the Gambia River in MacCarthy Island Division. Choya is located on the main highway about 235 km east of Banjul. Primarily Fula in ethnicity, Choya has about 26 compounds. Piniai lies about 6 km west of Choya along a well-graded dirt road. The village is populated primarily by members of the Mandinka tribe, although a substantial Fula population is present. Approximately 65 compounds are in Piniai. The main river swings by Piniai 7 km to the southwest and 8 km to the west. Villagers in Piniai participated in MFP sponsored activities such as deferred grazing, supplemental feeding and grain storage.

Boiram and Njoben are further east (up-river) from Piniai and Choya, about 50 km up the road. Boiram is about 7 km south of the road while Njoben is about 2 km southwest of Boiram. Both villages are primarily Wolof, with Boiram containing roughly 85 compounds and Njoben having about 40 compounds. Villagers in Boiram participated in the full range of MFP sponsored activities cited above.

The selection of the four villages was guided by the stated goals of the Mixed Farming Project. As mentioned earlier, all villages were initially selected as part of a stratified random

sample drawn for a baseline survey. In the baseline study, each rural farm in The Gambia had an equal chance of being selected, and information drawn from the 582 sample compounds in 89 villages is representative of the nation at large. Of the villages involved in the baseline study, nine were subsequently chosen for participation in the Intensive Village Study. Villages were selected on the basis of ethnicity, location and livestock ownership. Because MFP goals included a major emphasis on improving livestock production and greater integration between livestock and cropping systems, the nine villages were all located in areas of The Gambia in which livestock ownership was concentrated. Farms participating in the Intensive Village Study could therefore, by virtue of their relatively greater livestock holdings, be considered as "resource endowed", i.e., having greater resources than the average rural Gambian compound.

With the initiation of the Gambian Agricultural Data System, it was felt that due to the complexity and detailed level of data collection required, a smaller sample size would be desirable. The smaller sample would allow for more comprehensive data verification using the procedure outlined in a previous section of this paper. Greater control over all aspects of the data collection process could only improve the quality of the data. The use of the four "resource endowed" villages, however, imply that the data would not be representative of the all rural Gambian farms. Table 1 shows a comparison of average resources per compound for the baseline survey and for the 1985/86 GADS effort.

While the data in Table 1 generally confirm that compounds in the four GADS villages are more resource endowed than the average Gambian compound, substantial variation exists between resource levels of the Piniai/Choya area and the Boiram/Njoben area. Table 2 presents a comparison of average resources between the two areas. One may readily observe that resource levels in the Boiram/Njoben area are greater than those of the Piniai/Choya area. In fact, with the exception of draft animal ownership, resource levels in the Piniai/Choya area fall within those of the "central target group" of farmers which constitute over 42% of rural Gambian farmers.[2] Resource levels in Boiram/Njoben fall outside the target ranges in cattle and draft animals and livestock ownership is skewed toward cattle when compared to national averages. Comparing the two areas, large differences exist in percent of cropped area planted to millet and groundnuts. Compounds in Piniai/Choya planted 27% of cropped area to millet and 38% to groundnuts while in the Boiram/Njoben

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[2] Haydu, et al, 1986. The central target group consists of those farmers with between 2 and 8 hectares, between 5 and 20 adult equivalents, between 4 and 13 small stock, between 4 and 15 cattle and fewer than 2 draft animals.

Table 1. Comparison of Compound Resources between MFP Baseline Survey and MFP GADS Study

		Baseline 89 Villages 582 Compounds	GADS 4 Villages 24 Compounds
Hectares (a)	(HA)	4.2	5.9
Small Stock	(SS)	8.4	6.9
Cattle	(CA)	7.0	18.7
Adult Equiv. (b)	(AE)	12.0	13.2
Draft	(D)	1.6	4.8
Resource Ratios			
AE/HA		2.84	2.24
CA/HA		1.66	3.18
SS/HA		2.00	1.17
CA/AE		0.58	1.42
SS/CA		1.21	0.37

(a) Baseline survey did not enumerate fallow lands. GADS study consists of all land under control of the compound, including those in fallow.

(b) Baseline survey assigned all persons under age 13 a weight of 0.2 while GADS used a weight of 0.5. All other weights are equal; ages 13-59 are weighted 1.0 while those over age 59 are weighted 0.5.

area 29% of cropped area was planted to millet with 58% going to groundnuts. Compounds in Boiram/Njoben are involved in an irrigated rice program and cultivate no swamp rice while compounds in Piniai/Choya cultivate swamp rice and do not participate in the irrigation scheme. For a number of reasons which will be investigated in greater detail below, there are major differences between Piniai/Choya and Boiram/Njoben in the allocation of labor amongst crops.

Table 2. Comparison of Compound Resources between Piniai/Choya and Boiram/Njoben

	Piniai/Choya 12 Compounds	Std. Err.	Boiram/Njoben 12 Compounds	Std. Err.	Sta. Sig.
Hectares	4.69	1.52	7.10	2.05	.01
Small Stock	8.08	3.97	5.75	5.17	.10
Cattle	12.25	12.65	25.25	27.37	.20
Adult Equiv.	10.92	6.55	15.08	5.00	NS
Draft	4.08	4.44	5.58	2.56	NS
Resource Ratios					
AE/HA	2.33		2.12		
CA/HA	2.61		3.56		
SS/HA	1.72		0.81		
CA/AE	1.12		1.67		
SS/CA	0.67		0.23		
Area in Crops (Avg. HA)					
Maize	0.65	0.25	0.68	0.42	NS
Swamp Rice	0.89		0.00		
Irrig. Rice	0.00		0.19		
Early Millet	1.18	0.53	2.03	0.68	.01
Groundnuts	1.66	0.74	4.06	1.60	.01

In the analysis of labor utilization found in this paper, the areas of Piniai/Choya and Boiram/Njoben were treated as representative of different populations. The Piniai/Choya case study can be considered as being more representative of the average Gambian compound, but the statement must be qualified with recognition of ethnic factors, the relatively greater level of resources held by compound heads in Piniai/Choya and the small size of the sample. The Boiram/Njoben area is a bit more difficult to characterize. These are Wolof villages in an area with few Wolofs. Further, compounds have a very high resource endowment in comparison with the average Gambian compound. Lastly, these villages are participating in an irrigated rice scheme. These factors probably limit the extension of the findings to other areas/populations of The Gambia. As a final caution regarding the representativeness of the GADS study, it must be noted that the villages of Piniai and Boiram, and, to a lesser extent, Choya and Njoben, were influenced by MFP programs in deferred grazing, supplemental feeding and grain storage. As such, the analysis of labor utilization is best approached as a case study.

While one should exercise care in extending the findings of this study to the general agricultural population of The Gambia, these case studies are a valuable supplement to large scale surveys of agricultural production methods. The primary strength of the case study is that it provides detailed in-depth analysis. A properly conducted case study will limit the amount of non-sampling error creeping into the analysis - at the cost of increased sampling error. Large scale farm management surveys will decrease sampling error - at the cost of increased non-sampling error. The detailed nature of farm management data suggests that analysis be conducted using each data collection method in a complementary manner.

Terminology

The following analysis disaggregates Gambian agricultural labor into eleven different labor types and by nine crop activities in various enterprises. Crop enterprises covered include maize, groundnuts, early millet, swamp rice and irrigated rice.

Labor is broken down into six family categories and five other labor types. Family labor is disaggregated by age, less than 13 years of age and older than 59, ages 13-19, and adults aged 20-59. Hired labor was defined as that labor for which cash was exchanged. Temporary labor was defined as that labor for which reciprocal labor had been or would be provided by the family. The last labor category was permanent labor. "Strange" labor constituted this group, in which labor is provided to the compound in exchange for food and lodging. Except for permanent labor, which was invariably male, each labor category was further disaggregated by gender.

In the calculation of Adult Hourly Equivalents (AHE), youth and old family labor was given a weight of 0.5, while all other labor was given a weight of 1.0. Thus, youth and old labor must work two hours in order to achieve one adult hourly equivalent. The primary unit of measure for labor used in cropping activities is the Adult Day Equivalent (ADE), which is simply eight AHEs.

Crop enterprises were divided into activities. Land preparation included activities such as clearing, burning, plowing, ridge making and leveling. Planting and fertilization consisted of seed preparation (e.g., decorticating groundnut seed), hand and machine planting, and hand and machine application of organic or inorganic fertilizers. Monkey and bird scaring were the primary components of crop protection. No farmers in the sample applied chemical pesticides. Irrigation activities included preparation and maintenance of water channels as well as application of water by furrows, flood or buckets. Weeding included all weedings by hand or machine and earthing up.

Thinning, transplanting or both comprised the thinning/transplanting activity. Knocking down, uprooting, cutting, heaping and bagging the crop product in the field made up the harvest activity. Should a field be located more than 15 minutes from the compound, the time spent traveling to and from the field was recorded under the transportation activity. For all fields, time spent transporting the product to and from the field or to a market, or time spent transporting inputs from their source were also recorded in the transportation activity. The category other included hand and machine threshing, winnowing, drying, bagging and storage of the threshed product and marketing. The computer programs were also designed to put all activities not identified with the first eight activities into the other category.

Use of Labor Profiles

The labor profiles presented in the following sections should be interpreted with respect to the following cautions as outlined by Cleave (1974). Because the seasonal distribution of labor is presented by calendar month, labor peaks of shorter duration or peaks extending over two calendar months may not show up in the profiles. Secondly, the types of labor and the level of resources available to a given farmer may vary considerably. When individual labor profiles are aggregated, the resulting profile may vary substantially from those of the original farms. Lastly, environmental factors, market conditions and resource availability will affect an individual farmer's decisions regarding resource allocations. Thus, conditions present in 1985/86 represent a unique agricultural situation and care must be exercised in assuming that the labor profiles remain relatively constant from year to year.

Per Hectare Labor Utilization

Crop analysis will proceed in the following manner: all crop enterprises in the Piniai/Choya area will be discussed first, followed by the analysis of crop enterprises in the Boiram/Njoben area. For each crop a general discussion highlighting the major findings will be presented. A table showing total labor input per hectare, by type and timing of labor, and a figure depicting timing and amount of labor by activity will accompany discussion of each crop. All crop data in all tables and graphs are in Adult Day Equivalents per Hectare. The numbers represent the average ADE/Ha across all sample farms engaged in the enterprise at the study area. In each figure, specific activities include land preparation, planting/fertilization, weeding, thinning/transplanting and harvesting. The reader should note

the difference between "other" as a defined crop activity (meaning marketing, threshing, winnowing, etc.) and "other" as "all other activities" used in the figures (crop protection, transport, threshing and marketing).

Piniai/Choya

Maize: Sample farmers in the Piniai/Choya study area planted an average of 0.65 Ha of maize per farm. Including those fields which were never harvested, the average labor input was 26.18 ADE/Ha, or about 209 AHE/Ha (see Table 3). Of this total, slightly over 75% of the labor was provided by adult male family members. As a whole, family males accounted for nearly 86% of all labor invested in maize production. Only about 6% of total labor was provided by females, of which family females accounted for less than half. All hired labor (3.8%) was female.

Most labor use was concentrated in the months of July and August when 42% and 41% of total labor was used, respectively. At this time most laborers were engaged in weeding activities (about half of July labor and nearly all of August labor). Figure 1 displays labor distribution by major activity and timing in ADE/Ha.[3] Of major activities comprising maize production, land preparation accounts for 14.5% of total labor, of which over 80% is provided by adult family members. Male adult family members also account for 75% of time devoted to planting and fertilization, an activity which makes up an estimated 8% of total labor. Weeding accounted for about 60% of total labor, of which over 75% was provided by adult males of the family. At harvest, male adult family members provided almost 70% of the necessary labor. As an activity, harvesting accounted for just under 11% of total labor. It was at harvest time that female family members participated in the production of maize with 75% of their total labor input used in October. As a whole, however, females accounted for less than 25% of per hectare harvest labor.

Groundnuts: Area planted to groundnuts averaged 1.66 Ha per farm at the Piniai/Choya study site. Average labor input was 74.24 ADE/Ha, or about 594 AHE/Ha (see Table 4). Male adult family members provided slightly more than 75% of total labor, with all family males contributing almost 85% of total per hectare labor. Only 4.5% of total labor came from family females, although all females contributed 13%. Hired labor accounted for 8% of total labor input, nearly all of which was provided by hired females.

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[3] In all figures, LP = land preparation, Pl = planting and fertilization, Wd = weeding, Thn = thinning and transplanting, Hv = harvesting and Oth = all other crop activities.

