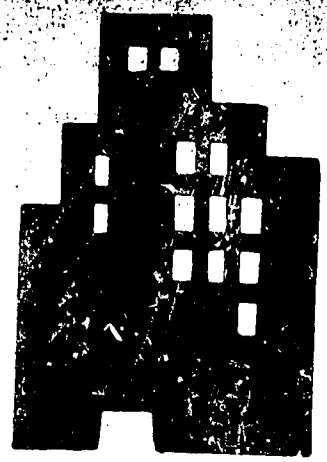

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Cropping Systems in Pespire,
Southern Honduras
University of Kentucky
INTSORMIL Project
Preliminary Report Number 1

University of Kentucky • College of Agriculture
Agricultural Experiment Station
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Cropping Systems in Pespire, Southern Honduras

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INTSORMIL Project
Preliminary Report Number 1

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CHAPTER I: THE BACKGROUND

THE PROBLEM AND ORGANIZATION OF THE REPORT

The Foreign Assistance Acts of 1973, 1975, and 1978 resulted in the New Directions Mandate which called for programs in support of countries which pursue development strategies designed to meet basic human needs and achieve self-sustained growth with equity. One aspect of this mandate was the Title XII Amendment, "Famine Prevention and Freedom from Hunger." This amendment required the U.S. Agency for International Development to make greater use of resources available in U.S. Land and Sea Grant Institutions "...to increase production and distribution of food, to increase institutional capability in research, education, and extention in developing countries in all levels of agriculture and rural development." The Board for International Food and Agricultural Development (BIFAD) was created to implement these New Directions policies.

As one means of increasing the coordinated involvement of U.S. universities in international development efforts, a number of Coordinated Research Support Programs (CRSP's) were created. These "...were conceived as a series of research efforts designed to address the major research

constraints associated with commodities and farming practices of particular importance to third-world nations" (Campbell, Nolan and Galliher 1981: 3). From the beginning, the Joint Research Committee (JRC), the policy making committee on research established under BIFAD, directed that research efforts be long-term, multidisciplinary, primarily organized around commodities, and collaborative with third-world countries.

The research reported here was undertaken under the auspices of the Coordinated Research Support Research Program that has come to be known as INTSORMIL--the International Sorghum and Millet program. The overall goal of INTSORMIL, stated in the simplest terms possible, is to increase the world-wide production of sorghum and millet. Seven United States universities--Arizona State, Florida A & M, Kansas State, Kentucky, Mississippi State, Nebraska, Purdue and Texas A & M --make up the consortium that is working cooperatively to accomplish this goal.

The University of Kentucky's contribution to the INTSORMIL project is designed to determine the existing system of production, distribution and consumption of sorghum and/or millets in various parts of the world. Our purpose is to try to understand the role of sorghum and millets in farming systems and nutritional systems. In brief, this kind of research can 1) identify the principal existing constraints on increased production of these grains

thus identifying priorities and directions for agricultural research efforts; 2) identify the perceived needs of farmers regarding what aspects of new technology might be of greatest benefit to them; 3) suggest how new varieties and/or technologies might most easily and beneficially be introduced into communities and regions; and 4) suggest what sorts of implications changing production, distribution and consumption patterns might have on these communities, regions, and nations.

The research reported here was carried out in Honduras in the period June 5 through August 12, 1981. The personnel involved, all from the University of Kentucky, were Dr. Billie R. DeWalt, of the Department of Anthropology and Dr. Kathleen DeWalt of the Department of Behavioral Science (Medical School) as co-directors; Elizabeth Adelski, Susan Duda, Miriam Fordham and Karen Thompson, all graduate students in Anthropology. Elena Mendoza, a student in Social Work at the Honduran National University, was a valuable addition to the team.

This report is organized in the following manner. First, a general introduction to Honduras and to the southern region, the region of greatest production of sorghum, is provided. These two sections will provide a basic picture of the production of sorghum within the national and regional context. The heart of the report will focus on data that we collected in interviews with 52 male and 72

female household heads in three small communities in the municipio of Pespire, located in the foothills of southern Honduras. These data will focus primarily on a descriptive account of the cropping systems used there.

A fuller report will be issued when our data analysis is completed. Particularly emphasized in future reports will be analyses of the contribution of sorghum to the diet in the Pespire region.

GENERAL INTRODUCTION TO HONDURAS

Honduras lies in the middle of the five small republics that stretch along the Central American Isthmus from Mexico to Panama. The country has had a turbulent political history since Central America declared its independence from Spain in 1821. Honduras declared its independence from the United Provinces of Central America on October 26, 1838. Its history since then has been marked by strong foreign

influence and intervention, occasional skirmishes and wars with neighboring countries, and continuing military involvement in the governance of the country (see Woodward, 19xx).

The country occupies an area of approximately 43,277 square miles (the second largest of the five republics) and has a population estimated to be about 3.4 million in 1978. Although the population density (78.6 per square mile) is not as great as in other Central American countries, only about 5% of the total land area is cultivated (Durham 1979:105) because of the rugged topography of the nation. The industrial sector is the smallest in all of Central America and per capital income ($480) is the lowest in all the republics. Other social and economic indicators also show the effects and the extent of poverty in Honduras (see Table 1, following page).

Table 1

Basic Indicators for Honduras as Compared with the United States

	Honduras	U.S.A.
Population (millions) mid-1978	3.4	221.9
Area (thousands sq. km)	112	9363
GNP per capita (dollars), 1978	$480	$9590
Adult literacy rate (%), 1975	57%	99%
Life expectancy at birth (years), 1978	57	73
Average index of food production per capital (1969-71 = 100), 1976-78	84	114
Percentage of labor force in agriculture, 1978	64%	2%
Percentage of total population living in urban areas, 1980	36%	73%

Source: The World Bank, "World Development Report--1980," Oxford University Press, New York, 1980.

Despite the small proportion of cultivated land, the economy of Honduras is predominantly agricultural with 33% of the Gross Domestic Product, 75% of exports, and 68.6% of the population being accounted for by this sector (AID 1978:7). Bananas, coffee, livestock, and forest products are the major sources of export income. Because approximately 83% of the total land area has been determined to be best suited for forest or grazing, it is not surprising that forestry products and livestock are receiving priority treatment in investment plans (AID 1978: 7).

Commercial farms produce most of the items marked for export while the production of the basic food crops has been left to small farmers. These traditional farmers have received a very small percentage of credit and other forms of agricultural assistance. The production of basic grains, as we would expect, has not kept pace with the growing domestic demand. Tables 2 and 3 provide production and demand data for the four principal food crops in Honduras--corn, beans, rice, and sorghum. These tables demonstrate general tendencies that include the following:

1. The area of each "basic grain" cultivated has increased dramatically.

2. Production yields per hectare have fallen fairly steadily over time.

Table 2

PRODUCTION AND DEMAND OF CORN AND SORGHUM

CORN

Year	Area Cultivated (hectares)	Production Metric Tons	Yield Metric Tons per Hectare	Internal Demand	Production Minus Demand
1965-66	278.655	236.325	0.84	nd	nd
1966-67	279.685	334.681	1.19	nd	nd
1967-68	280.400	335.655	1.19	nd	nd
1968-69	281.115	336.631	1.19	nd	nd
1969-70	281.831	337.610	1.19	nd	nd
1970-1971	282.546	338.591	1.19	319.700	+18.891
1971-72	283.261	339.576	1.19	360.100	-20.524
1972-73	283.977	340.563	1.19	377.400	-36.837
1973-74	287.011	342.561	1.19	389.600	-47.039
1974-75	286.284	343.557	1.20	408.900	-65.343
1975-76	330.532	358.129	1.08	429.900	-71.771
1976-77	380.705	388.566	1.02	452.700	-64.134
1977-78	430.878	419.002	0.97	478.300	-59.298

SORGHUM

1965-66	60.130	44.102	0.73	nd	nd
1966-67	26.654	39.674	1.49	nd	nd
1967-68	31.276	41.267	1.32	nd	nd
1968-69	32.904	42.860	1.30	nd	nd
1969-70	34.530	44.454	1.29	nd	nd
1970-71	36.155	46.047	1.27	43.000	+3.047
1971-72	37.780	47.640	1.26	45.100	+2.540
1972-73	39.405	49.234	1.25	47.200	+2.034
1973-74	52.802	40.624	0.77	48.700	-8.076
1974-75	42.655	52.420	1.23	50.500	+1.920
1975-76	55.605	52.271	0.94	52.200	+0.071
1976-77	60.702	43.753	0.72	54.200	-10.447
1977-78	65.799	35.236	0.54	56.700	-21.464

Source: Secretaria de Recursos Naturales, "Los Granos Basicos en Su Aspecto Economico," Tegucigalpa, Honduras, January, 1980.

Table 3

PRODUCTION AND DEMAND OF BEANS AND RICE

Year	Area Cultivated (hectares)	Production Metric Tons	Yield Metric Tons per Hectare	Internal Demand	Production Minus Demand
			BEANS		
1965-66	65.550	30.037	.59	nd	nd
1966-67	69.788	53.082	.76	nd	nd
1967-68	73.387	50.486	.68	nd	nd
1968-69	72.803	47.891	.65	nd	nd
1969-70	72.219	45.295	.62	nd	nd
1970-71	71.635	42.699	.59	33.161	+9.538
1971-72	71.050	40.103	.56	34.482	+5.621
1972-73	70.466	37.508	.53	35.999	+1.509
1973-74	62.075	34.148	.55	37.522	-3.374
1974-75	62.015	33.299	.53	39.247	-5.948
1975-76	73.525	32.406	.44	40.972	-8.566
1976-77	75.111	30.968	.41	42.899	-11.931
1977-78	76.696	29.529	.38	45.130	-15.601
			RICE		
1965-66	7.798	9.209	1.18	nd	nd
1966-67	9.280	11.195	1.21	nd	nd
1967-68	9.711	11.968	1.23	nnd	nd
1968-69	10.191	12.794	1.26	nd	nd
1969-70	10.694	13.678	1.28	nd	nd
1970-71	11.222	14.622	1.30	20.800	-6.178
1971-72	11.776	15.632	1.33	22.000	-6.368
1972-73	12.358	16.711	1.35	23.200	-6.489
1973-74	13.549	19.913	1.47	24.500	-4.587
1974-75	14.218	21.288	1.50	25.900	-4.612
1975-76	20.692	34.584	1.67	27.300	+7.284
1976-77	17.998	27.519	1.53	38.9000	-11.381
1977-78	15.304	20.454	1.34	30.400	-9.946

Source: Secretaria de Recursos Naturales, "Los Granos Basicos en Su Aspecto Economico," Tegucigalpa, Honduras, January, 1980.

3. Demand for all basic grains has increased considerably over time.

4. Despite the increase in area planted, the declining yields per hectare combined with growing internal demand means that Honduras is now unable to produce enough food crops to feed its people.

The bleak picture that is indicated by the above data is one of the factors that led the United Nations to identify Honduras as a "food priority country." This designation has been assigned because of the country's low per capita income, the projected deficits in cereal grains, and widespread nutritional deficiencies (Wortman, 1976). The extent of the latter was investigated by the Institute of Nutrition of Central America and Panama which determined that 58% of the children under five years of age in Honduras suffer from identifiable malnutrition (INCAP 1969).

While the figures presented above indicate that Honduras is having a great deal of difficulty feeding its population, the picture is not without hope. For example, it has been estimated that only about one-third of the area suitable for annual crops and one-fourth of the area suitable for perennial crops is currently being utilized. To be sure, the underutilized land is largely in inaccessible locations that will require infrastructural investment in access roads to open them up. Another reason for hope is that the Government of Honduras has put very little public sector

investment into agriculture. During the period 1960-75, for example, only 4.2% of public sector investment went to agriculture. For the period 1976-83, this figure was projected to rise to 40.4% of total investment (AID 1978: 7).

As Honduras works to improve its agricultural situation, sorghum cannot help but increase in importance. As we have seen in a comparison of Tables 2 and 3, the number of hectares sown in sorghum is exceeded only by corn and beans in Honduras. Sorghum is an important food for both human consumption and as a feed for livestock. It thus has the potential to contribute to the solution of the shortage of basic food grains as well as to contribute to the increasingly important livestock industry in the country.

The most important region of the country in terms of the production of sorghum is the south (see Table 4). While sorghum is grown in other regions of Honduras, it is in the south that there is the greatest reliance on sorghum both as a food crop for subsistence purposes and as a cash crop to be sold for feeding to livestock. Thus, we will now turn to a description of the general features of southern Honduras before proceeding to a description of the farming systems that are used in that region of the country.

Table 4

PRODUCTION OF SORGHUM BY REGION IN HONDURAS

Region	Production (in quintales)*
South	588,307
Central	186,366
Northwest	1,647
North	13,531
Central East	303,403
West	81,789
TOTAL:	1,175,043

*(1 quintal = 200 pounds)

GENERAL INTRODUCTION TO SOUTHERN HONDURAS

Southern Honduras is a triangular-shaped area that is pinched on the north by El Salvador and on the south by Nicaragua. That portion of Honduras lying on the Pacific Ocean is only about seventy miles wide at its narrowest point although the south coast winds around the Gulf of Fonseca so that the country has about ninety miles of coastline on the Pacific (Blutstein et al. 1971: 30). Along this south coast lies one of the few extensive plains on the whole Pacific coast of Central America. The Gulf and the lowlands surrounding it were formed by a major tectonic fault traversing Honduras from north to south. The flat plains receive a good deal of volcanic debris from the adjoining foothills. These foothills are quite steep and eventually become the mountain ranges that form the broad base of the triangle to the northeast. These inactive volcanic mountains rarely reach altitudes of more than 1400 meters but are extremely steep and isolate numerous narrow valleys (see James 1959; Butland 1960; Boyer nd. for more extensive descriptions).

