The Farmers of Yurimaguas and Cropping Strategies in the Peruvian Jungle

With E. Rhoades & Pedro Bidegaray

INTERNATIONAL POTATO CENTER (CIP)

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THE FARMERS OF YURIMAGUAS

Land Use and Cropping Strategies in the Peruvian Jungle

Robert E. Rhoades and Pedro Bidegaray

1987

International Potato Center
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Abstract

Among world environments considered most fragile in the face of human activity is the Amazon Basin. Landless colonists, seeking a better life, have migrated into the tropical rain forests and begun a process of agricultural exploitation that many individuals and governments consider destructive. Development efforts are now underway to seek alternatives for these populations in terms of their farming practices. Yurimaguas in Peru has been the focus for over a decade of scientific research on tropical soils and agronomy. This monograph complements the technical research efforts by focusing on the farmers themselves, their practices and beliefs about farming. It describes the agrarian ecology which is not only determined by climate, soils, and plants but by household goals, available technology, labor constraints, markets, and policy. Within the physical and social environments of Yurimaguas, farmers combine in a creative manner their resources to achieve both consumption needs and cash requirements. Farmers, rather than being seen as only sowing wanton destruction, are shown to have knowledge and skills valuable for agricultural development efforts.

Compendio

La cuenca amazónica está considerada como uno de los ambientes más frágiles frente a la actividad humana. Colonos sin tierra, en busca de una mejor vida, emigraron hacia las selvas tropicales donde han empezado un proceso de explotación agrícola que muchos individuos y gobiernos consideran destructivo. Actualmente se están desarrollando esfuerzos para encontrar alternativas para estas poblaciones en cuanto a sus prácticas agrícolas. Yurimaguas (Perú) ha sido el centro de investigación científica en suelos tropicales y agronomía durante más de una década. Esta monografía complementa los esfuerzos de investigación al centrar su atención en los agricultores, sus prácticas agronómicas y sus creencias sobre agricultura. Describe la ecología agraria, la cual no está determinada únicamente por clima, suelos y plantas, sino también por los objetivos de la familia campesina, la tecnología disponible, los factores laborales limitantes, los mercados y la política agraria. Dentro del ambiente físico y social de Yurimaguas, los agricultores combinan sus recursos de manera creativa, para lograr satisfacer tanto sus necesidades de consumo como las de dinero en efectivo. Lejos de presentar a los agricultores como meros sembradores irresponsables de destrucción, este documento los muestra como individuos con conocimientos y habilidades valiosos para los esfuerzos de desarrollo agrícola.
Acknowledgements

Many individuals assisted us in the completion of this study through field support and insightful criticism of our research findings. We would especially like to thank Dr. Dale Bandy, North Carolina State University, and Ruben Mesia, who at the time was Head of the Yurimaguas Experiment Station. Pedro Ruiz of CIP in Yurimaguas was helpful in gathering and verifying information after the basic fieldwork ended. Funds for the research were provided by the Rockefeller Foundation, IDRC-Canada, and CIP core budget. Beatriz de Bidegaray assisted with the art work. Vera Niñez graciously supplied her fieldnotes on Yurimaguas home gardens for our use. Lilia Salinas and Mariella Altet typed numerous versions of the text. We are grateful to all of the members of the Social Science Department at CIP and David Midmore of the Physiology Department for their support. Valuable comments on the report were made by Douglas Horton, Gordon Prain, Gregory Scott, Charles Crissman, and Emilio Moran. Finally, but not last in our appreciation, a special thanks to the farmers of Yurimaguas, Balsapuerto, and Tentente Coronel Cesar Lopez who not only had the patience to answer our long interviews but also offered their hospitality, food, and drink. This report is dedicated to them.
I. INTRODUCTION

Yurimaguas is a quiet jungle frontier district located 2,000 km from Lima by seasonally impassable roads. Although isolated away in Peru’s lower Amazon Basin, Yurimaguas is one of the most famous agricultural research sites in the developing world. Many Peruvians would be surprised to learn that renowned international scientists have either visited or conducted basic research in the Yurimaguas environs. The application of modern science and technology to Yurimaguas soils has brought her name to the pages of the most prestigious scientific journals, such as Science, and to popular lay science magazines, such as National Geographic. International agencies have invested considerably in manpower and expenditures in Yurimaguas research in an effort to learn more about tropical soils so as to meet the challenge of improving food production in developing countries (Sanchez 1975).

This monograph examines a different and equally important aspect of Yurimaguas tropical agriculture: the traditional farming practices and strategies of rural households. Our study is grounded in an evolving viewpoint increasingly shared by agricultural scientists that farming is much more than simply a collection of crops and animals to which one can apply this input or that, and expect immediately results. Rather, it is a complicated interwoven mesh of soils, plants, animals, implements, workers, other inputs and environmental influences with the strands held and manipulated by a person called the farmer who, given his preferences and aspirations, attempts to produce output from the inputs and technology available.

(CGIAR 1978)

To complement the rich information available on the biophysical aspects of Yurimaguas agriculture, a team of agricultural anthropologists collaborated in a farmer-oriented study with biological scientists from the International Potato Center, North Carolina State University, and Peru’s Instituto Nacional de Investigación y Promoción Agraria-INIPA (National Institute of Agricultural Research and Promotion). Although fieldwork was conducted mainly by the anthropologist, daily interaction took place both on the San Ramon Experiment Station with expatriate and national scientists as well as in the field with extension workers of Centro Regional de Investigación y Promoción Agropecuaria-CIPA (Regional Center of Agricultural Research and Promotion).

Our main objective in writing this report is to give outsiders, whether agricultural scientists or other development specialists, a glimpse

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1 Rhoades was the Project leader who visited Yurimaguas on data collecting trips numerous times from 1980 to 1985. Bidegaray, anthropology assistant, lived in Yurimaguas from July to October, 1980. This report forms part of a comparative agricultural systems project of the International Potato Center. CIP has conducted similar studies in Cañete, Mantaro (Mayer 1979), and Chanchamayo regions.
into the rationale and complexity of subsistence and commercial farming in Yurimaguas District. This report deals primarily with the agricultural system of the mestizo settler population and neglects native groups living in the region (cf. Stocks 1981). To guide our research, we entertained three basic questions:

1. **What** are the present farming practices and strategies of Yurimaguas?

2. **Why** have farm households chosen these practices and strategies?

3. **How** do farmers themselves perceive their farming problems?

We realize our study is only the beginning in understanding the rich detail that characterizes the agrarian ecology of Yurimaguas. We administered no formal questionnaires nor relied on random sampling, both techniques we found to be cumbersome and forced for farmers. Instead, our approach was informal, relying heavily on the time-tested anthropological method of participant observation; that is, living and working with the farmers as they go through their daily activities (Rhoades 1982). We have condensed these experiences from detailed field notebooks to give this overview of the agrarian system of Yurimaguas. We hope this report will serve as a basis for future, more detailed studies that help bring farmers and their knowledge into agricultural research and development efforts aimed at the tropical zones of the world.
II. HUMAN SETTLEMENT

A. Historical Overview

The evolution of Yurimaguas agrarian society mirrors historical processes which have occurred throughout the Amazon Basin of South America over the past 300 years. This humid, tropical jungle region was originally inhabited by indigenous groups that survived by fishing, gathering, hunting, and swidden agriculture when the first European arrived in the sixteenth century. Between 1700-14 Jesuits established an outpost on the Huallaga river, which, over time, took the name Yurimaguas from two tribal groups (Yuris and Omaguas) that had settled in the region after fleeing Portuguese colonialist violence along the Brazilian border. The District of Yurimaguas was created in 1853. By 1868 the town of Yurimaguas had become the capital of the Province of Alto Amazonas, Department of Loreto (Concejo Provincial Alto Amazonas, 1983:5). See Map 1.

During the latter half of the 19th and the first half of the 20th century, Yurimaguas like many Amazon communities became economically linked with international markets. Rubber exploitation (1880-1914) was followed by short-lived exploitation of products such as lumber and barbasco, which served as major income sources for native or recently settled farmers (Weinstein 1983). To extract these products, an habilitación (habilitation) system involving small capitalists who acted as intermediaries was organized. Foreign companies supplied local go-betweens with money and merchandise which, in turn, were provided to workers who went into the jungle to extract raw rubber or the roots of barbasco (Serjania perulacea). After some months, they returned with their harvests, repaid their debt and received their profits. The practice of habilitación has been widely used throughout Amazonia, primarily in exploitation of lumber, fine skins, rubber, and barbasco. This system often benefited foreign investors and the middlemen more than local farmers who remained in a dependency relation to outside market influences.

When rubber and barbasco were replaced on the international market by less expensive chemical products, laborers were forced to return to their original economic activity, agriculture. Farmers again dedicated their time to subsistence household production supplemented by maize and bean production for sale in local markets. Occasionally, they worked as laborers on haciendas of the region.

Beginning with the 1970s, the petroleum "boom" began and many farmers seeking greater sources of income elected to work as laborers for oil companies and left their fields in the hands of relatives. Around 1974 petroleum exploitation in the regions ceased and farmers returned again to work the fields. In the 1980s, the major source of capital for farmers has been rice production financed by Peru's Agrarian Bank.
B. Settlement Pattern

Historically, migration of settlers (colonos) into Yurimaguas District has been spontaneous rather than government planned and executed as were large colonization projects connected with the construction of the Carretera Marginal de la Selva, e.g. Tingo Maria and Tocache, and elsewhere in Peru, e.g. Genaro Herrera and Caballococha (Schuurman 1980). Less than 10 percent of Peru's population lives in the humid tropical zone (selva), which comprises 50 percent of the country's land area. However, migration from the sierra (highlands) has become increasingly attractive to Peru's land hungry farmers. The Peruvian Government is stimulating this migration by giving increasing importance to its jungle region. Foreign agencies have also in recent years stepped up their aid for development in the Amazon, especially the high jungle (ciela de selva).

In Alto Amazonas, six out of ten people live in rural areas while in Yurimaguas District town dwellers outnumber rural inhabitants by approximately 30 percent (Table 1). Inhabitants of the town of Yurimaguas, commercial hub of the province, mainly hold jobs in public offices, banks, schools, trade, and other minor occupations. An important sector of the urban population, however, consists of small farmers residing at the town's periphery who have emigrated from the countryside in hopes of better living and educational opportunities. The average size of the Yurimaguas family is 6 persons, although 45 percent of the families have between 7 and 11 or more members.

Peru's Ministry of Agriculture divides Alto Amazonas into three agrarian districts for executing its projects: Yurimaguas, Lagunas, and San Lorenzo. The Yurimaguas Agrarian District, described in this study is further subdivided along the lines of three political districts: Yurimaguas, Balsapuerto, and Teniente Coronel Cesar Lopez. Nearly 40 percent of the rural population of the province is concentrated in Yurimaguas district.

Table 1. Population distribution of Alto Amazonas and Yurimaguas District

<table>
<thead>
<tr>
<th>Year</th>
<th>Total population Province</th>
<th>District</th>
<th>Urban Province</th>
<th>District</th>
<th>Rural Province</th>
<th>District</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1961</td>
<td>47,022</td>
<td>23,020</td>
<td>18,902</td>
<td>8,057*</td>
<td>26,691</td>
<td>14,963*</td>
</tr>
<tr>
<td>1972</td>
<td>66,125</td>
<td>26,744</td>
<td>26,691</td>
<td>17,624</td>
<td>39,434</td>
<td>9,476</td>
</tr>
<tr>
<td>1981</td>
<td>81,687</td>
<td>36,417</td>
<td>32,675</td>
<td>22,858</td>
<td>49,012</td>
<td>13,559</td>
</tr>
</tbody>
</table>

* Estimated.

Source: Adapted from Comité de Desarrollo de Alto Amazonas (Table 1, 2). 1980.

2 The eleven districts of Alto Amazonas are: Yurimaguas, Teniente Coronel Cesar Lopez, Santa Cruz, Lagunas, Balsapuerto, Pastaza, Manseriche, Morona, Cahuapanas, Barranca and Jeberos.
Map 1. Political map of the Province of Alto Amazonas.

Source: Adapted from Ministerio de Agricultura, Región Agraria XXII, Oficina Agraria de la Provincia.

Scale 1 cm: 1’875,000
In 1980, the Ministry of Agriculture registered almost 3,000 producers living in 66 hamlets distributed throughout the Yurimaguas sub-zone (see Annex 1). These were grouped into five sectors with the following distribution of farmers (see Table 2 and Map 2).

<table>
<thead>
<tr>
<th>Sector</th>
<th>No. of Hamlets</th>
<th>No. of Producers</th>
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<tbody>
<tr>
<td>Huallaga</td>
<td>26</td>
<td>1,020</td>
</tr>
<tr>
<td>Shucushayacu</td>
<td>9</td>
<td>463</td>
</tr>
<tr>
<td>Shanusi</td>
<td>9</td>
<td>252</td>
</tr>
<tr>
<td>Paranapura</td>
<td>13</td>
<td>588</td>
</tr>
<tr>
<td>Carretera</td>
<td>9</td>
<td>433</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>2,766</td>
</tr>
</tbody>
</table>

Source: Ministerio de Agricultura y Nutrición (Registry of Producers), Yurimaguas, 1972.

The rural population of Alto Amazonas lives predominantly in politically autonomous hamlets. An elected lieutenant governor oversees the normal functioning of each settlement and executes decisions taken in public assembly. In addition, a municipal agent appointed by Yurimaguas political authorities represents the community in all outside matters. Each hamlet has a school for basic education of farm children. In some cases, the school is utilized for assemblies to discuss community problems.

Settlements are organized according to two patterns: nuclear and dispersed. In the nuclear pattern, farm houses as permanent residences are grouped around one another, close to a river or other important communication routes. Farmers also have other houses, tambos, that are more rustic and located close to fields. Families often overnight in the tambos especially while clearing fields or harvesting rice. The tambo is also used as storage place for newly harvested rice.

3 The hamlets which make up each sector have been defined according to their location along the main communication routes which cover the sub-zone.

4 In 1984, Ministry of Agriculture conducted the national survey of rural homes. This research, however, was not available at the time of this publication.
Map 2. Yurimaguas Agricultural Zone

Communities

1. Callao  
2. Munichis  
3. Varadero  
4. Oculiza  
5. Loma Linda  
6. Varadero  
7. Carmen Playa  
8. Cunchiyacu
9. Chirepa  
10. Libertad  
11. Zapote  
12. Mandongo  
13. Dos de Mayo  
14. Oramina  
15. Providencia  
16. Cerro Azul


Scale 1: 750,000
Photo 1. The Yurimaguas-Tarapoto road. Note agricultural activity near the road and gradual conversion to pasture land for cattle grazing operations. Photograph by R. Rhoades.
In the dispersed settlement pattern, farm families live permanently in isolated houses built close to their fields. Houses and shelters are constructed with local materials. Even farmers with relatively high incomes use palm leaves for roofs, cane or split lumber for walls and a palm trunk called pona for the floor. If the settlement is located in flood-prone areas, houses are constructed on poles with the floor one meter above ground.

