Socioeconomic Aspects of Sorghum Research in Central America

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Resumen Sistemas intercalados maíz-sorgo se encuentran en Centroamérica a lo largo del Pacífico del Itsmo desde el Sureste de Guatemala hasta el Lago Nicaragua, con mayor concentración en El Salvador y el Sur de Honduras. Coincidencialmente, estos sistemas de cultivos intercalados son practicados por algunos de los agricultores más pobres del Hemisferio Occidental. El sorgo es producido como cultivo al contado (que entra al mercado nacional para ser usado principalmente para alimentación animal) y también como un cultivo de subsistencia (que provee una importante fuente de alimento para el segmento más pobre de la población o también para alimentar animales domésticos). Este trabajo reporta los aspectos socioeconómicos de la producción de sorgo con los sistemas intercalados maíz-sorgo en la región. Las características familiares y los patrones comunales descritos están basados en una larga extensión en el diagnóstico de la investigación de los sistemas de cultivos conducidos por INTSORMIL, comenzando en 1981, en siete comunidades en varias zonas agro-ecológicas del Sur de Honduras.

Este reporte formula las siguientes preguntas:

1. *Cómo es el sorgo intercalado en los sistemas de cultivo de la región?*
2. *Cuáles son los enlaces entre la producción familiar de sorgo y el contexto macro-económico?*
3. *Cuáles son las características de las familias que cultivan sorgo y cuál es la importancia económica y nutricional del sorgo para estas familias?*
4. *Cuáles son las principales limitantes para incrementar la producción y utilización de sorgo en la región?*

ABSTRACT

Sorghum-maize intercropping is found in Central America along the Pacific side of the Isthmus from southeast Guatemala to Lake Nicaragua, with the heaviest concentrations in El Salvador and in southern Honduras. Coincidentally, this intercropping

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system is practiced by some of the poorest farmers in the Western Hemisphere. The sorghum is grown both as a cash crop (that enters national markets for use primarily as animal feed) and as a subsistence crop (that provides an important human food for the poorest segment of the population as well as feed for domestic animals).

This paper reports on the socioeconomic aspects of sorghum production within this sorghum-maize intercropping region. The household characteristics and community patters described are based, to a large extent, on the diagnostic farming systems research conducted by INTSORMIL, beginning in 1981, in seven communities in various agro-ecological zones of southern Honduras.

This report addresses the following questions:

1. How is sorghum incorporated into the farming systems of the region?
2. What are the linkages between household sorghum production and the more macro-economic context?
3. What are the characteristics of the households that grow sorghum and what is the economic and nutritional importance of sorghum to these households?
4. What are the principal constraints to increasing the production and utilization of sorghum in the region?

INTRODUCTION

Over the past decade, social scientists have increasingly been incorporated into agricultural development efforts (Jones and Wallace, 1986; Rhoades, 1986). This has been due, in part, to the major reorientations of policies that occurred in the 1970s among leading international agencies concerned with economic development. These shifts included a greater concern with equity and with serving the "basic needs" of the poorest of the poor (see Foreign Assistance Act 1979; Hoben, 1984) and in turn resulted in augmenting the examination of the sociocultural aspects of economic development. In addition, this "new direction" included a greater effort to design agricultural research and development projects that directly address the food consumption

and nutritional problems of the rural poor (FAO, 1982; Pinstrup-Anderson, 1981; USAID 1982a, 1982b, 1984a, 1984b).

This paper describes work aimed at integrating socioeconomic and nutritional goals into agricultural research and development that was done within the context of the International Sorghum and Millet Project (INTSORMIL). Between 1981 and 1984 anthropologists from the University of Kentucky carried out diagnostic farming and nutritional systems research in southern Honduras that coincided with the implementation of biological agricultural research efforts.

Southern Honduras is part of the sorghum-maize intercropping region that extends along the Pacific from southeast Guatemala to Lake Nicaragua. The heaviest concentration of sorghum-maize intercropping occurs in Southern Honduras and El Salvador where nearly all the sorghum is intercropped with maize (Hawkins, 1984).

The sorghum is grown both as a cash crop (that enters national markets for use primarily as animal feed) and as a subsistence crop (that provides an important human food for the poorest segment of the population, as well as feed for domestic animals).