Four major rivers flow south from the mountains to empty into the Pacific in the south. The rivers are the Nacaome and the Choluteca (the largest), the Goascoran that forms the border between El Salvador and Honduras and the Rio Negro that forms part of the border with Nicaragua.

The vegetation of the south responds to the variables of elevation and climate. Immediately surrounding the Gulf of Fonseca is a band of mangrove swamp and marsh grass that comprises about 17% of the total surface area of the south. The lowlands beyond are open savanna dotted with jicaro, tituilote, ceiba, guanacaste and carreto trees. More than forty species of broad-leafed deciducus trees grow in the foothills while pine forests begin to dominate above elevations of approximately 800 meters (Butland 1960; Boyer n.d.).

The south coast is quite hot with maximum temperatures frequently reaching around 40 C (104 F) during the hottest months of March and April. Minimum temperatures lower than 16 C (60 F) rarely occur along the coast even in the coldest months of December and January. The more broken topography of the south, especially the rapid descent to the ocean, and the fact that the waters off the coast are quite deep produces a less humid climate than on the north coast of Honduras. Mean humidity levels for the city of Choluteca, for example, range from about 51% in January to 80.1% in September (Direcion General de Aeronautica Civil, Oficina de Climatologia, Choluteca Station). The hotland conditions (tierra caliente) become much more temperate (tierra templada) at an altitude of approximately 450 meters, producing considerably cooler conditions, although even here frosts do not occur.

Rainfall patterns are seasonally distinctive and quite variable. The months of May through November are referred to as "winter" (invierno) by local people. The period from December to April is the "summer" (verano) in which there is little or no rainfall. Precipitation varies considerably from year to year and from place to place. Rainfall in the south may be as little as 500 millimeters per year or as much as 2500 millimeters. Table 5, for example, shows some rainfall statistics summarized from the records of the Choluteca weather station for the period 1963-1979. While the mean number of millimeters of rainfall per year gives some idea of general patterns, the wide variability that exists can be seen from the information on the minimum number of days with rain recorded in each month and the maximum number of days with rainfall in each month. During the rainy season, it may rain almost every day in most months or there can be months, especially in May and July, when there are as few as 5-7 days of rain in a month. In addition to these widely varying amounts of rain from year to year, locations that are quite close geographically may receive widely disparate amounts of rain. This variability and distribution of rainfall is the major constraint that has created the kinds of farming systems practiced in the southern region.

It is these geographical, climatic, and vegetational characteristics that have formed the parameters within which the southerners have established their agrarian economic

Table 5

MEAN AND RANGE OF NUMBER OF DAYS WITH PRECIPITATION
FROM THE CHOLUTECA WEATHER STATION, 1963-79*

Month	Average Number Days with Rain	Minimum Number Days with Rain	Maximum Number Days with Rain	Average Number of MM Rainfall
January	1.27	0	6	1.08
February	.69	0	2	1.79
March	1.56	0	6	6.43
April	4.94	0	10	43.78
May	16.63	5	22	261.26
June	22.87	17	30	347.56
July	17.50	7	25	175.33
August	20.19	13	27	235.84
September	23.59	16	29	93.86
October	21.13	11	28	301.51
November	8.81	2	16	61.66
December	2.69	0	6	5.52

ANNUAL MM. RAINFALL: 1,792.72

*Missing data for a few months occurred. Means were computed on the basis of the existing data. The mean annual rainfall was computed based on the thirteen years for which complete information existed.

systems. It should be noted that this characterization of the south as a region is not made on the basis of some artificial economic or political boundaries (although the southern region does generally correspond to the Honduran states of Valle and Choluteca). As Boyer has written: "The existence of the Honduran south as a distinctive region can be traced through innumerable references in the literature from the colonial period to the present. It is salient as a spatial, social and economic category in the minds and actions of Hondurans throughout the country" (Boyer n.d.: 22). Government statistics frequently are broken down by region with the states of Choluteca and Valle comprising the southern region. However, it should be borne in mind that the region is not homogeneous, obvious differences existing between lowlands and highlands for example, and that some of the patterns existing in the south could easily be applied to portions of surrounding states (and to portions of the countries of El Salvador and Nicaragua as well).

In the data from the latest census in 1974, approximately 10.7% of the population of Honduras was in the southern region. Because the south makes up only 5% of the total area of Honduras, it is clear that the population density is higher in the south than in most other regions of the country. Although the birth rate in the south in 1974 was higher than that of the country as a whole, the annual growth rate of the population is slower than in the rest of Honduras. This is because there has been and continues to

be considerable outmigration from the south, particularly the highlands, to other parts of the country.

Data on the occupational structure of the population show that the south is still largely an agrarian economy. It can be seen in Table 6 that 71% of all those economically active in the south are employed in agriculture. The only urban centers are the department capitals of Choluteca and Nacaome. Apart from these two small cities, the municipios of the south are largely rural and largely agricultural.

A GENERAL INTRODUCTION TO PESPIRE AND THE FIELD RESEARCH

Pespire is one of the municipios (roughly equivalent to an American county) that comprises the departamento (state) of Choluteca. The municipio lies in the foothills just at the point where the generally flat topography of the Pacific coast turns into steeply sloped mountains and narrow valleys. Although the community of Pespire is only about 60 meters above sea level, other parts of the municipio range up to 800 meters.

Like most of the south, the terrain around Pespire is divided by numerous rivers and streams (quebradas). The town center is located on the Rio Grande which eventually becomes the Rio Nacacme before emptying into the Pacific. Just south of the town, the Rio Sacamil joins the Rio

Table 6

POPULATION TEN YEARS OF AGE AND OLDER
OCCUPIED IN VARIOUS SECTORS IN THE SOUTH*

	Choluteca	Valle	Total in the South	Percent of Southern Population
Agriculture	34,913	15,995	50,908	71.0
Mines and Quarries	146	298	444	.6
Manufacturing	3,984	2,200	6,184	8.6
Electricity, Gas and Water	56	38	94	.1
Construction	1,439	515	1,954	2.7
Commerce	2,380	1,136	3,516	4.9
Transportation and Communications	674	809	1,483	2.1
Financial and Insurance	155	24	179	.2
Social and Personal Services	3,884	1,345	5,229	7.3
Other Activities	1,304	368	1,672	2.3
TOTALS:	48,935	22,728	71,663	99.8

*Source: "Direcion General de Estadistica y Censos," Censo Nacional de Poblacion 1974, Tomo III, pp. 76-93, Tegucigalpa 1979.

Grande. In addition to these larger bodies of water, it can be seen in Map 1 that there are many smaller streams, most of which are seasonal and contain water only in the rainy season.

Pespire is located on the major paved highway that runs south from Tegucigalpa to the Pan American Highway. Though the road was in disrepair in 1981, it was being reconstructed and widened. Along with the Pan American highway, it gives Pespire and the whole southern region excellent access to the rest of Honduras and the rest of Central America.

Pespire is an attractive town; the three golden domes of its principal church shining in the midst of tall trees and tiled roofs is the first glimpse of the town that one obtains. The main street into the central plaza is paved with concrete. The community appears to be fairly prosperous with such amenities as electricity, a sewage system, a post office, telegraph office, medical clinic, numerous small stores, and a number of well-kept, modern houses. There were 1,895 people living in the town in 1974 (D.G.E.C. 1979: III: 23).

The outlying parts of the municipio are organized into nine aldeas, each of which is centered around on a principal town. Each aldea has numerous caserias (villages or hamlets) that belong to it. In comparison with the town center, these communities have few amenities of modern life

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and the people who live there are much poorer. These *aldeas* and *caserias* are difficult to reach because they are connected with the town of Pespire only by dirt roads and paths. During the rainy season travelling is particularly difficult as the existing roads become muddy and the fords through the rivers and streams become too deep to traverse. Approximately 16,366 people lived in these outlying communities in 1974 (D.G.E.C. 1979: III: 23).

According to the local people, Pespire is known throughout much of Honduras for two principal products--its mules and its mangos. Pespire mules won their reputation during the period when the only way to market the minerals produced in mines in central Honduras was to ship them from ports on the south coast. Mules carried the minerals on the arduous journey overland to the ports and Pespire mules were reputed to have great stamina. People report that buyers still come from other parts of the country to buy mules raised in Pespire.

Pespire mangos, in the estimation of local informants, are the best in Honduras. Hundreds of thousands are shipped annually to markets in Tegucigalpa and beyond. According to several informants, a semi-official census determined that there were 87,000 mango trees in the *municipio* in 1980.

Most of the people of the *municipio*, however, earn their living through agricultural pursuits. Table 7 shows that there were a total of 1,714 farming units in Pespire in

Table 7

FARM SIZES IN THE MUNICIPIO OF PESPIRE, 1974

Size of Exploitations	Number of Exploitations	Percent of Farms	Total Surface (in hectares)	Percent of Area
less than 1 ha.	382	22.3	242	1.2
1 - 5 ha.	704	41.1	1,734	8.9
5 - 10 ha.	273	15.9	1,920	9.9
10 - 20 ha.	168	9.8	2,367	12.2
20 - 50 ha.	126	7.4	3,798	19.6
50 - 100 ha.	37	2.2	2,481	12.8
100 - 500 ha.	21	1.2	4,156	21.4
500 - 1000 ha.	2	.1	1,162	6.0
over 1000 ha.	1	.05	1,523	7.9
TOTALS:	1,714	100.00	19,383	99.9

Source: "Direcion General de Estadistica y Censos," Censo Nacional Agropecuario 1974, Tomo II, pp. 116-117, Tegucigalpa, 1978.

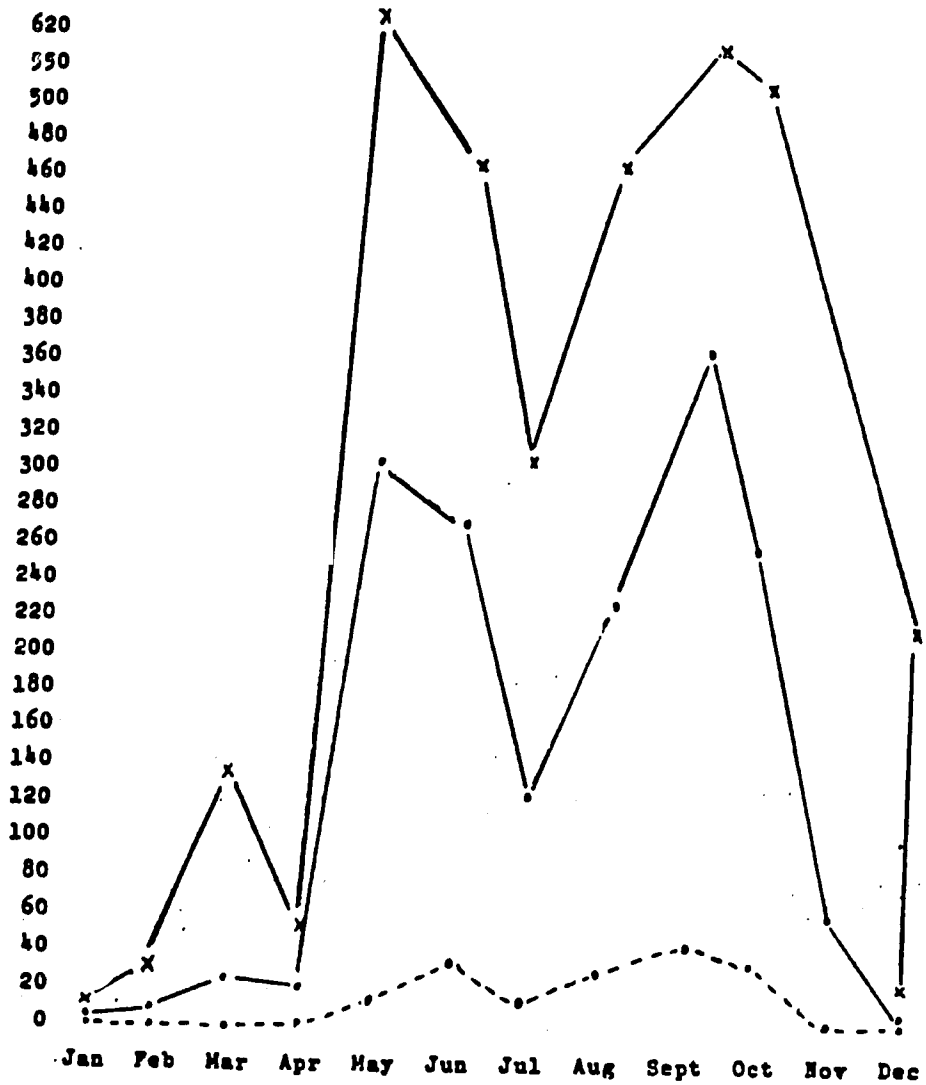
1974. This table also shows the size of these farming units. It can be seen that the great majority of those who own land in Pespire are small farmers. Those individuals with fewer than ten hectares make up over 79% of all those controlling some land yet they hold only 20% of the total land. Sixty-one landowners (only 3.5% of the total landowners) control close to half of the land in the municipio. This land concentration would appear even more skewed if the landless agricultural laborers were also included in these data.

The primary parameters for agricultural production in the Pespire region are related to 1) the steeply sloping topography of most of the land; and 2) the variability of rainfall. With respect to the former, Pespire is located in the foothills where the generally flat coastal plan begins to give rise to the mountains that constitute the central part of the country. The foothills themselves are extremely steep and the only kind of agriculture that can be practiced on the rocky, volcanic soils is shifting cultivation or slash and burn agriculture. There are a few fertile river bottom areas where plow agriculture is possible and is practiced but this accounts for only a minor portion of cultivated land in the municipio.