Table 3. Per Hectare Labor Inouts, by Labor Type
Adult Day Equivalents per Hectare
Crop: Maize
Village: Piniai/Choya, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Tot	Pct. of Total
Family										
Male Y/O	0.07	0.84	0.55	0.29	0.26	0.01			2.02	7.72%
Female Y/O									0.00	0.00%
Male Teen		0.38	0.33	0.07					0.78	2.98%
Female Teen					0.15				0.15	0.57%
Male Adult	0.47	8.89	7.50	0.62	2.18	0.04			19.70	75.25%
Female Adult		0.16			0.34				0.50	1.91%
Temporary										
Males		0.29	1.68	0.07					2.04	7.79%
Females									0.00	0.00%
Permanent										
Males									0.00	0.00%
Hired										
Males									0.00	0.00%
Females		0.35	0.64						0.99	3.78%
Total	0.54	10.91	10.70	1.05	2.93	0.05	0.00	0.00	26.18	

Percent Family 88.43% Percent Female 6.26%
Percent Hired 3.78% Percent Family Fem 2.48%

Figure 1. Maize Activities

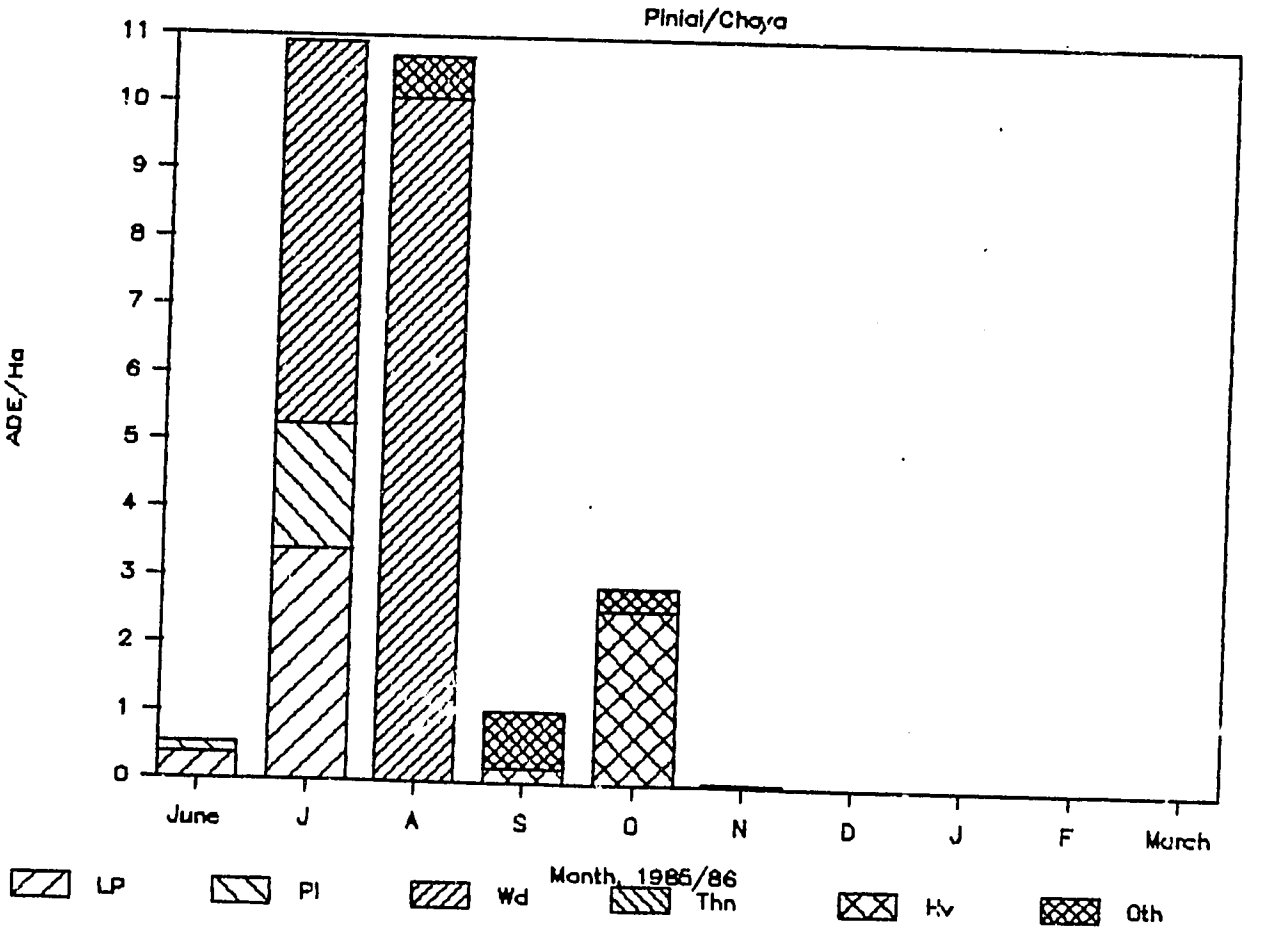
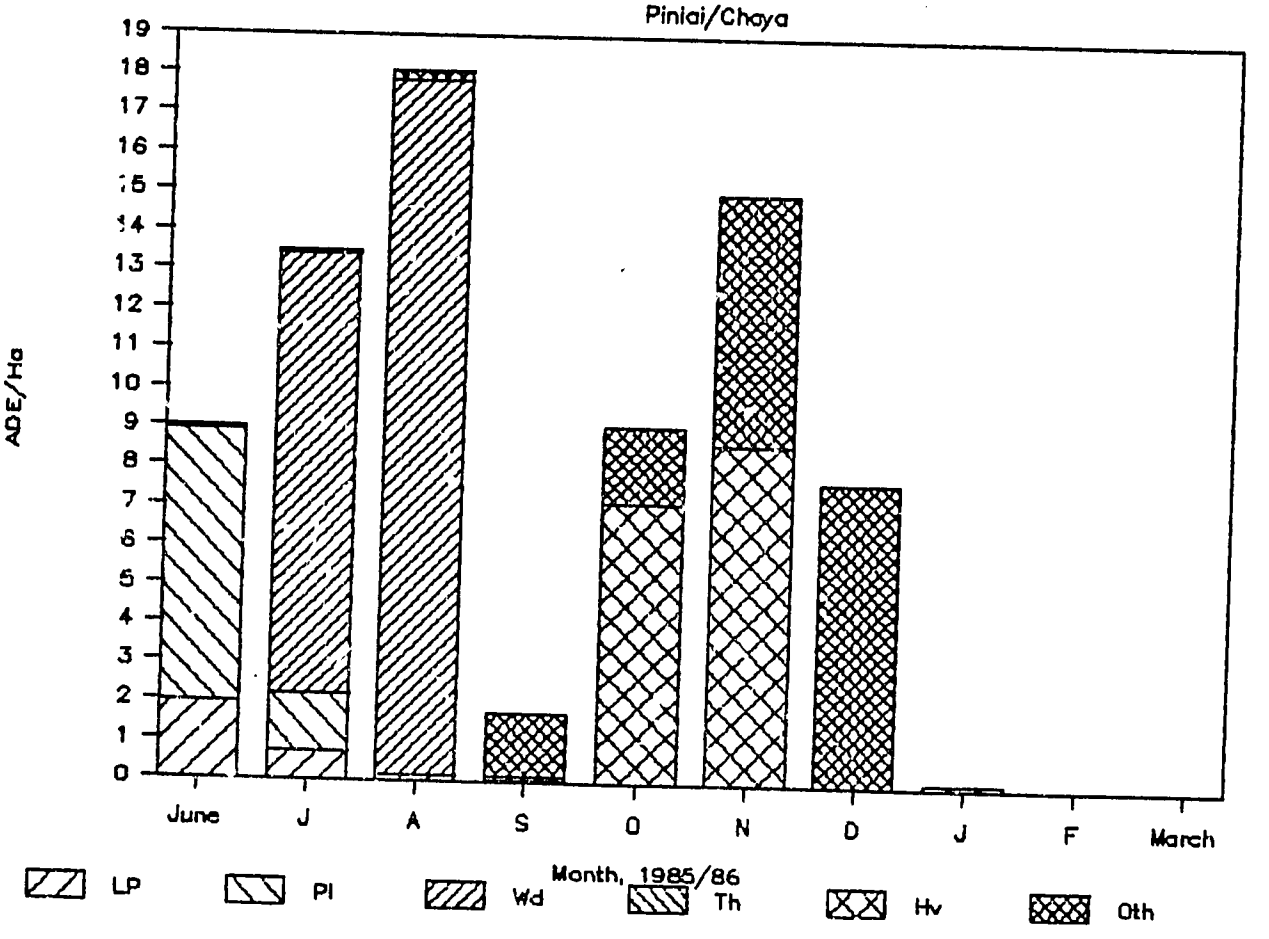


Table 4. Per Hectare Labor Inputs, by Labor Type
Adult Day Equivalents per Hectare
Crop: Groundnuts
Village: Piniai/Choya, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Tot	Pct. of Total
Family										
Male Y/O	0.94	0.76	0.76		0.55	0.50	0.39		3.90	5.25%
Female Y/O	0.11			0.11	0.01	0.02			0.25	0.34%
Male Teen	0.21	0.15	2.48						2.84	3.83%
Female Teen	0.36		0.03		0.07	0.04		0.06	0.56	0.75%
Male Adult	5.36	11.36	13.51	0.61	6.23	12.53	6.45		56.05	75.50%
Female Adult	1.31	0.05	0.19		0.42	0.41	0.10	0.06	2.54	3.42%
Temporary										
Males	0.21	0.12	0.23		0.28	0.21	0.26	0.01	1.32	1.78%
Females							0.21		0.21	0.28%
Permanent										
Males	0.02	0.15			0.10	0.33	0.01		0.61	0.82%
Hired										
Males						0.02			0.02	0.03%
Females	0.49	0.83	0.96	1.03	1.40	0.93	0.30		5.94	8.00%
Total	9.01	13.42	18.16	1.75	9.06	14.99	7.72	0.13	74.21	

Percent Family 89.09% Percent Female 12.80%
Percent Hired 8.03% Percent Family Fem 4.51%

Figure 2. Groundnut Activities



Labor use in groundnut production had two peaks, with highpoints in August (24% of total labor) and November (20% of total labor). September was an exceedingly slack month for labor use in groundnuts with only 2% of total labor used at that time (see Figure 2). During the peak labor month of August, 97% of labor used was given over to weeding. In November, 58% of the time was used in harvest and 42% in other activities. Land preparation accounted for less than 4% of total labor, 70% of which came from adult male family members. Planting and fertilization used slightly more than 11% of total labor, of which almost 59% came from male adult family members. Family females accounted for nearly 22% of labor expended in the planting/fertilization activity. (While family females provided only 4.5% of total per hectare labor input to groundnut production, over half of that labor was used in this activity.) Weeding was the major time consuming activity in groundnut production, comprising over 39% of total per hectare labor. All but 1% of weeding labor was expended in the months of July and August. Nearly 94% of weeding labor was provided by family labor, essentially all of it by males. All hired labor used in weeding (5.1%) was female. Harvesting took up about 21.5% of total labor, about 77% of which was provided by male adult family members. Females accounted for 13% of harvest labor, about half coming from family females and half from hired females. It was in harvesting that family females provided about 32% of their total labor input to groundnut production. Other activities used about 18% of total per hectare labor, 86% of which came from male adult family members.

Early Millet: Sample farmers in the Pinini/Choya area grew an average of 1.18 Ha of millet per farm. Average labor input was 102.28 ADE/Ha, or about 818 AHE/Ha (see Table 5). Over 79% of total per hectare labor input came from male adult family members. Another 11% came from young and old male family members, with family males providing over 95% of total labor utilized in millet production. Females comprised somewhat less than 2% of total labor input, with family females contributing only 0.2% of total per hectare labor.

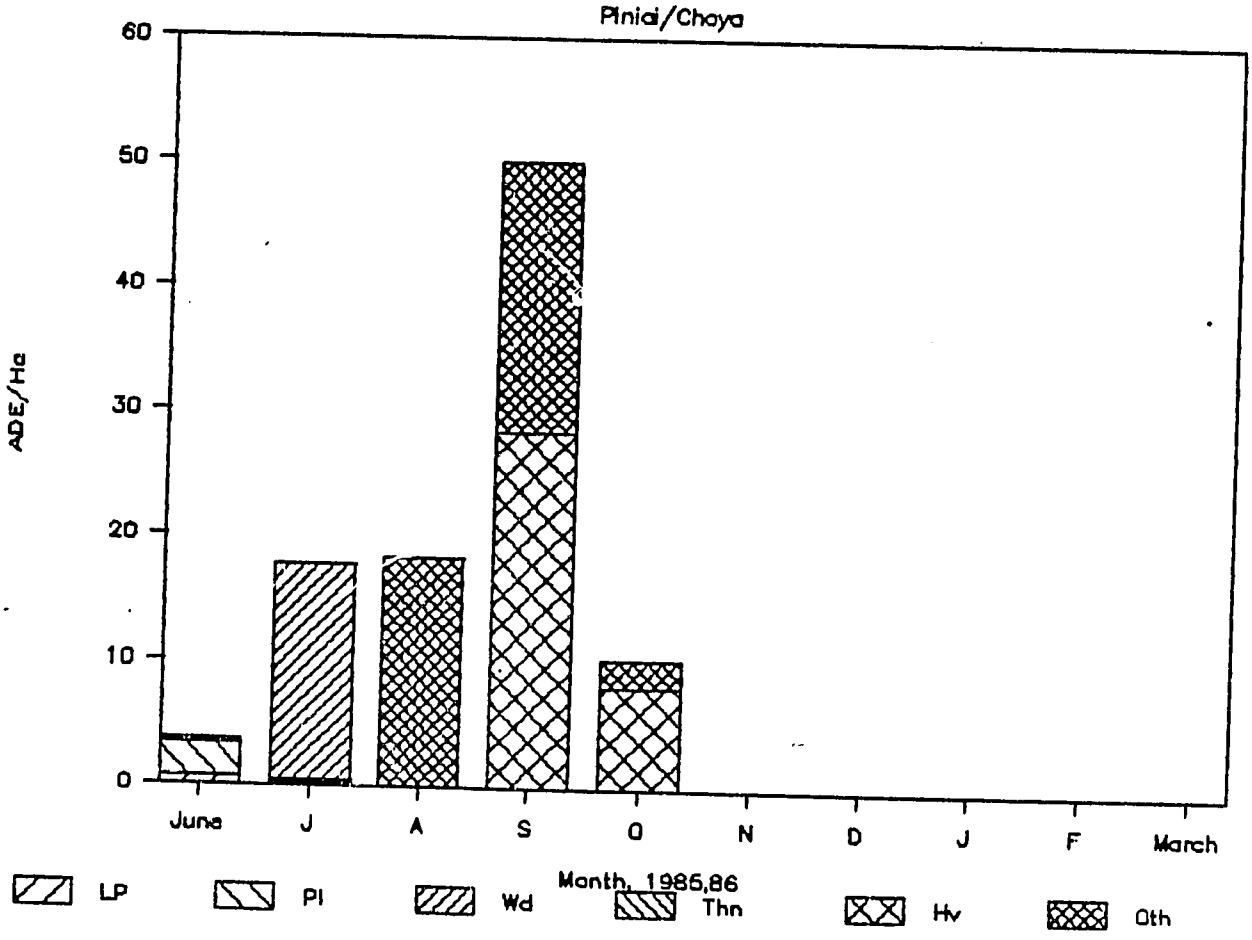
The peak labor month in millet production was September, with 49% of total per hectare labor used at this time. Crop protection and harvest were the main activities occurring at the time (42% and 57% of September labor, respectively). Figure 3 shows labor distribution by activity and timing. Land preparation accounted for less than 3% of total labor, with male adult family members providing over 85% of labor devoted to this activity. Planting/fertilization also used less than 3% of total labor input, 73% of which came from adult males of the family. More than 18% of planting/fertilization labor was given by youth and old family males. About 5% of labor in this activity was hired, all of which was female. Protecting the millet crop used over 38% of total per hectare labor, all of this occurring in