This paper addresses the following questions:

1. How is sorghum incorporated into the farming systems of the region?
2. What are the linkages between household sorghum production and the market?
3. What are the major findings of the socioeconomic and nutritional research and the relationships between agricultural production and nutrition.
4. What are the principal constraints to increasing the production and utilization of sorghum in the region?

SOUTHERN HONDURAS: THE RESEARCH CONTEXT

While the military crisis occurring in Central America is well known, a related but much less known emergency also is taking

place in southern Honduras - one that is resulting in devastating human and environmental consequences. Militarization, economic recession, climate, topography, population growth, unequal distribution of landholdings, competitive allocation of cropland, and high unemployment all are contributing to food and resource scarcity evident in widespread regional poverty.

Armed conflict and the Central American economic recession of the 1980s have combined to diminish permanent and seasonal wage labor opportunities and consequently has led to increased out-migration and to intensified agricultural production by limited resource households (see Stonich, 1987).

Climatic conditions and rugged topography make agriculture risky for small farmers in the south. Maximum temperatures frequently exceed 40°C during the hottest months of March and April, while minimum temperatures along the coast rarely fall below 16°C. Temperature are more moderate in the foothills and mountains, but even there hot, muggy conditions prevail. Rainfall is seasonal and quite variable. There is little or no precipitation from December to April. The rainy season, from May to November, may produce as little as 500 mm per year or as much as 2500 mm. It is almost always marked by a *canícula* - a dry period of two or more weeks. Even in the years of "average" rainfall serious difficulties may arise.

In 1982, for example, heavy rainfall caused floods and landslides at the beginning of the rainy season; a drought occurred during June, July, and August; and damaging rains returned in September. It was a disastrous crop year in spite of "average" rainfall. The heat, irregular precipitation, and the *canícula* impose severe environmental constraints on agriculture in the region. The rough topography characteristic of most of the region also contributes to making agriculture difficult. Although theres is a small coastal plain with relatively flat land, the adjacent foothills and highlands, which constitute about 75% of the region and where most of the people live, are characterized by slopes to 60% (CRIES, 1984).

Data from agricultural censuses since 1952 show an increasing polarization of landholdings into very small and relatively large farms (Boyer, 1982; Stonich, 1983, 1986). The large landholdings are concentrated along the coastal lowlands

and are devoted to export oriented commercial agricultural production; sugar cane, cotton, cattle, melons. The small landholdings are in mountainous areas where farmers plant the basic food crops; maize, sorghum, and beans. By 1974, 68% of all farms in southern Honduras were less than five hectares in size (DGECH, 1976). In addition to the growing number of farmers who do not have access to sufficient land to meet family requirements, there are an escalating number of rural landless families. As larger farmers invest more heavily in machinery and switch to less labor-intensive crops, and as seasonal agricultural wage labor opportunities in Nicaragua and in border areas within Honduras are diminished or eliminated, these marginal farmers encounter more and more difficulty in finding employment.

In 1980 the region contained nearly half a million people, with some rural areas having a population density of 160 people per square kilometer (Stonich, 1986). Agricultural unemployment has been estimated at 62.2% and per capita income at $118, making this one of the poorest regions in all of Latin America (CESPE/OEA, 1982).

A 1979 nutritional survey in the region indicated that 53% of children up to five years of age had some form of nutritional deficiency, 24% had severe nutritional deficiency, and one percent bordered on death due to malnutrition (SAPLAN, 1981). More recent evidence indicates further declines since that time (Valverde, personal communication).

RESEARCH DESIGN AND METHODS

The research methodology integrated farming systems research (Shaner et al., 1982; DeWalt, 1985) with the study of nutritional systems (DeWalt 1981, 1983a, 1983b, 1984). Investigations focused on three agrarian reform communities located on the coastal plains and on six communities located in two ecological zones in the highlands (Figure 1). University of Kentucky researchers were in the field for significant parts of the years between 1981 and 1984. The research combined ethnographic qualitative research with survey research designed to yield quantitative data on relevant variables.