Figure 1 gives a graphic picture of the rainfall problems with which Pespire farmers must contend. The minimum rainfall recorded in each month of the year during the

Figure 1

MINIMUM, AVERAGE, AND MAXIMUM MONTHLY RAINFALL TOTALS
FOR PESPIRE, SOUTHERN HONDURAS



Note: While Hargreaves computed probabilities, the data he included for many months and several years in Pespire were quite obviously wrong due to the unreliability of the station. I have used the data for those years and months that appear to be correct in compiling this figure. The data reported here are consistent with the figures from the Choluteca station (see page 17).

Source: George Hargreaves, Monthly Precipitation Probabilities for Moisture Availability for Honduras, Utah State University Report, 1980, pp. 82-83.

eleven years for which fairly reliable data exist is indicated by the dotted line in the figure. The maximum rainfall recorded in each month is indicated by the solid lines. Average monthly rainfall for the twelve months is given by the broken line. The salient points to be made about this figure and about rainfall in Respire are the following:

1) As in the rest of the southern region, there is a very marked wet season that usually occurs from May to November. The other five months of the year are extremely dry.

2) Average yearly rainfall is about 1600 millimeters but there is considerable variation in the amount of rain that falls from year to year and from month to month. A particularly notable illustration of this is the month of May in which as little as nine millimeters or as much as 620 millimeters may fall.

3) In the middle of the rainy season, there is usually a period that is quite dry. This is shown in the figure by the dropoff in rainfall totals that is shown for July on all three lines. People in the Respire region actually report that there are two distinct dry periods within the rainy season. The first they call the _Veranillo_ (little summer) _de San Juan_. This is a relatively brief period of about ten to fifteen days that begins sometime around the saint's day of San Juan. Informants readily admitted that this dry

period often does not occur at all and that its onset and duration are quite variable. The same also applies to the second dry period which is called la canicula (dog days). The canicula may also be referred to as the Veranillo de Santa Ana because it occurs around the feast of Santa Ana, July 24. The dates most frequently given for this dry period were from July 15 to August 15, although most individuals also said that there were generally only about two weeks without substantial rain. Disaster strikes when the Veranillo de San Juan extends into the canicula and there may be up to two months with little or no rain. These years of drought are, of course, feared by farmers. A noticeable edginess begins to mount whenever a few days without rain go by during the rainy season.

CHAPTER II: CROPPING SYSTEMS IN PESPIRE

INTRODUCTION

In order to obtain information about cropping systems in the Pespire region, we chose three small contiguous communities for intensive research. The three were Cacautare, the principal town in the *aldea* of the same name, and El Naranjito and El Corinto, two of its *caserias*. Cacautare was the largest of the three communities with eighty-two houses within its limits. There were forty-two houses in El Naranjito and fifteen houses in El Corinto.

These three communities were chosen for our research site for a number of reasons. A major consideration was that the three were located about six kilometers from Pespire and could be reached by a dirt road that was passable even during the wettest rainy season weather. A second reason for choosing these communities was that in conversations with the Save the Children Federation officials who had organized grain marketing cooperatives in the *municipio* of Pespire, it was mentioned that the cooperative in El Naranjito was one of the most successful while the cooperative in Cacautare was one of the least successful. One of our objectives was to determine why this might be so.

A third consideration was that a Club de Amas de Casa (Homemakers Club) had been organized in Cacautare. This provided the opportunity for us to see what sorts of ideas concerning food, health, and other matters of concern were being expressed in the communities. Finally, when we visited the villages, we found that people were generally quite open and that the communities were physically attractive locations in which to work.

In order to obtain as representative a sample of people as possible in the three communities, our first task was to try to obtain a list of all the household heads from some key informants. We were initially misled in estimating the number of households by the maps of the communities that we obtained from the census bureau in Tegucigalpa. These maps had been drawn for the 1974 census but we found them to be quite inaccurate. Lists that we obtained from key informants were also incomplete so that we had to keep adding names as we proceeded with our interviewing. In addition, we were only interested in interviewing men who had cultivated land during the past year. This eliminated quite a large number of households in which the men had other occupations or worked a good part of the time outside the community.

Because of the short time period we had to complete the research, it was not possible to begin by doing a complete census of the three communities (although we ultimately did

this in the course of our work). We tried to obtain a one-half random sample of all female household heads. Our sample was not completely random because of our problems with obtaining a complete list. In addition, there were several women who refused to talk with us because they said we were "Communists." Given the events in El Salvador and announcements on Honduran radio about being careful of strangers, it is surprising that we did not have more problems than we actually encountered. Our final sample consisted of 72 female heads of households and 52 male household heads. We have matching male and female interviews for a total of 52 households.

Although we cannot claim that our data are representative of these three communities in a strictly statistical sense (because we did not succeed in obtaining a truly random sample), we do believe these data are substantively representative. The women's interviews are a good cross-section of all the households in the community while the men's interviews are a good representation of the households that cultivate land. While a complete report on these data will have to await final data analysis, this preliminary report will provide a descriptive account of the cropping systems being practiced in and around the communities of Cacautare, El Naranjito, and El Corinto.

Any discussion of agricultural systems must clearly begin with a discussion of land tenure. As Table 8 shows, 46% of

Table 8

Land Tenure in Pespire

Landowners: 24 (46% of total sample).

Number of Landowners	Number of Manzanas Owned
6	0-5
7	6-10
3	11-15
	16-20
4	21-25
2	26-30
	31-40
2	41+

Land Renters: 20 (39% of total sample).

Number of Land Renters	Number of Manzanas Rented
8	0-1
9	1+ - 2
	2+ - 3
2	3+ - 4
	4+ - 5
1	5+

Farmers Loaned Land: 8 (15% of total sample).

Number of Farmers Loaned Land	Number of Manzanas Loaned
1	0-1
2	1+ - 2
3	2+ - 3
	3+ - 4
2	4+

our sample (24 people) owned their own land in 1981. Thirty-nine percent of our sample (20 people) were renting land, while another 15% (8 people) were loaned land by their parents. Control over land in these three communities is similar to that of the municipio as a whole because most landholdings are relatively small. Only two individuals own more than 40 hectares of land.

Thus, people in this region are generally small landholders. About half control their own land, while the other half either rent or borrow land to plant their crops. The majority of cultivation is practiced on steeply sloping hillsides. The patterning of rainfall is a significant constraint with very marked wet and dry seasons, considerable variability in the amount of rain that falls during the wet season, and sometimes prolonged dry periods in the middle of the wet season.

SLASH AND MULCH CULTIVATION SYSTEMS

The hillside agriculture that is practiced in Cacautare, El Naranjito, and El Corinto is referred to as a system of shifting cultivation. Harwood defines this as a system in which "several crop years are followed by several fallow years with the land not under management during the fallow" (1979: 137). Much of the cultivation in southern Honduras is done using the slash and burn method in which the

vegetation on the fallow land is cut down and burned at the end of the dry season and then the crops that will grow during the rainy season are planted. While this system is important in Pespire, fallow land generally enters the cropping cycle through a method that we will call slash and mulch cultivation. In this system, brush and small trees are cut down during the middle of the rainy season and are allowed to remain in the field to serve as a mulch for the crops that must grow up through them.

Hillside land is usually allowed to lie fallow for a period of five or six years. The land in this fallow state is called <u>en guamil</u>. By the end of the fallow period, the land has become covered with brush and small trees. While most descriptions of shifting cultivation systems indicate that at that point the land is ready to be slashed and burned, the people around Pespire have a different system to begin the cycle of cultivation. This slash and mulch system actually involves three different crops and thus can be described as three separate systems.

MAIZ DE LA POSTRERA

The most frequently used slash and mulch system is based on the cultivation of corn. It is called either maiz de la postrera (the last planting) or socolar (to clear land). Agricultural operations for this system generally begin toward the end of August (see Table 9 for a summary of labor requirements for this system). When planting corn with this system, the first step is to cut down the brush, vines and weeds, leaving the trees standing. After this vegetation is cut, the plot is ready for planting. Planting is done with a digging stick (bareta). The decaying vegetation is pushed aside to make a hole and plant the seed. No attempt is made to clear the field unless the cut brush is particularly dense in which case it is dragged off to the side of the field. After the corn has germinated and grown for about two weeks, the larger trees are felled. Farmers report that this does not harm the growing plants so long as the trees are cut before the corn stalks have become rigid. The felled trees are left in the field and the corn must find a space to grow around the trunks and branches.

Table 9 shows the labor requirements for this system. Fence repair is important and necessary if livestock are to be kept from destroying the crop in the field. Because the land has lain fallow for a number of years, fence posts frequently must be replaced, some barbed wire restrung or replaced, or the rock wall base may require attention.

Table 9

PRODUCTION COSTS FOR ONE MANZANA OF CORN
PLANTED IN THE POSTRERA

Activity	Date	Number of Man-Days	Cost (in Lempiras)*
Fence repair	July, August	10	40
Clear land (socolar)	August	5-8	20-32
Plant corn	August	3	12
Cut trees (hachear)	September	1-3	4-12
Harvest	December	2-3	8-12
Transport	December	1-2	4-8
Husk and shell corn	December	1-2	4-8
	TOTALS:	23-31	92-124
Other inputs:			
20 pounds of corn seed			4.80

RANGE OF TOTAL COST OF INPUTS (Lempiras): 96.80 - 128.80

*(2 Lempiras = 1 dollar)

Although this task is extremely variable in terms of labor requirements, we have estimated about ten days. Clearing the land usually takes between five and eight man-days. Once the small brush is cut down, the corn is planted with the digging stick. This is somewhat tedious because it is necessary to poke through the dying vegetation to plant the corn seed. After the corn has germinated, another day or more is required to cut down the larger trees.

According to our informants, the corn should be planted between the 24th and 30th of August. Particularly propitious days were August 24, August 26 and August 30. At least one farmer in 1981 had planted his maiz de la postrera in the middle of July, but most people agreed that this was much too early and that he would get little if any harvest. One of our informants said that there are usually eight straight days of rain in October and that, if planted too early, the corn is caught in a delicate condition by these rains. He said that if this happens the corn does not develop ears, or if ears do develop they are too small to be of use. Another informant stated that corn planted too early is apt to rot. If it is planted at the end of August, however, it will always produce a good crop.

MAICILLERA

The second crop that is grown using the slash and mulch system is sorghum. At this time of the year, sorghum, in contrast to corn, is not planted in the ground but is broadcast sown. This system is called maicillera (maicillo means sorghum). The sowing of sorghum is done in the following manner. One man scatters seed among the brush and trees just in front of where he and other men are cutting the vegetation with their curved machetes (machete de taco). The brush and trees that are cut fall on top of the sorghum seed and are left to serve as mulch. Maicillera is only sown in periods when it is raining frequently, because it is essential for the sorghum to germinate quickly before it is eaten by ants, termites, mice, rats, other animals, and birds. Should a day or two go by without rain, farmers stop sowing maicillera until the rains return.

There is considerable flexibility of time when the maicillera system can be used. Because the varieties of sorghum grown in southern Honduras are photosensitive, the flowering period is the same for crops planted from late April up until early September. Yields are said not to differ despite the different planting dates. Maicillera is planted in the Pespire region throughout the months of July and August. Contained in Table 10 are the labor requirements of this system.

Table 10

PRODUCTION COSTS FOR ONE MANZANA OF MAICILLERA (SORGHUM) PLANTED IN THE POSTRERA

Activity	Date	Number of Man-Days	Cost (in Lempi
Sow sorghum and clear land	July, August, September	6-8	24-32
Bird scaring (4-6 hours/day)	December	2-15	48-60
Harvest	December, January	4-8	16-32
Transport	December, January	3-6	12 24
Threshing and winnowing	December, January	3-5	12-20
TOTALS:		28-42	112-16
Other Inputs:			
10 pounds of seed			1.60

RANGE OF COST OF INPUTS (Lempiras): 113.60 - 169.60

*(2 Lempiras = 1 dolla

GUATERA

The third slash and mulch system used in the Pespire region is really a variant of the second. Sorghum is again the crop and the system of sowing the seed and cutting down the brush and trees is the same. The sowing takes place later (all of September and October), however, and the goal of the farmer is not to obtain grain but to grow the sorghum for animal fodder during the dry season. This system is called guatera and the fodder that is produced is called guate. Guatera is practiced exclusively by individuals who have livestock; no one with whom we talked produced it to sell. Although the same type of sorghum seed is used for guatera as for maicillera, the sorghum is not allowed to grow for the same length of time. It is planted later and more densely and it is pulled up when it is still immature. The whole plant--roots, stem, leaves and the immature panicle--is uprooted and stored and fed to the livestock during the long, hot dry season. Between 48-60 pounds of seed are required to sow one manzana of guatera.

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ADVANTAGES AND PREVALENCE OF SLASH AND MULCH SYSTEMS

Fields sown by any of the three slash and mulch systems are quite easy to spot in the Respire region. They contrast with the rich green color the rains have produced in the fields and mountains. The cut vegetation passes quickly from bright, intense oranges and browns to more subdued browns as it decays. Within twelve to fifteen days, however, the nascent corn or sorghum seedlings have poked through the mulch and begun to impart their fresh, pale green color to the landscape.

Farmers say that there are many advantages to these slash and mulch systems. One clear advantage is that all three systems are carred out during the rainy season so that the vagaries of the onset of the rains that plague the first sowing (see below) are not a problem. A second advantage is that in the maicillera and guatera systems, broadcast sowing eliminates the onerous labor of planting the seeds with the digging stick. Third, the mulch provides a ground cover that helps to conceal the seeds from pests that would eat them, holds in moisture to help the seeds germinate, and helps to impede weed growth to allow the sorghum to germinate successfully. Fourth, farmers acknowledge that the mulch is important because it helps to prevent the sorghum seeds and seedlings from being washed off the steep slopes by the rain. The dead and decaying vegetation provides many crevices and crannies in which the seeds

nestle until they germinate. Finally, farmers report that the slash and mulch systems also help to decrease the erosion of land from the hillsides. The cut vegetation helps to absorb the impact of the falling rain, the root structure of the weeds and trees is still present to hold the soil, and the ground cover provides places to retard and stop soil run-off.