Table 5. Per Hectare Labor Inputs, by Labor Type
Adult Day Equivalents per Hectare
Crop: Early Millet
Village: Piniai/Choya, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot	Pct. of Total
Family												
Male Y/O	0.61	1.80	2.26	5.29	0.91				0.06		10.93	10.69%
Female Y/O				0.17							0.17	0.17%
Male Teen		0.22	1.97	2.90							5.09	4.98%
Female Teen											0.00	0.00%
Male Adult	2.68	13.97	13.93	39.06	8.68			0.07	2.01		81.20	79.39%
Female Adult			0.03								0.03	0.03%
Temporary												
Males	0.14	0.82		1.25	0.67						2.88	2.82%
Females											0.00	0.00%
Permanent												
Males	0.04	0.22									0.26	0.25%
Hired												
Males											0.00	0.00%
Females	0.21	0.73	0.18	0.57	0.03						1.72	1.68%
Total	3.68	17.76	18.37	50.04	10.29	0.00	0.00	0.07	2.07	0.00	102.28	

Percent Family 95.25% Percent Female 1.88%
Percent Hired 1.68% Percent Family Fem 0.20%

Figure 3. Early Millet Activities



July and August. Male family members provided 99% of labor in crop protection. Male adult family members provided 76% of crop protection labor, with youth and old male family members and teenaged males giving 13% and 9%, respectively. Nearly all weeding occurred in July, with the weeding activity as a whole accounting for over 17% of total per hectare labor input. Male adult family members gave almost 80% of the labor to this activity, while youth and old family males provided another 10%. About 4.5% of the labor was hired, all of which was female. Harvest activities accounted for about 36% of total labor. Adult family males accounted for over 82% of the labor expended in this activity. Only 1.4% of the labor was hired, all female.

Swamp Rice: Farmers sampled in the Piniai/Choya area planted an average of 0.89 Ha of swamp rice per farm. Average labor input was 473.00 ADE/Ha, or about 3784 AHE/Ha (see Table 6). It should be noted that this figure includes a substantial amount of transportation time, i.e., time spent walking to and from the field. When transportation time is removed from the total and only "in-the-field" activities remain, labor input was 305.20 ADE/Ha, or about 2442 AHE/Ha. Female adult family members provided more than 80% of total labor input, with all family females contributing nearly 97% of all per hectare labor in swamp rice. Family males provided a mere 1.4% of total labor. Hired labor constituted only 0.03% of total labor.

Peak labor months were September and January, with labor in those months accounting for 19% and 26% of total labor, respectively. Thinning and transplanting of rice was the primary activity in September (66% of September labor) while harvest occupied the most time in January (62%) (see Figure 4).

The strikingly small amount of labor used in November and December is curious. It is at this time that activities such as crop protection and preparations for harvest should be observed. The lack of activity in rice production was constant across all twelve farms in both villages.[4] Data from groundnut enterprise activities and livestock enterprise activities continued unabated through this time period. Women's labor in these enterprises account for only a small portion of total possible labor. No hypothesis is offered for this observation.

Land preparation was concentrated in the months of July and

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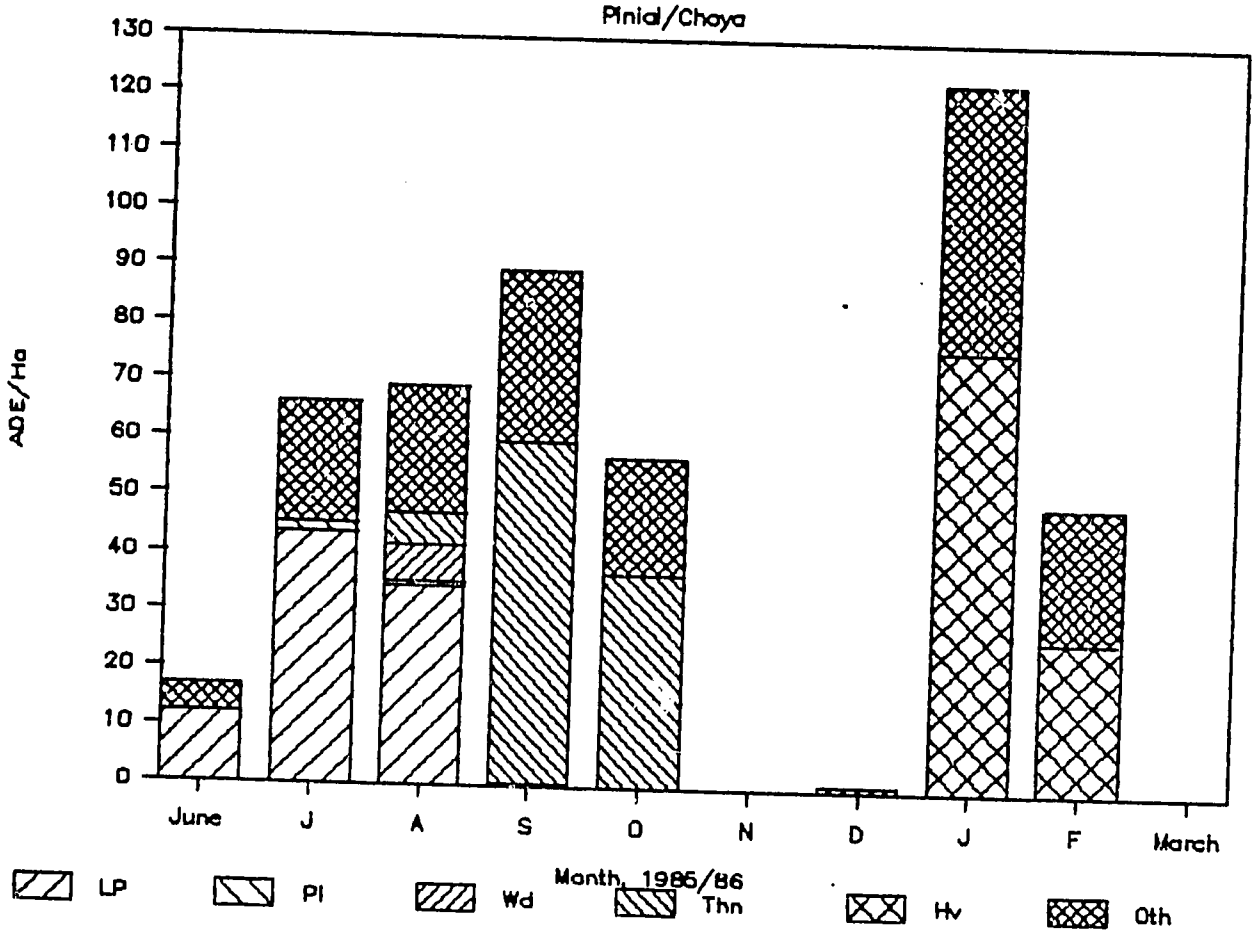
[4] Because enumerators posted in each village independently generated data sets consistent with one another, enumerator error/bias can be discounted somewhat. Data from these twelve farms were entered onto computer disks by three different data entry operators. The consistency of the data set across these operators also means that clerical error can be discounted to some degree.

Table 6. Per Hectare Labor Inputs, by Labor Type
Adult Day Equivalents per Hectare
Crop: Swamp Rice
Village: Piniai/Choya, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot	Pct. of Total
Family												
Male Y/O		0.14		0.01					0.21		0.36	0.08%
Female Y/O		0.75	1.59	4.69	3.70			6.71	2.44		19.88	4.20%
Male Teen											0.00	0.00%
Female Teen	0.18	6.90	7.78	13.09	7.66			14.20	7.02		56.83	12.01%
Male Adult		0.55	0.99	0.26	0.07				4.48		6.35	1.34%
Female Adult	16.66	56.57	58.96	67.49	43.73	0.04	1.04	102.03	34.09		380.61	80.47%
Temporary												
Males				0.93					0.86		1.79	0.38%
Females		1.42		3.21	2.00				0.22		6.85	1.45%
Permanent												
Males									0.20		0.20	0.04%
Hired												
Males			0.06						0.07		0.13	0.03%
Females											0.00	0.00%
Total	16.84	66.33	69.38	89.68	57.16	0.04	1.04	122.94	49.59	0.00	473.00	

Percent Family 98.10% Percent Female 98.13%
Percent Hired 0.03% Percent Family Fem 96.68%

Figure 4. Swamp Rice Activities



August and accounted for about 19% of total labor. Family females provided over 98% of labor expended in land preparation. No hired labor was used in this activity. Planting/fertilization took up only 0.6% of total labor while weeding activities needed only 1.4% of total labor input. Family females provided essentially all labor used in these activities. The thinning/transplanting activity accounted for over 21% of total labor, with family females giving more than 95% of the labor. Another 4% came from temporary female labor.

Transportation time accounted for more than 35% of total labor input. Most of this time was spent merely walking to and from the fields, although some time was spent transporting inputs and crop products. Family females made up 95% of the transport time recorded, while family males added another 3%.

Boiram/Njoben

Maize: Farmers sampled in the Boiram/Njoben study area planted an average of 0.68 Ha of maize per farm. Each hectare required an average of 31.45 ADE/Ha, or about 252 AHE/Ha (see Table 7). Male adult family members provided about 47% of the total labor, while family males as a whole combined to give almost 71% of total per hectare labor. Female adult family members put in over 9% of the labor while all family females combined to total more than 11%. Permanent males provided 11% of total labor. Hired labor accounted for 5% of total labor, about half from females and half from males.

August was the peak labor month with about 39% of total labor used at that time, mostly in the weeding activity (see Figure 5). Land preparation took up only 3.7% of total labor, 64% of it coming from family males and 36% coming from permanent males. Planting/fertilization accounted for slightly over 7% of total per hectare labor, of which 84% was provided by family males. Most weeding occurred in July and August and comprised more than 58% of total labor. Family males accounted for 79% of all weeding labor, permanent males another 10% and family females 8%. About half of the total family female labor used in maize production was given over to the weeding activity (most of the remainder was used at harvest). Harvesting took up 24% of total labor, most of which occurred in October. Family males provided 50% of this labor while family females provided 27%. Hired labor provided 12% of harvest labor, most of which was male. Permanent males provided the remainder (10.5%) of labor used at harvest.

Groundnuts: In the Boiram/Njoben study area, sample farmers planted an average of 4.06 Ha of groundnuts per farm. Farmers put in an average 116.81 ADE/Ha, or about 934 AHE/Ha (see Table 8). Male adult family members provided almost 42% of total labor while female adult family members accounted for almost 23% of

Table 7. Per Hectare Labor Inputs, by Labor Type
Adult Day Equivalents per Hectare
Crop: Maize
Village: Boiram/Njoben, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Tot	Pct. of Total
Family										
Male Y/O	0.04	1.05	0.38		0.08			0.33	1.88	5.98%
Female Y/O					0.28				0.28	0.89%
Male Teen	0.11	1.01	3.05	0.22	1.48				5.87	18.66%
Female Teen			0.03		0.28				0.31	0.99%
Male Adult	0.33	3.38	7.25	0.60	3.13			0.13	14.82	47.12%
Female Adult	0.27	1.21			1.50				2.98	9.48%
Temporary										
Males									0.00	0.00%
Females									0.00	0.00%
Permanent										
Males	0.08	1.52	1.04		0.95				3.59	11.41%
Hired										
Males						1.04			1.04	3.31%
Females			0.48		0.20				0.68	2.16%
Total	0.83	8.17	12.23	0.82	7.90	1.04	0.00	0.46	31.45	

Percent Family 83.12%
Percent Hired 5.47%
Percent Female 13.51%
Percent Family Fem 11.35%