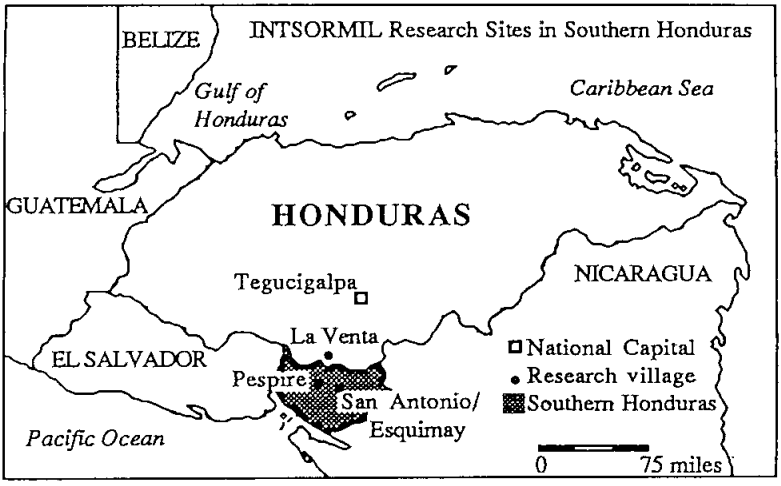

Figura 1. INTSORMIL Research Sites in Southern Honduras.

Detailed descriptions of the research design and methodology. Are given by DeWalt and DeWalt (1982) and Stonich (1986).

RESEARCH FINDINGS

Both comprehensive and detailed research reports on agricultural production and food consumption are available (DeWalt and DeWalt, 1982; DeWalt, 1983; DeWalt and Alexander, 1983; DeWalt and Stonich, 1985; Thompson et al., 1985; Stonich, 1986, DeWalt and DeWalt n. d.). The following section includes more specific results on cropping and marketing systems and a summary of the most important findings regarding agricultural production and nutrition.

CROPPING SYSTEMS

Southern Honduras has two growing seasons imbedded in the rainy season which extends from May trough November. The first, the *primera*, begins with planting maize and sorghum in early May and ends with a maize harvest in July, during the *canícula*, a (usually) short dry period that falls in the middle of the rainy season. Maize will not survive the *canícula* but the more drought tolerant sorghum will. Sorghum is sensitive to

photoperiod and will not flower until fall. It stays in the field until December or January when it is harvested. The second planting season, the *postrera*, begins in late July, at the end of the *canícula*. A second planting of maize may be made and both grain and forage sorghums may be planted at this time.

Nationally, approximately 90% of the sorghum that is grown in Honduras is intercropped with maize and yields 0.9 t/ha. Between 1980 and 1982, sorghum yields in the south were less; varying between 0.54 to 0.73 t/ha.

The sorghum planted by small farmers in the south is invariably intercropped with maize (80% to 90%, according to INTSORMIL community based data). In the plains, maize is sown in furrows approximately 0.9 to 1.0 meter apart. Either immediately afterwards or a week or two later, after the maize has emerged, sorghum is sown in between the rows of maize. A similar system is employed in the highlands. There maize and sorghum are sown simultaneous in the same hole (3-4 seeds of maize and a handful of sorghum) or sorghum is sown between the hills of maize after the maize has emerged.

A complex variety of sorghum-maize intercropping systems are found in the highlands. Figures 2 and 3, in part illustrate this complexity (see DeWalt and DeWalt, 1982 and DeWalt and Stonich, 1985 for other examples). In foothill communities, such as Esquimay (Fig. 2), a field in secondary growth forest enters the cropping cycle through one of three slash and mulch systems used after the *canícula*. In all three systems the basic method used is to sow either maize (with a digging stick) or sorghum (broadcast) first, then chop down the forest cover leaving the vegetation on the field as a kind of mulch. The maize or sorghum then grows in the interstices of the dead and decaying vegetation. The sorghum grown in this way can be used for grain (*maicillera*) and/or for fodder (*guatera*). The second and third year that a field is in cultivation, preparation is most often with the slash and burn method. The field is burned in late March or early April, after which maize and sorghum are interplanted. In communities above 500 meters, such as San Antonio de Padua (Fig. 3), beans may also be added to the cropping system (see also Díaz, 1982). There a slash and burn or a slash and mulch system may be used to begin the cultivation cycle after the *canícula*. Maize and beans may be intercropped,