There is a further advantage to slashed and mulched fields. Some farmers will only cultivate a field that is slashed and mulched for a single year or perhaps two. One farmer that we observed had left several small fruit trees standing in his maicillera. He had cut back the branches so they would not shade the sorghum but planned to leave the trees standing. He was not going to burn his field the following year and therefore was able to begin a small orchard.

We asked farmers why it was not necessary to burn these fields right after the vegetation was cut. (Obviously it would be difficult for them to do so during the rainy season anyway). They pointed out that the reasons why they burn are 1) to control insects and 2) to control weeds. With regard to the former, they said that by the time the rainy season is underway the insects have largely ceased to be a significant problem. It seems likely that the annual cycle of most insects is timed, as is the annual cycle of most plants in the region, to the onset of the rains. Thus, most

insects may be in a stage of their lives when they are apt to do little damage to the newly-emerging crops. It should also be pointed out that, by this time of the year, there are immense quantities of vegetation available and any insect damage occurring is likely to be quite diffuse. Weed control is affected both by cutting down the weeds and then by using the dead vegetation as a mulch to keep down the competition for the desired crops. So, farmers report that it is unnecessary to burn the fields when planting at these times of the year.

Another contrast between the slash and mulch systems as compared with the slash and burn systems practiced earlier in the year is that corn and sorghum are not interplanted in the slash and mulch systems. Informants reported that the reason for this is that when corn and sorghum are interplanted early the sorghum is quite slow in developing. The corn grows more quickly and it is only after it is harvested in late July or early August that the sorghum begins to flourish. When planted in July or August, however, the sorghum grows more quickly and would crowd out the corn. Thus, with all of the slash and mulch systems corn and sorghum are planted separately and are not mixed as they are in the slash and burn systems.

Table 11 indicates the prevalence of the three slash and mulch systems. Corn, befitting its importance as the subsistence crop most desired by the people of these three

Table 11

Crops Cultivated in 1980

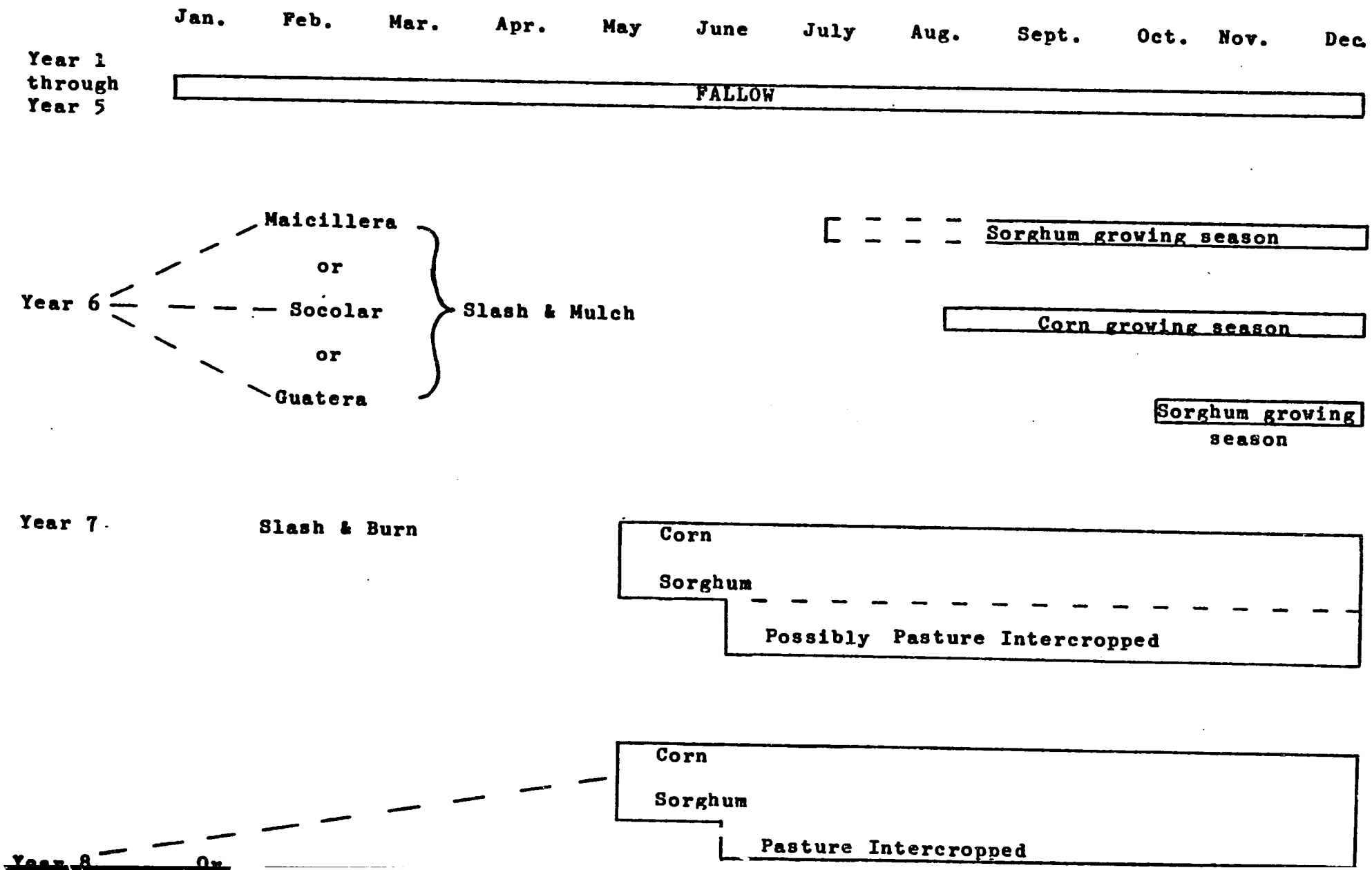
Slash & Mulch Systems	Number of Cases	Percent of Sample
Corn (second planting, *postrera*)	39	75%
Sorghum (*maicillera*)	8	15%
Forage Sorghum (*guatera*)	29	56%
Slash & Burn System		
Corn & Sorghum (first planting, *primera*)	45	87%
Secondary Crops		
Squash	21	40%
Yuca	15	29%
Beans	13	25%
Zacate jaragua	26	52%
Watermelon	7	14%
Melons	3	6%
Rice	2	4%
Sesame	2	4%
Gourds	1	2%

communities, is planted in the postrera by over 70% of the people in our sample. Sorghum planted for fodder (guatera) is grown by over 40% of our sample, indicating the importance of livestock in the economy of Cacautare, El Naranjito and El Corinto. A second planting of sorghum (maicillera), on the other hand, is grown by only about 15% of the sample. This probably reflects the confidence people have that their first plantings of sorghum will provide enough grain for their own use. It is somewhat surprising, however, given the relatively low labor costs in comparison with the expected yield for this crop. What is probably indicated by these figures is that sorghum is not seen as an important or valuable cash crop by the people around Pespire. This is a topic to which we will return in the section on Marketing in Chapter III.

Most of the land enters the cultivation cycle via the slash and mulch system, and is cultivated for three years in a row before it is returned to fallow or, as is increasingly the case, before it is planted with pasture grasses (see Figure 2). In these last two years of the cycle, the slash and burn system is used and it is this system that will now be presented.

Figure 2

Fallow and Alternative Cropping Cycles from Pespire in 1981



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THE SLASH AND BURN CULTIVATION SYSTEM

The slash and burn system in the Pespire region is not usually practiced the first year a field is cultivated. As we have seen, land passes from fallow into the cultivation cycle during the postrera (second planting) of a year when one of the slash and mulch systems is practiced. Land that has been cultivated in this manner produces harvests in November, December, or January. Late in March or early in April people begin to turn their attention to preparing their fields for planting again. As can be seen in Table 8, about 85% of those who cultivate land did use the slash and burn system in 1981.

In late March and early April most people are in their fields cutting down the brush and trees (if the field was not cultivated the year before) or cutting down any remaining rastrojo (stubble) from the previous year's crop and collecting the larger branches and twigs from the previous year's slash and mulch operation. This clearing operation (called chapiar) is quite rapid according to most informants and takes only about three or four days per manzana. A second step in the process is to rake the debris away from the fences to create a firebreak (this operation is called rondar). In Pespire, those who can afford to hire someone for this operation usually pay for it on a sort of piece work basis. In 1981, men were being paid between $9 and $10 for cleaning a firebreak of 1000 varas (a vara is

equivalent to about 33 inches; there are 100 *varas* on each side of a *manzana*). Firebreaks are usually about two *varas* in width.

The timing of the burning (*la quema*) is a matter of considerable guesswork. If the land is burned and seeded too early, the weeds will grow back before the seeds germinate. If a farmer waits too long, the rains will drench the debris and it will be difficult to burn. Burning is practiced on both the steeply sloping hillside lands that are sown with a digging stick as well as the more fertile flat lands where plow agriculture is possible.

Burning of agricultural fields is currently under attack in Honduras because it is thought to be a prime cause of soil erosion (Hughes-Hallett 1980: 11). Radio commercials sponsored by the government exhort the farmers not to burn their fields. In addition, the government now requires farmers to have a permit to burn their land. These permits can be obtained in the municipal building in communities like Pespire. Farmers are especially warned to take care in burning so that fires do not escape to accidently char other plots of land or forest land. Farmers are conscious of this danger and there are usually five or six men present and ready to take action to prevent accidents whenever a field is burned.

Most weeds and agricultural insect pests begin their annual cycles in association with the onset of the rainy

season. Were farmers to be prevented from burning their fields, significant declines in yields might result. Part of this might be offset with the use of pre-emergent herbicides and the application of insecticides prior to or in conjunction with planting. One difficulty with these measures, however, is that small farmers lack the capital resources to employ them. In addition, as Harwood (1979: 110) and many other people have pointed out, burning releases nutrients in plant remains in highly soluble forms so that they are available to support crop growth. While there should be concern about the erosion problems in southern Honduras, careful research on the tradeoffs and implications of dissuading farmers from burning should be done before such measures are implemented.

Most farmers plant their first crop of the year during the last week in April. One farmer said that the reason they plant at this time is because they know that on or about May 1 it will rain. Thus, even if the land is dry and dusty they plant with the digging stick anyway. Farmers with flat land plant somewhat later because they have to wait until after the first rains when their plows pulled by oxen can cultivate the soil.

The majority of the farmers we interviewed sow their corn and sorghum at the same time and place the seeds in the same hole. Four or five corn seeds and approximately 12-15 sorghum seeds (farmers say <u>al calculo</u>, i.e., a bunch) are

put in each hole made with the dibble stick (bareta). The spacing of the holes on the rocky hillsides is not always precise but farmers say that there is one vara (33 inches) between each group (mata) of seeds. Two rows are usually sown at a time and the farmer works back and forth, opening the hole with the digging stick, dropping seeds into the hole from the bag suspended around his waist, and then covering the seeds with dirt pushed over the hole with the feet. Farmers often state production units in terms of the amount of seed planted rather than in terms of area. In general, most farmers report that they use 15-20 pounds of corn seed and 5-10 pounds of sorghum seed per manzana. It takes approximately two or three man-days to sow one manzana using this method.

There are a number of farmers who sow some or all of their intercropped corn and sorghum separately. The corn is sown in the same manner as above with one vara between holes. The farmer waits until the corn germinates (about a week if the rainy season has begun), then returns to the same field to plant sorghum in the spaces between the corn. Farmers report that this system produces a better corn crop. In some years, when the corn and sorghum are planted in the same holes the sorghum overwhelms the corn and impedes its growth. No one mentioned that sowing the two in the same hole was detrimental to the sorghum, nor did it seem that there was much difference in sorghum yields between the two systems. All of the farmers, however, noted that better

corn yields resulted from sowing the two apart. Farmers reported that the principal constraint on sowing them apart was the additional labor needed to do so. Sowing the two crops apart requires an additional one or two days of labor per manzana.

Approximately four weeks after the plants have germinated, many farmers apply herbicides to their fields. The hillside slopes are difficult to weed and this operation is very time consuming and laborious if done by hand. For this reason, most farmers now use herbicides on their fields. The most frequently used herbicides are 2-4-D, Hedonal 720, and Hesaprin. Almost all of the farmers in our sample obtained their herbicide from the Save the Children Federation office in Pespire. The agricultural extension agent in Pespire complained that many farmers waited too long before applying the herbicides. He said that the farmers waited until they thought all the weeds had germinated before they sprayed. Often, the weeds were then too large and dense for the herbicides to be effective.

The Save the Children Federation has started grain storage cooperatives in fifteen communities in the municipality of Pespire, including Cacautare and El Naranjito (see below). One of their programs is to provide credit to farmers for herbicides which the farmers repay by selling part of their harvest to the cooperative. This project made it possible for 66% of the 52 farmers in our

sample to use herbicides in 1981.

Farmers spoke about herbicides in almost reverential terms. One of them asked if we knew who had invented them; he said he would like to know the person's name because he had created something that was of great benefit to farmers. The reason for this positive attitude toward herbicides is that it takes approximately 20-28 man-days of labor to weed one manzana of corn and sorghum by hand. Often this requires a farmer to hire laborers. All farmers complain that laborers are hard to find, do not work hard, and are expensive ($2 per day in 1981). Thus it could cost between $40 and $56 to weed a field with hand labor. In contrast, with one to three liters of Hedonal 720 and a sprayer borrowed from the Federation, the task can be accomplished in just one day. The Federation was selling 5 liters of 2-4-D for $14 in 1981, making the cost of weeding one manzana about $3.20. This cost is somewhat misleading, however, because those who obtain credit for the herbicides from the cooperative are required to repay by selling their sorghum to the cooperative for only $7 per carga, about half what it would bring later in the season on the open market (see below on Marketing). Herbicides were first utilized in Cacautare, El Naranjito and El Corinto about ten years ago. The fact that now over 66% of the farmers are using them attests to their effectiveness and the way in which they have cut the costs of cultivation.