Figure 5. Maize Activities

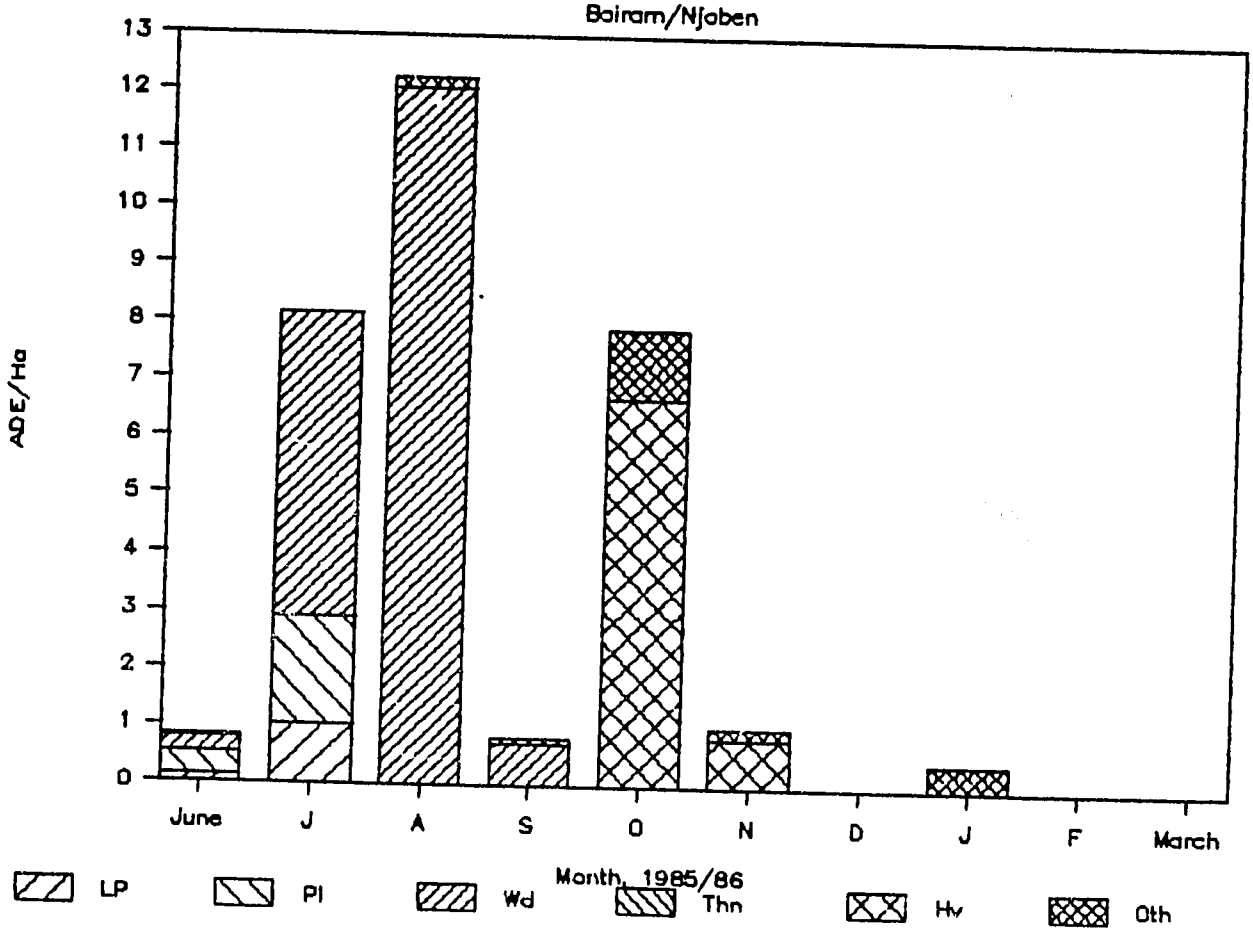
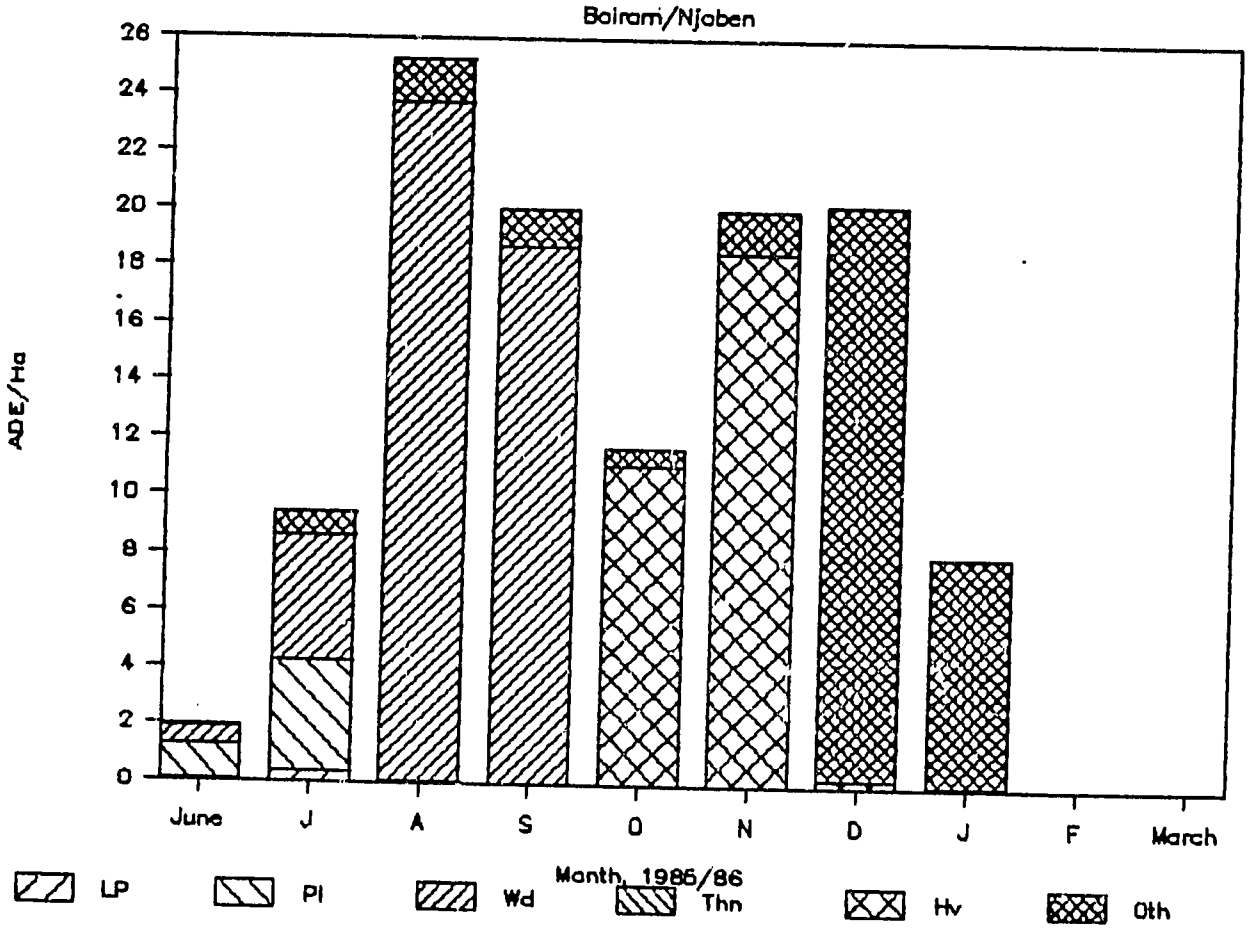


Table 8. Per Hectare Labor Inputs, by Labor Type
Adult Day Equivalents per Hectare
Crop: Groundnuts
Village: Boiram/Njoben, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Tot	Pct. of Total
Family										
Male Y/O	0.16	0.61	1.33	0.64	0.53	1.03	0.67	0.69	5.66	4.85%
Female Y/O		0.01	0.06	0.08	0.21	0.42	0.50	0.14	1.42	1.22%
Male Teen	0.41	1.21	3.15	3.14	1.23	1.93	2.98	0.85	14.90	12.76%
Female Teen		0.17	0.60	0.57	0.70	1.49	1.70	0.51	5.74	4.91%
Male Adult	0.85	4.84	10.11	8.64	4.32	8.02	8.26	3.83	48.87	41.84%
Female Adult	0.11	1.20	7.05	5.11	3.02	4.95	3.74	1.18	26.36	22.57%
Temporary										
Males		0.14	0.12		0.53	0.08	0.28	0.12	1.27	1.09%
Females								0.13	0.13	0.11%
Permanent										
Males	0.39	1.13	2.17	1.70	1.17	1.93	2.02	0.07	10.58	9.06%
Hired										
Males		0.02	0.48				0.03	0.36	0.89	0.76%
Females	0.04	0.08	0.23	0.13	0.05	0.26	0.20		0.99	0.85%
Total	1.96	9.41	25.30	20.01	11.76	20.11	20.38	7.88	116.81	

Percent Family 88.13% Percent Female 29.65%
Percent Hired 1.61% Percent Family Fem 28.70%

Figure 6. Groundnut Activities



total per hectare labor. All family males combined for about 59% of total per hectare labor against nearly 29% for all family females. Permanent males contributed just over 9% of total labor. Both temporary and hired labor contributed only 2.8% of total per hectare labor.

Labor input remained relatively constant from August through December, although a trough occurred in October after weeding and before harvest (see Figure 6). Land preparation accounted for less than one-half of one percent of total labor input, all of which was male labor. The planting/fertilization activity required just over 4% of total labor. Male adult family members provided 61% of planting/fertilization labor while all family males contributed a total of 74% of the labor for this activity. Permanent males gave 12% of the labor while all hired labor (1.2%) was female.

Weeding activity peaked in August and September when it accounted for 94% of labor expended in each of those months. All family males combined for 60% of total per hectare weeding labor with 41% of weeding labor coming from adult family males. Adult family females contributed almost 25% of weeding labor, while family females as a group combined to give 28% of weeding labor. Permanent males provided about 9.5% of labor devoted to weeding. Less than 2% of labor for weeding was hired, about half from males and half from females.

As an activity, harvesting accounted for about 26% of total per hectare labor for groundnuts. Almost all harvesting activity occurred in October and November. Adult males of the family contributed about 39% of harvest labor while all family males combined for over 53% of harvest labor. Nearly 25% of harvest labor was given by adult family females. Family females as a group contributed about 34% of total harvest labor. The compound family totaled 87% of all harvest labor. When combined with the 10% contributed by permanent males, 97% of all harvest labor is contributed by compound members. Less than 1% of harvest labor was hired, all female.

The transportation activity accounted for just under 6% of total per hectare labor. Family males made up about 63% of transport time while family females provided nearly 23%. The "other" category accounted for 23% of total per hectare labor input. Most of this labor occurred in December and January as the groundnut crop was threshed and winnowed. Family males gave 58% of this labor while family female contributed about 29% of time spent in this activity. Permanent males gave almost 8% while hired labor accounted for just over 2% of "other" time.

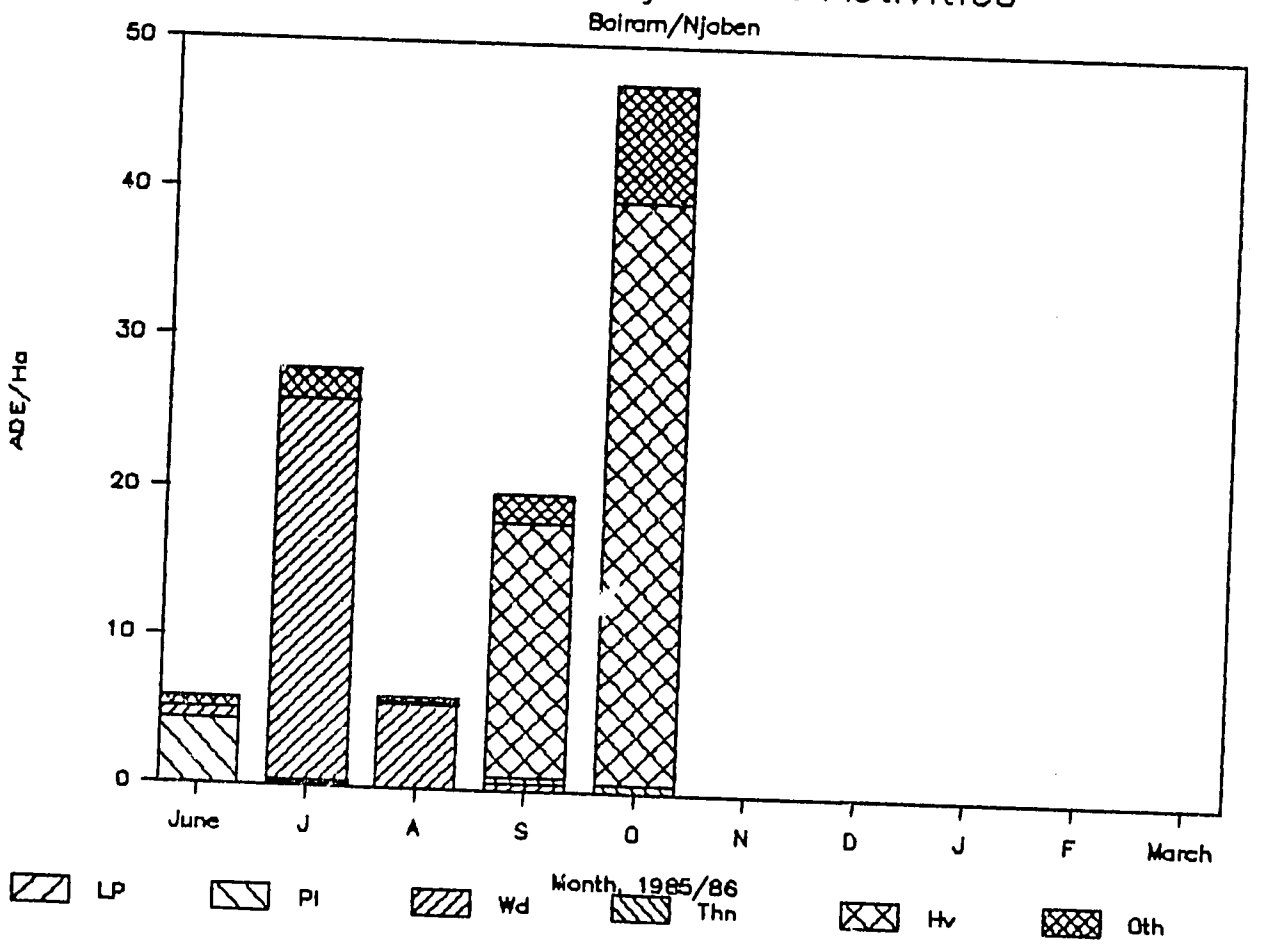
<u>Early Millet:</u> Boiram/Njoben sample farmers had an average of 2.03 Ha of millet per farm. Average per hectare labor input was 107.13 ADE/Ha, or about 857 AHE/Ha (see Table 9). Adult male

Table 9. Per Hectare Labor Inputs, by Labor Type
Adult Day Equivalents per Hectare
Crop: Early Millet
Village: Boiram/Njoben, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot	Pct. of Total
Family												
Male Y/O	0.21	1.27	0.23	0.83	3.20						5.74	5.36%
Female Y/O					0.20						0.20	0.19%
Male Teen	0.97	3.83	0.86	4.67	7.35			0.01			17.69	16.51%
Female Teen		0.06	0.13		1.06						1.25	1.17%
Male Adult	3.35	13.38	2.74	8.21	18.24						45.92	42.86%
Female Adult	0.52	5.55	0.79	2.96	8.88			0.06			18.76	17.51%
Temporary												
Males	0.03	0.07			0.33						0.43	0.40%
Females											0.00	0.00%
Permanent												
Males	0.61	3.24	0.92	2.85	7.42						15.04	14.04%
Hired												
Males	0.02	0.02	0.26								0.30	0.28%
Females	0.13	0.53	0.07	0.30	0.77						1.80	1.68%
Total	5.84	27.95	6.00	19.82	47.45	0.00	0.00	0.07	0.00	0.00	107.13	

Percent Family 83.60%
Percent Hired 1.96%
Percent Female 20.55%
Percent Family Fem 18.86%

Figure 7. Early Millet Activities



family members accounted for about 43% of total labor while family males as a whole contributed about 65% of total per hectare labor. Family females comprised about 19% of total per hectare labor, almost all of which came from adult females. Permanent males contributed just over 14% of total labor. Hired labor accounted for less than 2% of total per hectare labor, most of which was female.