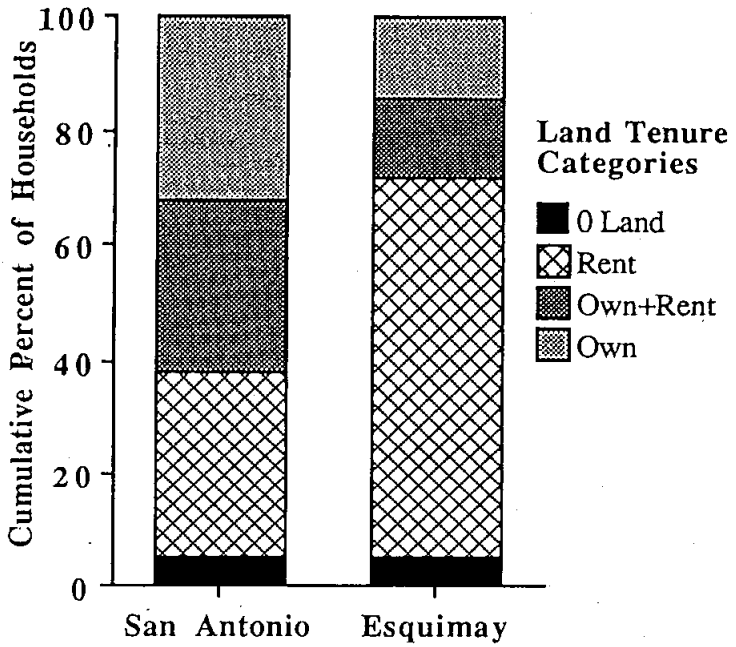

Figura 2. Land Tenure in San Antonio and Esquimay, 1982. Source: Computed from male survey data.

beans may be planted alone, or, less frequently, a pure stand of sorghum may be planted. In the second and third years of cultivation, maize and sorghum are intercropped as in the foothill communities.

Subregions within southern Honduras are in various stages of transition from shifting to permanent cultivation. In the two representative communities, Esquimay and San Antonio, land is returned to fallow for two five years after the third year of cultivation. A five year follow period was the maximum found in the highland communities studied. In the municipality of Pespire, site of the majority of foothill and highland communities included in the research, the range in the ratio of length of the cropping cycle to the total cycle (cropping years + fallow years) was 0.38 to 0.60. These values compare to similar ratios (computed on the basis of census data) of 0.52 for southern Honduras and 0.54 for eastern El Salvador (Hawkins, 1984). Actually, several areas had ratios much higher than these. For

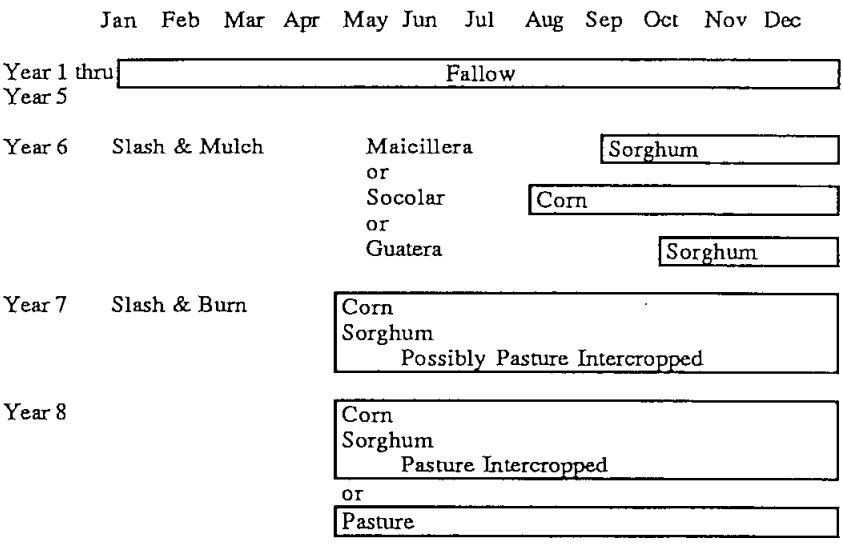

Figura 3. Eight year fallow and alternative cropping cycles • Esquimay, 1983. (Dewalt and Duda, n.d.).

example the ratios in areas further south and closer to the Nicaraguan border, and further north, closer to Tegucigalpa ranged from 0.6 to 0.1, with no fallow period in several areas (Stonich, 1983). There is a statistically significant ($P < .001$) positive correlation between the population density in a given area and this ratio. As population density increases, the practice of continuous cropping also increases. Therefore, although agricultural systems in Pespire are probably classified as shifting cultivation, other areas of the south are much closer to being systems of permanent cultivation.