C. Transportation Arteries

Hamlets (caserios) distributed throughout the Yurimaguas region are always located close to rivers, riverlets, or roads. Easy access to routes of communication is important for settlers as their livelihoods depend in part on selling a portion of their agricultural production in the urban center. The income is used to hire labor or buy manufactured products.

The main navigable rivers are the Huallaga, Shanusi, and Paranapura (see Photograph 1). The two latter, smaller rivers connect hamlets located on their banks direct with the city of Yurimaguas, and are used by farmers and small merchants (regatones). Merchants carry merchandise from the urban center to the furthest settlements to exchange for produce of outlying zones. The Huallaga is also a highly important route for commerce with other cities in the jungle. Merchants carry rice and livestock all the way to Pucallpa and Iquitos in larger vessels and return with manufactured products.

River boats is the most common means of transport for farmers. Agricultural surplus (rice, cassava, banana, maize) are carried on a regular basis to Yurimaguas to sell. Commonly, row boats or small motor boats loaded with bunches of banana and baskets with cassava pass along the river as do barges with specially constructed roofs to protect passengers from the sun.

Other minor communication routes are small side streams (riachuelos) and paths (trochas) opened by machete through the jungle which farmers use almost daily to get from their homestead to the fields.

The road connecting Yurimaguas with Tarapoto, the only terrestrial outlet for the district, is another important communication route. This dirt jungle road allows travel by large trucks which come from the coastal cities with merchandise. Cooler climate crops such as potato, lettuce and carrots must be brought to Yurimaguas from the coastal cities or highland markets. As throughout much of the Amazon basin, an important rural migration and settlement with associated agricultural activity occurs along newly opened roads.
Photos 2 and 3. Above, a street and barrio of the town of Yurimaguas. Below, a rural village (caserío) near the Shanusi river. Photographs by R. Rhoades.
Photo 5. The rivers are the main transportation routes connecting rural hamlets with each other and the town of Yurimaguas. Photograph by R. Rhoades.
III. ECOLOGY AND LAND USE

A. Agroecological Conditions

The Yurimaguas agrarian district (5° 40' S - 76° W) is bisected by the Huallaga river, an affluent of the Marañón, which penetrates the southern province of Alto Amazonas. The Huallaga river receives waters of the Paranapura and Shanusi on the left, those of Chipurana on the right. These rivers tend to wander due to the gentle incline of the Amazon basin causing the formation of numerous meanders and permanently flooded areas termed aguajales by the local population. The altitude of Yurimaguas is 184 m.a.s.l.

1. Agricultural Calendar: Influence of Physical Factors

Although rainfall and climate greatly influence the agricultural calendar in Yurimaguas, the ability to grow produce nearly year round gives farmers a wide margin to plant according to their needs and available resources. During June to September, farmers take advantage of diminishing rainfall to prepare fields. The medium annual temperature oscillates between 22.5 and 24°C (FAO 1970; ONERN 1967, 1976), reaching the highest temperatures during the rainy season. Although medium monthly temperature variations are low, the lowest medium temperatures occur during the months of July and September, precisely those months during which farmers prepare and plant their fields.

Precipitation around Yurimaguas is intense reaching annually a medium of 2,200 mm. This rainfall distribution is highly uneven. Generally, rains are concentrated around specific periods causing a surplus of moisture at some times while at others, water shortage is a major agricultural constraint. During the planting season the rains diminish.

Cultural factors with possible physical origins also influence the agricultural calendar of Yurimaguas. One is the belief in the phases of the moon; for example, farmers believe that one must never plant until after the "fifth" (five days after the new moon), if one wants to avoid the risk of having the plants grow tall without producing.

2. Terrain and Soil Conditions

Contrary to popular belief, the topography of the Amazon region is mainly undulated. Flat regions or gentle slopes are found only along the banks of the great and winding rivers which cross the region. Recent studies have also shown that soils of the humid tropics are as diverse as temperate climate soils (Sanchez and Berol 1975, Moran 1982). The natural acidity of the soil together with its rapid depletion has caused agriculture to maintain a migratory character oriented principally toward subsistence. With rare exceptions, a field is not used for more than two or three years consecutively since production would diminish significantly causing the farmer to seek a new field in a different location.
1. The first year the farmers plant the bananas, but in the second year the new plants grow next to the mother plants.
2. There are two periods of sowing in Yurimaguas: winter (rainy season) and summer (dry season).

1. Clearing: 
2. Planting: 
3. Weeding: 
4. Harvest: 
5. Vegetative cycle: 
Although slightly acid and alkaline, soils closest to the rivers are those with the greater agricultural potential due to their recent alluvial origin. However, alluvial soils comprise only 20 to 25 percent of the area under study. The rest are clay soils consisting of the minerals kaolinite, iron, and aluminium oxides which strongly limit the natural fertility (Nye and Greenland 1960). A second type of older alluvial soil is located along the middle terraces close to the rivers. Like alluvial soils of more recent origin, these soils are on level terrain and have developed on top of older alluvial sediments. Although acid with poor permeability, they are rich in organic matter. Soils of the residual type which represent 70 percent of the area under study are found on sloping terrain. These are soils with acid reaction and low fertility.

The high percentage of soils with low fertility and the characteristics of the tropical climate call into question the common opinion about the natural potential of the Amazon region for agricultural production under existing technology (however, see Meggers 1971). Continuous but uneven rains and the thin cap of organic matter which covers the soils constrain the development of an intensive agricultural system. Scientists at the Yurimaguas San Ramon experiment station have been seeking technologies and management practices to overcome these constraints (Bandy 1977, Nicholaides et al 1983).

Nutrients in the tropical rain forest are stored in the biomass and in the top layer of the soil (Sanchez 1973). Plants extract only 20 percent of required nutrients from the subsoils while the rest is obtained from the thin organic layer which has formed by the falling of the leaves and branches from trees, the washing of leaves by rain, and the decomposition of roots. The nutritional elements (N, K, P, Ca, S, Mg) which make up the top layer can be used by the plants due to shallow root systems of jungle vegetation. After deforestation of an area, the terrain loses its fertility in one or two years.

These ecological facts explain why around Yurimaguas, as in nearly all of Amazonia, the inhabitants — whether native or mestizo — practice shifting agriculture as a strategy to solve the problem of low fertility of soils and their rapid depletion. Combining a series of crops (cassava, banana, maize and beans) in one field allows utilization of soil nutrients while at the same time limiting erosion by rains.

B. Shifting Cultivation

Although virtually nonexistent in temperate zones during contemporary times, the slash and burn, shifting cultivation system of Yurimaguas is widespread in tropical countries and is still practiced by 200 million people worldwide. Ruthenberg (1976:16) defines shifting cultivation as:

agricultural systems that involve an alternation between cropping for a few years on selected and cleared plots and a lengthy period when the soil is rested. Cultivation consequently shifts within an area that is otherwise covered by natural vegetation.
Around Yurimaguas, farming is based on rudimentary technology with a large dependence on manual labor, and extensive land-use where farmers alternate periods for planting of two to three years with ten or more years of fallow. Farmers pursue dual production strategies: part of their land is dedicated to home consumption crops (cassava, banana, maize), and another part to commercial crops, primarily rice. Development of the market economy has created an increasing demand among farmers for market products (e.g. salt, cloth, ammunition, fuel) which can only be obtained with cash. Local farmers, as we will discuss in the following pages, organize production and mobilize resources in the absence of wage earning employment in such a way to fulfill consumption needs while pursuing other activities which provide needed capital.

C. Land Use

1. Intensity of Land Use

Intensity of land use is determined by numerous factors: extension and vegetation type of cultivated area, location of fields, labor availability, and technology. When human population increases in tropical forest areas and the agricultural frontier remains the same, intensification will naturally follow as a result of continuous field cropping and concomitant decreasing of the fallow period. Around Yurimaguas, however, land is not yet a scarce resource. Farmers are inclined, however, to limit their properties and use them more intensely due to difficulties in transport, labor constraints, and necessity to maintain market relations.

A field's production span in this region is generally two to three years versus ten or more of fallow. Production-fallow relationships vary depending on several factors: physical qualities of the terrain, distance of fields from the population center, size of a holding, and size of family. For example, lands located in the flood zone (bajiales) are normally planted again after five years, taking advantage of the organic sediments deposited by water following flooding. Conversely, land within the forest (alturas) is typically left to fallow no less than eight years before returning to cultivation.

Since transportation costs are highly important to the economy of domestic units, the fallow period is influenced by the distance between field and the residence. The tendency of locals to situate fields as close as possible to population centers in order to facilitate transport of harvested produce fosters higher pressure on lands close to urban centers (Rhoades and Bidegaray, 1984). Closer to Yurimaguas, for example, fields are rarely fallowed for more than six years. The predominant vegetation around the city is brush and grassland, indicating a more intensive land use than in more remote areas where forest is dominant.

Shortening of fallow periods has not yet caused a significant deterioration of the soil as to worry most farmers. Fifty farmers were asked whether they noted a difference in yield between a field planted in
secondary forest (purma) and another planted in virgin forest, over 90 percent answered that there was hardly any difference. In fact, most preferred to clear fields in secondary forest areas to save labor costs.

2. Ownership

Compared to Peru’s highland and coastal farmers, Yurimaguas farmers control a considerably larger land area (cf. Table 3).

### Table 3. Agricultural units, total and cultivated areas in Yurimaguas District

<table>
<thead>
<tr>
<th>Range (ha)</th>
<th>Farming Units</th>
<th>Total area (ha)</th>
<th>Cultivated area (ha)</th>
<th>Maximum possible fallow</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 10</td>
<td>328</td>
<td>1,846.0</td>
<td>5.6</td>
<td>1,009.5</td>
</tr>
<tr>
<td>10 - 20</td>
<td>1,012</td>
<td>12,060.5</td>
<td>11.9</td>
<td>3,734.5</td>
</tr>
<tr>
<td>20 - 50</td>
<td>948</td>
<td>24,852.5</td>
<td>26.2</td>
<td>4,263.5</td>
</tr>
<tr>
<td>50 or more</td>
<td>64</td>
<td>4,637</td>
<td>72.4</td>
<td>511.5</td>
</tr>
<tr>
<td>Total</td>
<td>2,352</td>
<td>43,396.0</td>
<td>18.5</td>
<td>9,519.0</td>
</tr>
</tbody>
</table>


Percentage of cultivated area is much less than total area held by farmers due to fallow and uncleared land. As a farmer’s holding increases in size, the percentage of cultivated area diminishes to a degree that large holders hardly cultivate ten percent of their property. Given subsistence goals, market conditions, and labor constraints, smaller farmers are also reluctant to expand production over the complete extent of their available land.

Larger farmers with over 25 hectares often prefer to invest much of their resources in more profitable enterprises like livestock and commerce. When a farmer acquires a large holding, he does so with the amplification of pastures in mind and not as an extension of cultivated fields.

Land holdings in Yurimaguas are individual and private. Only one community of natives Chayawitas (linguistic group Cahuapana) in the study area had communal land ownership, although even in their case land was mainly utilized individually. Few farmers hold title to their land. By 1980, the Ministry of Agriculture was providing certificates of ownership to untitled farmers which credits them with the Agrarian Bank as being in

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5 For a detailed study of two native populations in Yurimaguas District see Stocks (1981).
possession of a certain number of hectares. Although a certificate of ownership does not locate or delimit property boundaries it helps farmers to pressure the Office of Agrarian Reform to determine boundaries and grant titles to properties they have been working for years.

Land leasing is also practiced, generally by recently arrived migrants or poor farmers who settle temporarily and work a neighbor's land in exchange for a small amount of money, produce, or labor. Large holders also lease lands for rice production. If a farmer's land is insufficient, land is sought to rent near river shores. Rent consists of a small part of the harvest and clearing the land so the owner can later plant banana, maize, peanuts, or beans.

Farmer's strategies of allocating capital reflect the necessity of diversifying enterprises to assure survival. Capital is used to obtain and maintain labor needed for working fields. Credit from the Agrarian Bank is used to pay labor, not to modernize production technology. Little is invested in fertilizers or insecticides. Capital not spent on agricultural tasks is destined for purchase of manufactured goods (clothes, food, fuel, tools) and farm animals like chickens and pigs. Animal husbandry provides additional income when money is needed to contract workers, buy food, or take care of immediate family needs.

D. Stages in Agricultural Cycle

1. Selection of Fields

Farmers select pieces of land based on the criteria of soil quality and adequacy for the specific crop or complex of crops to be planted. To make this selection, they examine the location of the future field in relation to the river, type of fallow vegetation, and soil color and texture (see part 5 of this report for a detailed discussion of ethnoecology and zones).

2. Field Preparation

a. Slash (roso): This first stage consists of cutting by machete the brush which covers the terrain. Size and density of vegetation determine the duration of this task. Labor will be more intense if secondary forest vegetation is denser than that of virgin forest (cf. Table 4).

In the roso, the owner lines up workers at one end of his parcel and makes them advance in a straight line (juvo), cutting the vegetation with machete.

b. Felling (tumba): After cutting the lower vegetation, felling of trees begins. The axe is used, although machete may be sufficient if the forest is young (purma). Amount of labor invested depends on type of forest, as illustrated in Table 4.
Table 4. Labor requirements in different forest types (man days/ha)

<table>
<thead>
<tr>
<th></th>
<th>Secondary forest (Purma)</th>
<th>Primary forest (Monte Alto)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slashing (rozo)</td>
<td>18 (sogal)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>14 (libre)</td>
<td></td>
</tr>
<tr>
<td>Felling (tumba)</td>
<td>7-8</td>
<td>30</td>
</tr>
<tr>
<td>Burning (guema)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Planting (siembra)</td>
<td>15-19</td>
<td>15</td>
</tr>
<tr>
<td>(rice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeding (deshierbo)</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Harvesting (cosecha)</td>
<td>69</td>
<td>58</td>
</tr>
</tbody>
</table>

Source: Survey by the authors, 1980.

Photo 6. The felling of trees (tumba) in secondary forest. Photograph by R. Rhoades.
If a tree's circumference is over six meters, a platform is constructed around the tree to facilitate the job. When felling a tree the workers calculate the direction of its fall in such a way that it brings down other trees.

c. **Burning (quema):** Once cutting and clearing is accomplished, the field is left to dry. On a sunny day, the field's owner places four workers at different points around the field, and upon a signal they light the brush with torches. If the foliage is dry and the wind is favorable, burning is finished that same day, leaving the field ready for planting. Unburned tree trunks remain in the field. This is an indirect method of fertilization as the wood deteriorates and leaves organic material in the soil. Ashes, the only "fertilizer" farmers use, also lower the acidity typical of tropical soils.

3. **Planting (siembra)**

A digging stick called tacarpo is used for planting. A wooden instrument 1.5 meters in length with a point at one end, the tacarpo is employed in a distinct manner for each crop. For maize or rice, holes are made where grains are deposited while for cassava, the tacarpo (digging stick) is used as lever to raise the soil and bury the small root.

The juyo system is also used for planting. Juyo implies the lining up of workers at one end of the field and have them advance in a straight line to the other end as many times as needed by the size of the field.

Two planting methods are practiced:

(1) **Chicken system (sistema del pollo):** Planting is done in pairs, one worker making the holes with the digging stick followed by another worker depositing seed.