Peak labor use occurred in July and October when 26% and 44% of total per hectare labor was used, respectively. Weeding and harvest were the main activities of these months (see Figure 7). Land preparation took up only 0.15% of total per hectare labor input, all of which occurred in July. Planting/fertilization used over 4% of total labor, most occurring in June. Male adults of the family gave 50% of this labor while all family males contributed about 73% of labor for this activity. Adult females of the family gave almost 12% of labor necessary for this activity. Permanent males accounted for 11.5% of per hectare planting labor while hired females contributed 2.8%. All labor hired for planting came to 3.3%. Crop protection took up less than 1% of total per hectare labor, 62% of which came from hired females. Young and old family males gave another 28% of protection time. A small amount of thinning occurred in Boiram, but this accounted for less than 1% of total per hectare labor.

The weeding activity took up about 30% of total per hectare labor input. About 50% of weeding time was contributed by adult family males, with all family males comprising 68% of weeding time. Family females contributed almost 20% of the time devoted to weeding millet, essentially all of which came from adults. Permanent males accounted for just under 12% of weeding time. Less than 1% of weeding labor was hired, all of which was male.

Harvesting accounted for 52% of total per hectare labor. Of this labor, adult males accounted for 41% while family males as a group contributed 63%. Family females gave 21%, of which most came from adults. Permanent males contributed 15% of harvest labor.

Transportation activities took up nearly 11% of total per hectare labor input. Family adult males accounted for 38% of transport labor, with teenaged males from the family contributing another 21%. Family females gave 14%. Permanent males made up about 18% of labor used in transportation while only 1.5% of the labor was hired, mostly female.

Farmers in the Boiram/Njoben area gave little effort to bird-scaring activities. Two hypotheses are proposed: firstly, millet fields at this study site were concentrated in one area where fewer people were needed to scare birds, thus dampening labor demand and crop losses for any given farmer; secondly, and somewhat unsubstantiated by empirical evidence, villages closer

to the main river suffer greater losses to birds than those further from the river as millet eating birds tend to congregate near water sources.

Irrigated Rice: Farmers sampled in the Boiram/Njoben area planted an average of 0.19 Ha of irrigated rice per farm. None of the farmers engaged in swamp rice cultivation. Use of irrigation techniques allows farmers at this study site to obtain two harvests per calendar year. If one considers the onset of the rainy season as the "start" of the agricultural year, the first harvest occurs mainly in November and December; the second occurs in April and May. The study period ended in March, thus harvest data for the second crop was not collected. Data in the following discussion will include data collected for the study period June 1985 through January 1986). Figure 8 also shows the beginning activities of the second crop.

Per hectare labor input for the study period averaged 571.52 ADE/Ha (see Table 10). (Considering the full study period, per hectare labor input averaged 785.55 ADE/Ha.) Transport to and from the fields accounted for almost 29% of total per hectare labor. If this is removed from the total, leaving only "in-the-field" activities, total per hectare labor averaged 404 ADE/Ha.

The peak labor month was December during which 60% of all labor was utilized. The activities in which compound members were involved were harvesting, transportation and threshing, with threshing accounting for the bulk of the time allocated to rice production in December. It should be noted that two farms of the twelve sampled had very high rates of labor at this time. The daily data for these farms appear very reasonable, and despite the eye-catching magnitude of per hectare labor rates for these two farms, there is no reason to exclude them from the analysis.

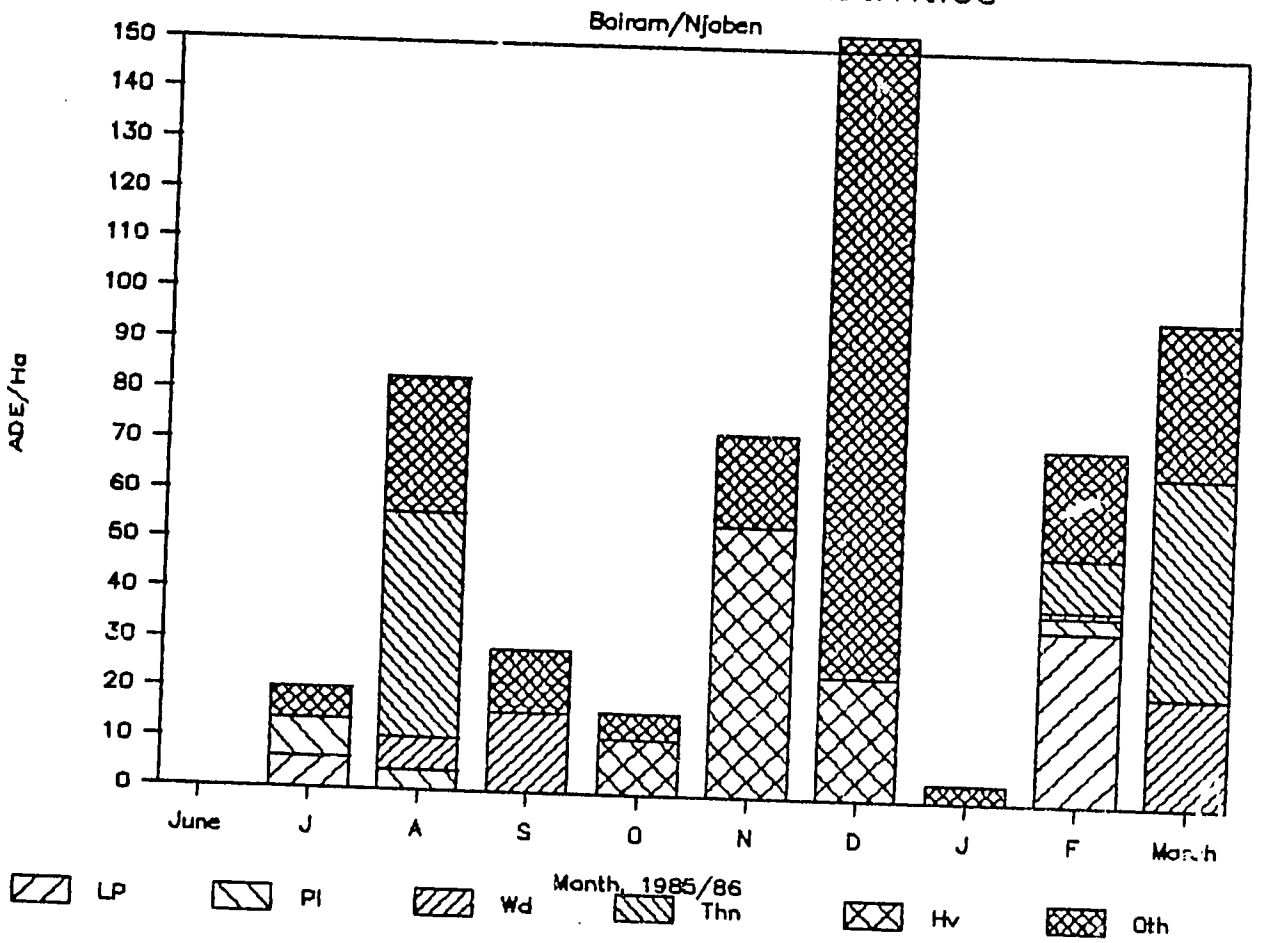
Of total per hectare labor input, adult family males contributed over 52% of labor. Teenaged family males provided another 15% of total per hectare labor. As a group, family females totaled just over 16% of total labor, almost all of which came from adult females. Permanent males provided 12% of total per hectare labor, while hired females contributed 2.5%.

Land preparation for irrigated rice took place in July and February, accounting for just over 1% of total per hectare labor input (see Figure 8). Adult family males provided nearly 61% of land preparation labor, with teenaged male contributing another 24%. Family males totaled over 89% of land preparation labor, whereas family females contributed just over 7.5% (all adult).

Table 10. Per Hectare Labor Inputs, by Labor Type
Adult Day Equivalents per Hectare
Crop: Irrigated Rice
Village: Boiram/Njoben, 1985/86

Labor Type	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Total	Pct. of Total
Family										
Male Y/O		0.46	0.18			0.16			0.80	0.14%
Female Y/O									0.00	0.00%
Male Teen		3.37	3.46	2.50	1.99	14.14	59.21	0.79	85.46	14.95%
Female Teen					1.15				1.15	0.20%
Male Adult		12.46	32.13	15.40	7.53	43.61	188.15	2.82	302.10	52.86%
Female Adult		3.50	34.82	9.37	1.39	0.49	41.52	0.12	91.21	15.96%
Temporary										
Males					2.94				2.94	0.51%
Females									0.00	0.00%
Permanent										
Males			2.69	0.86	1.54	12.81	52.84		70.74	12.38%
Hired										
Males			2.63				0.17		2.80	0.49%
Females		0.72	7.07	0.72		1.60	4.21		14.32	2.51%
Total	0.00	20.51	82.98	28.85	16.54	72.81	346.10	3.73	571.52	

Figure 8. Irr. Rice Activities



Adult family males and adult family females gave 37% and 50%, respectively, of the total per hectare planting/fertilization time, an activity which accounted for 2% of total per hectare labor input. Irrigation activities came to 2.4% of total labor, 89% of which was provided by adult family males. Weeding activities accounted for just over 4% of total per hectare labor. All family labor accounted for 88% of total weeding labor, from adult male (48%), teenaged males (16%) and adult females (25%).

Thinning/transplanting activities took up 7.9% of total per hectare labor. Of this labor, adult males gave 32%, adult family females 44%. Hired female labor accounted for nearly 15% of all thinning/transplanting labor. (For all hired labor used in cultivation of irrigated rice, 55% was used in this activity.) Harvest activities accounted for 15.8% of total labor, of which 52% came from male adult family members. Teenaged males from the family gave 15% of harvest labor while adult females contributed 9.6%. Permanent males were an important source of harvest labor, providing almost 18% of the necessary labor.

The location of the ricefields in relation to the villages (about 10 km distant) caused the transportation activity to account for over 29% of total per hectare labor input. Family adult males provided 57% of this time, teenaged males giving another 19%. Adult family females gave nearly 16% of transport time. "Other" activities related to rice production accounted for 37% of total per hectare labor input, nearly all of which occurred in December. Adult family males provided 54% of this labor. Permanent males contributed 19%, with family teenaged males giving 15%. Adult family females contributed 11%.

Comparison of Two Study Sites

Composite Farms: Using average per farm hectarage figures for the four major crops, it is possible to develop composite farm activity profiles for the entire study period. Figures 9 and 10 represent all crop activities for the four major crops grown at each study site.

Figure 9 shows the labor required to farm 0.65 Ha of maize, 1.66 Ha of groundnuts, 1.18 Ha of early millet and 0.89 Ha of swamp rice, the average situation found in Piniai/Choya in 1985/86. September is the peak labor month with nearly 21% of total farm crop labor used in that month. Work requirements ease off after September as the maize, millet and groundnuts are harvested, but requirements jump again in January and February as the rice crop is harvested and threshed.