By mid-July, the corn plants are beginning to produce ears of corn that can be roasted and eaten fresh off the cob (called elotes). In late July and early August, the corn is mature and the corn stalks may be doubled over (la dobla) to allow the corn to dry on the cob. Because it is the rainy season, drying is never very effective at this time of the year. People report that this corn must be consumed or sold within two or three months otherwise it will begin to spoil.

After the corn is harvested, a second weeding of the field is done so that the remaining sorghum can grow to maturity. No one in our sample used herbicides for this operation; the weeding was done by hand with the curved machete as the only tool. Informants reported that this weeding occupied approximately seven to fifteen man-days of labor per manzana, depending on the density of weed growth.

Several different reasons were given for not using herbicides for the second weeding. One reason is that the farmers believe that the herbicides damage the crop. Several of them mentioned that after the application of herbicides, the corn and sorghum plants turned yellow for a time. All farmers said that the herbicides burned (quemar) the weeds and plants. While some farmers refused to use herbicides for even the first weeding for this reason, most gave it as their reason for not applying herbicides later in the growing season. It is quite clear that the trade-off in terms of labor saved versus a possibly diminished yield is

substantial enough to make most farmers decide to use herbicides for the first weeding, although not the second. A second reason for not using herbicides was expressed by one farmer who talked about the fact that herbicides burned the weeds. He believed that because the weeds were burned they lost the value that they had for returning nutrients (he used the word abono, or fertilizer) to the soil. Again, he felt that the benefit of reducing his labor by using herbicides once was sufficient to offset the potential decline in soil fertility. He reported, however, that he always weeded by hand the second time so that the abono contained in the dead weeds could be returned to the soil. Finally, other people reported that spraying the fields was harmful to the cattle that ate the stubble after the harvest.

Sorghum stalks are sometimes cut back to the ground after the corn harvest. This is done if the sorghum has grown too high by August and September. The extension agent in Despire reported that a general rule of thumb is that if the sorghum is two meters high in August, it should be cut and allowed to sprout again (called rebollo). He said that if the sorghum grows much higher than four meters high, it will fall over and the grain will lodge. The cutting of sorghum is most necessary on the more fertile, usually flat lands of Despire. It also seems to be much more common in the flatter lands of the communities on the southern coast. In contrast, on the hilly lands of villages like El Naranjito,

Cacautaro, and El Corinto where the soil is less fertile it is usually not necessary to cut back the sorghum. The only place we saw this being done was on the border of a field with a rock wall. Earth that had run off the hillside had accumulated behind the wall and the sorghum plants growing in this fertile soil had already attained a height of two meters in early July. As the farmer cut these back to the ground, he came across one plant that was being damaged by a stem borer. He remarked that this was one advantage of cutting back the stems: the insect pests are eliminated and the plant that grows back from the roots would probably be healthy. Farmers say that this cut-back sorghum always produces a harvest and the heads of grain are just as large as those from plants that are not cut back. One farmer reported that the only precaution necessary is to cut the sorghum during a period when it is not raining. If it is wet when the sorghum is cut, it will become "sour" (agra) and will not produce new shoots (hijos).

After the second weeding and cutting back the sorghum, if necessary, the next major input of agricultural labor begins when the heads of grain are mature in the fields. At this point, bird pests become a significant problem. In addition to the birds that are present year round, the populations are swelled by migratory doves that descend on southern Honduras at this time of the year. To keep losses to birds to a minimum, it is necessary to have someone in the fields from sunup until about 9:00 a.m. and from about 3:00 p.m.

until dusk to scare away the birds. (The birds stay in the shade during the heat of the day and only bother the fields close to trees along the rivers and streams). This task is usually performed by young boys with a slingshot although some people use sheets of plastic on poles or scarecrows to deter the birds. Occasionally fields will also be raided by small mammals such as raccoons. When this happens, pairs of men will spend the night in their fields trying to kill the culprits.

The sorghum can be harvested any time after the mature heads have dried on the plants, from late December until February. The sorghum heads are cut and put into sacks for transport back to the house. This can be an onerous task, particularly when the fields are far from the house and/or when the terrain is rough and hilly.

Before storing the sorghum it is threshed and sometimes winnowed. Everyone agreed that in the past the threshing and winnowing operations were usually carried out on a tall wooden platform (tapezco). These platforms were built with three enclosed sides, with the fourth side open and facing into the prevailing direction of the wind. The heads of sorghum were laid on the platform and beaten with a long wooden stick. The sorghum grains fell through the floor of the platform to the cleared ground below. As they fell, the wind blew off the chaff. Although these platforms can still be seen around Pespire, the people with whom we talked in

Cacautare, El Naranjito, and El Corinto no longer use them.

The present system to thresh sorghum is to clear a large open space, usually in the garden by the house (solar). The sorghum heads are put on the ground, usually on a piece of plastic, and beaten with a stick until the grains fall off. With this method a second operation is necessary for the final winnowing. The grain is shoveled into a pile, scooped up in a container (usually plastic), held above the head, and poured into the prevailing wind Sometimes farmers will sell their grain to truckers without having done this final winnowing but they receive less money for their harvest because the trucker must have it done before selling the sorghum.

It was not entirely clear why the farmers had abandoned the previous system in which threshing and winnowing were both accomplished at the same time. The reason given by farmers was that with the platforms one could only thresh and winnow when the wind was coming from the right direction. When the wind shifted, it was necessary to stop the whole operation because the chaff is quite irritating to the skin. Some people, in fact, reported that they could not participate in this work because their skin was especially sensitive. When the grain is threshed on the ground and winnowed by pouring, the participants simply move around whenever the wind shifts. This was not possible with the stationary platforms.

Figure 3 provides a summary of the main agricultural operations by month for the three villages. The system of maicillera is not included because only eight people used it in 1980 but it is essentially similar to the guatera system with the guarding for birds and threshing and winnowing added as in the "corn and sorghum, first planting" portion of the diagram. A discussion of the minor crops, many of which are intercropped with the corn and sorghum in some of the systems discussed above, is not included in this diagram. It is these secondary cultigens that we will now examine.

CULTIVATION OF OTHER CROPS IN THE PESPIRE REGION

Corn and sorghum are the basic subsistence crops in the Pespire region and the scheduling of agricultural labor activities is dictated by the requirements of these two crops. There are a wide variety of other cultigens that are grown in the region, however, and these are quite important in terms of providing variability in the standard diet and providing the nutrients not available from the basic grains. Some of these crops are planted in the same fields as the corn and sorghum and others are grown in gardens around the house. Fruit trees are grown both around the house and on other property. Only field crops will be discussed in this section.

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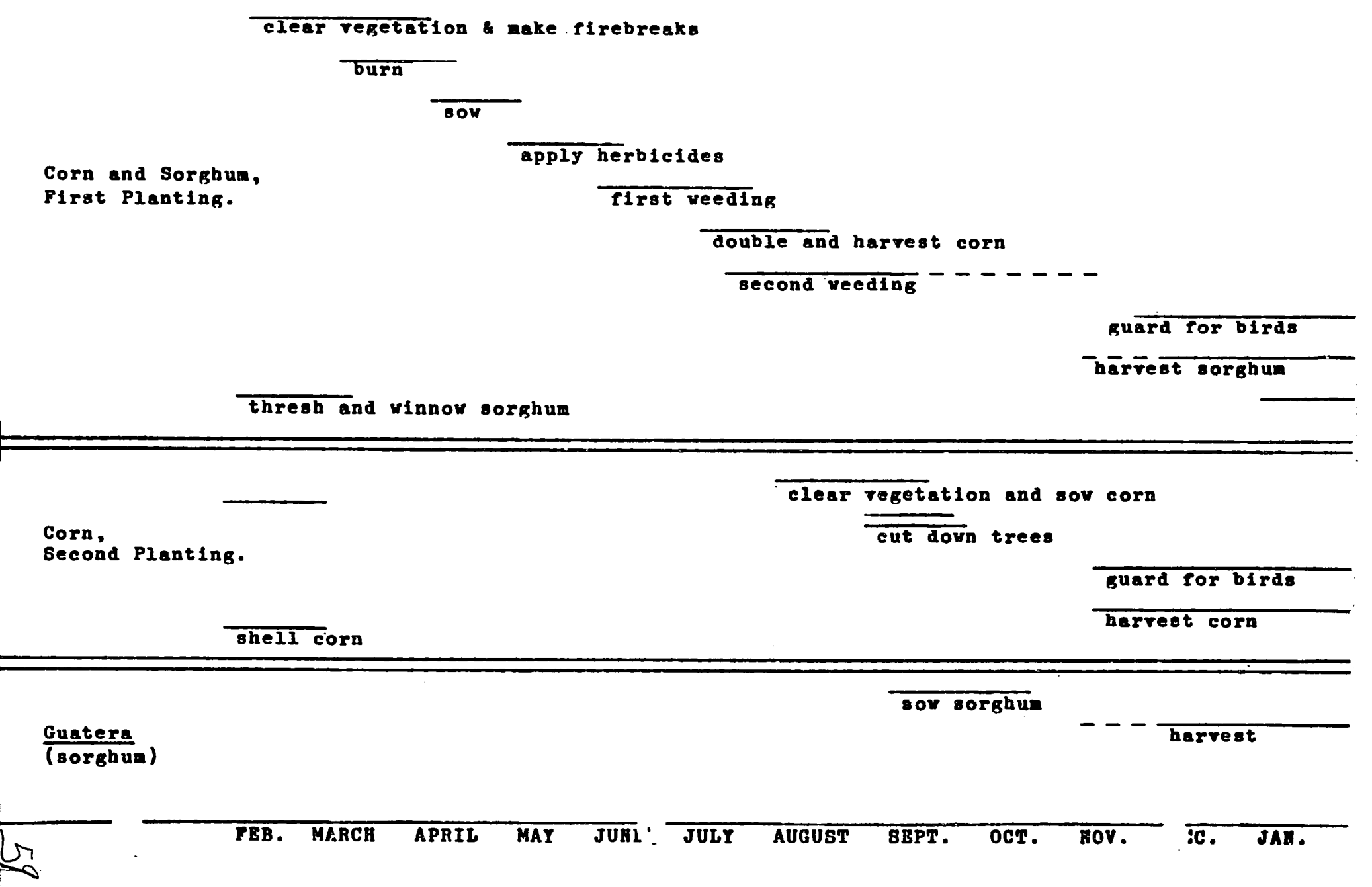
Figure 3

MAIN AGRICULTURAL OPERATIONS BY MONTH



It is necessary to point out that it is difficult to obtain accurate data on the amount of these cultigens planted, their labor requirements, and yields. Small amounts are planted, weeding and other agricultural operations are performed as needed and usually in the course of doing the more onerous and time-consuming work on the corn and sorghum fields, and these fruits and vegetables are harvested a few at a time as they ripen. We even suspect that the data in Table 11 showing the numbers of people who planted each of the different crops underrepresents the actual numbers.

Crops planted in the fields (see Table 11) are usually interplanted with the corn and sorghum. If the farmer plans to use herbicides on his field, one portion of the field is set aside for growing these other crops. These are broad leaf plants that would be killed by the herbicide so that the portion is set aside to be weeded by hand. Occasionally, only vegetables are planted in this separate portion of the field, but the usual pattern is to sow these other crops within the corn and sorghum that will be weeded by hand. Because of the growth in the use of herbicides in the past decade, it is likely that there has been some decline in the amounts of these other crops grown due to the "set-aside" requirements.