(2) **Individual system:** One worker alone makes the holes and plants. This method is one way of solving the problem of labor scarcity, especially during the time of planting rice, and also not to lose seed. If the worker making the holes using the "chicken system" goes too fast, the one placing the seed may miss some holes or place two seeds in one hole.

4. **Weeding (deshierbo)**

Between planting and harvest, clearing weeds is the main field task. Farmers use the valeriana or valisha, a tool similar to the machete but with a wider rounded blade. Bent over or squatting, they cut the roots of weeds with the valeriana.

The time for weeding varies by crop. For rice, weeding is done during the month of planting while for cassava and banana three months after planting is more appropriate. Maize fields, however, are not cultivated since growth of maize is more rapid than most weeds. Weeding is accomplished with family labor. Only in weeding of rice where work should be
Photos 7 and 8. Above, the **lyp** system of planting where workers are lined up and advanced in a straight line across a field. Below, a woman uses the **cacamo**, a digging stick. Photographs by F. Bidegaray.
completed as soon as possible, farmers prefer to replace manual labor by applying a herbicide (hedonial).

5. **Harvest (cosecha)**

The nature of harvest activity depends on the crop. For example, rice, once ripened, must be harvested immediately since the grain rapidly falls from the panicle and thus part of production could be lost. Therefore, the owner of a field must find enough laborers to finish the harvest as quickly as possible. In secondary forest (purma), rice requires more labor due to higher yields and more planting space than in the forest where planting is hindered by large, unburned logs.

Cassava, on the other hand, can be harvested from six months to a year after planting. Cassava is harvested little by little depending on family daily needs. Cassava does not store well after harvest and thus is left in the field to guarantee the farmer a constant access to this readily available form of food energy.

**E. Agricultural Technology**

1. **Implements**

In Yurimaguas, agricultural practices serve to satisfy consumption needs using a minimum of locally adapted implements but intensive use of manual labor. The tools used to execute tasks are: machete, valeriana, and tacarpo. These tools do not, as happens with mechanization, free part of the labor force for other activities. The local tool kit allows the Yurimaguas farmer to directly use the natural fertility of the soil but not to follow practices sometimes recommended by outside change agents such as making rows or hoeing.

Farmers are generally unknowledgeable about tools such as the pick, pala (shovel, spade), or chain saw. For example, on the experimental station of San Ramon, INIPA and North Carolina State University contracted local farmers as laborers. They learned to use pick spade and hoe in the intensive cultivation experiments, but for their own fields these tools were not utilized. When asked why, all responded that sticks and stumps remaining in fields after burning did not permit their use.

2. **Fertilizer and Insecticides**

Yurimaguas farmers do not use commercial fertilizers to improve soil quality nor insecticides for control of pests and diseases. Agricultural production depends on the natural fertility of the soil and on nutrients

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6 Between 1980 and 1984, however, the chain saw became an increasingly important tool for wealthier farmers.
incorporated after burning. In 1980, no agency for the commercialization of inputs existed in Yurimaguas. During 1980, however, the Empresa Nacional de Comercialización de Insumos-ENCI (National Agency for the Commercialization of Inputs) requested INIPA to promote the use of fertilizers among farmers.

Under these conditions, and due to the characteristics of the tropical soils, an area can stay in production for two to three consecutive years after which nutrients are largely depleted. Climatic conditions (sun, rain, temperature) of the tropical forest accelerate the process of lixiviation of the soil increasing the acidity to levels intolerable to crops.

Given that little chemical control of pests and disease is available, crop association is used as an alternative form of protecting a secure production. The only chemical substance available in 1980 in the zone was hedonal, a herbicide applied to the rice fields one month after planting.
IV. LABOR

Agriculture in Yurimaguas is labor-intensive thus making labor availability one of the main constraints to expanded production. Rice producers, for example, reserve 72% of credit received from the Agrarian Bank for paying day laborers. The area cultivated is determined by the number of day laborers a farmer can contract. If they can pay 30 day laborers, a hectare of virgin forest will be cleared and planted. As a family's resources grow, the cultivated area increases. For this reason, the largest holdings belong to merchants or ranchers who have money for paying day labor.

Medium-sized and small farmers prefer not to pay salaries if possible. If cash for labor is insufficient, they choose alternate ways of payment such as labor interchange (chova-chova). Lack of resources also forces farmers to develop a cropping system to match family labor. Association and rotation of crops, and dispersion of agricultural chores over time are means which permit settlers to effectively use time and energy.

A. Influence on the Agricultural Calendar

Whether a farmer places emphasis on subsistence or commercial production depends on how his family unit combine factors of production (land, capital, and labor). Labor and capital availability determine in an important way the course of agricultural practices, considering that land is not a scarce resource, and traditional technology is "rudimentary."

Although the influence of natural factors on agricultural activity is overriding, these are not the only determinants, except during the "dry" period when fields must be prepared. Decision to plant rice during September, for example, is the logical consequence of the need to give as much time as possible to the largest income producing crop. Associations of rice with cassava and banana result from the need to insure the provision of family food without applying more time and labor, both scarce resources. If the rice field is located in the bajial zone and cannot be planted in association with cassava and banana, farmers conduct their work so they can prepare their cassava fields on dry lands.

The decision to prepare new fields depends on each household's consumption needs as well as on land and capital resources. If, for example, a landowner holds fields along the river he will plant these in beans and maize during May if time allows. Extra time results from the ability of the farmer to contract labor, which in turn depends on his access to capital.
B. Types of Labor

1. Labor Exchange

Chova-chova refers to reciprocal, labor arrangement whereby farmers call on neighbors for help with agricultural tasks in exchange for a similar service in the future. Through this system, labor can be obtained without paying salaries. The only monetary investment goes into the food purchased for workers. During periods of highest labor demand (rozo and tumba), farmers work in the neighbors’ fields to accumulate enough reciprocal labor time to have their own work accomplished.

Farmers do not formally meet to prepare a work schedule that would help avoid that various farmers’ tasks are mistakenly planned for the same day. It is up to the individual farmer to decide, calculating that his neighbors might be able to help that same day.

Chova-chova does not necessarily imply an interchange of like services. A farmer who helps in the felling and clearing process can ask to be paid back labor during planting. Likewise, the same individual may not return the service. The head of a domestic unit can send an adolescent son or his wife to replace him in any type of agricultural chore. As women participate in almost all labor in the fields, except in felling and clearing, they are fully part of the interchange system.

2. Wage Labor (Jornal)

Although small farmers prefer to work with chova-chova, they sometimes pay daily salaries (jornal). Compensation of agricultural labor with wages implies an availability of capital which normally settlers do not possess. Farmers with extra income from livestock or commerce prefer to pay daily wages which allows them to utilize more labor than in the chova-chova system. Paying a salary does not depend on their personal energy but on accumulated capital. Freed from obligations to neighbors, farmers feel they can invest their time in more profitable activities such as small enterprise, commerce or ranching.

Two types of day laborers can be distinguished: (1) agricultural workers without land who live from what they can earn as laborers, (2) "periodic" day laborers (jornaleros eventuales) who are sometimes farmers who work for wages to acquire money to pay labor or satisfy domestic needs. Yurimaguas farmers use both types of workers, although a certain predominance of one type over the other depends on the resources of each landholder. Ability to hire more labor gives farmers the potential to cultivate more land than those who cannot. Farmers who are owners of shops employ different means to acquire laborers. One farmer with six hectares to sow in rice reported he hired laborers by paying enough to pay their entrance to the village festival. Farmers may also offer consumption goods to settlers in exchange for labor. Farmers prefer labor exchange over wages in preparing fields, while during rice harvest daily wages are preferred.
The need for efficiency and speed explains the difference in the rice harvest. In paying a day's labor, farmers have some control in making workers do their best. On the other hand, farmers have three to four months available for the preparation of fields during the dry season. During this time they can obtain labor by exchange of their own services without major capital investment except for food. An additional reason for paying wage labor in rice harvesting is that different age and sex groups have different work capacities. Able-bodied adolescents and adults both participate in preparing the field. During harvest, however, women, children, and old people also help. In the later case, the employer prefers to pay for the actual amount of rice picked (al destajo) since the output is not the same for all workers. A child's labor, for example, does not generally yield as much as an adult.

A "labor day" (peonada) designates the day a farmer, with the help of neighbors, carries out a task on his holding. The neighbors who help in the day's task are called peones, as they participate in a day's work, the peonada.

A worker's goal is to either pay back service or to gain a day of labor which the owner of the field has to pay back in the future. Others wish to receive a day's wages. The average daily wage in the zone in 1981 was 400 soles (equivalent at that time to approximately one U.S. dollar) plus one or two meals. Sometimes a worker will want the equivalent of his wages in kind, especially when his own cassava fields and bananas are out of production.

3. Description of a Day's Work

The farmer in charge (patrón) decides the date and tasks and then advises his neighbors. Farm women begin preparations for drink (masato, a mildly alcoholic drink made from cassava) and food for the fieldwork.

Early in the morning on a predetermined day, workers appear at the farmer's house where they are invited to partake of a soup made from salted fish with cassava and cooked banana. When this meal is finished they sharpen their axes and machetes, depending on the tasks to be performed. A lady (convidadora) makes a round passing out masato in large cups. Shortly after drinking, the workers set out for the fields.

Despite an intense and exhausting rhythm of work, workers retain their spirit and pass jokes back and forth, and continue to drink masato. This drink refreshes and keeps them going until lunch. A short break is taken at midafternoon when they sharpen machetes and chat.

Another break is taken at lunch, although sometimes only one daily meal is offered at the end of the day. The ladies who have come to prepare the meal serve a soup made from meat or fish and a plate of rice with beans, cassava and boiled banana. After resting, the workers continue until four in the afternoon when the day's work is over.
Before workers return home the owner asks each how he would prefer to
be remunerated. Some workers ask the owner to come to work in their fields
at a future date. Farmers then put down in writing to whom they owe labor
and who owes them a day’s work. Others request cash or kind according to
their needs.
V. ETHNOECOLOGY

Ethnoecology has been defined as "indigenous perceptions of 'natural' divisions in the biological world and plant-animal-human relationships within each division" (Posey et al. 1984:97). An understanding of how farmers perceive their environment is fundamental in any type of development project which strives to change farmers' viewpoints or their behavior. Farmers through long-term experience have developed a folk wisdom that is often useful in guiding agricultural research. Allan (1967) has noted:

The 'shifting' cultivator has an understanding of his environment suited to his needs. He can rate the fertility of a piece of land and its suitability for one or other of his crops by the vegetation which covers it and by the physical characteristics of the soil.

A. Agroecological Zones

The most common agroecological zone and soil classification among Yurimaguas settlers involves location of land in relation to the river (Figure 2). Color and texture of the soil, or vegetation which covers it, are elements used by Yurimaguas settlers to determine the fertility of a terrain.

1. Playa

The river bank or playa is also known as barrial (Meggers 1971). These rich river Amazonian soils have in the past made possible the formation of culturally complex civilizations which at one time populated Amazonia (Lathrap 1977). The river banks are inundated six months of the year during the rainy period (November to April) and remain dry the rest of the year due to subsiding of the river thus allowing agricultural activity.

The largest playas of Yurimaguas are along the Huallaga, where year after year--rice, peanuts and cowpea (chiclayo) are planted. These soils are of alluvial origin possessing a natural fertility highly valued by farmers. Playa lands belong to the Peruvian port authorities and no individual ownership is allowed. When farmers wish to plant these areas, permission must be annually obtained from port authorities and the Ministry of Agriculture.

2. Bajial

Lands covered only several weeks with water during the rainy season are called bajial. Farmers prefer bajial for planting upland rice, maize, and beans. Sometimes banana (musa spp.) varieties tolerant to excessive moisture are planted. Rice in flood areas can be planted earlier than in
Photo 9. Aerial photograph of Huallaga river (upper right) and Paranapura river (crossing photograph). This photograph was taken August 21, 1963 when the rivers were still low. Note the white reflections along the rivers indicating the playa zone. Most agricultural activity takes place close to the rivers or along roads. Photograph: Instituto Geográfico Militar, Lima, Peru. 1969.
Photos 10 and 11. Above, the playa zone (right) of the Shanusi near the Yurimaguas San Ramon Experiment Station. Below, a farmer harvesting chiclayo (cow pea) from her playa field. Photo 10 by R. Rhoades. Photo 11 by P. Bidegaray.
higher locations where planting must wait for rain. After one year of production, fields with bajial soils are fallowed for two to three years. Fields recuperate quickly due to frequent flooding.

Although playa and bajial soils are the most desired, farmers do not rely only on these land types. Farmers also have a strategy of searching for the best soils in the restinga and altura.

3. Restinga

Elevations of land which the water does not cover during flooding are called restinga. Cassava and banana are the main crops in this zone.

4. Altura

All areas never flooded are called altura where cassava, banana, pineapple, and beans are cultivated. When a farmer has no lands in the bajial or along the shores of the river he will also plant rice, cowpea, and maize in the altura. Individuals with only higher lying land will attempt to lease playa fields.

B. Classification of Soils

Farmers use both color and texture to determine a soil's agricultural potential. Some examples are:

(1) Gredosa is a black, slightly sandy soil, with good moisture retention. Farmers judge this type of soil best for rice, corn, and banana production.

(2) Colorada contains very permeable reddish clay in which banana and rice are planted.

(3) Arenosa soils are those with low agricultural quality but adequate for the production of cassava, pineapple and sugar cane.

Grouping of certain crops or vegetation associations also indicate to farmers a certain soil quality. The varina, for example, is a small palm species no more than two meters in height. The leaves are utilized for roofing of houses. When the farmer discovers these palms concentrated in a certain area of the forest, he believes the soil is of good quality. On such terrain, rice, maize, and banana are cultivated. In another case, the cituyo, a tree of soft wood which grows on land with low fertility, may be found. These lands serve well for cassava and pineapple. Finally caña brava grows on flood soils where every two to three years, maize and poroto (bean) are planted.

Figure 2. Agro-ecological zones.

1. Playa
2. Bajial
3. Restinga
4. Altura

River water level during rainy season
River water level during dry season
C. Types of Forest Fields and Vegetation

High Forest (Monte alto) designates virgin forest with a high organic matter content (humus). Purma is secondary forest. Machuyal designates purmas of over 15 years growth. Although virgin forest (Monte alto) has higher production than secondary forest (Purma), many farmers prefer to work Purma because it requires less labor input at the stage of felling large trees (cf. Table 4).

The vegetation of the humid, tropical forest is thick and exuberant, filled with bromeliaceas and bejuco. The trees can be grouped by height into five categories. The first layer constitutes those trees with branches over 50 meters in height. The first "tier" (layer) of trees rises to about 40 to 45 meters and forms a compact mass of vegetation which hardly allows the rays of the sun to penetrate. Below this are trunks of 30 meters high and one meter in diameter. And finally, two layers with a height of below 20 meters.

The FAO (1970) has developed a classification of the vegetal formations for the region of Yurimaguas taking into account their relationship with soil topography, chemical composition, and drainage. Farmers use a similar classification of soils based on observations of existing vegetation patterns.

1. Soils in low-lying areas with poor drainage and in flood areas support palms like the ungurahui and the aguaje. Also, a plant of the ponae type and bejuco are found to a minor degree.