Figure 10 depicts the labor required to cultivate 0.68 Ha of maize, 4.06 Ha of groundnuts, 2.03 Ha of early millet and 0.19 Ha

Figure 9. Whole Farm Crop Activities

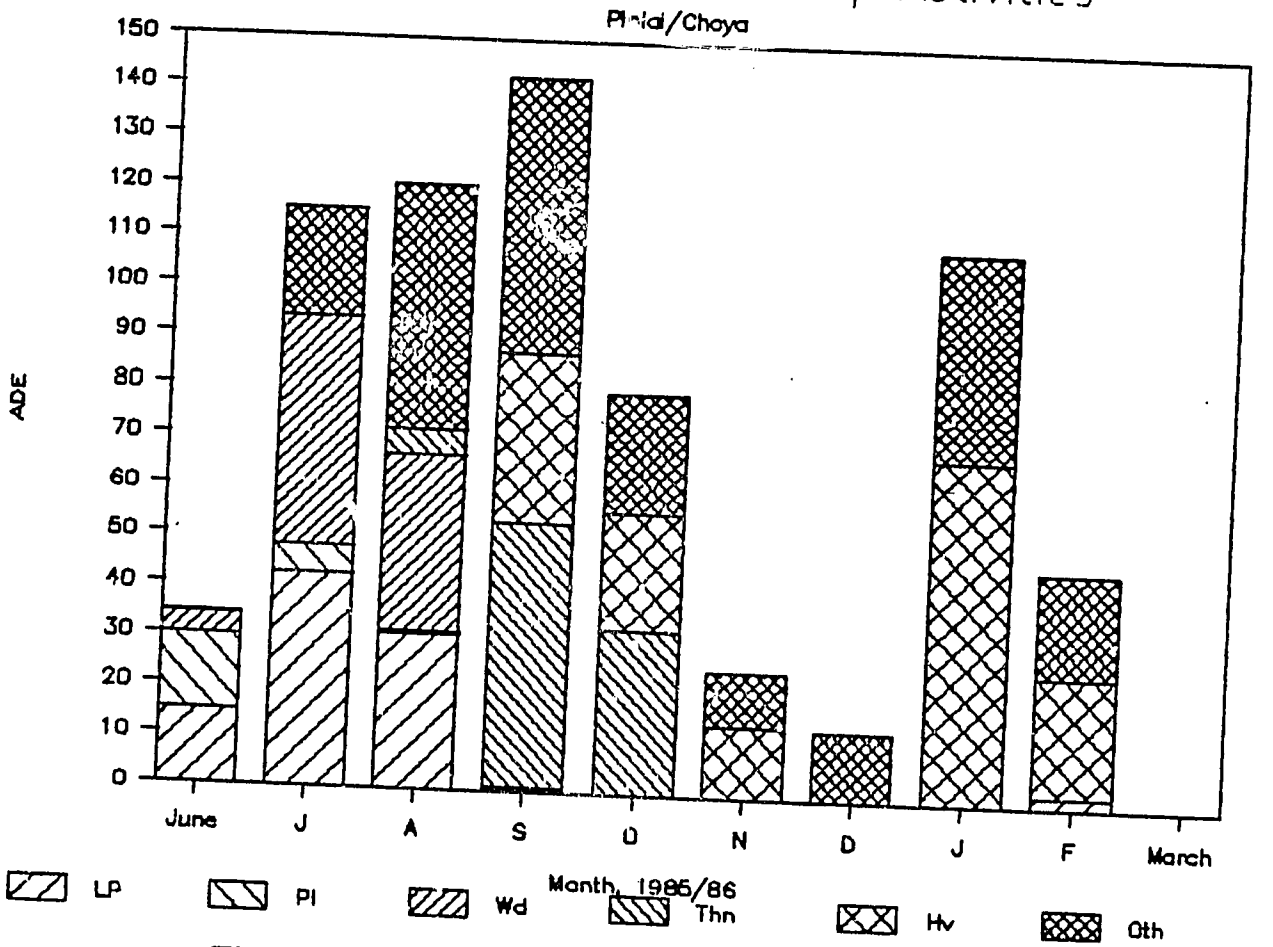
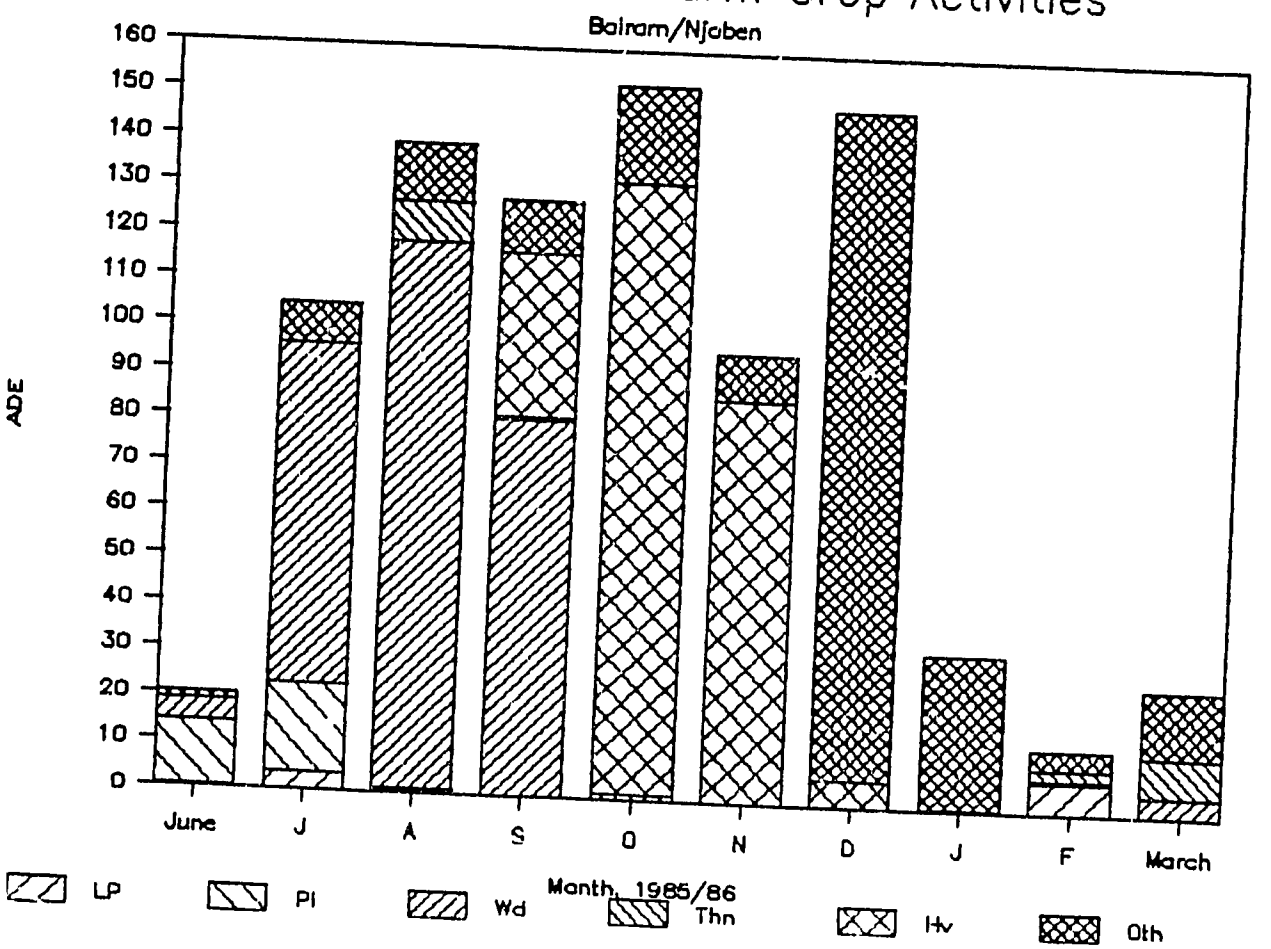


Figure 10. Whole Farm Crop Activities



of irrigated rice, the average situation found in the Boiram/Njoben area in 1985/86. Labor requirements remain high from August through December, with peak months in October and December ("other" labor used in post-harvest activities related to groundnuts as well continuing rice activities). These months used 18% and 17% of total farm crop labor, respectively.

The labor peak observed at Boiram/Njoben in December occurred because the harvests of groundnuts and rice followed one after the other. This situation is avoided at Piniai/Choya because the rice harvest does not begin until January.

Table 11 uses the composite farm figures to determine total seasonal labor input into the various crops by adult family males and adult family females. In the Piniai/Choya area these two labor types account for 80% of all crop labor while in the Boiram/Njoben area family male and female adults combine to provide 63% of all crop labor. It is in the allocation of labor from these two categories that major differences between the two study sites can be seen.

For each site, the column on the left shows total farm ADEs into the given crop by all labor types, total ADE into the crop by adult family males and by adult family females. The right hand column for each study site shows the percentage of total labor for each labor type utilized in production of the given crop. For example, 5.9% of all crop labor expended by adult family males in Piniai/Choya was used in maize cultivation. The lower portion of the table shows labor inventories and average labor input per adult equivalent in the compound, by sex.

One may readily discern that adult females at the Piniai/Choya study site spent almost all of their time in the rice fields, with only 1.3% of time allocated to production of crops other than rice. Adult family males contributed only 3% of their time to rice production, putting most of their efforts into the production of early millet (46%) and groundnuts (45%). Maize required little labor in comparison with the other three crops.

The findings for the Piniai/Choya study accord well with commonly held notions regarding sexual division of labor in The Gambia. These generalizations state that rice is the preferred staple crop of Gambians and is cultivated by females. Millet represents a relatively low risk food crop and is cultivated by males. Groundnuts, while an integral part of the Gambian diet, is the primary cash crop of Gambian farmers. Males control the cultivation and sale of groundnuts. The role of groundnuts as a cash crop in the Piniai/Choya area can be inferred from the use of hired labor at critical periods during the crop season. Nearly 8% of total labor used in groundnuts was hired; this represented 71% of all labor hired by the composite Piniai/Choya farm.

Table 11. Average ADEs by Family Adult Males and Family Adult Females into Various Crops (weighted by crop areas)

	Piniai/Choya		Boiram/Njoben	
	ADEs	% of type	ADEs	% of type
Maize	0.65 Ha		0.68 Ha	
Total	17.02		21.39	
Male Adults	12.28	5.90%	10.03	2.70%
Female Adults	0.33	0.01%	2.03	1.20%
Groundnuts				
	1.66 Ha		4.06 Ha	
Total	123.24		474.25	
Male Adults	93.04	45.00%	198.43	52.30%
Female Adults	4.21	1.00%	107.04	64.70%
Early Millet	1.18 Ha		2.03 Ha	
Total	120.69		217.47	
Male Adults	95.82	46.00%	93.21	24.60%
Female Adults	0.04	0.00%	38.08	23.00%
Rice	0.89 Ha		0.19 Ha	
Total	420.97		149.25	
Male Adults	5.64	2.70%	77.86	20.50%
Female Adults	338.75	98.70%	18.19	11.00%
All Crops				
Total	687.85		862.34	
Male Adults	206.78	100.00%	379.6	100.00%
Female Adults	343.33	100.00%	165.34	100.00%
Average Labor Inventory (Persons)				
Male Adults	2.83		3.42	
Female Adults	3.17		3.17	
Compound	10.92		15.08	

Examination of Table 11 for the Boiram/Njoben study site reveals a marked difference in the sexual distribution of labor among crops when compared to the Piniai/Choya area. The majority of time that women devoted to crop activities was used in groundnut production, a crop which absorbed almost 65% of adult family female labor. Another 23% of adult female family labor went to millet production, while only 11% was used in rice production. For adult males , 52% of total labor devoted to crop activities went to groundnuts with just under 25% going to millet production. Irrigated rice activities took up 20.5% of adult male family crop labor.

Even allowing for differences in labor resource availabilities (see average labor inventory, Table 11), it is quite obvious that farmers in the two study sites allocate labor among crops in a decidedly dissimilar manner. In fact, the data suggest that compounds in the Boiram/Njoben area do not follow what is commonly regarded as the traditional sexual division of labor. The major factors involved in determining why such a difference has been observed are many, among them differences in ethnicity, economics, resource endowment, environment and the presence of the Jahaly and Pacharr Smallholders Project (the irrigated rice scheme).

Ethnicity: The Piniai/Choya area was composed of a mix of Mandinkas and Fulas while the Boiram/Njoben site was primarily Wolof in ethnicity. Wolof women have long held their own groundnut fields while women of the Mandinka and Fula ethnic groups held rice fields and dry season gardens. Researchers such as Gamble (1967) have written that Wolof women are responsible for rice production activities, but the Boiram/Njoben area is composed entirely of land suited only for upland crops, with irrigated rice fields 10-12 km distant. Until the recent introduction of irrigated rice production, compounds in the Boiram/Njoben area were not likely to have engaged in rice production. Further, rice production among the Wolofs does not receive the same attention as millet, the primary staple of this ethnic group. Rice, on the other hand, is the main staple of the Mandinkas and Fulas. Thus the traditions of each group can explain much of the difference in compound labor allocation amongst crops.

Work habits observed for each group also help account for the labor ratios found at the bottom of Table 11. It is seen that the average seasonal male and female adult labor inputs in Piniai/Choya are about 73 and 108 ADEs, respectively. Male adults in the Boiram/Njoben study site put in a seasonal average of 111 ADEs while female adults contributed about 52 ADEs.

Among Wolof women, mornings are traditionally spent working in the fields while afternoons are spent conducting household activities. Wolof men work in the fields in the mornings as

well, and return to the fields following lunch as the day cools off. This leads one to expect greater labor input levels for males as compared to females, and this expectation is confirmed in Table 11.

Mandinka compounds operate in a different manner. Women leave for the rice fields in the morning and remain there until near the end of the day. Mandinka men work mornings throughout the season, returning to the fields in the afternoon only during the most critical periods of the season. This observation would lead one to suspect greater labor input levels for females as compared to males, an expectation again confirmed in Table 11.

In light of these observations regarding the manner in which the different ethnic groups conduct crop production activities, it is clear that ethnicity plays a major role in determining the allocation of labor among crops. Further, ethnicity is a major factor in determining the absolute number of days worked by each sex.

Resource Endowment: Recalling the data presented in Table 2, it was found that compounds in the Boiram/Njoben area had, on average, 38% more adult equivalents, 51% more hectares of cropland, 106% more cattle and 37% more draft animals than compounds at the Piniai/Choya site. For their part, compounds in Piniai/Choya had 41% more small stock than compounds at Boiram/Njoben. Leaving aside any discussion about the reasons for such a resource imbalance, its very existence may affect farmer decisions regarding allocation of labor among different enterprises in Gambian farming systems. While this paper has concentrated exclusively upon cropping systems, it is recognized that crop enterprises cannot be managed entirely independent of livestock enterprises. A decision to utilize an ADE of labor in crop activities precludes the use of that ADE in livestock activities.

One would surmise that, given the relative absence of adult female labor in crop enterprises at Boiram/Njoben, perhaps some of this potential labor had been utilized in livestock enterprises. Preliminary examination of livestock management data does not support this argument. Cattle at the Boiram/Njoben study site were generally turned over to contract herders for the crop season, so little to no compound labor was necessary while crops were being cultivated. Small stock at both sites required a small amount of daily watering and herding, but this accounted for only about 30 to 60 minutes per day per compound. This was generally provided by teenaged males and females, although adult females often watered small stock. Draft animals were tended by teenaged males and adult males. In short, the different levels of livestock holding are not felt to account for the substantial differences in the sexual distribution of labor between the two study sites.