The technology involved in the shifting cultivation systems was fairly simple. The use of fertilizers (except that provided by burned vegetation), plows, and irrigation was virtually absent. Capital investments were minimal. Herbicide use was irregular; in some communities 45 to 50% of farmers reported using herbicides whereas in others, no one did. Insecticides, however, were used in virtually every community, with 20 to 40% of farmers reporting their use - generally to treat seed before planting. Tools for planting were rudimentary; *machetes* used for clearing, digging sticks with metal points (barretas) used for

planting, gourds used as seed containers, and plastic and string sacks used to transport crops. When possible, seeds were saved from the previous harvest. Few farmers owned horses or mules to transport grain; most carried sacks of harvested crops on their back.

MICRO TO MACRO LINKAGES: FROM THE HOUSEHOLD TO THE MARKET

Data from the two highland communities, Esquimay and San Antonio, demonstrate intra-regional diversity in terms of the degree and nature of socioeconomic differentiation and in linkages between household producers and markets. These two

Table 1. Land Tenure by Total Access, Amount Owned & Rented (Land Amounts in Hectares)

Location		Rent (ha)	Own+Rent (ha)	Own (ha)
San Antonio				
n=65	Access	1.95	4.69	4.97
	Owned	0.00	2.30	4.97
	Rented	1.95	2.39	0.00
	n (%)	21 (32%)	21 (32%)	23 (36%)
Esquimay				
n-63	Access	1.97	5.30	25.70
	Owned	0.00	3.80	25.70
	Rented	1.97	1.50	0.00
	n (%)	45 (72%)	9 (14%)	9 (14%)

communities are geographically adjacent and located in zones having similar agricultural potential. They, nevertheless, differ significantly in land tenure (Fig. 4), in the distribution of land (Table 1), in patterns of household economic strategies, and in the overall way each is articulated with the larger economy (Fig. 5). This diversity is, in part, the outcome of local responses to the regional expansion of commercial agriculture.

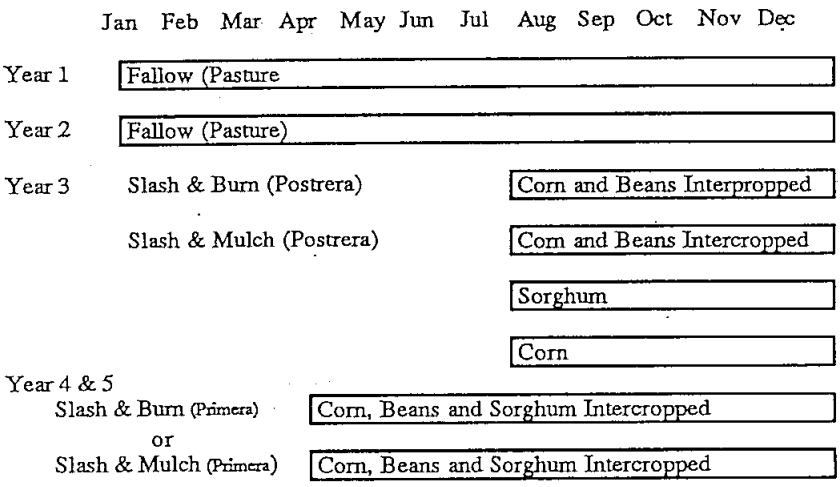

Figura 4. Five year fallow and alternative cropping cycles • San Antonio, 1983. (Dewalt and Duda, n.d.).

Much more socioeconomic diferentiation has taken place in Esqquimay making it much easier to clasify households in terms of patterns in their major economic production strategies: 1) the largest landholders (who own 20-75 ha of land and constituted 5% of farmers) relied on cattle raising and on animal and food grains produced by their tenants; 2) a few merchants who did not cultivate crops; 3) a very few number of households who relied almost totally on wage work and did not cultivate; 4) a few medium sized landholders (5-20 ha/8% of farmers) who raised a few livestock and chickens, bought and sold animals, and in general included the greatest array of community based agricultural options in their overall economic production strategies; and 5) the largest group of land poor and landless farmers (<5 ha/87% of farmers) who sharecropped or were loaned land for temporary use. In Esquimay, this horizontal segmentation was related to the extent to which households in each group met nutritional requirements. Associated vertical socioeconomic hierarchies were also created which served to regulate this more complex structure.