2. Old alluvial soils which do not suffer inundations, vegetation acquires higher growth and larger circumference. The vegetation of these zones is comprised of moena, lupuna, tangarama, bolaina, bombonaje, and varina.

3. Sufficiently drained alluvial soils of low-lying areas are affected only periodically by inundations throughout the year and where cetico, renaco, and topa or palo de balsa are predominant.

4. Residual soils contain vegetation which reaches the greatest heights. The trees of this zone are: ceoba, cedro, capirona, lagarto caspi, moena, palo de sangre, tornillo, and shiringa. These also represent the most important lumber woods of Amazonia.
Photo 13. Anthropologist Bidegaray interviewing a farmer in the altaura, or primary forest being cleared for the first time. Photograph by R. Rhoades.
VI. CROPS

The food crops of Yurimaguas District can be divided into major crops (rice, cassava, banana, and maize), secondary crops (beans, peanuts, sugar-cane, pineapple), household garden, and marginal field crops. In this section, major and secondary crops will be examined individually, followed in the next section by an analysis of mixed cropping systems. Although crops have been isolated for purposes of in-depth analysis, most with the exception of rice, are grown in crop associations. Rice is the main cash crop while cassava, banana, maize, beans, peanuts, sugarcane and pineapple serve for subsistence and minor cash income. Banana and cassava are especially notable for their importance in the export sector of the agricultural economy (cf. Table 6). Diversity of species increases tremendously in the household garden or in marginal field production for home consumption.

Precise data on area under cultivation of each crop are lacking, although Table 5 gives some indications of tendencies in 1972 for cassava, banana, and rice. More land is given to rice cultivation than cassava and banana together. No data were available on extent of cultivation of maize. Table 6 shows production figures in kilos for six major crops while Table 7 shows hectares and tons harvested for seven crops from 1980 to 1983.

Table 5. Area in cassava, banana, and rice (1972)

<table>
<thead>
<tr>
<th>No. of units</th>
<th>Total area</th>
<th>Cultivated area</th>
<th>Cassava (ha)</th>
<th>Banana (ha)</th>
<th>Rice (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>328</td>
<td>1,846</td>
<td>1,009</td>
<td>142</td>
<td>187</td>
</tr>
<tr>
<td>10 - 20</td>
<td>1,012</td>
<td>12,060</td>
<td>3,734</td>
<td>527</td>
<td>720</td>
</tr>
<tr>
<td>20 - 50</td>
<td>948</td>
<td>24,852</td>
<td>4,263</td>
<td>552</td>
<td>800</td>
</tr>
<tr>
<td>50 or more</td>
<td>64</td>
<td>4,637</td>
<td>511</td>
<td>52</td>
<td>87</td>
</tr>
<tr>
<td>Total</td>
<td>2,352</td>
<td>43,396</td>
<td>9,519</td>
<td>1,274</td>
<td>1,796</td>
</tr>
</tbody>
</table>

Table 6. Production of selected crops in Yurimaguas in kg (1979)

<table>
<thead>
<tr>
<th>Crops</th>
<th>Total</th>
<th>%</th>
<th>Local consumption</th>
<th>%</th>
<th>Export</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rice</td>
<td>12,204,890</td>
<td>18.28</td>
<td>3,875,758</td>
<td>20.25</td>
<td>5,414,862</td>
<td>12.02</td>
</tr>
<tr>
<td>(unhusked)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Maize</td>
<td>1,218,000</td>
<td>1.82</td>
<td>360,000</td>
<td>1.88</td>
<td>858,000</td>
<td>1.90</td>
</tr>
<tr>
<td>3. Banana</td>
<td>28,000,000</td>
<td>41.93</td>
<td>7,247,000</td>
<td>37.87</td>
<td>20,753,000</td>
<td>46.06</td>
</tr>
<tr>
<td>4. Cassava</td>
<td>23,400,000</td>
<td>35.04</td>
<td>7,022,000</td>
<td>36.70</td>
<td>16,378,000</td>
<td>36.35</td>
</tr>
<tr>
<td>5. Beans</td>
<td>300,000</td>
<td>0.46</td>
<td>631,000</td>
<td>3.30</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>6. Jute</td>
<td>1,650,000</td>
<td>2.47</td>
<td></td>
<td></td>
<td>1,650,000</td>
<td>3.67</td>
</tr>
<tr>
<td>Total</td>
<td>66,772,890</td>
<td>100.00</td>
<td>19,135,758</td>
<td>100.00</td>
<td>45,053,862</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: CODEAA, 1980.

Table 7. Crops harvested in Yurimaguas, 1980-83

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice (has.)</td>
<td>7,347</td>
<td>9,503</td>
<td>8,312</td>
<td>8,623</td>
</tr>
<tr>
<td>(t)</td>
<td>10,083</td>
<td>13,520</td>
<td>12,865</td>
<td>13,067</td>
</tr>
<tr>
<td>Maize (has.)</td>
<td>1,341</td>
<td>892</td>
<td>781</td>
<td>2,326</td>
</tr>
<tr>
<td>(t)</td>
<td>1,759</td>
<td>1,267</td>
<td>1,227</td>
<td>3,813</td>
</tr>
<tr>
<td>Beans (has.)</td>
<td>178</td>
<td>204</td>
<td>136</td>
<td>328</td>
</tr>
<tr>
<td>(t)</td>
<td>149</td>
<td>174</td>
<td>134</td>
<td>328</td>
</tr>
<tr>
<td>Banana (has.)</td>
<td>1,191</td>
<td>1,549</td>
<td>943</td>
<td>1,282</td>
</tr>
<tr>
<td>(t)</td>
<td>10,161</td>
<td>16,653</td>
<td>10,008</td>
<td>13,620</td>
</tr>
<tr>
<td>Cassava (has.)</td>
<td>780</td>
<td>1,446</td>
<td>862</td>
<td>1,047</td>
</tr>
<tr>
<td>(t)</td>
<td>10,287</td>
<td>15,954</td>
<td>9,535</td>
<td>11,316</td>
</tr>
<tr>
<td>Orange (has.)</td>
<td>15</td>
<td>9</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>(t)</td>
<td>88</td>
<td>37</td>
<td>45</td>
<td>107</td>
</tr>
<tr>
<td>Peanut (has.)</td>
<td>---</td>
<td>12</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>(t)</td>
<td>---</td>
<td>17</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Yurimaguas Oficina Agraria, 1984.
Harvested area for banana, cassava, orange, and peanut for 1979 estimated from area planted.

46
A. Rice: Its Importance and Role

During the past three decades, rice has become the main cash crop of Yurimaguas. It has, however, experienced strong production fluctuations brought about by credit policies, inappropriate technologies, and alternative uses of labor. Stillman Bradfield (1974), a scientist from CIAT of Colombia (Centro Internacional de Agricultura Tropical) visited Yurimaguas in 1974 and filed the following report on rice:

Rice production fluctuated between three and four thousand tons between 1960 and 1966, then increased rapidly to a peak of 12,000 tons in 1970, and then declined sharply to less than 6,000 in 1972 and 1973. Apparently, a number of factors account for this fluctuation. Some people apparently lost interest in the production of rice as a result of the sad experience with the Surinam-Apura variety which was tried one year at the experiment station and looked so good that the bank pressured a number of people into using it next year. The weather was unfavorable and as this is a light-sensitive variety, the crop failed. Nevertheless, the expansion of activity by the San Ramon people apparently overcame this obstacle and they continued to expand to 1970. At this point several things began to happen. One was the increasing competition from the oil fields for labor. A laborer can earn three times as much in oil exploration as he can working as a farm laborer. Moreover, the price in 1970 that EPSA paid for rice was 5.10 soles per kilo. This was lowered in the 1971-72 campaign to 4.10 and then raised again to 5 in 1973. In 1974 it is 6.50, but the damage has been done. People are already out of rice production and find it not worthwhile considering the higher labor requirements. Farmers were further discouraged this past year by EPSA, not only because they offered a low price, but refused to pay for as much as three and four months after receiving the rice.

By the late 1970s, however, the Peruvian Agrarian Bank initiated an aggressive credit policy destined to stimulate rice production. This, together with rice being very adaptable to the climate and the possibility of planting with the existing technology, has converted rice into the main source of income for Yurimaguas farmers.

Time and effort expended in rice cultivation is another measure of rice's importance in the domestic economy. From June to April, farmers spend most of their time with rice-related activities: soliciting credit and preparing, planting, and harvesting fields. Farmers must try during these months to capture opportunity for other activities related to home consumption crops. Multicropping is a partial solution which saves time and energy. Women and children also execute crucial tasks such as cultivation, hoeing, or harvest during this period.
1. Credit

The Agrarian Bank calculations in Table 8 is based on rice crop's need for intensive use of manual labor.

<table>
<thead>
<tr>
<th>Table 8. Basic Budget for Rice Production: Agrarian Bank (1981)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area:</strong> 1 hectare</td>
</tr>
<tr>
<td><strong>Basic day labor:</strong> S/. 800*</td>
</tr>
<tr>
<td><strong>Date:</strong> 01001281</td>
</tr>
<tr>
<td><strong>Location:</strong> Altura</td>
</tr>
<tr>
<td><strong>Irrigation:</strong> Rain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Season</th>
<th>No. of workers</th>
<th>Labor costs</th>
<th>Percent of total costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( jornaleros)</td>
<td>(soles)</td>
<td></td>
</tr>
</tbody>
</table>

**A. Crop expenses**

1. **Field preparation**
   - Cutting secondary: Jun-Aug 30, 24,000, 20.7%
   - Vegetation, cleaning: 24,000
2. **Seeding and transplanting**
   - Jun-Aug: 10, 8,000, 7%
   - Aug-Sept: 15, 12,000, 10%
   - Chasing birds: Nov-Dec 8, 6,400, 5.5%
3. **Cultivation tasks**
   - Weeding, hoeing: Sept-Nov 10, 8,000, 7%
   - Fitosanitary treatment: 2, 1,600, 1.3%
4. **Harvest**
   - Harvest, cutting, rice, selection, packing: Dec-Apr 30, 24,000, 21%

**Total expense per crop**: 84,000, 72.5%

**B. Separate costs**

1. **Inputs**
   - Seeds: 30 kg/ha (123 sl./kg) 3,690, 3.1%
   - Chemicals: 8,000, 7%
2. **Transport of harvest**
   - 10,500, 9%
3. **Containers**
   - 9,000, 7.7%

**Total separate costs**: 31,190, 26.8%

**C. General costs**

1. **Incidental expenses**: 810, 0.7%

**Total general costs**: 810, 0.7%

**Summary**

- **Cost per crop**: 84,000, 72.5%
- **Special costs**: 31,000, 26.8%
- **General costs**: 810, 0.7%

**Total investment**: 116,000, 100%

**Value of harvest**

- **Production per hectare**: Kg 1,500
- **Per unit price**: Kg 117
  - Gross Value of Production: 175,000

**Total costs**: 116,000

**Profits per hectare**: 59,000

Source: Banco Agrario (Dpto. de Créditos), 1980.

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* In 1981, exchange rate was 440 soles to one U.S. dollar.

* In addition to the total amount of money received (which generally does not supersede 80% of the investment calculated here) farmers must pay 42% of interest annually.
In granting a loan, the bank does not require collateral, only the presentation of a document called "certificate of possession" that states the farmer owns a specified area of land. In exchange for the loan, the farmer is obliged to sell the bank the total of his rice production. The interest of the Agrarian Bank in augmenting production, coupled with the necessity of the farmer to produce rice for income, makes this relationship very similar to that which existed between landlord and laborer under the habilitación system that has characterized the history of the region.

Credit is necessary for the rice producer to hire required labor for each agricultural task (tarea). Part of the loan is also for transport and marketing costs. With their loans, however, farmers not only contract required labor for production but also use a certain amount to acquire market products (clothes, food, medicine, ammunition). This is possible because they use unpaid family labor and the chova-chova system of labor exchange with neighbors. Cash for Yurimaguas producers is scarce thus stimulating farmers to seek strategies to pay themselves from their credit loan. In the basic budget (Table 8) outlined by the Agrarian Bank most small farmers reserve 72% of the total loan for their own family needs (84,000 soles in 1981).

After harvest, farmers take their rice to Empresa Comercializadora del Arroz S.A.-ECASA (the state agency in charge of rice marketing. With the receipt from the agency they obtain the amount corresponding to their production, discounting loan and interest.

A few persons do not qualify for or desire loans:

(1) Non-rice producers.

(2) Those owing the bank from a previous crop; until the first loan is cancelled, no credit is extended.

(3) Some farmers have enough capital available so that they do not have to seek a loan from the Agrarian Bank. For example, an owner of a pineapple plantation was able to pay for labor from his own cash reserves. A few informants did not require loans since family labor was sufficient for agricultural tasks.

2. Agricultural Calendar of Rice

Rice production occupies the major part of the annual agricultural cycle. Other labor activities are often staggered and arranged in relation to the demands of the rice crop. Farmers follow a strategy of dividing their cultivable area into parcels in order to distribute agricultural tasks over different time periods. Thus, a farmer may clear a piece of land toward the end of July, and another toward the middle of August, thus spreading the demand for labor over a longer time period. Another apparent reason for temporal distribution of fields is to avoid risk of losing part of the production due to unforeseen variations in climate or appearance of pests.
Table 9. Rice Calendar

<table>
<thead>
<tr>
<th>Zone</th>
<th>Cutting clearing</th>
<th>Planting</th>
<th>Weeding for birds</th>
<th>Watching for birds</th>
<th>Harvest drying to the Agrarian Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playa</td>
<td>May</td>
<td>--</td>
<td>Aug</td>
<td>Sept</td>
<td>Oct Nov</td>
</tr>
<tr>
<td>Bajial</td>
<td>Jun-Jul</td>
<td>Aug-Sept</td>
<td>Oct Dec</td>
<td>Jan Feb</td>
<td>Mar Apr</td>
</tr>
<tr>
<td>Altura</td>
<td>Jun-Jul</td>
<td>Sept-Oct</td>
<td>Nov Jan Feb/Mar</td>
<td>Mar Apr</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors' survey, 1980.

a. Preparation of fields. Rice fields are prepared between June and July, when farmers have received the first part of their bank loan. Although farmers may have received a loan to plant only a certain area, they may use it to plant a larger area. Each year, farmers clear new pieces of forest for sowing rice. Only in exceptional cases are fields planted which have been harvested just a few months before.

b. Planting. Planting dates depend on field location in relation to the river. If located in a bajial, farmers prefer to plant between August and September. If in a higher zone, they plant between September and October when rains are more frequent. Farmers do not keep their own seed from one year to the other; preferring to buy new seed each season. Seed rates involve 40 kg for a hectare of purma and 30 kg for monte alto. Farmers often sow varieties mixed which causes a disparate maturation of the differing varieties and problems for the farmer in harvesting and obtaining a quality product. A common rice variety was africano desconocido although today the varieties Carolina and Cica 8 are preferred by the government and many farmers.

Cultivated area of secondary forest (purma) is always greater than monte alto because of fewer tree trunks. During planting, whether under the "chicken" or "individual" system, the farmer deposits that amount of rice seed which he can hold between the fingers of one hand in random holes made with the tacarpo.