Differences in labor inventories provide some help in explaining the differences between study sites, but are not adequate to explain a great deal. Compounds at Boiram/Njoben have on average 21% more adult family males than compounds at Piniai/Choya, but this might account for only a portion of the 84% more labor contributed by adult family males at Boiram/Njoben (as has been noted above there are ethnic factors involved in this). But while average inventories for adult family females are identical for both areas, females at Boiram/Njoben put in only 48% of the labor given by their counterparts at Piniai/Choya. Possible ethnically based reasons for this were discussed above.

Regression analysis was utilized to help determine the relationship between compound labor inventories and total ADEs used in crop production. Complete specification of the equations can be found in Appendix A. A summary of results is presented here. Labor inventory explained 70% of the variation in total crop labor for the 12 farms in the Piniai/Choya area, but only 49% of the variation for the 12 farms at the Boiram/Njoben site. For these simple regressions, the independent variable (compound adult equivalents) was significant for both study areas at the 0.01 level. When both cropped area and labor inventory were used as explanatory variables, however, labor inventory was not significant in either equation at the 0.1 level. In fact, in the Boiram/Njoben area neither cropped area nor compound labor inventory were significant in explaining the variation in a compound's total crop labor use. At the Piniai/Choya site, cropped area was significant at the 0.01 level.

The relationship between a compound's resource endowment and its subsequent allocation of labor to crop enterprises involves a more complex set of analyses than can be attempted with the available management data. A farmer's decision to allocate labor may have more to do with social/ethnic factors than with the quantitative factors dealt with here.

Economics: Table 12 presents yield and efficiency measures of labor for the four major crops at each study site. Data include some statistical measures of yield at each site for each crop. Differences in yield were highly significant (0.01) in groundnuts and in maize when failures were included. Prices used were D 0.8/kg for maize and millet and D 1.10/kg for groundnuts and rice. Efficiency measures for rice were adjusted for transport time and February and March labor to obtain comparable "in the field" return to labor estimates for each site.

Economic theory predicts that as labor is allocated to the enterprise which provides the greatest return and diminishing returns set in, returns to labor will tend to be constant across enterprises. Examination of the data reveal efficiency measures

Table 12. Yield and Efficiency Measures of Labor for Four Crops at Two Study Sites

	Piniai/Choya		Boiram/Njoben	
	Yield (kg/ha) (Std. Err.) n= number of fields	Earnings per ADE (D)	Yield (kg/ha) (Std. Err.) n= number of fields	Earnings per ADE
Maize				
With failures	673.0 (767.0) n=13	20.56		
w/out failures	1242.2 (624.6) n=7	37.95	1517.0 (388.9) n=14	38.59
Groundnuts	1664.0 (464.0) n=27	24.66	744.7 (219.7) n=52	7.01
Early Millet	1325.4 (424.7) n=15	10.37	1434.1 (466.3) n=30	10.71
Rice				
All Labor	2676.4 (3926.9) n=51	5.76	2858.4 (2023.7) n=12	4.00
Net of Transport, Feb., March Labor		8.93		7.79

to be relatively constant between sites rather than within a site.

At Piniai/Choya, female labor is almost exclusively devoted to swamp rice, a crop which ranks last in returns to labor, while males control production of the other three crops. This might imply that males assume production of crops with greater returns to labor. On both per farm and per hectare bases, women spend the most time on swamp rice, followed by groundnuts, maize and early millet. For adult males, on both per farm and per hectare bases, the most time is spent on early millet, followed by groundnuts, maize and rice. Adult males, it may be noted, allocate their time in a manner precisely opposite of that predicted by theory.

The data present a different picture at Boiram/Njoben. Irrigated rice ranks last in terms of return to labor, but for both males and females this crop uses the greatest amount of per hectare labor. In terms of absolute labor (as measured by the composite farm), this crop demands the third most amount of labor from these two labor categories, behind groundnuts and early millet. In fact, whether measured on a per farm or per hectare basis, adult males and adult females contribute labor in the same relative amounts to the same crops. On a per farm basis, both males and females spend the most time on groundnuts, followed by early millet, rice and maize. On a per hectare basis, both males and females spend the most time on rice, followed by groundnuts, early millet and maize. This result implies a more egalitarian relationship between the sexes in terms of crop labor, without regard for the relative efficiencies of the various crops.

Efficiency measures such as those presented in Table 12 must be interpreted with respect to the environment in which they were generated. First, despite very high returns maize remains an experimental crop in the eyes of many farmers. Maize production is a risky enterprise, dependent upon well timed rainfall, fertilizer and weeding. Failure to meet crop requirements in any of these inputs may cause the field to fail. Further, maize is only beginning to be integrated into the Gambian diet and is not yet viewed as a major staple. The maize that is being grown is seen as a secondary export crop with a small portion of maize cob consumed during the hungry season. Viewed within this context, it is not surprising to find that high returns to maize production is not met with a commensurate increase in labor effort.

Secondly, groundnut yields at the Boiram/Njoben site were well below normal in 1985. Typical yields are about 1200-1500 kg/ha. No agronomic rationale for this result was identified during the growing season. A 50% increase in yield (1140 kg/ha) would be required to bring groundnut returns up to that of early millet (assuming constant labor input). Should this normal yield

be attained and the "experimental" nature of maize be recognized, farmers at the Boiram/Njoben site would appear to be allocating labor in an economically rational manner when looking at composite farm labor figures.

Measures of efficiency do not provide any clearcut method of evaluating the differences in the sexual distribution of labor between the two study sites. While the data suggest that females in the Piniai/Choya area work with a low labor productivity crop with females at Boiram/Njoben enjoying more diversified production activities alongside males, the factors involved are not exclusively economic in nature. The possibilities may best be investigated in conjunction with sociologists.

Environment: The Piniai/Choya area is proximal to a large rice growing region of The Gambia. While rice fields are certainly not adjacent to the villages, the distance (6 km) is not excessive. In the Boiram/Njoben area, however, ricefields were at a distance of 10-12 km from the villages. As was mentioned previously, this distance caused little rice to be grown by area farmers prior to the initiation of the irrigation project. The fact that rice has traditionally been grown in Piniai/Choya and not grown in Boiram/Njoben can result in differences in labor allocation between the two sites as farmers in each area were faced with different potential cropping systems.

The marginal quantities of rainfall received in The Gambia over the last few years may have affected farmer decisions regarding labor allocation among crops. Working under the assumption that subsistence farmers are risk-averse and desire to assure an adequate food supply for the compound before engaging in production of non-staple crops, one may expect farmers to devote more time to low-risk staple crops. Farmers in the Piniai/Choya area were faced with dependence on uncertain, erratic rainfall for their crop enterprises. Early millet, a relatively drought tolerant early maturing crop, absorbed 46% of family adult male labor while nearly all adult female labor went into the higher risk (but preferred grain) swamp rice crop. Production of these two staple crops accounted for 79% of total farm crop production labor, with groundnuts requiring only 18%.

Introduction of irrigation techniques at the Boiram/Njoben site effectively lowered the risk of rice production as farmers were no longer dependent upon erratic rainfall. With irrigation water guaranteed and the likelihood of two rice crops per year fairly high, farmers could be relatively assured of adequate rice supplies for home consumption and sale. Combined with production of early millet, these two staple crops accounted for only 43% of total farm labor devoted to crop enterprises, leaving much time available for the production of groundnuts.

Irrigation Project:. An obvious difference in production

techniques between the two sites is the presence of the Jahaly-Pacharr Smallholders Project, an irrigated rice project, in which farmers from the Boiram/Njoben study site are participating. Eastman and Jammeh (1985) found that the rice project caused male participation in rice cultivation to increase "as rice production increases in scale or becomes more commercial." This occurred despite the fact that rice plots were initially allocated to women. In a study of 150 plotholders from 42 villages of differing ethnicity, the authors note that pre-project rice production had been largely in the hands of females, but that in the two years following project initiation control of field activities and produce had been transferred to males. Transplanting, weeding, harvesting, threshing and winnowing involved a labor force composed of both males and females, while 50% or more of the plotholders reported exclusively male labor use for land preparation and crop protection. These data match those presented in this study.

Eastman and Jammeh attribute increased male participation in rice production to three major factors. Firstly, the relatively high labor productivities associated with irrigated rice and the increased risk of upland crop production due to declining rainfall have caused men to be more attracted to rice production.[5] Secondly, the dominant role of males in Gambian society has allowed men "to control what they have always controlled" - the major crop producing enterprises. Lastly, irrigated rice production is an enterprise in which timing of activities is critical. Because women perform household and child-rearing tasks in addition to their crop related activities, these duties may preclude participation at critical periods. Another possibility (not suggested by Eastman and Jammeh) is that men tend to "take over" activities perceived to be modern, involve machines or generate new sources of income. Women, in return, are allocated more traditional activities.

In their study of the impact of the Jahaly-Pacharr project on upland crop production (Eastman and Jammeh, 1986), the same authors reported a modest increase in area of upland crop production. When asked the source of the additional labor required to cultivate this expanded area, 17% of the respondents indicated that compound members provided the additional labor. This finding may help explain a portion of the relatively high labor input provided by adult family males at the Boiram/Njoben site, but the study did not attempt to measure any impact of the project on the sexual distribution of labor allocated to upland crop production.

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[5] The assertion that labor productivities associated with irrigated rice production are high in relation to other crops grown in the area is not supported by the data on which this report is based. See Table 12.

Summary

The factors influencing allocation of labor among crop enterprises are varied and complex. The major factors cited above - namely ethnicity, economics, resource endowment, environment and technological innovation provide an initial framework within which to analyze labor utilization. It is tempting to point to ethnicity and the presence of the irrigation project as the major factors causing the observed differences between study sites in the division of crop responsibilities among the sexes, but it would be premature to do so.

While the available data are believed to be of relatively high quality and accurate for the sites at which data were collected, the small size of the sample makes one cautious of drawing sweeping conclusions. Only 12 compounds were studied at each of the two sites, not nearly enough to allow researchers to account for all the geographic, ethnic and social diversity found in Gambian society.

Ethnicity clearly plays a role in determining both the absolute number of days a given person will work, but also the crops with which that person will work. The data suggest that Wolof compounds allocate labor in a decidedly different manner than compounds of Mandinka or Fula heritage.

Resource endowment as measured by control of physical resources (land, labor and livestock) provides inconsistent results when attempting to determine the role of resources in the utilization of labor in Gambian cropping systems. Detailed examination of livestock management data will help provide a more complete picture of farm management by Gambian farmers, but since livestock enterprises tend not to be labor intensive their impact on allocation of labor in crop enterprises is not expected to be of a magnitude sufficient to result in major differences in sexual distribution of labor observed at the two study sites. Labor inventories do not adequately explain the variation in labor use by compounds between the two study sites.

Environmental factors such as rainfall (and the risk associated with its uncertainty) may impact the distribution of labor. With the Jahaly-Pacharr project effectively lowering the major environmental risk of rice production (poor rainfall), and virtually assuring adequate supplies of this staple grain, a farmer's decision criteria for the selection of crop mixes and allocation of available labor will likely be modified.

Economic measures of labor efficiency did not provide any conclusive evidence to explain the wide differences in sexual distribution of labor, but it did suggest an avenue of investigation. The data imply that in the Piniai/Choya area males have control of crops with higher returns to labor while

males in the Boiram/Njoben area share with females a more equal division of labor among the different crops. This possibility can be more thoroughly investigated by an integrated sociological/economic approach.

The full impact of the Jahaly-Pacharr project on the project area has not been completely documented. Its impact on the sexual division of labor will perhaps be found to be substantial. Eastman and Jammeh, in their qualitative study of sexual distribution of labor, have hinted at potential shifts in the utilization of labor by compounds participating in the project. The project needs to be evaluated with regard to the complete range of ethnic, resource and physical diversity found in The Gambia.

The farm management data collected in 1985/86 by the Mixed Farming Project suggest major differences in the sexual distribution of labor at the two sites studied. No conclusive reasons for these differences can be confirmed, but the likely effects lie with ethnic differences, economics, resource endowment, environmental factors and the Jahaly-Pacharr Smallholder Project.