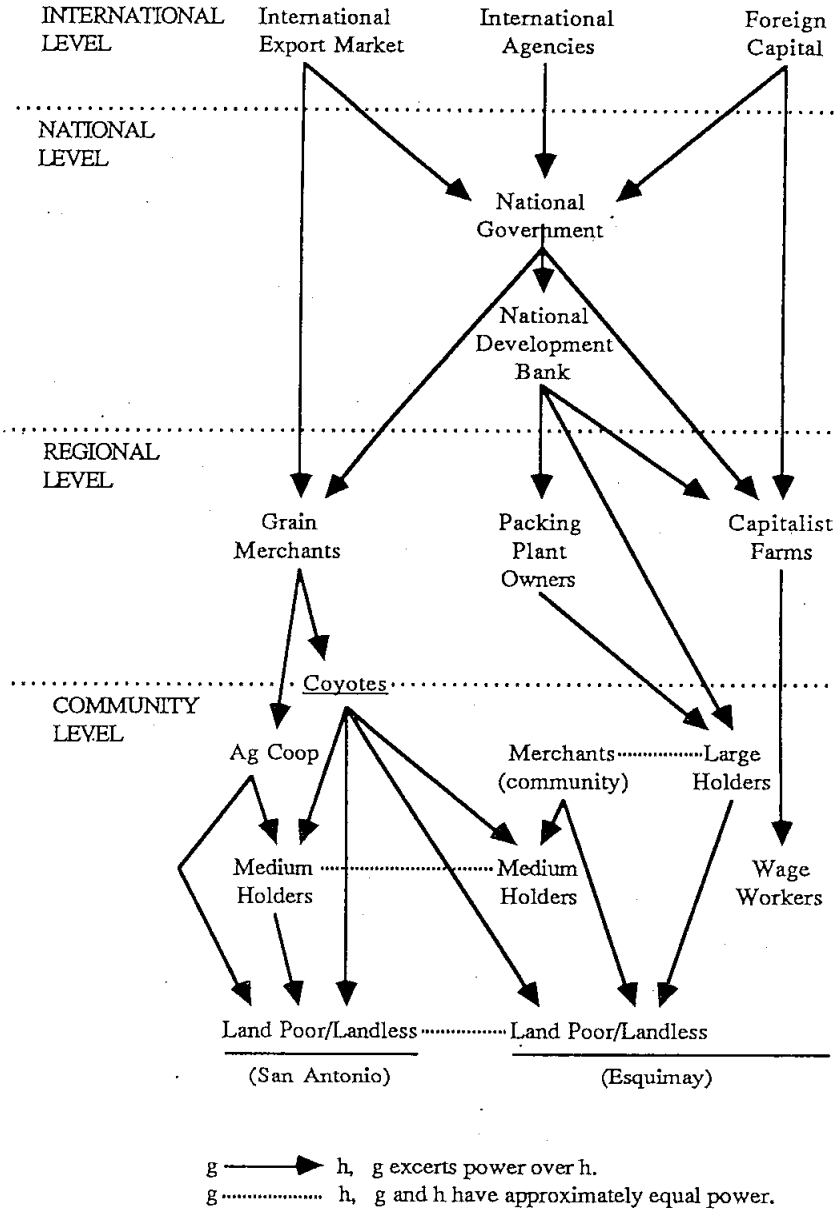

Figura 5. Relationship among operating units engaged in Agriculture in San Antonio and Esquimay in the Region, the Nation, and Internationally.

The largest landholders were linked to the landless and land poor through contractual relationships involving sharecropping. The large land ownersreceived one third of the crops produced by their tenants which they used for both human and animal food, and which also reduced their agricultural risk. These large land owners also benefited from the labor of their tenants who prepared the land for use as pasture. These contractual sharecropping arrangements also appeared to be advantageous to the tenants in the short term since they were given the temporary use of land for their own food grain production. In the long term their labor may limit their alternatives if the land they prepare is turned into permanent pasture. These large landholders also had supplies of grain which lasted long after the grain produced by the land poor and the landless was consumed, sold or lost. During times of shortage these large holders often sold grain black to the producers. The few largest landowners also served as community social and religious leaders and as the primary political mediators between the community and the larger system. While the group of largest landowners served as their own economic mediators with the larger systems, village merchants served as a major economic link between most people in the community and the outside. They bought and sold grain, often contracting with producers before harvest at disadvantageous prices to the producers but thereby providing producers a source of cash. Often the sharecropper who owed one third of his production to the landlord also owed part of his production to the community merchant or to the itinerant merchant truckers (*coyotes*) who also served as major economic links with larger economic systems.