The most frequently grown minor crop in the Pespire region is squash (called <u>ayote</u>). A variety of shapes and

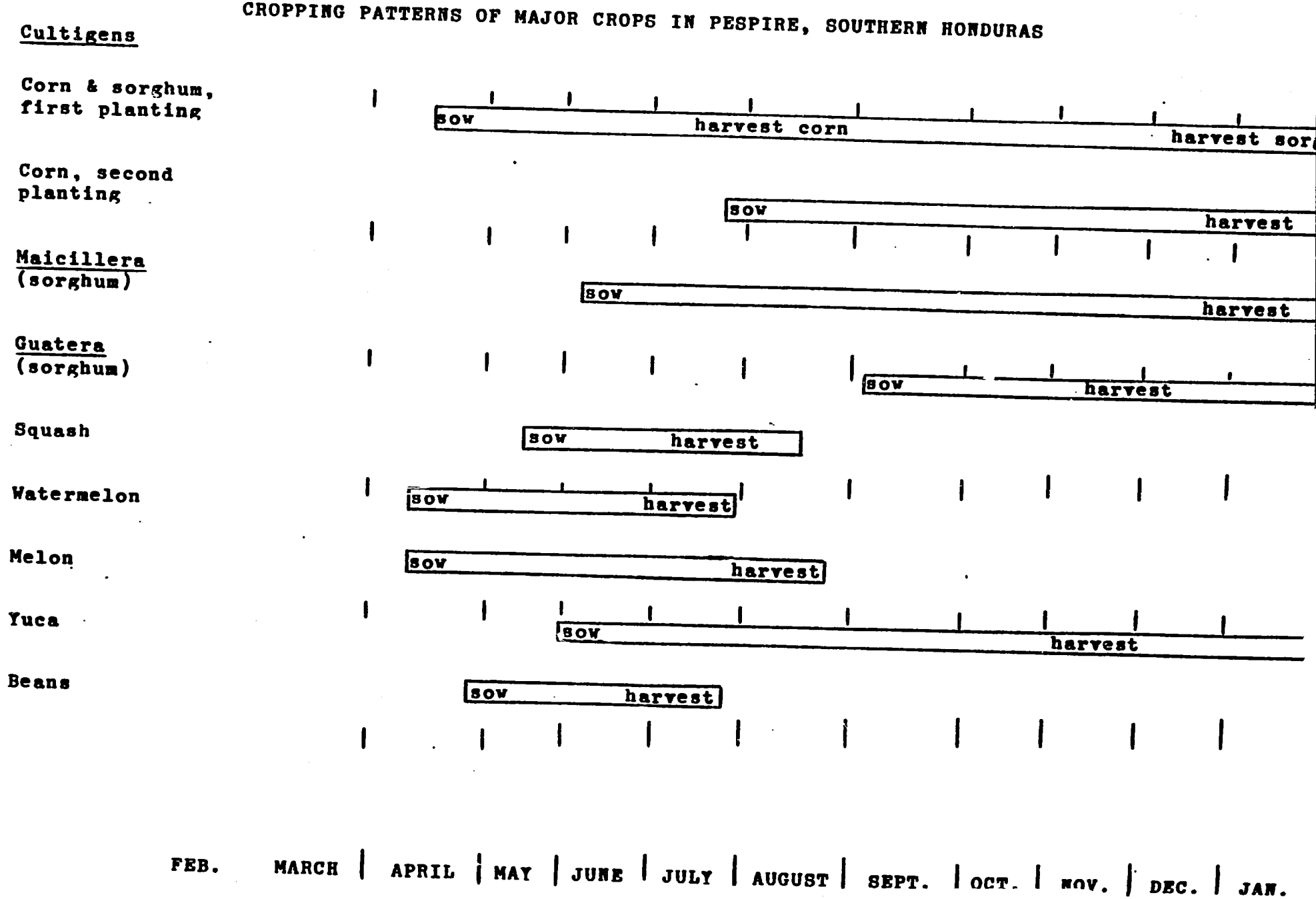
colors of squash are grown. They are planted in early May just after the corn and sorghum are sown and are ready for harvest in early July (see Figure 4). Through July and August the squash is harvested and cooked as a fresh vegetable. After this period, it can be left on the vine to be harvested later as a winter squash. These can be stored for a few months before being eaten. In addition to the squash grown for eating, there is another variety grown for the use of the gourd (called calabasa). Some people use the inner parts of these gourds to make a fresh drink, but the majority use them as a storage container for water. They keep water quite cool during the hottest days which is appreciated by the men who use them as water containers when they are working in the fields.

Table 11 shows that the second most frequently cultivated crop is yuca (sweet manioc). This is also planted in early May but is not ready for harvest until the end of the year. Yuca is a crop that could be left in the ground and harvested as needed but most people do not do this because they report that thievery is quite common. Thus, most of the yuca is dug up soon after it is mature and consumed during the first few months of the year.

Common beans are another frequently cultivated crop. There are two main varieties and two major times of the year when these can be planted. The variety that has traditionally been cultivated in the Pespire region is

Figure 4

CROPPING PATTERNS OF MAJOR CROPS IN PESPIRE, SOUTHERN HONDURAS



called *frijol alazin*. This variety can be planted during the rains in May but people say that these beans do not generally yield well. They are susceptible to insect plagues, including *diabrotica* species and slugs (see Hughes-Hallett 1980: 32), and often the dry periods during the rainy season are extensive enough to kill them. This bean is usually planted during the *postrera* when the rains are more regular and the threat from insects is not as great. The other type of bean planted is a fairly recent introduction into the Pespire region in the south of Honduras. The people call it *frijol cuarentena* because it matures in approximately forty days. This variety is frequently planted during the rains in May and can be harvested and eaten by the end of June and in July. The beans are eaten fresh as green beans or the whole plant is pulled up and allowed to dry in which case the beans are shelled and eaten as dry beans. *Frijol cuarentena* are also sown in the *postrera* toward the end of the growing season. The short maturity date has made this a particular favorite in the region.

Beans are not as important a crop in Pespire as they are in other parts of the southern highlands. This is because most of the *municipio* of Pespire is low-lying (the town is at 68 meters) and hot. Beans grow better at higher and cooler elevations. Both Hughes-Hallett (1980: 29) and Boyer (n.d.) report that at elevations above 400 meters beans are intercropped with corn and sometimes with both corn and

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sorghum. Our informants reported that only one community San Antonio de Padua, in the Despire region was significant producer of beans. San Antonio is at a higher elevation and is quite cool.

Other significant cultigens in Cacautare, El Naranjito and El Corinto are melons and watermelons. These are, like the other crops discussed, varieties that are cultivated year after year and that are constantly being cross-pollinated. They therefore come in a variety of shapes and colors. Both watermelons (sandias) and melons (melones) are also planted in May and are ready for harvest by mid-July. Both of these cultigens do quite well when the veranillo or canicula occur in the southern region. Because 1981 was a year when the rains were fairly regular, the watermelons and melons did not do well although the other crops benefitted. Like the beans, yuca, and squash, the watermelons and melons are used for home consumption and are not sold. If someone has a particularly bountiful supply, they are more apt to give these foods away than to sell them.

Rice is consumed by almost everyone in the villages we studied although almost everyone must purchase this commodity. There are two individuals who have planted rice and produce enough for their own yearly requirements. Both of these men are large landowners with thirty or more manzanas of land and can afford to grow rice. Rice is a crop that has been grown in the southern highlands for a

long time although not on a large scale. Like sorghum, it is planted around the first of May and does not produce a harvest until the end of the year. Farmers reported that they always obtain some harvest from the rice, but that the largest harvests come in years when the rains are regular and heavy. As with the other grain crops, other cultigens are interplanted with the rice. One field we saw had watermelons snaking among the rice plants.

Another field crop that is sometimes grown is sesame (ajonjoli). Small quantities of sesame had been grown for a long time in the region and within the past decade the amount increased. The steeply sloping hills and the volcanic soils of Cacautare, El Nararjito and El Corinto are not appropriate for growing sesame which is why it has not been cultivated as a major cash crop. In the past ten years, sesame has been grown in the flatter areas of the municipio in the postrera as a cash crop. The seeds used are improved hybrids (Venezuela 44 and Instituto 71). In the past, the crop was bought by a firm from Choluteca that shipped the sesame across the border to a processing plant in Nicaragua. In 1979, the farmer's price for sesame was $45 per carga (200 pounds) with an average yield of between eight and ten cargas per manzana. In 1980, the price suddenly dropped to $15 to $18 per carga so that the farmers took a significant loss on the crop. Many farmers were quite disappointed about this development and reported that they would not sow sesame again. The two farmers in

Cacautare who grew sesame used it primarily for their own home consumption; they were not planting significant amounts and did not expect to sell their produce.

III: SIGNIFICANT CONSTRAINTS AND POTENTIAL SOLUTIONS

INTRODUCTION

In this section of the report we will focus on some of the major constraints limiting increased agricultural production in these villages. We will discuss the ways in which farmers are attempting to deal with these constraints and we will suggest potential ways in which some of these constraints may be lessened. We recognize that there are probably better measures that might be adopted and we hope that others will help in identifying them. Our purpose is to point out what the farmers' needs are and to suggest the general parameters within which solutions to these constraints must fit.

PESTS AND PESTICIDES

There are a variety of insects that plague the growing of sorghum in the Pespire region. Insect damage may occur at almost any stage of plant life from the time when the seed is planted until the time when it is stored. Because storage losses are so great and the methods for combatting

them so varied, storage techniques will be discussed in a separate section. The preliminary data reported below suggest some of the major pests of sorghum and also indicate the measures that farmers take to control them.

Both sorghum and corn seeds come under insect attack from the time they are planted. Farmers in the Pespire region report that termites and ants, as well as birds and small rodents, sometimes eat the seed before it germinates. Four individuals (7.4%) among the farmers we interviewed treated their seed with insecticide before planting it. Two individuals reported that they used chlordane to treat the seed, but it seemed that the term "chlordane" was used in a generic sense to name whatever insecticide was used. Some individuals reported that chlordane was no longer sold in the region but we were never able to verify this. The other insecticide mentioned for treating seed before planting was called sompopin (probably after somropo which is a yellow ant in Honduras). The technique for treating the seed apparently involves nothing more than putting the seed into the insecticide with a little water and mixing it around with the bare hands.

Mosquita de la panoja (Contarinia soghicola) has been identified as a major problem for sorghum in the south of Honduras (Secretaria de Recursos Naturales, 1980). In Pespire, however, no one ever mentioned the pest although it is quite likely that the problem exists. There is some

speculation that farmers do not recognize the damage done by this pest because, at the time the sorghum heads form, the plants are three to four meters tall and the farmers do not see the damage occurring.

The major insect pest mentioned by farmers in Pespire was the langosta. A small insect with three pairs of legs, the langosta seems to come in waves and to leave most fields untouched while wreaking major destruction on other fields. Farmers report that they have no way of knowing when and where an outbreak of langosta will occur. Consequently, few farmers take any precautionary methods against the insect, which generally does most of its damage when the plants are quite small.

Another insect pest that affects the young corn and sorghum plants is the cogollero (Spodoptera frugiperda). Although this pest is reported to be the most discussed pest of food crops in Central America (Andrews 1980: 456), farmers in Pespire did not report it as a major threat to crop production. They recognize the distinctive damage that this whorlworm causes but they view the langosta as a greater threat.

These and other insect pests of minor importance are treated primarily with two insecticides: malathion and dipterex. These are obtained either from the Save the Children offices or from one of several stores in Pespire. Application is generally done using a spray from a backpack

applicator. In 1981, ten farmers in our sample (19%) used insecticides on crops growing in the field.

Few precautions are taken when using insecticides in Pespire although farmers are aware of the toxic effects of both insecticides and herbicides. Many farmers complained of having headaches after using them but none ever wore a mask. One or two reported using a handkerchief to shield their mouth and nose. Several farmers reported that they always carried a lime in their pocket when spraying. They said that sucking on a lime was the only measure they were aware of that would counteract the effects of breathing the spray.

Birds are probably the major cause of grain loss for sorghum. Several species of migratory doves make southern Honduras their home during the time when the sorghum is producing its grain. This invasion of birds attracts dove hunters from the United States and other countries to southern Honduras. For the farmer, the infestation is not welcome because, when added to the parakeets and other birds that live year around in the region, considerable grain losses are sustained. Toward the end of the year, someone must stay in the fields in the early morning and late afternoon hours to scare away the birds. Local names for the birds that eat sorghum include: tonita, a small nonmigratory dove; alas blancas (white wings), llanera (plain dweller), and morena (tawny) which are all migratory

doves; clarin (trumpeter); tordo (thrush); and pericos (parakeets).

Farmers report that another major pest of the grain in the field is the cricket. Some farmers report that they do as much damage to the grain as birds. Farmers stated that crickets were a major problem with the improved varieties of sorghum that they had tried and rejected. No action is taken to reduce the damage of crickets.

Weed growth is a significant problem for the farmers. Two of the predominant weeds are called flor amarilla (for the yellow flowers that grow on it) and camotillo which has tuberous roots like a yam. In Chapter II we discussed the considerable investment of time that is necessary to clear weed growth by hand. The labor costs entailed have made investments in herbicides an attractive alternative. Thirty-five of the fifty-two farmers (67.3%) we interviewed used herbicides on their fields in 1981. Most of the farmers obtained their herbicides with credit received from the Save the Children Federation. The Federation provided the herbicide and loaned farmers the sprayers to apply it. Few farmers were aware of the name of the herbicide they were using, but the two most common varieties were 2-4-D and Herbisol.

The impressive numbers of farmers using herbicides suggests that these peasarts will quickly adopt new techniques that promise them a better return on their

investments. Since herbicides were first used in Pespire, about ten years ago, the two-thirds adoption rate in Cacautaro, El Naranjito and El Corinto indicates that herbicides are clearly seen as beneficial by most of the population. Many individuals who do not use herbicides are those who continue to plant other crops between the rows of corn and sorghum. These people are willing to expend extra time, effort, and money (to hire labor) to harvest a greater variety of crops from the land they are cultivating.

POST-HARVEST STORAGE LOSSES AND ALTERNATIVE SOLUTIONS

Post-harvest storage losses have been considerable in the south of Honduras. The corn that is harvested during the rainy season never dries sufficiently to be stored for any significant length of time. Another problem for both corn and sorghum storage is the insects that eat the grain. The prime culprits in the south of Honduras are called gorgojos (C. granaria). There are two types prominent in the Pespire region; one is reddish, while the other is black and has pincers on its snout (for this reason it is also called picudo). In the past, a variety of methods have been utilized to combat these pests, including the use of chlordane and malathion (Teetes, personal communication). The former is especially dangerous when applied to a grain that will be consumed by humans.

Storage techniques in the Respire region are designed with these pests in mind. The older methods of storing the grain that are still used by some people include the following. Cedar boxes were and are used to store some grain. These do not seal tightly and even those who still use them agree that they do not prevent gorgojo damage and that the grain has to be either eaten or sold within a few months.

A second type of container used is called the troja. This is a pen constructed of corn stalks or wood on the floor of the house. The grain is simply dumped into this container. A number of people reported that they first put down a layer of lime (cal) on the floor of the troja to alleviate some of the insect damage. Some farmers reported that this method served to control insect damage quite effectively. Others stated that it helped but that it did not work very well. Wood ash was another substance that was mixed with the grain for storage in a troja. Those farmers who used ashes reported that it was useful although by no means a final solution to the problem.