As the river banks (playas) result from the retreat of water during the dry season, farmers plant during the month of May and harvest in September. Due to the natural richness of the alluvial soil, production in the playa zone reaches three tons per hectare.

Cultivation of rice along the river shores does not differ from other zones, except in two aspects:

(1) planting of rice along the rivers is done by broadcasting the seed (al boleo). The soil is so humid that the seed can root easily on soil surface.

(2) rice fields are not weeded.
c. **Cultivation.** Weeding is done during the planting month with the objective of keeping weeds from growing as fast as rice, and thus competing with soil nutrients and sunlight. Two weeding methods are practiced:

1. **Day labor:** the owner contracts a certain number of workers to cultivate the field with the *valeriana*. Advancing in a straight line (*juyos*) they pull out weeds by the roots.

2. **Herbicides:** using a rented backpack sprayer (*mochila*), *hedonal* (a commercial product) is applied to the entire field. One gallon of *hedonal* per hectare is used, the price of which was 5,000 soles in 1980.

Following weeding, a series of crops associated with rice is planted: cassava, maize, banana, peppers, and *caihua*.

d. **Watching for birds (**pajarillo**).** Four months after planting, the grains begin to form. During December to January, farmers jealously guard their rice field against flocks of black birds. For this purpose, they span lines between sticks across the field from which they hang tin cans and rags which, when stirred by the wind, hopefully scare the birds away (Rhoades and Bidegaray 1984b). The effectiveness of this technique is debatable although farmers insist on its use.

e. **Harvest.** During the fifth month after planting, rice begins to ripen and producers initiate harvest. Efficiency and time are very important in harvest. If too much time passes, overly ripe grain is easily dispersed and lost. The number of kilos collected during the day determine the laborers wage (4 soles per kg in 1980). Workers walk the rice field, cutting penicles with a small knife, placing bundles in a basket. The harvesters continue through the afternoon when the owner finally weighs what has been collected and pays each worker. According to the Agrarian Bank, average yield per hectare in five sectors was 1.5 tons in 1980 (Agrarian Bank, 1981).

f. **Threshing, drying, and sacking.** The rice, cut at the stem base at harvest, is then stored and dried in the *tambo*. When dry, rice is spread and stomped until the grains fall out. The threshed rice is then arranged on a platform to separate the grain from the straw sheaves (*pajillas*) and other impurities. Sometimes, a hand-operated ventilator is used. After cleaning, the rice is packed immediately in sacks provided free by the Agrarian Bank.

g. **Delivery and payment.** Transport of rice is a major problem faced by farmers. To carry rice from the field to the river, horses (rented or their own) are utilized or workers are paid to carry the sacks. Farmers must also pay boat transport to Yurimaguas as well as for unloading in the harbor, loading and unloading of the truck that brings sacks to the mill. Although farmers complain of transportation costs, no other options are available.
Three mills were found in Yurimaguas in 1980: El Progreso, Marco Antonio, and San Ramon. Inadequacy of storage facilities at these mills has caused problems for producers who often suffer long waits with loads before being received. Sometimes, the mills send a part of the stored rice to Pucallpa or Iquitos in order to facilitate reception of new, incoming production. Farmers also complain that the mills apply unduly exaggerated moisture and cleanliness controls to rice. The mills, they claim, subtract too much in moisture weight from the total volume of rice. Once the rice is delivered and weighed, the mill gives farmers a receipt which they take to the bank to liquidate their loan and receive their profit.
h. **Utilization of rice.** Rice is foremost a commercial crop. However, rice also is an indispensable part in the local daily diet, and it is important that farmers store a part of the total harvest for household daily consumption and preparation of food for day laborers. According to official statistics, over 20% of total production is locally consumed (cf. Table 6). Unhusked rice is prepared for home consumption by being placed in a hollow tree trunk where it is then pounded with a mallet until the grains are freed.

3. **Wet Rice Production in the Lower Selva: Tupac Amaru's New Farming System**

The most forward looking developers of agricultural areas and designers of new farming systems are often farmers themselves. This point is well illustrated by the recent expansion of "paddy" systems in the Yurimaguas area. Farmers from Cajamarca, Rioja (Province of San Martin), and Lambayeque have migrated to Yurimaguas to explore possibilities of irrigated as opposed to upland rice production. These highland farmers learned rice production as peones in Piura and Lambayeque. Later they migrated to the cesta de selva (high jungle) where they continued to produce both upland and paddy rice. Diseases, pests, and lower production brought them to explore further into the Amazon. Since 1981, when the first group visited the Yurimaguas zone, some 120 migrant families have settled in the area. By 1984, they already had sown 280 hectares in wet rice and purchased 2 tractors. They plan to expand up to 600 hectares by 1985 and believe 5,000 hectares can ultimately be put into wet rice. They came initially without government assistance although now credit is received from the Agrarian Bank and technical assistance from the Programa Nacional de Arroz Bajo Riego (National Program for Irrigated Rice). In 1982, INIPA contracted CIAT (Centro Internacional de Agricultura Tropical) to conduct a diagnosis of rice needs in the lowland, humid tropics (CIAT 1985). However, Tupac Amaru farmers had earlier on their own initiative already expanded production to the rice frontiers of the lower jungle.

Formerly known as Caserio Cunchiyacu, Tupac Amaru is the first new settlement around Yurimaguas based on irrigated rice. Luis Perez Mera, a native of Cajamarca, now President of Tupac Amaru, visited Yurimaguas in 1980. He judged it was suitable for rice and bought 30 hectares from a Señor Renjifo. Perez returned to Cajamarca in 1981 and brought back his family and peones. His family members and their peones subsequently acquired land. Luis Perez Mera convinced the bank in Yurimaguas to loan money for wet rice cultivation as well as to locate and acquire heavy machinery to open the jungle, level fields, make paddies, and construct canals. By 1984, Luis Perez had put 12 of his 30 hectares under wet rice.

According to an article in the Newspaper Hoy written by the Diputado of Loreto, O. Pardo, there are possibly 50,000 has in Alto Amazonas suitable for wet rice production (Pardo, 1984). In addition to Tupac Amaru, two other communities -Sanago and Tumiplaya- are engaged in irrigated rice production.
Photo 15. Drying rice for home consumption. In the background, note the home garden arrangement of cassava and banana. Photograph by R. Rhoades.
and next the year he planned to expand further. Tupac Amaru is organized into 3 groups called "Grupo Uno," "Grupo Dos," and "Grupo Tres." Perez believes future of the selva is "wet rice." Field interviews in 1984 revealed that on ten hectares, after the cost of first cleaning with bulldozer, a farmer could under supported price conditions clear 8,000 U.S. dollars, an extraordinary income for selva producers.

The 3 groups each have 13-16 families with family units sowing from 5 to 30 hectares. No individual family sows more than 12 hectares, although two families in some cases have joined to plant 20 hectares or more.

According to the growers, their problems in rice production in 1984 were:

1. Lack of water for second sowing (segunda siembra), thus they need irrigation pumps or rain;
2. Roads for getting rice to market are inadequate;
3. The mill takes advantage of farmers by discounting too much for humidity and stacking weights in their favor.

Photo 16. Luis Perez, the founder of Tupac Amaru, an irrigated rice farming community in Yurimaguan District. Photograph by R. Rhoades.
Photo 17. Wet rice in the lower Amazon Jungle. The future potential of this new farming system for the Yurimaguas region is now being explored by farmers and scientists. Photograph by R. Rhoades.
The emergence of this new farming system, largely created by farmers themselves, should be studied in greater detail and compared to the agricultural systems of colonos, natives, and the practices proposed by the Peruvian Government (INIPA) and North Carolina State University. B

B. Cassava

Cassava’s adaptability to hot climates, in-ground storability, and simple, low cost technology required for cultivation make it an indispensable subsistence food in the region (see Box and Doorman 1982). Only a small surplus is sold in the market. When farmers were asked why they did not increase production, they answered it would not make sense. The surplus could not be used or profitably marketed.

1. Cultivation of Cassava

Cassava grows in all types of soils except those subject to flooding. Farmers prefer to select high-lying areas for cultivation since excessive moisture causes cassava roots to rot easily. Low nutrient requirements make it possible to plant cassava in sandy soil that has limited agricultural potential.

Yurimaguas settlers recognize different varieties of cassava by root or stem color and time of maturation. Although some varieties mature three months after planting and others only two years after, the maturation process takes normally between six months and one year. This means after six months farmers can harvest one single field of cassava little by little according to family needs. Cassava has no fixed agricultural calendar for planting or harvest, as both can be continuous throughout the year.

a. Field preparation and planting. Cassava is not given planting priority by farmers. During field preparation in the months of least rainfall (May to September) the farmer dedicates himself first to his rice fields, leaving little time for other activities. If he plants cassava, he does so in the rice field, so that he saves time and labor. At the same time, he assures himself of the production of an indispensable subsistence crop. The planting of cassava in rice, maize or peanut fields occurs two weeks after weeding or following harvest. Cassava is normally planted in association with banana. Farmers plant various cassava fields at different times to assure constant production since harvests will be spread over time. Furthermore, this strategy safeguards against risk such as prolonged

8 Stillman Bradfield (1974) reports that in 1972 the owners of the Hacienda San Ramon, a spread of some 30,000 hectares, had a plan to import rice technology from the International Rice Research Institute in the Philippines and from the Lambayeque project in order to put several thousand hectares into two crops of inundated rice per year. This project was never realized due to confiscation of the hacienda through Agrarian Reform.

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absence of rain or attack of insects or other diseases and pests. From newly harvested cassava stems, 15 to 20 centimeters long stems are cut. With the tacarpo, holes are opened where cassava stems are placed, leaving a part of the stem showing. No particular order is kept in planting, except to keep the stems at one and one half meters distance.

Farmers sometimes fell virgin forest to plant cassava. In the hamlet of Cunchiyacu (Tupac Amaru in 1985), for example, rice is planted in the bajal, an area too moist for cassava. Subsequently, farmers prepare cassava patches on higher terrain.

No fertilizer or insecticide inputs are used for cassava production. Cassava production also requires little labor. On some occasions, family labor is sufficient to accomplish a task, above all in cultivating the field or during harvest. On the other hand, when a new field is prepared or planted, the chova-chova system is implemented.

b. Weeding. The first weeding occurs three months after planting. Other weeding occurs simultaneously as continuous harvesting of individual plants take place. One objective in weeding before harvest is to facilitate later extraction of roots, and to prepare the field for replanting. Only when weeds compete severely with the crop is the chova-chova system used.

c. Harvest. Cassava harvest is continuous, taking advantage of the prolonged maturation process. The half year which cassava can be stored in-ground allow farmers to extract the crop little by little according to needs. Cassava in hot, humid climates cannot keep for more than three days out of the ground without going bad (kauya). The field, thus, serves as a store.

During harvest, farmers clear part of the cassava field with machete to facilitate extracting the root (sepa) and, in turn, prepare the land for replanting. A single field of cassava is usually planted consecutively twice. The second planting is called cutipa. When weeding is finished, stems are cut at approximately 30 centimeters from the ground, and piled at one end of the field. The remains of the stem are then pulled out. Farmers carefully watch that the soil is loosened so that the root comes out in one piece. With the machete, the root is separated from the stem, cleaned and placed in a basket for transport to the farmers' house or store.

2. Uses of Cassava

a. Commercial. Cassava, through limited sales to neighbors or in the market, gives farmers a minor source of extra income. Although the present demand is small and earlier attempts at starch production failed, possibly within the next few years mills will be established which need to buy large volumes of cassava for extraction of starch (almidón).

b. Consumption. For domestic use, cassava is mainly consumed in the form of masato, a mild alcoholic drink prepared from freshly fermented cassava. Masato is offered to workers and to visitors as a sign of hospitality. Preparation of masato is the task of women. First, cassava is

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Photo 18. Yurimaguas woman processing cassava to prepare *masato*, a mild alcoholic drink widely consumed in the region. Photograph by R. Rhoades.
boiled and allowed to cool in a wooden container. One woman continues beating the mass until it is smooth while other women chew to ensalivate it. Some families prefer to use sugar to effect fermentation thus avoiding the chewing (bocado). When reduced to a watery consistency, the mass is placed into clay jars to ferment. After three or four days, it is mixed with water (chapear) and offered in cups to visitors. The masato is indispensable for work. In addition to its thirst-killing qualities, masato tides laborers over until food is served.

Boiled cassava is consumed in minor quantities as part of daily nutrition. It is also utilized whole or cut into pieces for animal feed, especially for pigs and chickens. The greater the number of animals a farmer has, the greater the extension he plants to cassava.

C. Banana

The banana (Musa spp.) is an indispensable food in the daily diets of the region. As with cassava, banana plantings are small, rarely more than one hectare due to transport difficulties and reduced market demand. That portion of the harvest which cannot be immediately consumed is sold to neighbors or taken to town markets.

1. Varieties of Banana

Farmers distinguish two varieties of banana. The guineo is consumed when mature, considered a fruit, and is planted close to the house. The plantain, locally called inguirí or allpa platano (Musa paradisiaca), is planted in larger fields and eaten boiled (sancochado) at virtually every meal, having a staple function similar to bread in western meals. This variety is appreciated for its eating quality in a green state due to a high starch content. Inguiri is known to be resistant to diseases called mal de panamá and sigatoka but susceptible to moko, nematodes, and gorgojo negro (Cosmopolites sordidus). Mal de panamá is caused by the fungus Fusarium oxysporum while sigatoka or mancha de la hoja is caused by the fungus Cercospora musae.

2. Planting Strategies

Importance of plantains as a daily subsistence food obliges farmers to employ mechanisms which allow them to confront risk of harvest failure. As with other crops, spreading production over different fields planted at different times is one means. Farmers have not one, but two or three banana plantations, dispersed over their entire extensions in order to reduce possibility of total harvest loss due to pests or lack of rain. These fields are not planted at the same time, assuring a staggered harvest and thus a constant production throughout the year. Furthermore, farmers must take care not to produce more than the family needs since surplus cannot be stored or profitably marketed.
Farmer's prefer gredoso or dark soils for banana due to their capacity to retain moisture and richness of soil nutrients. Farmers feel if they take good care of these fields, production can be maintained over several consecutive years. On the other hand, if planting is in sandy soils, production is only good during the first year. After that, production diminishes considerably, even to the point of abandoning the field. Very seldom is a field subjected to clearing (tumba) to plant banana.

If banana is to be associated with rice, the farmer must go through his banana plantings and with the machete cut shoots of mature banana. When they have collected enough mashques (local term designating the young shoot of the banana) he plants them in holes made days before with the machete or cavador. The planting is done by family members without outside help. The banana mashque is planted at a distance of three meters between plants.

3. Cultivation and Weeding

The first cultivation takes place three months after planting. If planted in association with rice, cultivation is postponed until after rice is harvested. Every three months, the farmer cuts the weeds without pulling out roots to avoid hurting the new banana trees (huactapear). On gredosa or dark soil, this activity is practiced frequently to keep the field in production for several consecutive years.