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Appendix A

Regression Equations

Y = Total Farm Crop Labor (Adult Day Equivalents)

X1 = Compound Labor Inventory (Adult Equivalents)

X2 = Compound Crop Area (Hectares)

Piniai/Choya

(1) Total ADE = f(AE)

$Y = 87.65 + 39.80\ X1$
(8.32)
Std. Err. of Regr. = 114.33

n = 12
df = 10
R2 = 0.70

(2) Total ADE = f(Ha)

$Y = -14.83 + 117.78\ X2$
(13.32)
Std. Err. of Regr. = 69.8

n = 12
df = 10
R2 = 0.89

(3) Total ADE = f(Ha, AE)

$Y = -18.24 + 4.61\ X1 + 107.40\ X2$
(10.35) (27.12)
Std. Err. of Regr. = 72.79

n = 12
df = 9
R2 = 0.89

Boiram/Njoben

(4) Total ADE = f(AE)

$Y = 130.14 + 44.16\ X1$
(14.19)
Std. Err. of Regr. = 254.19

n = 12
df = 10
R2 = 0.49

(5) Total ADE = f(Ha)

$Y = 62.1 + 103.44\ X2$
(38.10)
Std. Err. of Regr. = 270.59

n = 12
df = 10
R2 = 0.42

(6) Total ADE = f(Ha, AE)

$Y = -48.72 + 30.34\ X1 + 54.57\ X2$
(18.05) (45.52)
Std. Err. of Regr. = 248.80

n = 12
df = 9
R2 = 0.56

Appendix B

Tables of Labor Use

Table B.1

ADEs per Ha by Crop and Activity
Piniai/Choya

Activity	Maize	Groundnuts	Millet	Rice
Land Prep.	3.79	2.90	3.02	90.31
Plant./Fert.	2.01	8.41	2.84	2.73
Crop Pro.	1.45	3.50	39.20	0.57
Irrig.				
Weeding	15.73	29.11	17.66	6.73
Thin./Trans.				101.90
Harvest	2.77	15.95	36.75	102.79
Transport	0.39	0.75	2.62	167.80
Other		13.68	0.12	0.13
Total	26.14	74.30	102.21	472.96

Table B.2

ADEs per Ha by Crop and Activity
Boiram/Njoben

Activity	Maize	Groundnuts	Millet	Rice
Land Prep.	1.17	0.49	0.16	6.51
Plant./Fert.	2.25	5.06	4.60	11.66
Crop Pro.		0.01	0.97	
Irrig.				13.50
Weeding	18.33	47.52	32.34	23.15
Thin./Trans.			1.01	45.05
Harvest	7.36	30.00	56.19	90.43
Transport	1.65	6.78	11.53	167.99
Other	0.46	26.88	0.31	213.19
Total	31.42	116.74	107.11	571.48

Table B.3

Per Hectare Labor Input, by Activity

Crop: Maize
Village: Piniai/Choya

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Tot
Land Prep	0.38	3.41							3.79
Plant/Fert	0.16	1.85							2.01
Crop Pro			0.61	0.84					1.45
Irr.									0.00
Weed		5.65	10.08						15.73
Thin/Tran.									0.00
Harvest				0.21	2.56				2.77
Transport					0.34	0.05			0.39
Other									0.00
Total	0.54	10.91	10.69	1.05	2.90	0.05	0.00	0.00	26.14

Table B.4

Per Hectare Labor Input, by Activity

Crop: Groundnut
Village: Piniai/Choya

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Tot
Land Prep	1.97	0.7	0.14	0.05					2.90
Plant/Fert	6.97	1.44							8.41
Crop Pro			0.26	1.60	1.64				3.50
Irr.									0.00
Weed	0.05	11.25	17.70	0.11					29.11
Thin/Tran.									0.00
Harvest					7.13	8.69		0.12	15.94
Transport		0.07			0.30	0.03	0.35		0.75
Other						6.28	7.39	0.01	13.68
Total	8.99	13.50	18.10	1.76	9.07	15.00	7.74	0.13	74.29

Table B.5

Per Hectare Labor Input, by Activity

Crop: Early Millet
Village: Piniai/Choya

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot
Land Prep	0.69	0.26							2.07		3.02
Plant/Fert	2.63	0.21									2.84
Crop Pro			17.96	21.24							39.20
Irr.											0.00
Weed	0.34	17.24	0.08								17.66
Thin/Tran.											0.00
Harvest				28.50	8.18			0.07			36.75
Transport			0.20	0.31	2.11						2.62
Other			0.12								0.12
Total	3.66	17.71	18.36	50.05	10.29	0.00	0.00	0.07	2.07	0.00	102.21

Table B.6

Per Hectare Labor Input, by Activity

Crop: Swamp Rice
Village: Piniai/Choya

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot
Land Prep	12.11	43.71	34.31	0.18							90.31
Plant/Fert		1.86	0.87								2.73
Crop Pro							0.57				0.57
Irr.											0.00
Weed			6.38	0.35							6.73
Thin/Tran.			5.48	59.38	36.95			0.09			101.90
Harvest				0.01				76.49	26.30		102.80
Transport	4.70	20.82	22.35	29.73	20.19	0.04	0.40	46.36	23.21		167.80
Other	0.02			0.03			0.08				0.13
Total	16.83	66.39	69.39	89.68	57.14	0.04	1.05	122.94	49.51	0.00	472.97

Table B.7

Per Hectare Labor Input, by Activity

Crop: Maize
Village: Boiram/Njoben

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot
Land Prep	0.14	1.03									1.17
Plant/Fert	0.39	1.86									2.25
Crop Pro											0.00
Irr.											0.00
Weed	0.27	5.25	12.08	0.73							18.33
Thin/Tran.											0.00
Harvest					6.71	0.85					7.56
Transport	0.03		0.15	0.09	1.19	0.19					1.65
Other								0.46			0.46
Total	0.83	8.14	12.23	0.82	7.90	1.04	0.00	0.46	0.00	0.00	31.42

Table B.8

Per Hectare Labor Input, by Activity

Crop: Groundnuts
Village: Boiram/Njoben

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot
Land Prep	0.08	0.33	0.08								0.49
Plant/Fert	1.16	3.90									5.06
Crop Pro				0.01							0.01
Irr.											0.00
Weed	0.68	4.41	23.68	18.75							47.52
Thin/Tran.											0.00
Harvest					11.11	18.54	0.28	0.07			30.00
Transport	0.05	0.76	1.49	1.26	0.63	0.90	0.63	1.06			6.78
Other			0.02			0.62	19.32	6.92			26.88
Total	1.97	9.40	25.27	20.02	11.74	20.06	20.23	8.05	0.00	0.00	116.74

Table B.9

Per Hectare Labor Input, by Activity

Crop: Early Millet
Village: Boiram/Njoben

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Tot
Land Prep		0.16									0.16
Plant/Fert	4.35	0.25									4.60
Crop Pro		0.53	0.07	0.37							0.97
Irr.											0.00
Weed	0.72	25.47	5.62	0.53							32.34
Thin/Tran.			0.10	0.30	0.63						1.03
Harvest				17.13	38.89			0.06			56.08
Transport	0.68	1.53	0.19	1.44	7.69			0.01			11.54
Other			0.02	0.05	0.24						0.31
Total	5.75	27.94	6.00	19.82	47.45	0.00	0.00	0.07	0.00	0.00	107.03

Table B.10

Per Hectare Labor Input, by Activity

Crop: Irrigated Rice
Village: Boiram/Njoben

Activity	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Tot
Land Prep		6.51							6.51
Plant/Fert		7.67	3.99						11.66
Crop Pro									0.00
Irr.		1.30	4.48	4.16	2.19	1.37			13.50
Weed			6.86	16.30					23.16
Thin/Tran.			45.05						45.05
Harvest					11.36	54.32	24.75		90.43
Transport		5.03	22.61	8.39	2.99	17.10	111.87		167.99
Other							209.46	3.73	213.19
Total	0.00	20.51	82.99	28.85	16.54	72.79	346.08	3.73	571.49

Table B.11

Per Hectare Labor Input into Activities, by Labor Type

Crop: Maize
Village: Piniai/Choya

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O	0.16	0.24	0.46		0.88		0.24	0.02		2.00
Female Y/O										0.00
Male Teen					0.71		0.07			0.78
Fem. Teen							0.15			0.15
Male Adult	3.10	1.50	0.94		11.87		1.93	0.34		19.68
Fem. Adult		0.16					0.31	0.03		0.50
Temporary										
Male	0.29				1.68		0.07			2.04
Female										0.00
Permanent										
Male										0.00
Hired										
Male										0.00
Female	0.24	0.11	0.05		0.59					0.99
Total	3.79	2.01	1.45	0.00	15.73	0.00	2.77	0.39	0.00	26.14

Table B.12

Per Hectare Labor Input into Activities, by Labor Type

Crop: Groundnuts
Village: Piniai/Ch_ya

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O	0.41	0.79	0.12		1.26		0.78	0.02	0.53	3.91
Female Y/O		0.11	0.11				0.03	0.03		0.28
Male Teen		0.21			2.63					2.84
Fem. Teen	0.02	0.36					0.17	0.01		0.56
Male Adult	2.04	4.92	1.04		23.40		12.32	0.56	11.77	56.05
Fem. Adult	0.12	1.36			0.02		0.89	0.06	0.10	2.55
Temporary										
Male	0.12	0.21			0.23		0.48	0.05	0.23	1.32
Female									0.21	0.21
Permanent										
Male	0.02	0.07			0.08		0.25	0.01	0.18	0.61
Hired										
Male							0.02			0.02
Female	0.17	0.38	2.23		1.49		1.01	0.01	0.66	5.95
Total	2.90	8.41	3.50	0.00	29.11	0.00	15.95	0.75	13.68	74.30

Table B.13

Per Hectare Labor Input into Activities, by Labor Type

Crop: Early Millet
Village: Piniai/Choya

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O	0.12	0.52	5.18		1.83		3.03	0.25		10.93
Female Y/O			0.17							0.17
Male Teen			3.66		0.22		1.15	0.05	0.01	5.09
Fem. Teen										0.00
Male Adult	2.57	2.07	29.96		14.05		30.29	2.09	0.11	81.14
Fem. Adult			0.01					0.02		0.03
Temporary										
Male	0.29	0.1			0.56		1.75	0.18		2.88
Female										0.00
Permanent										
Male	0.04				0.22					0.26
Hired										
Male										0.00
Female		0.15	0.22		0.78		0.53	0.03		1.71
Total	3.02	2.84	39.20	0.00	17.66	0.00	36.75	2.62	0.12	102.21

Table B.14

Per Hectare Labor Input into Activities, by Labor Type

Crop: Swamp Rice
Village: Piniai/Choya

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O		0.14						0.21		0.35
Female Y/O	1.04	0.06			0.16	5.46	5.59	7.56		19.87
Male Teen										0.00
Fem. Teen	8.00	0.20			0.46	13.84	12.77	21.56		56.83
Male Adult	0.55				0.99	0.22		4.59		6.35
Fem. Adult	79.85	2.33	0.57		5.06	77.63	84.29	130.74	0.13	380.60
Temporary										
Male										
Female	0.87					0.74		1.05		1.79
Permanent						4.01	0.14	1.82		6.84
Male										
Hired								0.20		0.20
Male										
Female					0.06			0.07		0.13
										0.00
Total	90.31	2.73	0.57	0.00	6.73	101.90	102.79	167.80	0.13	472.96

Table B.15

Per Hectare Labor Input into Activities, by Labor Type

Crop: Maize
Village: Boiram/Njoben

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O	0.02	0.13			1.32		0.08	0.01	0.33	1.89
Female Y/O							0.28			0.28
Male Teen	0.19	0.46			3.66		0.99	0.54		5.84
Fem. Teen					0.03		0.28			0.31
Male Adult	0.54	1.29			9.51		2.70	0.64	0.13	14.81
Fem. Adult					1.48		1.50			2.98
Temporary										
Male										0.00
Female										0.00
Permanent										
Male	0.42	0.37			1.85		0.80	0.15		3.59
Hired										
Male							0.85	0.19		1.04
Female					0.48		0.08	0.12		0.68
Total	1.17	2.25	0.00	0.00	18.33	0.00	7.56	1.65	0.46	31.42

Table B.16

Per Hectare Labor Input into Activities, by Labor Type

Crop: Groundnut
Village: Boiram/Njoben

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O	0.11	0.16			2.41		1.40	0.25	1.33	5.66
Female Y/O					0.15		0.60	0.02	0.66	1.43
Male Teen	0.12	0.49			6.96		2.91	0.82	3.58	14.88
Fem. Teen					1.32		2.08	0.06	2.27	5.73
Male Adult	0.11	3.09	0.01		19.28		11.73	3.85	10.78	48.85
Fem. Adult		0.56			11.85		7.47	1.45	4.99	26.32
Temporary										
Male	0.01	0.09			0.16		0.59	0.01	0.4	1.26
Female									0.13	0.13
Permanent										
Male	0.14	0.61			4.52		2.96	0.25	2.12	10.60
Hired										
Male					0.45			0.06	0.38	0.89
Female		0.06			0.42		0.26	0.01	0.24	0.99
Total	0.49	5.06	0.01	0.00	47.52	0.00	30.00	6.78	26.88	116.74

Table B.17

Per Hectare Labor Input into Activities, by Labor Type

Crop: Early Millet
Village: Boiram/Njoben

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O		0.17	0.27		1.39		3.07	0.86		5.76
Female Y/O							0.20			0.20
Male Teen	0.05	0.88			4.33	0.03	9.93	2.38	0.06	17.66
Fem. Teen					0.19		1.01	0.05		1.25
Male Adult	0.02	2.30	0.03		16.13	0.03	22.87	4.40	0.14	45.92
Fem. Adult		0.54			6.19	0.02	10.36	1.62	0.03	18.76
Temporary										
Male		0.03			0.07		0.33			0.43
Female										0.00
Permanent										
Male	0.09	0.53	0.07		3.79	0.02	8.42	2.04	0.08	15.04
Hired										
Male		0.02			0.25			0.03		0.30
Female		0.13	0.60			0.92		0.15		1.80
Total	0.16	4.60	0.97	0.00	32.34	1.02	56.19	11.53	0.31	107.12

Table B.18

Per Hectare Labor Input into Activities, by Labor Type

Crop: Irrigated Rice
Village: Boiram/Njoben

Type	Land Prep	Plant/Fert	Crop Pro	Irrig	Weed	Thin/Trans	Harvest	Transport	Other	Total
Family										
Male Y/O	0.25	0.12		0.10		0.15		0.17		0.79
Female Y/O										0.00
Male Teen	1.58	1.05		0.47	3.65	0.95	13.65	31.48	32.62	85.45
Fem. Teen							1.15			1.15
Male Adult	3.95	4.33		12.00	11.07	14.36	46.77	95.28	114.34	302.10
Fem. Adult	0.49	5.84		0.12	5.73	19.98	8.65	26.89	23.49	91.19
Temporary										
Male										
Female							2.94			2.94
Permanent										0.00
Male				0.33	2.54	0.31	15.99	12.04	39.53	70.74
Hired										
Male						2.63		0.17		2.80
Female	0.24	0.32		0.48	0.16	6.67	1.28	1.96	3.21	14.32
Total	6.51	11.66	0.00	13.50	23.15	45.05	90.43	167.99	213.19	571.48