A third method for storing grain is to put it in the rafters right above the hearth. Farmers reported that the smoke from cooking fires discouraged the gorgojos. This method is used almost exlcusively with corn that is stored with the husk still covering the grain. Quite obviously, the smoke from the fire covers the corn with a black soot, but when stored with the husk still over the cob, the

unappetizing soot comes off and is discarded with the husk.

Other farmers simply store their grain in plastic sacks. These are not air-tight and allow the gorgojo to enter. Some farmers put Phostoxin pills in the plastic sacks to kill the gorgojo. Phostoxin is a fumigant whose active ingredient is aluminum phosphate. While the fumigant will kill those insects present, it works best when used in conjunction with air-tight containers where its effects will not be so quickly dissipated.

Almost all farmer report that the best solution to the grain storage problem is to use 55 gallon drums. These barrels can be capped and retain the grain in an air-tight condition for long periods of time. Farmers said that one could easily keep sorghum or corn for two or three years in such a barrel. The main problem with the barrels is their cost. Although the farmers buy used barrels (those we saw had previously contained substances such as carbon tetrachloride, herbicides and insecticides), they cost 25 lempiras ($12.50) each in 1981. Because they hold about one and a half to two cargas of grain (150-200 pounds), each farmer would need a substantial number of them to store his whole harvest. The barrels are used almost exclusively for storing sorghum. Corn is harvested twice a year and the harvests are so small that it is generally consumed within a few months, before it is damaged substantially by insects. Sorghum is ony harvested once a year and is both a cash crop

and a backup subsistence staple for the people of the region.

The merchants in Pespire recognize the effects of the different storage techniques in their pricing of sorghum. The sorghum that has suffered quite a bit of insect damage is called maicillo de troja (i.e. stored in a simple pen) and was priced at .75 lempira (37 cents) for five pounds in July, 1981. Merchants regarded this sorghum as fit ony for consumption by animals. The sorghum undamaged by insects was called maicillo de barril (stored in a barrel) and was selling for .80 lempira (40 cents) for five pounds.

A final storage alternative for the people of the municipio of Pespire has been provided by the Save the Children Federation. The Federation began storage cooperatives in 1978. The people of fifteen different communities were organized, a building was bought in each community, and large laminated metal containers were built by the members of each cooperative. Each member pays one lempira (50 cents) to join and dues of five lempiras ($2.50) per year. If a member leaves the cooperative, he can take his accumulated dues with him. The cooperatives function by extending credit to members in April, May, and June so that they will have enough cash to prepare their land, plant seeds, and purchase herbicides and insecticides if these are needed. A farmer who wants to borrow money solicits it from an administrative counselor who is from the same

community. The counselor determines the amount of money a farmer can borrow by inspecting the land that is being sown and estimating the harvest that will be produced.

The loans are repaid in January or February with sorghum from the harvest. The amount to be paid for the sorghum is determined by a meeting of all the representatives of the cooperatives. This amount is below the market price for sorghum: in 1981, for example, it was fourteen lempiras ($7.00) per hundred pounds. The sorghum bought by the cooperative is stored in the laminated containers and treated with Phostoxin to protect it from insect damage. Depending on the amount purchased by the cooperative and the anticipated demand for sorghum in the community, the grain is either sold when the price is high to trucker for distribution in the nationewide market or held in reserve to be sold to members of the community.

The cooperatives have not all been equally successful. In some, the members have complained that the Federation has made excessive profits from them or that it denied credit to them after a poor harvest made it impossible to repay the amount of grain they owed. For its part, the Federation has tried to make it clear that it is the cooperative of farmers themselves who are running the graneries, and that the Federation just provides support facilities. Despite this, the perception of most people is that they are selling their grain "to the Federation" rather than to a cooperative to

which they belong. As the data in Table 12 show, the amount of sorghum sold to the cooperatives has declined each year since they were formed.

There is a cooperative in Cacautare and one in El Naranjito. The people who live in El Corinto belong to the cooperative in Cacautare. The cooperative in Cacautare has thirteen laminated silos while the one in El Naranjito has eight. Each silo holds sixten cargas (3200 pounds) of sorghum. As Table 12 shows, the amount of sorghum delivered to the cooperative in Cacautare has fluctuated considerably while in El Naranjito it has remained fairly steady. It should also be noted that almost every farmer in El Naranjito is a member of the cooperative while the proportion of members in Cacautare is only about one-half of the resilents.

There is no denying that there are organizational problems within the cooperatives. They do, however, offer an excellent solution for the problem of storing the harvest until the national price is high. Profits from the sale of the harvest are supposed to be divided among the members of the cooperative. Unfortunatley, because many farmers have defaulted on their loans, profits have not been common among the cooperatives. For this reason, members have become suspicious of the cooperatives because they believe their harvests are sold at a cheap price compared to the price on the open market.

Table 12

Sorghum Marketed by the Cooperatives of Pespire

Community	Number of Members	Pounds of Sorghum Delivered to the Cooperatives by Members 1979	1980	1981	Total
San Juan Bautista	136	46,303	38,300	17,800	102,403
El Portillo Grande	28	7,410	8,800	---	16,210
San Francisco	54	40,936	33,300	36,000	110,236
La Montana	26	14,600	14,600	18,600	47,800
La Arrinconada	72	5,000	3,400	2,240	10,640
San Juan Bosco	66	21,431	19,200	19,079	59,710
San Ant. de Padua	65	13,503	14,500	5,800	33,603
Esquimay	91	16,103	11,700	7,000	34,803
El Espinal	83	37,602	19,100	7,400	64,102
El Tamarindo	26	16,000	14,800	18,703	49,503
El Coyolito	31	15,303	11,400	6,000	32,703
Cacautare	47	17,160	7,200	12,703	37,063
El Naranjito	45	15,903	18,800	14,800	47,503
Tapatoca	122	82,800	38,500	7,903	129,203
Concepcion	39	---	600	600	1,200
Total	931	350,054	254,200	174,628	778,882
		(45%)	(33%)	(22%)	(100%)

Source: Save the Children Federation office in Pespire

Hopefully, these cooperatives will work better when all of the problems which have arisen in establishing them are resolved. The Federation has provided the people of Pespire with a successful storage alternative, has provided farmers with credit so that they are better able to cultivate their crops, and has provided them with herbicides, insecticides and sprayers at a fair price. These are all services that are needed to make sorghum cultivation a more productive and profitable activity.

The final storage technique to be discussed here is that used with the forage sorghum guate. The plant, as mentioned previously, is pulled up and gathered into sheaves or hands (mancios). These hands are tied together with the bark of either the ceiba or berberillo trees. The bark is first soaked in water to make it pliable and then tied around the sorghum. The hands of sorghum are stored in the rafters of the hourse or, if there is an outbuilding for the animals, in the rafters of this building. The sorghum will last all through the dry season so long as it does not get wet.

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SEED TYPES AND THEIR CHARACTERISTICS

It is well recognized that peasant farmers around the world practice techniques of seed selection, and Honduran peasants are no exception. In this section of the report, we will discuss the varieties of corn and sorghum seed used in the Despire region, describe some of their qualities, discuss the experience of farmers with some improved seed varieties, and finally identify those characteritistics that would be desirable in new seed lines that might be created.

Almost all of the farmers in Cacautare, El Naranjito and El Corinto recognize and plant two varieties of corn seed: amarillo (yellow) and blanco (white). Both varieties mature in a relatively short time (between 65 and 75 days), probably as a result of the selection of such types over a long period of time. The short growing season for corn usually makes it possible to obtain one harvest before the onset of the canicula and another harvest after the canicula ends.

The people in the three communities grew considerable quantities of white corn, although most indicated a clear personal preference for yellow corn. The main advantage of the white corn was its marketability: farmers reported that it was the variety preferred by people in Despire and the larger urban centers, that it was thus easier to sell and that it brought a higher price. In fact, on the national market, it is generally true that white corn is slightly

higher in price than yellow corn. Farmers said that the reason consumers preferred white corn was because tortillas made from it were whiter and thus more aesthetically appealing than those made with yellow corn.

Apart from its marketability, farmers did not consider the white corn to have many desirable characteristics. They reported that it was slower to mature, generally weaker (mas debil) and harder to harvest and to "peel" when making tortillas. Most farmers considered yellow corn to be superior to the white, although one or two people did report that white corn produced larger ears.

Yellow corn was seen to have many desirable characteristics. There was a suprising amount of agreement that the yellow corn possessed the following attributes:

1. it is "tresher" (fresco) so that it can tolerate drought better than white corn.

2. it matures more rpidly (mas ligero) so that there is usually a better chance of its producing a harvest, especially if the rains are delayed.

3. the grain is more resistant to insect damage in storage (mas valiente para la rica).

4. it is sweeter and thus better to eat as fresh corn.

5. it tastes better than white corn in tortillas.

6. it contains more vitamins (*mas vitaminas*) so it is a good food for humans and animals. Several people called it "donkey corn" (*maiz del burro*) and most agreed that if one wanted to give an animal strength, one should feed yellow corn.

7. it yields more in the field.

The primary disadvantage cited for yellow corn was that it was not as easy to market and did not bring as high a price as white corn. One or two individuals stated that it yielded smaller cobs than the white corn and one person also mentioned that it was a little more difficult to grind.

Almost everyone plants both yellow and white corn. The yellow corn is used in the household, while the white corn is either sold or held for sale in an emergency (because most of the corn produced is only for household consumption).

The variety of sorghum that is grown in the region also is quite uniform although people have utilized several varieties and rejected them because of their undesirable characteristics. The sorghum that had been grown by most farmers up until about five years ago was called *pina*, because the heads were pineapple-shaped. The farmers reported that a new variety from El Salvador called *coludo* was introduced into the region several years ago. This variety is also sometimes called *gigante* because of the

large size of its head.

Coludo has become the sorghum variety of choice in the Pespire region because it has the following characteristics:

1. the heads are larger and it yields more grain than the pina.

2. it is much easier to thresh than the pina. The grains are large and fall off the heads quite easily. Several people said that pina also was easy to thresh but that the chaff was much more irritating.

3. The coludo variety is somewhat more drought resistant (necessita menos agua).

4. it yields even in poor soils whereas pina requires good soil.

5. the grains are hard and are not as easily damaged in storage by granary beetles.

The coludo has similar positive characteristics in terms of cooking and eating as the pina variety. The coludo grains are a bit whiter than those of the pina, yield light colored tortillas and taste quite good although not as good as the preferred corn tortillas.

The people in the region have been exposed to and tried several different new varieties of sorghum. One of these is called blanco (white, because of the color of its grains)

and another is del banco (from the bank, because it was introduced by the agricultural bank). The latter variety yielded quite well, even in thin soils and people liked it for its qualities as a forage crop because it produced more leaves than the ccludo. Some farmers also said it was good for doing maicillera (the slash and mulch system used with sorghum) because the white grains could easily be seen when sowing among the cut vegetation. Unfortunately, the seeds from this variety do not have a hard covering and are easy prey for the granary beetles.

Centa S-1 and SAB are two new seed types that have been tried by some farmers. Both have the advantage of not being photoperiodic so that they yield two or three harvests instead of one. While farmers perceive the potential benefits, in their trials to date they have not had much success with these new varieties. The harvests before the main harvest season in December and January have been minimal because most of the crop has been attacked by crickets and birds. The little that is harvested cannot be adequately dried and thus rots quicly. Despite these difficulties, some farmers are willing to continue experimenting with these new types of sorghum but they have had difficulty obtaining the seed. Centa S-1 is of particular interest because of its forage possibilities. Farmers say that its canes are quite sweet and the animals can eat the whole plant. (The stalks of the traditional varities are too hard to be eaten by animals). In addition,

Centa S-1 has very white grains and produces tortillas with pleasing aesthetic qualities.

Farmers around Respire have been quite willing to experiment with new varieties of sorghum. Their preferred varieties have changed over the years as they acquire new seeds with better qualities than the ones they had been cultivating. Thus, if breeders are successfl in creating new varieties of sorghum with the necessary characteristics these will be adopted quite readily. Among the qualities that a better seeds should possess are:

1. the ability to yield well even in poor soils,

2. good food qualities in terms of color and taste,

3. some resistance to the major insect and bird pests of the area,

4. good qualities for use as forage as well as a grain. Sorghum is valued for its multi-purpose nature as a crop and varieties that can satisfy the demands of both humans and animals are valued. The increased prevalence of <u>guate</u> (forage sorghum) as a crop, however, suggests that a purely forage sorghum with superior characteristics may also be accepted.

5. grain sorghums must have a hard pericarp to withstand the attacks of granary beetles unless improved storage techniques become more widespread than they currently are.

The potential offered by obtaining three harvests of sorghum in place of the current single harvest is immense. It will require, however, that enough farmers plant these varieties so that pest damage is diffused rather than concentrated in a few fields. And, finally, this potential will only be realized if seed-drying facilities become available. These facilities may be either small-scale appropriate technology dryers in the villages or larger-scale operations in one of the major grain markeing centers.

Appendix I :

Sorghum as Human Food in Southern Honduras

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Sorghum as Human Food in Southern Honduras

The University of Kentucky has been involved in the study of sorghum consumption in Southern Honduras as well as its production. The human consumption of sorghum in Central America offers an interesting problem in the study of cultural and agricultural change and nutrition, since sorghum is a crop which is not native to the Western hemisphere and which has been introduced in relatively recent times. In this paper we will explore the nutritional implications of increasing production and consumption of sorghum. At the same time, because this study takes place as part of a group focused on the improvement of sorghum and millet production in areas where these grains are staples of the human diet, we will consider the problems of assessing the nutritional impact of single foods on established dietary complexes.