4. Harvest

Nine months after planting, most banana varieties begin to form clusters (racimo). Three months later development is complete. An entire banana field is not harvested at the same time but in accordance to family needs of consumption and sale. As the clusters can also be cut green, farmers can readily stagger harvests for various objectives. To harvest bananas, the machete is used. Farmers first cut the cluster, then the trunk so that one of the shoots can develop into a new tree and produce the following year. Normally, a banana cluster produces two consecutive years. Depending on soil quality and care, a cluster can go on producing for several more years.

5. Agricultural Calendar

The agricultural production calendar of banana can only be understood in relation to associated crops. Banana is a product generally planted in association with rice, maize or cassava. The rice economy demands the most time and energy of small farmers, thus pushing production for home consumption into a secondary position. For example, if rice is planted in September, the mashque of the banana can be planted a month and a half later, or shortly after rice harvest when labor demands are less.
D. Maize

1. Preparation of the Field and Planting

Farmers customarily plant maize on lands located close to the river (bajial) with secondary forest of five to six years age. As these soils are alluvial and rich in nutrients, they are preferred over fields located at higher elevations.

Once a field is prepared and ready for planting, the farmer employs workers who are paid with salary and food. Either individually or in the "chicken" system, they make holes spaced a distance of not over half a meter. In each hole, three to four seeds are placed. The principal variety grown today is Cubano amarillo.

Although maize is preferably planted as the first crop in a new field, the farmer does not pass up the chance to utilize small areas in already planted terrain (rice or peanut fields). In such cases, planting distance will be larger (raleado).

Normally, crops such as cassava, beans or banana are associated with maize. If cassava or banana are selected as associated crops, the farmer allows one month to pass after planting maize before planting the associated crops or even waits until after maize harvest. Beans as an associated crop, however, can be planted one week later or they wait up to three months when maize begins to turn yellow.

2. Weeding

As the vegetative cycle of maize is only four months, its growth is not hindered by the development of weeds, rendering weeding unnecessary.

3. Harvest

During the fourth month after planting, harvest begins when the plant has turned yellow and the grain is dry. Only when the family wishes to eat choclo (tender ears) it is harvested some weeks earlier. Harvest activity itself depends on whether maize is planted in association with banana or beans. If associated with banana, the farmer cuts maize with the machete and separates the cob at the same time. Thus, while harvesting one crop, he is freeing the field to allow the associated crop to grow better. If the maize stalk is used for supporting climbing beans, only the ears are harvested.

4. Uses of Maize

Farmers plant maize as feed for animals, mainly chickens and pigs. The hardness of the grains of local varieties is not favorable for human consumption. A few farmers produce maize for the market. With financial
aid of the Agrarian Bank and the assurance of sale of their production they plant small areas of a variety with hard grain (maiz duro) which is purchased by the National Bureau of Commercialization of Farm Inputs (Empresa Nacional de Comercialización de Insumos - ENCI) for manufacturing balanced feeds (alimentos balanceados).

5. Agricultural Calendar

Maize can be planted throughout the year due to its growth characteristics and the favorable agro-climatic characteristics of the zone. However, the farmers distinguish between two periods: "winter" (rainy season) and "summer" (dry season). In winter, the fields of the high areas are prepared and planted in December and January. Harvest is in April and May. In summer, fields located along river shores are prepared taking advantage of the water retreat. Planting occurs in June or July and harvest in October and November. Production is higher in playa fields due to alluvial soils, and better for planting maize destined for market.

E. Other Produce/Secondary Crops

1. Beans

Two varieties of the bean family (Vigna spp.) are cultivated in Yurimaguas: poroto (cajanus cajan) and chiclayo (Vigna sivena). Both are planted during May and June, and harvested three or four months later. Beans are typically planted under the following distinct circumstances:

(1) association with maize (along the rivers and high-lying terrain)

(2) fields where maize has just been harvested

(3) caña brava (monocrop of poroto) or playa (monocrop of chiclayo, especially on Huallaga)

(4) association with cassava and banana (high-lying areas).

Although farmers prefer to plant beans (poroto and chiclayo) in bajial areas, farmers frequently adjust to available resources. If they do not hold any land along the river they use high-lying areas. As with cassava or banana, surplus bean production is sold for supplemental income in local hamlets or the town of Yurimaguas.

2. Peanuts

Peanuts, locally called mani, are mainly produced in small fields near hamlets located along the shores of the Huallaga river, in recently cleared
virgin forest, or in sectors where rice has been harvested. The vegetative cycle of peanuts is three and one half months but without a specific planting time. In a single settlement, for example, we were informed by one farmer that he planted peanuts during April and by another in November. Peanuts are usually planted in association with cassava and banana, and only monocropped on the river banks. Peanuts are harvested by pulling out the roots and leaving them to dry in the sun for two days. When dried, they are separated from the root. The entire harvest is stored at the farmstead.

3. **Sugar Cane**

Farmers always plant some sugar cane (*Saccharum officinarum*) close to the house. A small sector of farmers who own *trapiches* (sugar mills) are the only ones who plant one or two hectares of this crop in order to be able to make *chancaca* (unrefined brown sugar) and sugar cane rum. Other farmers, however, plant sugar cane to sell to the owners of mills. Sugar cane is also planted as a monocrop on high-lying terrain with sandy soil.

4. **Pineapple**

Pineapple (*Ananas comosus*) is a minor crop around Yurimaguas. It is planted amongst cassava in the second year of production, taking advantage of the low nutrient extraction of pineapple and the possibility of production on sandy soils of low agricultural aptitude.

5. **Sweet Potato**

Sweet potato (*camote*), apparently does well in Yurimaguas but few farmers grew the crop in 1980. Stocks (1981:4), however, reports that the partially assimilated Cocama and Cocamilla, native groups use considerable sweet potato along with taro, beans, and *cara* (*Dioscorea* sp.) and *cava cara* (*Solanum* sp.). Reasons for the lack of interest for this crop among colonos should be investigated before attempts are made to promote sweet potato in the Yurimaguas region. Beginning in 1986, the International Potato Center launched a program of sweet potato research on the Yurimaguas San Ramon experiment station.
VII. CROPPING SYSTEMS OF YURIMAGUAS

Along with the factors of subsistence goals and market conditions, the area a farmer puts under cultivation is related to the number of available and affordable laborers, either domestic or hired. Generally, Yurimaguas farmers do not possess capital necessary to make large investments in contracting labor. They even spend money lent by the Agrarian Bank earmarked specifically for contracting laborers or marketing costs on the purchase of goods (e.g. cloth, ammunition, salt) vital to the household economy. Scarcity of capital obliges the farmer to look for efficient ways in utilizing land and labor. One is the chova chova system, interchange of labor discussed earlier, and the other is crop association to minimize risk and increase diversity of production per unit area.

A. Crop Association and Succession

The farmer who plants several crops sequentially or at the same time in the same field during the same year saves space, time, labor, and spreads risk. This system permits farmers to respond to limitations of the tropical environments with the available technology (without irrigation, insecticides, fertilizers). Diversification of species in one field with different vegetative cycles and size has several advantages: shade for protection from the intense tropical sun, control of pests, and erosion control. In some cases, crop association generates an ecological mutual benefit between plants, as the case of maize and beans.

1. Crop Association

Crop association in Yurimaguas has the following characteristics:

- Associated crops are usually planted over several weeks and sometimes months to avoid plant competition and spread labor requirements.

- Planting is irregular, except in spacing between plants (banana 2 to 3 meters; cassava 1 meter; rice 20 to 25 cm). Crops are not planted in linear rows or furrows but scattered and mosaic.

- The principal focus in crop associations is rice. Given time and energy demanded by rice production the farmer takes advantage while cultivating rice to produce subsistence crops. Furthermore, one or two fields with associated crops are planted to assure continuous production. This is illustrated in Figure 3.

- The earliest crops planted have short vegetative cycles (e.g., rice, maize, beans, peanuts). Subsequently, those with longer vegetative cycle (e.g. banana and pineapple) are planted. Upon harvesting the rapid maturing crops, those with a longer vegetative cycle remain.
Minor crops like peppers, caihua, dale dale or cocona are planted along fields borders, beside tree stumps, or in the farm yard area (cf. Section 6).

Rice Associations. Generally only part of rice fields are mixed cropped, mainly for two reasons: (1) production would exceed family need if the entire rice field were planted to cassava and banana; and (2) associated cropping diminishes rice yield. Some farmers prefer to wait until rice harvest before planting associated crops in the same field to keep rice yields as high as possible (see Figure 4). In pure stands, rice can yield up to 5 tons per hectare while mixed cropped yields reach only 1.5 tons.

The main crop association pattern is: Rice + Maize + Banana + Aji + Caihua. In high-lying areas, maize is planted eight days after rice. Maize is metido, the term meter designates the association of one crop with another in the same field. Following weeding, cassava and banana are added. When rice is planted, women of the household place caihua and aji seeds close to stumps of fallen trees and also along field borders.

Another important association involving rice

Rice + Maize + Banana. Rice planted in the bajial area is associated only with maize and banana because cassava roots easily spoil in humid terrain.

Figure 3. Rice, maize, and banana association
Another succession is rice and peanuts. In a rice field located in the bajial, farmers prepare for peanuts where otherwise cassava and banana would be planted if possible.

**Figure 4.** Maize and climbing beans (poroto)

Maize Associations. If not planted in association with rice, maize is planted first. Preferably, the farmer selects floods areas (bajial) to plant maize. Maize is often associated with poroto and planted along river banks toward the month of June. Poroto grows using the maize stalks as support or the farmers place poles in the field as support.

**Figure 5.** Mixed cropping with banana

Maize + Cassava + Banana. Three weeks after planting maize, banana is planted in the same field. Following maize harvest, he plants cassava. These fields are nearly always one half hectare in size.
Maize is also associated with cowpea (Chiclayo), especially when planted on high terrain.
Cassava-Banana. These two crops are the most important for home consumption around Yurimaguas. A newly arrived settler first plants cassava and banana since they provide the nutritional basis for subsequent work. Although generally associated with crops of short growing cycles (maize, rice, peanuts), cassava and banana are sometimes planted separately in a recently prepared field on land located in the high zone. In this manner, farmers assure themselves a constant supply of subsistence food.

Association of cassava and banana depend on different criteria and farmers' opinions vary. Some farmers believe banana should be planted first and then cassava, because as cassava grows more rapidly, it might retard the growth of banana. Planting, however, can be done in the reverse manner. Farmers admit that growth of banana is retarded, but believe yields are not affected. Some producers even prefer to plant banana and cassava separately in the rice fields.

These divergencies only serve to indicate that although agricultural practice can be systematically assessed, farmers chose always among the different options to fit their necessities and economic and land resources.

B. Crop Rotations

Fields are cultivated for 2 or 3 years and then abandoned. A decision to fallow a field is taken either because yield no longer justifies the farmer's time or because of labor unavailability for continuous weeding. Weed growth is a major reason for abandoning fields (Papendick 1976 and Ruthenberg 1976).

Various harvests and plantings are undertaken in the same field over a time span of three years. The most common succession begins with rice planting, followed by maize and later banana and cassava. When cassava is harvested, it is replanted (cutipa) and if the land is of good quality, new shoots of banana are allowed to grow. Upon termination of this cycle, the field is left to grow up in weeds while they begin preparing a new field in a new place. Occasionally, farmers wait until the replanting of cassava to plant pineapple.

Figure 7 illustrates a cropping pattern where the objective is diversified planting involving both cash crops (rice) with subsistence crops. Rice yields will be lower than if planted in pure stands, but overall food production per unit area may be greater.

Figure 8 illustrates the strategy where farmers attempt to obtain higher yields of cash crops such as rice and then peanuts rather than a mixed cropping system involving subsistence crops earlier in the production cycle.
Figure 7. Intercropping and crop rotation in a lowland tropic farm.
Figure 8. Intercropping and crop rotation in plots next to the river (bajiales) in a lowland tropic farm.
C. Household Garden

During the 1980s, scientists and development agencies have come to recognize the importance to rural households of backyard garden production systems (Niñez 1985). Although small-scale gardening is found in all agricultural, and even some urban settings, their function and role in nutrition is still poorly understood. Around Yurimaguas, the backyard garden is an indispensable and integral strategy of the subsistence economy in terms of nutrition, convenience, and supplying condiments to the household. According to Niñez (1985), who has studied gardens on several continents, the Yurimaguas case supports a general axiom on gardening: the more difficult or costly the access to retail markets for households, the more intense and diverse the utilization of the garden strategy.

To many outsiders, the Yurimaguas garden appears extremely disordered, especially to visitors from temperate zones who understand gardens exist at all. Gardens are not fenced although fences are sometimes built to keep animals from wandering off into the jungle where they could get lost or destroy the fields of neighbors. In horticultural terms, the Yurimaguas gardens are of the tropical type described in general by Niñez (1984a:17):

"Tropical layered gardens represent well-adapted micro-environments. They are governed by a laissez-faire, extremely conservationist management philosophy which entails functional interdependence of species, spontaneous soil regeneration, erosion and leaching controls, and optimal utilization of horizontal and vertical space. Traditional tropical species are non-seasonal and propagation is typically vegetative."

"In the top tier, tropical gardens feature a canopy of tall shade trees benefitting garden, homestead, and livestock. The next "layer" consist of a lower tier of bushy growth made up of starchy root crops (cassava, fruit-yielding bushes) followed by ground-covering species (taro, sweet potato, squash)."

In addition to the area around the house, garden-type production occurs in shifting fields which are never far from dwellings but generally out of reach of domestic animals, mainly chicken and pigs. Women and children plant small amounts of maize, peanuts and other crops in or along the margins of rice and cassava fields or among the banana plantings. A favorite planting site is adjacent to tree stumps or kirumas which have been left after burning. In the new wet rice settlement of Tupac Amaru (cf. pages 53-57), marginal gardens supporting dozens of crops are found on the boundaries between rice fields where soil and debris have been piled.

1. Diversity in Yurimaguas Gardens

Yurimaguas household gardens are extremely diverse in vegetables, medical plants and trees. Niñez (1984b) in preliminary research has developed a partial list of plant species consumed or used by Yurimaguas...
Table 10. Plant species found around the homestead consumed or used by Yurimaguas households

<table>
<thead>
<tr>
<th>Local name</th>
<th>English</th>
<th>Scientific name</th>
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<tbody>
<tr>
<td>Huito</td>
<td>Leaf</td>
<td>Genipa oblongifolia, R. y Spondias dulcis</td>
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<tr>
<td>Tapetibá</td>
<td>Star apple</td>
<td>Spondias dulcis</td>
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<td>Zapote</td>
<td>Star apple</td>
<td>Pouteria caimito / Eugenia jambos / malacensan</td>
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<td>Caimito</td>
<td>Star apple</td>
<td>Grias neubertii</td>
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<td>Sachamangua</td>
<td>Star apple</td>
<td>Mangifera indica</td>
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<td>Mango (vit.*)</td>
<td>Mango</td>
<td>Mangifera indica</td>
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<td>Palta (lipids)</td>
<td>Avocado</td>
<td>Persica americana</td>
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<td>Toronja (vit.)</td>
<td>Caribbean grapefruit</td>
<td>Citrus paradisi</td>
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<td>Lukuma (starch, vit.)</td>
<td>Lucuma</td>
<td>Lucuma obovata</td>
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<td>Castaña (protein)</td>
<td>Chestnut</td>
<td>Castanea dentata</td>
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<td>Sugar apple</td>
<td>Anona aquamosa</td>
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<td>&quot;Guava&quot; (paeae) (vit.)</td>
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<td>Inga feuilii</td>
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<td>Shimbito</td>
<td>Inga alba</td>
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<td>Guanabanc</td>
<td>Soursop</td>
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<td>Mauritia flexuosa</td>
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<td>Guayaba (vit.)</td>
<td>Guava</td>
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<td>Musa sp.</td>
<td>&quot;Butter&quot; fruit</td>
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<td>piátano (starch) guineo</td>
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<td>Humari (lipids)</td>
<td>Plantains</td>
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<td>Yarina (&quot;water&quot; coco)</td>
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</tbody>
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Table 10. (cont.)

<table>
<thead>
<tr>
<th>II. Vegetables and other (18)</th>
<th>Cyclanthera</th>
<th>Cynclanthera pedata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caigua</td>
<td>Sweet pepper</td>
<td>Capsicum spp.</td>
</tr>
<tr>
<td>Aji dulce</td>
<td>Hot pepper</td>
<td>Capsicum spp.</td>
</tr>
<tr>
<td>Aji picante</td>
<td>Maize</td>
<td>Solanum totoiro</td>
</tr>
<tr>
<td>Cocona</td>
<td>Bean</td>
<td>Zea mays</td>
</tr>
<tr>
<td>Choclo</td>
<td>Cucumber</td>
<td>Vigna spp., Phaseolus spp.</td>
</tr>
<tr>
<td>Frijol</td>
<td>Muskmelon</td>
<td>Cucumis satiurs</td>
</tr>
<tr>
<td>Pepinillo</td>
<td>Squash</td>
<td>Cucumis melo</td>
</tr>
<tr>
<td>Melón</td>
<td>Tomato</td>
<td>Cucurbita sp.</td>
</tr>
<tr>
<td>Calabaza</td>
<td>Onion</td>
<td>Lycopersicon esculentum</td>
</tr>
<tr>
<td>Tomate</td>
<td></td>
<td>Allium cea</td>
</tr>
<tr>
<td>Cebolla</td>
<td></td>
<td></td>
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<tr>
<td>Culantro</td>
<td></td>
<td></td>
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<tr>
<td>Huacatay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albahaca</td>
<td>Basil</td>
<td>Tagetes minuta</td>
</tr>
<tr>
<td>Frijol de palo</td>
<td>Pigeon pea</td>
<td>Ogimum microanthum</td>
</tr>
<tr>
<td>Caña</td>
<td>Sugar cane</td>
<td>Cajanus cajan</td>
</tr>
<tr>
<td>Sinca</td>
<td>Peanut</td>
<td>Saccharum officinarum</td>
</tr>
<tr>
<td>Maní</td>
<td></td>
<td>Arachis hypogea</td>
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</tbody>
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<thead>
<tr>
<th>III. Roots and Tubers (7)</th>
<th>Cassava</th>
<th>Manihot esculenta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuca</td>
<td>Yam bean</td>
<td>Dioscorea trifida</td>
</tr>
<tr>
<td>Sachapapa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dale dale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashipa</td>
<td>Yam bean</td>
<td>Pachyrhizus erosus</td>
</tr>
<tr>
<td>Pituca</td>
<td>Taro</td>
<td>Colocasia esculenta</td>
</tr>
<tr>
<td>Camu-camu</td>
<td>Sweet potato</td>
<td>Ipomoea batatas</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IV. Medicinal/Stimulants/Non-food plants (14)</th>
<th>Coca bush</th>
<th>Erythroxylon coca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ojé</td>
<td>Coffee</td>
<td>Coffea arabica</td>
</tr>
<tr>
<td>Toc</td>
<td>Cotton</td>
<td>Gossypium spp.</td>
</tr>
<tr>
<td>Coca</td>
<td>Barbados nut</td>
<td>Jatropha curas</td>
</tr>
<tr>
<td>Cafeto</td>
<td>Anatto</td>
<td>Bixa orellana</td>
</tr>
<tr>
<td>Algodón</td>
<td>Ginger</td>
<td>Zingiber officinale</td>
</tr>
<tr>
<td>Piñon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achote (coloring food)</td>
<td></td>
<td></td>
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<tr>
<td>Kión</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Huingo (bowls and construction)</td>
<td></td>
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<tr>
<td>Aire sacha</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malva</td>
<td></td>
<td></td>
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<tr>
<td>Kichua</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piri-piri</td>
<td></td>
<td></td>
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<tr>
<td>Rucñupichana</td>
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</tbody>
</table>


* Whenever possible the special nutritional contribution of the plant is noted in brackets.
2. **Fruit Trees and Bushes**

Table 10 illustrates the extensive use of food from trees, a fact which should be of interest to agro-forestry specialists. Each domestic unit has close to the house numerous food trees planted for their own consumption and market sale. Few farmers have regular fields with one variety of food tree. We only found two cases in Yurimaguas, both owners of umarales, the fruit (umari) of which is highly valued in the urban market. One farmer has lived for several years from the sale of this product.

The main food trees found around the farmsteads are: e.g. orange, guaba, bread fruit, tangerine, lemon, chirimoya, caimito, cashew, coco, anona, macambo, umari, uvilla, marañon, pijuayo, aguaje, taperiba, mango, guayaba, mandarino, zapote, cidra, cacao, pomarosa, palta (see also Table 10).

**Barbasco** (*Seriania perulacea*) is a bush planted by some farmers with the objective of selling the root to the settler of the zone who use them to fish in the rivulets and ponds (cochas) of the jungle. The root excretes a chemical substance (*rotenona*) which drugs the fish if put in the water and makes them float on the surface thus facilitating fishing. The cultivation of barbasco was widespread in the region during the 1930s and 1940s. The demand on the international market of a substance of barbasco that can be extracted to make creoline caused the farmers to plant large extensions. When this substance was replaced by synthetic products, the demand diminished and the farmers’ interest disappeared. Today, little barbasco is planted and even then only on small lots close to the house.

3. **Garden Vegetables, Roots and Tubers, and Medicinal Plants**

Favorites in the gardens are tomato, squash, melon, cucumber, and onions. In addition, maize, beans, peas, and peppers are planted. Caihua and tomato are preferably planted in the rice fields along the outer limits, or close to tree stumps, after the weeding. The dale dale, on the other hand, is nearly always found planted in the cassava and banana fields. Sweet *aji* and *papa china* are planted close to the house. Cassava and taro are virtually always found around the household. Also, many medicinal plants are planted in the farmyards (see Table 10 derived from Niñez 1984b). A number of the medicinal plants were unknown to us and could not be identified by a scientific name.
VIII. CASE STUDIES

In this chapter, some examples are presented which illustrate diverse strategies of specific farmers of different localities in their attempt to produce for both the market and household subsistence. The case studies stem from two settlements, Shucushyacu and Munichis, located on the main rivers of Huallaga and Paranapura. Cunchiyacu, located on the third river—the Shanusi—has already been described earlier in this report in Section VI.A.3.

A. Shucushyacu Settlement

Located up-river six hours from the town of Yurimaguas, Shucushyacu is the capital and largest town (158 registered producers in 1980) of the district Teniente Coronel César López. The wooden houses with roofs of palm leaves (yarin) are located along the right shore of the Huallaga. Even though the main activity is crop production, households also raise chickens and pigs for the daily diet. Their fields are concentrated on the opposite bank of the river, taking advantage of the fact that this is bajial land. For this reason, one can frequently see farmers cross the river in canoes every morning going toward their holdings, an activity they call chimbando.

We stayed several days in this settlement interviewing 14 farmers, eleven of whom came from the more densely populated areas of the Department of San Martin during the drought of the 1940s. Of these, three cases have been selected to briefly illustrate individual responses to the agricultural system of Yurimaguas: (a) Eduardo Rodríguez Torres, (b) Leonardo Ramirez, (c) Juan Salazar Meza.

Map 3. Shucushyacu settlement
Photos 22 and 23. Two family portraits from rural areas of Yurimaguas. Photographs by R. Rhoades.
Eduardo Rodriguez Torres is an entrepreneur-farmer who invested capital in the purchase of livestock and merchandise which he sells in his shop. Presently, he owns "El Porvenir," a holding of 100 hectares. The only title which credits him with this property is the certificate of possession from the Agrarian Bank.

He owns an additional 18 hectares of natural pastures where he grazes 58 head of cebu cattle. He also has six boats which he occasionally rents to merchants who bring their goods to sell them to the settlers of the river banks. During February to April, he rents his boats to rice producers for the transport of the harvest to Yurimaguas.

According to Don Eduardo, the physical characteristics of his holdings are not the best for agriculture causing him to rent land from neighbors. For example, of 16 hectares of rice he planted in 1980, only 5 fall within his property, the rest he has leased on a share crop basis from other farmers who hold land along the shores of the Huallaga.

Given his large extension, he uses contract day labor which he considers more productive than choya-choya. His store (tienda) gives him an additional means to obtain labor, exchanging goods on credit for labor.

Concerning crop associations, he holds that in a rice field, bananas should be planted after the harvest, and cassava two months later. In 1980, his major objective was to increase his pasture holdings. He, therefore, plans to sow rice fields in kudzu, a legume used for cattle feed. He made this decision upon considering that his cassava and banana plantings are sufficient to feed his family and animals (pigs and chicken). Increasing the area of these crops does not make sense in his opinion due to difficulties with commercialization of the produce.

Map 4. Farmstead of Eduardo Rodriguez
Leonardo Ramirez was born in San Martin and arrived in Shucushyacu 35 years ago. Out of nine children, only two along with his wife help in the agricultural work. He is the titled owner of 10 hectares located half an hour from the settlement where he has his house. He has built a tambo on his holding where he can spend the nights when he is preparing an agricultural chore. With money from the Agrarian Bank, he plans to plant 3 hectares of rice in a bajial zone between August and September, and one hectare of rice on higher ground in the beginning of October. In both cases, the vegetation he plans to cut is that in purma vegetation.

He associates cassava, banana, as well as dale-dale, caihua, aji dulce, sacha papa and tomato with rice. Presently, he has one hectare of cassava which is divided into two lots, and one hectare and a half with banana. When associating maize and rice, he plants maize on small plots with greater than normal distances between plants. Besides this planting, around November and December (summer planting) he prepares annually one field for maize on high terrain, where he will later plant cassava.

Map 5. Farmstead of Leonardo Ramirez

- house
- path
- Pt = banana
- Ar = rice
- Yc = yuca
- Fj = beans
- fruit trees
- forest, purma

(1) former corn field
(2) former rice field (1978)
(3) former rice field, now 3rd planting of yuca
(4) former rice field (1979) upon harvesting rice, planted banana which he consumes and sells
(5) corn crop failed in January, now in banana
(6) planted beans in April, harvested in August 1980
**Juan Salazar Meza**, born in the department of San Martín, arrived only nine years ago at this settlement. The first year he worked in petroleum and planted subsistence crops: cassava, banana, corn, and beans. Later he acquired his present holding of 40 hectares, located a little less than one hour's walk from the settlement. He is one of the few persons who have come to settle in the "center," or settlement.

Aided by the Agrarian Bank, he planned in 1980 to plant three hectares of rice in the high jungle with very fertile, black soils using the chova-chova system to obtain labor. His custom is to plant (meter) banana shoots in the rice fields 20 days after the sowing of rice. Cassava is planted one month after rice is sown. In these mixed crops fields he cultivates with the valisha and does not use the herbicide hedonal. Toward November or December the field will be cleared for the planting of maize.

*Map 6. Farmstead of Juan Salazar Meza*

- **Ar** = rice
- **Yc** = yuca
- **Fj** = beans
- **Pt** = banana
- **M** = corn

(1) was rice field in 1979
(2) was rice field in 1978
now in the second planting of yuca
(3) was rice field in 1975. Planted beans (poroto) in June 1980

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B. Munichis Settlement

Located upstream from Yurimaguas town on the Paranapura River some five hours by motorboat (peque-peque) is Munichis (80 registered producers in 1980). Its inhabitants have erected their rustic houses along the right river bank.

The fields of Munichis are strewn throughout the forest in a zone which is not flooded during the rainy season. The farmers live mainly from rice, banana, cassava, maize, and beans. The settlers also own chickens and pigs which serve as extra income when money is needed. Two farmers of those interviewed illustrate the different aspects of the agricultural system of this settlement.

Following is a map showing location of their holdings:

Map 7. Munichis settlement
Alejandro Vasquez Ríos was born in Bellavista, San Martin. He came to Munichis 19 years ago and is today owner with title of the homestead "Bellavista" with an extension of 30 hectares as well as lieutenant governor of Munichis. Like most farmers, Don Alejandro has his main house in the settlement and a cambo in his fields where he spends occasional nights.

With money from the Agrarian Bank, he planted five or six hectares of rice in 1980. Two hectares will be turned over to some relatives to work on a share cropping basis (habilitación).

Although he still has monte alto on his property, he has preferred to work on secondary forest during the past 8-10 years. He believes that there is not much difference in the production yields between one or another type of forest.
Photo 24. A banana "plantation" (platanal) situated in a recently cleared field near the hamlet of Minichis. Photograph by P. Bidegaray.
As most farmers, he prepared his rice fields in sequences, so that work does not concentrate itself around one specific data and he can find the labor force necessary for each step in the agricultural production cycle. He prefers to obtain labor through the chova-chova system. He associated banana with the rice and cassava after having applied hedonal to the field.

**Santos Vasques** was born in Bellavista, San Martin, the son of the lieutenant governor. He arrived to Munichis with his father 19 years ago. Until two years ago, he worked on the holding of his father, but presently he has acquired his own homestead of 20 hectares called "Vista Alegre." Located nearly one hour walk from the settlement it is one of the most distant holdings of Munichis. Most of his property is still covered in virgin forest.

**Map 9. Farmstead of Santos Vasquez**

(1) the entire area was planted in rice during 1979.
He has built a *tambo* in his fields where he can store his annual rice harvest and spend nights whenever necessary. In 1979 he first prepared the fields around his house to plant rice associated with banana and cassava. Upon harvesting rice, he plants in a free section of the field, peanuts, maize, beans and sugar cane. This area of land he plans to convert into pasture where he wants to graze cattle he plans to acquire as soon as he accumulates the capital from the sale of rice. With the aid of the Agrarian Bank he will plant two hectares of rice this year in an area of high jungle. Like his father, he uses the *chova-chova* system.

Toward August, 1980 he was harvesting a small extension of rice which he had planted the second time on the same field with the objective to use the harvest as seed.

C. Cunchiyacu Settlement

This settlement (22 registered producers) is located a few minutes from Yurimaguas along the Shanusi river. In contrast to the settlements described before, Cunchiyacu has a dispersed settlement pattern. Farmers have erected their houses of cane and palm leaves close to their holdings so that they might have easy access to fields.

The main peculiarity of this settlement is that a good part of its lands are flooded by the river during the period of rising waters. This has caused the farmers to dedicate themselves mainly to rice which is occasionally associated with maize.