Sorghum production has been increasing in Southern Honduras over the years. While much of the sorghum produced is used as animal feed, our studies show about 37% of the sorghum produced in this area is used as human food. Sorghum production in this area is partially replacing the cultivation of the traditional dietary staple - maize. As DeWalt and Adelski (n.d.) have pointed out, however, cropping systems including sorghum are complex and insure the inclusion of at least some of the more traditional crop - maize. In addition, sorghum production fits well with the trend toward increasing production of livestock for export. As DeWalt (1982) has recently pointed out, sorghum production, in part, is an intermediary point in the process of taking land out of the production of annual food crops and forest land, and putting it into the production of perrenial grasses for animal forage. Sorghum's popularity comes from its versatility in serving as a human food, as well as providing both grain and forage for animal feed; and its drought tolerant

nature. It can produce a good grain crop even in years with low rainfall. The increased production of sorghum may have temporarily slowed the transformation of crop and forest land into pasture and allowed the small landholders and landless farmers to continue to have access to agricultural land, although large landholders continue to increasingly dedicate their land to pasturage and cattle production.

Nutritional Problems in Honduras

The planning council of Honduras estimates that about two-thirds of the population (or about 2 million people) of Honduras is undernourished (SAPLAN 1981). A 1966 INCAP survey of child growth (INCAP 1966) showed that 76% of preschool children suffer from protein calorie undernutrition. Most recent surveys carried out by the Honduran government show substantially similar results (SAPLAN 1981). When average diets were compared for 1966 and 1979, the overall availability of energy, iron, and Vitamins A and C in the Honduran diet had declined slightly. The food balance data from the nation as a whole demonstrate trends seen in other Third World countries experiencing declines in nutritional well-being. Production of beef between 1960 and 1979 rose 89% and exports of beef rose to 126%. At the same time per capita consumption of meats rose by only 32%. During this same time imports of basic grains rose by almost 2,000% for maize, 330% for rice, and 200% for beans while consumption of maize and beans fell by 14% and 5%, respectively. National level data document an increase in sorghum production in Southern Honduras. Interestingly no national level data on sorghum consumption were available. Despite our initial belief that sorghum is an important food crop, that importance was not recognized by government officials. When questioned about sorghum consumption, government nutritionists denied that sorghum is consumed as human food in any quantity in Honduras.

INTSORMIL RESEARCH

Our mission as part of INTSORMIL (International Sorghum Millet Project) was to describe the nutritional system of Southern Honduras and the place of sorghum in it; to describe the acceptibility of sorghum as human food and beliefs about its appropriateness; and to anticipate the nutritional consequences of increased sorghum production. The research to be described here was carried out within the context of the INTSORMIL research project in Southern Honduras described earlier. Using standard ethnographic methodology we set about the task of describing household consumption patterns in three communities in the municipio of Pespire during a period of field research extending from June 5 through August 12, 1981. An interview schedule was constructed and administered to male and female heads of a one-half random sample of households. Male household heads in 52 households responded to a detailed questionnaire concerning agricultural practices and economic strategies. Female household heads in those households, responded to questions concerning household composition, economic strategies, food resources, diet, and health-related practices and beliefs. An additional 16 women who were living in female headed households or whose husbands were not available for interviewing were also interviewed for a total sample of 68 women.

RESEARCH FINDINGS

The figures obtained from the interviews reveal the following pattern of land tenure in Pespire: of a total sample of 52 farmers, 24 or 46% were landowners, 20 or 39% rented land while the remaining 8 or 15% were loaned land to cultivate. The major crops cultivated were maize and sorghum. Secondary crops consisted of squash, yucca, beans, zacate jaragua (a grass used for cattle fodder), watermelon, melons, rice, sesame and gourds.

In this paper we would like to present some preliminary data on the use of sorghum and maize in the three communities which were surveyed. These

basic grains are only part of the more complicated food system which includes a wide variety of food stuffs. Our preliminary analysis of the diets suggests that meals recorded in the 24-hour recalls generally included other foods such as rice and beans or cheese and dairy products, fish and vegetables. Table 1 includes a listing of foods reported used, categorized on the basis of whether they are purchased, produced, gathered, or obtained through the Food for Work Program. As shown in the table, some of the foods are obtained through more than one source.

Although maize is the preferred grain for the making of the basic dietary staple - tortillas, sorghum is widely used and is well-accepted. It is processed in a manner similar to maize: first, it is subjected to an alkali treatment either with lime or wood ashes, the pericarp is removed and the grain is ground wet and formed into tortillas.

Data obtained from a market basket survey for the week preceding the interviews indicate that maize, sorghum, or both grains were used in every household surveyed. Because it is our impression that landowners have more resources under their control than those who rent or borrow land, we have in this analysis separated the households into categories of owners and non-owners. In a comparison of one week's grain usage in Table 2 we find that among landowners, 68% of the households used corn exclusively while this was true for only 44% of the renters' households. Among renters, slightly more households used sorghum rather than using maize exclusively (about 56%), and households headed by single females were much more likely to use sorghum than to use maize along (75%). We suggest that this pattern of sorghum usage reflects the more limited resources available to non-owners.

Sorghum is also incorporated into the diets of children. In a survey of foods served to children under the age of 4 years, twelve children were served sorghum tortillas and 14 were served maize tortillas. Sorghum tortillas

are considered equivalent to maize tortillas for children. This raises questions concerning the impact, on children as well as on adults, of substituting sorghum for maize in the complex food system existing.

In looking at the relative importance of maize and sorghum throughout the year, for both groups sorghum is an important food stuff. Only 20% of the households surveyed reported using maize exclusively throughout the entire year. The rest of the households reported using sorghum (either alone or mixed with maize) during certain months of the year. Of the people who use sorghum it is used an average of 7 months by renters, 5.1 months by landowners, and 10.4 months by non-cultivators. (Table 3).

Table 4 separates the sources of maize and sorghum for both landowners and renters. Interestingly, one of the findings is that among the land renters the greater proportion of those who use sorghum are purchasing sorghum. This is understandable in light of the fact that renters usually have access to only a manzana or less of land, which is insufficient to meet their subsistence needs. Of landowners who purchased sorghum we suspect that their land holdings are also quite small.

In Table 5 we have calculated out the amount of corn and sorghum available per person in the households of renters and landowners and the amount of energy that this represents. One of the most obvious findings shown in this table is that the staple grains of maize and sorghum represent a large percentage of the energy requirements for people of the area. This is similar to data collected by DeWalt in rural Mexico. It appears that land renters rely more heavily upon staple grains for energy, with the average of nearly 2000 calories coming from sorghum. Although further analysis is necessary, we suspect that the differences between landowners and non-owners in grain consumption reflect a relatively more monotonous diet for renters relying more heavily on basic grains, while owners probably supplement grain diets with a use of a wider variety of

Conclusions

Grain sorghum has been used as a human food in Africa for thousands of years. The nutritional value of sorghum for humans has only come under scrutiny relatively recently, however. Preliminary studies of nutritional quality and protein availability in rats suggested that sorghum compared favorably with other grain foods. On the basis of these studies carried out by INCAP (Bressani 1978) a feeding trial with children was conducted. The results of this feeding trial were very poor (McClean et. al. 1981). The apparent digestibility of the proteins in sorghum was only about 46% as compared to over 70% for maize. Children fed sorghum as their primary source of protein ceased to grow, or lost weight. Because of the ethical implications of this result, the experiment was terminated early. These data raised serious questions concerning the nutritional effects of promoting sorghum consumption, and on the basis of this study, the U.S. government adopted a policy of not sending non-decorticated sorghum in the form of food aid to countries in which it was not already a common human food (for ex., Bangladesh, where there no indigeneous processing techniques). The experiments conducted with sorghum, however, were based on a product prepared by mixing raw sorghum flour with water and cooking it into a porridge. In Africa, sorghum batter is frequently allowed to ferment before it is cooked. In Central America, as we have noted, sorghum is cooked in an alkali medium similar to the preparation of maize before being made into tortillas. No one has yet investigated the effects of these preparation methods on the availability of nutrients and the digestibility of proteins in sorghum.

Our preliminary data from Southern Honduras suggest that increasing sorghum production is resulting in the increased use of sorghum as a human food in this area. For the poorer agriculturalists sorghum may be the staple grain used for up to seven months of the year and may provide up to 2000 kcal/

day of energy, even though this level of consumption has not been recognized by planning agencies within the country. In addition, sorghum is considered an appropriate food for children in the form of tortillas and atole, in the same way that maize is. Sorghum is certainly an acceptable food although not preferred, and some informants report that sorghum tortillas are less satisfying than maize tortillas.

Much of the sorghum consumed by poorer members of the community is purchased. We have assumed that those with more land produce sufficient maize for home consumption and sell the less preferred sorghum to their poorer neighbors as well as on the national market.

Serious questions remain as to the nutritional impact of increasing replacement of maize with sorghum due to sorghum's poorer nutritional quality. Resolution of this question must await more extensive studies of the effect of alkali treatment on the availability of nutrients, however.

More importantly our research reaffirms the conclusion that the Southern Honduran diet is relatively complex including a wide number of food stuffs, of which sorghum is only one.

From a dietary point of view, it is impossible to consider the nutritional impact of a single food without considering the rest of the nutritional system. For example, one question which has already arisen in the context of INTSORMIL is, what would the value of a high lysine sorghum be for Southern Honduras? Apart from its poor digestibility, sorghum protein, like the protein of other grains, is deficient in lysine (an essential amino acid). One response has been to say, in essence, "let them eat beans," that is, why not direct our attentions to the development of a beans/sorghum intercropping system rather than develop high lysine sorghum? We have certainly suggested this, but such a suggestion is difficult to incorporate into the context of a single commodity project. Our continuing analysis will focus on the contribution of other

food stuffs to the diet of the people of Southern Honduras to better assess the impact of what will most probably be an increasing use of sorghum into the diet of Southern Hondurans.

TABLE 1 FOODS USED LISTED BY SOURCE

1. FOODS GROWN IN GARDENS OR THE MILPA:

Maize	Watermelon (Sandia)
Sorghum	Banana (Guineo, Minimo)
Squash (ayote, petaste)	Guava
Manioc (yucca)	Acerola (Nances)
Cucumbers (pepinos)	Anonas
Frijol Verde	Coconut
Hot Peppers	Lemons
Sweet Peppers	Avocado
Camote	Achiote

POULTRY AND DAIRY PRODUCTS:

Chicken	Eggs
Milk	Cuajada
Cheese	

OTHER FRUITS AVAILABLE (not available during invierno):

Mango	Cashew
Papaya	Pineapple
Ciruelas	Jocote
Plantains	

II. FREQUENTLY USED PURCHASED FOODS:

Maize	Avocados
Sorghum	Cabbage
Beans	Onions
Rice	Potatoes
Tomatoes	
Coffee	Vegetable Oil (Aciete)
Sugar	Vegetable Shortening (Manteca)
Salt	Rolls (Panes)
Lime	Rosquillas
Milk	Spices
Cheese	Dry Soup Mix
Cuajada	Noodles
Mantequilla	Eggs

SOURCES OF PURCHASE: local pulperias, Pespire, Choluteca, Tegucigalpa

III. LESS FREQUENTLY USED PURCHASED FOODS:

Beef	Pork
Chicken	Game
Fish	Canned Sardines
Canned Tomato Paste	Canned Fruit Juices
Instant Oatmeal	Garlic
Flour	Sodas
Sweets	Minimo
	Prepared Baby Formula

IV. FOODS AVAILABLE FROM COHAT:

Maize	Beans
Rice	Sardines
Oil	

V. FOODS GATHERED:

Fruits: Nances
- Anonas
- Lemons

Fish: Fresh water shell fish (Chacalines, Camarones)
- Sardines
- Robales
- Pescado Blanco
- Miracielo
- Mojaras
- Llegua

Game: Garobo
- Rabbit (Conejo)
- Armadillo (Cuzuco)
- Iguana
- Venison
- Palomas

TABLE 2 NUMBER OF HOUSEHOLDS USING SORGHUM AND MAIZE

	LANDOWNERS: 25		RENTERS: 27		UNMATCHED HOUSEHOLDS: 16	
USED MAIZE	17	68.0%	12	44.4%	4	25.0%
USED SORGHUM (either alone or mixed with maize)	8	32.0%	15	55.6%	12	75.0%
CHILDREN $\leq$ 4:						
ATE MAIZE TORTILLAS	8		5		1	
ATE SORGHUM TORTILLAS (includes sorghum and mixed)	6		3		3	

TABLE 3 AVERAGE NUMBER OF MONTHS IN WHICH GRAINS ARE USED

	Owners	Renters	Others
Maize	9.1	6.9	6.8
Sorghum	3.3	4.8	6.8
Mixed	1.8	2.2	3.6

TABLE 4 SOURCES OF MAIZE AND SORGHUM FOR LANDOWNERS AND RENTERS

	Landowners		Renters	
	Number	%	Number	%
MAIZE:				
Own production	10	50	5	31
Purchased	7	35	4	25
COHAT	3	15	7	44
TOTAL	20		16	
SORGHUM:				
Own production	5	63	6	40
Purchased	3	37	9	60
TOTAL	8		15	

TABLE 5 ENERGY AVAILABLE FROM CORN AND SORGHUM PER PERSON PER DAY

	gm/person/day	kcal/person/day
LANDOWNERS:		
Maize	320.2	1152.7
Sorghum	306.9	1043.5
Mixed:		
Maize	384.4	1254.2
Sorghum	213.6	726.2
TOTAL MIXED:	526.0	1980.4
RENTERS:		
Maize	441.2	1588.4
Sorghum	473.6	1950.2
Mixed:		
Maize	440.5	1585.8
Sorghum	352.0	1196.8
TOTAL MIXED:	792.5	2782.6
SINGLE FEMALE HOUSEHOLD HEADS:		
Maize	915.2	3294.7
Sorghum	286.0	1029.6
Mixed:		
Maize	85.5	308.8
Sorghum	85.5	291.7
TOTAL MIXED	171.0	600.5

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