Due to the natural humidity of Cunchiyacu soils, farmers are forced to postpone the planting of cassava and banana until rice harvest since these crops normally develop on land with low moisture content. Furthermore, they prepare a third field during the months of May and June along the banks of the rivers where they plant maize and beans in association.

The *chova-chova* system of obtaining labor has the same importance as in the other settlement, indicating a low level of capitalization on the part of Cunchiyacu farmers.
IX. CONCLUSIONS

In contrast to a decade ago when little research had been done on the farming systems of the humid tropics, a rich and growing literature by both biological and social scientists is now available. As pointed out by Emilio Moran (1982a:3), specialists of many disciplines—along with developmentists and disenfranchised people—look to the Amazon Basin through different eyes: ecologists decry destruction of the tropical rain forests; agronomists design new production systems; and anthropologists warn against social consequences for local populations of unbridled development. In the end, as Moran notes, the central problems are, fundamentally, multidisciplinary.

In this report, we have gone into great detail about the cultivation practices of farmers in Yurimaguas District. At times, we are sure that our descriptions were complex and tedious, but we have learned that farming for survival in the Amazon is not a simple task and that it will not be a simple task to improve upon what farmers are presently doing. One major point that we have wished to drive home is that farm households do not merely respond to constraints but also shape the biophysical and social world around them to fit their needs. In doing so, they acquire knowledge and management skills that are of immense value to development projects aimed at improving agriculture in tropical areas. While much attention has been given to experimental research on the technical aspects of production, little has been done to understand farmers’ current practices or the rationale underlying those practices. Our report is meant to fill this research gap.

In this concluding section, we will briefly summarize our findings and point to new research directions.

A. Summary of Findings

1. General Aspects of Yurimaguas Agriculture

The predominant form of production, except along the river banks, is semi-permanent slash and burn shifting cultivation. Farmers pursue a dual strategy: part of land is given to crops for home consumption (cassava, banana, maize) while another for commercial production, mainly rice. The availability of labor determines to a great degree the agricultural system, given that land is not a scarce resource and technology is simple. Farmers use available capital mainly to hire labor to work fields. Bank credit is rarely used to modernize production or buy chemical inputs which at the time of the main survey (1980) were unavailable.

2. Land Use

Intensity of land use is dependent on several factors: physical qualities, distance from a population center or road, size of holding, size
of family and available labor. In some areas close to roads there appears to be population pressure on land, but this is not pressure against potentially available land so much as an expression of labor shortage. Given transportation and clearing difficulties, most farmers prefer to cultivate as close as possible to transportation arteries. In many areas, production is generally two or three years followed by ten or more years of fallow. The fallow period shortens closer to rivers, roads, or the city of Yurimaguas. Farmers are quick to point out difficulties of clearing virgin forest, especially in terms of labor costs.

The average land holding in the Yurimaguas subzone is 18.5 hectares, but only an average of 4 hectares are cultivated. This means that 14.5 hectares on the average are either in fallow or uncleared land. Out of 43,000 hectares in the subzone only 9,500 are under cultivation. There is an inverse correlation between landholding size and economic standing of a producer and amount of cultivated area. Larger landholders (50 hectares and more) rarely cultivate more than 10 percent of their land.

Land tenure is individual and private. Most settlers have no legal title to their land, although many have a certificate of ownership issued by the government which allows them to obtain bank credit. Land leasing is also practiced, especially by recently arrived migrants (colonos) or local land-poor farmers.

3. Agricultural Cycle

The agricultural calendar is largely influenced by climate and labor availability. Although in Yurimaguas the medium monthly temperature variations are low, the lowest medium temperatures occur during the months of July and September, precisely those months during which farmers prepare and plant their fields. It is also during this time span that the rains diminish. Periodic droughts between May and October are common.

Field activities vary according to specific crops, but the following general sequence can be identified:

- Clearing or rozo consists of cutting brush by machete. Size and density of vegetation determine duration of task. Generally, the owner lines up the workers at one end of a parcel and moves them in a straight line.

- Felling or tumba follows cutting of lower vegetation and involves the difficult process of bringing down large trees with an axe. One hectare of virgin forest takes 30 man days while one hectare of secondary growth (purme) takes 7 man days.

- Burning or guema occurs after the field vegetation has dried and the farmers are ready to plant. Trunks not burned are simply left in the field. The ashes are the only "fertilizer" farmers use.

- Planting or siembra is accomplished with a digging stick 1.5 meters long. For maize or rice, holes are made where grains are deposited while for cassava the digging stick is used as a lever to raise soil and bury the
A planting system called yuyo is used whereby workers line up and advance in a straight line as many times as necessary to plant a field. This can be coordinated, as in the "chicken method" where one person digs a hole and another drops seed, or can be the work of one individual executing both tasks.

Weeding is the only main field task between planting and harvest, except for guarding against bird predators. The weeding schedule obviously varies according to crop. In rice, for example, it is done in the same planting month while in cassava and banana it is done three months after planting. Weeding is accomplished only with family labor.

Harvesting varies also with the crop. Rice must be carefully harvested immediately upon maturity due to dispersal of grain. Owners of rice fields are pressured to find enough labor to quickly harvest rice. Conversely, cassava is harvested little by little depending on family needs.

4. Agro-ecological Zones

The study revealed rich local knowledge on the part of farmers about soils and plants in their habitat. This can be illustrated by the folk classification of agro-ecological zones. The reference point for farmers is the location of a piece of land in relation to a river.

a. Playa. The river shore is inundated six months of the year during the rainy period (November to April) and remain dry during the rest of the year when water level is low. The largest playas of Yurimaguas where the commercial rice crop is planted is along the Huallaga river.

b. Bajial. Lands covered briefly (several weeks) with water during the rainy season are called bajial. Farmers prefer bajial areas for planting rice, orn, and beans. Sometimes they plant banana varieties tolerant to excessive moisture. Rice planting in flood areas can be done earlier than in higher locations where planting must wait for rain. After one year of production, fields with bajial soils are fallowed for two to three years. The short fallow period is due to the quick recuperation of the soil nutrients because of flooding.

c. Restinga. Elevations of land which the water does not cover during flooding are called restinga. Cassava and banana are the main crops in this zone.

d. Altura. All areas never flooded are called altura. They are given to the cultivation of cassava, banana, pineapple, and beans. When a farmer has no lands in the bajial zone or along the shores of the river he will also plant rice, beans, and maize in the altura.

5. Cropping Systems

Most of the farming units in Yurimaguas are small-scale which have both subsistence and market objectives, varying in degree according to the
resource base of the farmer. Smaller producers are more subsistence oriented while larger producers are more commercial oriented. Among the means of production, capital and labor are scarce. Farmers use many strategies to overcome these constraints, including (1) crop associations and rotations of fields, (2) interchange of labor.

Mixed cropping involves intercropping and relay planting which saves space and time, requiring only one field preparation but staggered harvests. Imitating the tropical forest, the farmer strategy of diversifying species with different vegetative cycles and size in one field also has technical advantages: shade for protection against the sun, control of pests and erosion, and ecological symbiosis such as between maize and beans.

Crop association in Yurimaguas has the following characteristics:

- The associated crops are usually planted over several weeks and sometimes months to avoid plant competition.

- Planting is irregular, except in spacing between plant (banana 2 to 3 meters, cassava 1 meter, rice 20 to 25 cm). They do not plant, as in the case of western agronomy, the crops in different rows or furrows, but rather in a mosaic manner.

- A principal focus of many crop associations is rice. Given the time and energy demanded by rice production the farmer takes advantage at the same time to produce subsistence crops (cassava, banana, beans). Furthermore, fields with associated crops are planted at different times to assure continuous production.

- Another important characteristic of crop association is that the first crops planted have short vegetative cycles, e.g., rice, maize, beans, peanuts. Subsequently, those with longer vegetative cycles, e.g., banana, pineapple, are planted. Upon harvesting the rapid maturing crops, those with a longer vegetative cycle remain.

- Minor crops like peppers, cahuia, dale dale or cocona are planted along fields borders beside tree stumps, or in the farmyard area.

6. Labor

Mechanization in Yurimaguas farming is virtually non-existent. The only tools are two types of machete (machete and valeriana), and digging stick (tacarpo). Agriculture thus relies on human muscular energy, a fact which has far-reaching consequences for production patterns. Rice producers hold back 72% of credit from the agrarian bank to pay day laborers. The cultivated area, crops, dates of planting and harvest depend to a large degree on the number of day laborers a farmer can contract for any given chore.

Medium size to small producers prefer not to pay salaries. If they are short on cash, they use a labor interchange system called chova-chova. Chova-chova refers to a reciprocal arrangement whereby farmers call on their neighbors for help with some agricultural tasks in exchange for a
similar service in the future. Thus labor can be obtained without paying salaries. However, wage labor is frequently used by larger farmers who have extra sources of income or access to exchange goods, such as livestock or commerce. In nearly all cases, farmers prefer to pay wages for rice harvest work. The need for speed and efficiency at rice harvest help explain this tendency. While with field preparation activities the farmer can be more flexible. Also, workers are paid according to the amounts of rice harvested not by the hour or day.

A final point should be made about wage earning and the cash economy. Increasingly throughout the 20th century, the settlers and natives of Yurimaguas have been drawn into the cash economy through various economic "booms" in rubber, barbasco, and oil exploitation which have provided wage earning opportunities. Between 1980 and 1985, there was limited non-agricultural employment. However, when non-farm work is available, as still arises periodically with oil, able-bodied farmers quickly leave agriculture to women, children, and elderly family members to engage in wage earning. However, capital was largely obtained through the agrarian credit bank which extends credit for rice production, the area's main commercial crop. The credit is predominantly for labor cost but through the chova-chova system farmers spend little on labor and thus use the credit capital for buying manufactured goods or other day-to-day necessities.

B. Future Research Directions

The need for a better understanding of farming in the Amazon Basin is of concern not only to scientists but to policy makers as well. At present, there is much uncertainty and speculation about the destruction by shifting cultivation of the tropical forest habitat and its impact on global and local ecosystems (Singer 1986). While many writers paint a doomsday scenario few can produce firm data to back up their contentions about species loss or creation of widespread ecological disasters.

It is our position that more interdisciplinary research, involving social and biological scientists, needs to be conducted at the household or community level. The problem with existing studies is that they are either sociological and devoid of technical data or technical but devoid of any reference to human activity. Emilio Moran (1986, personal communication) has argued that the experiences and model of Farmer-Back-to-Farmer developed at the International Potato Center would be highly applicable to agricultural development in the Amazon Basin (Khoades and Booth 1982). The idea of Farmer-Back-to-Farmer is that research begins and ends with the farmer and aims to bring scientists, extensionists, and farmers into a productive, on-going dialogue. Above all, the model respects the knowledge and abilities of farmers themselves.

In the particular case of Yurimaguas, we would recommend that future interdisciplinary teams address the following needs:

a. Formal surveys. It is important that accurate statistical data be gathered from farmers. As a supplement to the present anthropological
study, a questionnaire on agricultural practices and problems should be
developed and, as much as possible, administered to a randomly selected
group of farmers. A formal questionnaire can give empirical teeth to
observations and place research on firmer ground.

b. Follow-up. The farmers interviewed in our study in 1980 should be
contacted anew (see Section VIII on case studies). The changes in their
farming strategy over the years would shed greater light on the problems
and potentialities faced by farmers. A time dimension is crucial for
planning and technology development.

c. Agro-forestry and household gardens. The present study con­
centrated on field production. Since our research began in 1980 we have
become more aware of the need to better understand the role of trees in
farming systems and their economic/nutritional significance for rural pop­
ulations. Likewise, gardens abound in the Yurimaguas region. They deserve
much greater study both from a human and technical viewpoint (Nifenez 1985).

d. Impact of agricultural policy. As our research has indicated, the
policy environment —especially related to rice— is as influential over
farmers' behavior as the physical environment. A greater understanding of
farmers' viewpoints on these policy would most likely enhance development
efforts.

e. Wet rice agriculture. During our research we witnessed the
beginning of wet rice farming, largely through the initiative of farmers
themselves. We were impressed by how farmers, who are all too often con­
sidered conservative, set about and created a totally new farming system
where it had never existed before. The Tupac Amaru experiment (cf. Section
VI. A.3) should be carefully monitored. If these pioneers are successful,
as they believe they will be, then wet rice production may offer both the
stability and productivity that so many dream about for the Amazon Basin.
Scientists must be involved with farmers in this challenge of seeking a
sustainable agriculture in the tropical forest environment.
Photo 25. Experimentation with irrigated rice on the San Ramon Experiment Station, 1984. Photograph by R. Rhoads.
References


## ANNEX 1:

### Number of Registered Producers by Hamlet

<table>
<thead>
<tr>
<th>Hamlet</th>
<th>No. of producers</th>
</tr>
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<tbody>
<tr>
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<td>Libertad</td>
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<td>Gloria</td>
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<td>Chirapa</td>
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<td>Sorrapa</td>
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<td>Mair Ujay</td>
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<td>Pucuna</td>
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<td>San Joaquin</td>
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<td>Cuipari</td>
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<tr>
<td><strong>SECTOR SHANUSI</strong></td>
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<td>Boca del Simuy</td>
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<td>Torres Poza</td>
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<td>Quinayoc</td>
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<td>Carmen Playa</td>
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<td>Km 46, Pampa Hermosa</td>
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<td><strong>SECTOR PARANAPURA</strong></td>
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<td>Puerto Libre</td>
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</table>

*Source: Ministerio de Agricultura y Nutrición, Yurimaguas, 1972. Adapted from Registry of Producers.*
ANNEX 2:

Examples of Labor Requirement for Field Preparation

The following cases from the hamlet of Majambo, located close to the city of Yurimaguas, illustrate amount and type of labor invested in a field from the moment of clearing to planting. Also, the provisions used to prepare breakfast and lunch for the workers who participated in the planting will be discussed.

Case 1: 761 m² to be cleared

Located in the bajial zone, the field had been fallowed for five years. For this reason, clearing of the secondary vegetation required a major effort.

Toward the first week of September, the owner of this field sowed rice.

Rozo: 1. peonada = 19 workers  
     2. peonada = 6 workers

Tumba: Only two days of labor were needed by the owner of the field to cut the few trees which were on the terrain.

Planting: One day with 31 workers.

Food consumed by the workers during the rice planting:

2 1/2 kg of beans  
4 kg of rice  
5 kg of fish  
1 basket of cassava

1 basket of boiled cassava  
2 chickens (2,000 soles each)  
1 bunch of banana  
1/2 kg of lard

Case 2: 2,487 m²

This terrain is located in a bajial zone with nine years of fallowing time.

Rozo: 1. peonada = 16 workers  
     2. peonada = 25 workers

This farmer hired furthermore one day laborer for seven days in order to finish the work. During the second week of September, the owner of this field sowed rice.
**Tumba:** 1. peonada = 20 workers

**Seeding:** 1. peonada = 55 workers

**Food consumed by the workers** during planting of rice:

- 7 kg rice
- 5 kg fish
- 3 kg beans
- 1 kg lard
- 3 baskets cassava (masato)
- 3 bunches of banana
- 1/2 pig of 10 kg (500 soles per kg)
- Spices