Much less socioeconomic differentiation occurred in San Antonio. There no households had access to more than 20 hectares of land. The remainder of the households could not be separated as discretely into subgroups on the basis of land and other socioeconomic indicators or on their ability to meet nutritional needs. Regulatory mechanisms in the community did not involve the creation of a socioeconomic hierarchy but rather in group cooperation taking the form of the agricultural cooperative and numerous voluntary associations. These served many of the same functions as did the large landowners and merchants in Esquimay. The cooperative rented a modest amount of land to the landless in the community for a small fee,

financed the purchase of seeds, contracted for the purchase of grain before the harvest, and acted as a marketing agent for a variety of grain and other food products with the larger system. In San Antonio no individual household could be clearly identified as acting as mediator with the larger system.

The two communities also differed markedly in the organization and complexity of suprahousehold labor and food sharing networks; San Antonio had fewer total but more complex cliques with fewer links leading outside the community (Stonich, 1987).

In Esquimay, resource monopolization contributed to socioeconomic differentiation and to the formation of a small group of more powerful farmers, merchants, and wage laborers who were much better off as measured by a number of economic and nutritional indicators. Despite their group consolidation, the majority of households in San Antonio were not able to meet their nutritional requirements (57% of households versus 37% of households in Esquimay).

Despite regional diversity, patterns did emerge in the production and marketing of sorghum that cross cut these and the other communities studied. In general, households with access to less than one hectare of land (15 to 30% of all households) sold between 4 to 20% of the sorghum that they grew (the variation being related to overall community patterns in the extent to which that community utilized sorghum as a human food); households with access to 1 to 10 hectares (60 to 85% of all households) sold one third of their sorghum crop; and households with more than 10 hectares (1 to 10% of all households) sold two thirds of their crop. Sorghum enters the market through the linkages described above. Household decisions regarding the marketing of maize are much different. In general, for all communities, households with access to less than 10 hectares of land sold very little if any of the maize that they produced; households with 10 to 15 hectares sold 33%; households with 20 to 50 hectares sold 60%; and households with more than 50 hectares sold 85%.

The destination for most sorghum that enters the national market is livestock feed. During the sorghum harvest season, independent truckers (*coyotes*) visit the villages offering to

purchase the grain. Because of grain storage problems and the need for cash, a large portion of sorghum is sold almost immediately, often at very low prices. Nevertheless, for a large number of families, sorghum is their major cash crop. From the villages in the south, sorghum then finds its way to markets in Tegucigalpa or San Pedro Sula where it is sold as feed for pigs and chickens. Demand for sorghum has been increasing steadily, and in recent years Honduras has been importing sorghum to augment insufficient domestic production.

Sorghum is also used as feed for domestic livestock in the village. Approximately 60% of households own a few pigs and chickens the major consumers of the grain. In addition, almost every household that has cattle (20% of all households), sow some sorghum to be used as fodder during the dry season. Another use of sorghum is that after the grain is harvested, cattle are pastured in the fields to eat the leaves of the sorghum plant. Thus, sorghum is economically important to households in the south both as a cash crop and as feed for domestic animals.

CONCLUSIONS AND RECOMMENDATIONS BASED ON FARMING SYSTEMS RESEARCH

Macro-level constraints restricting the production of sorghum

A number of political economic, socioeconomic and technological/environment constraints restrict increased production and consumption of sorghum in southern Honduras (Stonich and DeWalt, n.d.). Although the Honduran government has undertaken an agrarian reform program that has made some progress in redistributing land, the overall trends have been toward increased concentration of landholdings; a significant shift of land resources for use as pasture and for other large scale commercial agricultural production; and consequent decreases in per capita food production.

The competitive allocation of cropland

There is growing competition in the region between the production of basic grains and the production of commodities (Stonich, 1986). Land is continually being converted from annual crop production to permanent pasture for cattle often with the assistance of small farmers who are compelled into

participating in the deforestation of extensive areas (see DeWalt, 1983; 1986). As less land becomes available for the production of grain crops, specially for limited resource farmers, fallow cycles for steep sloped lands are reduced (Durham, 1979; Stonich, 1986). Small farmers increasingly are required to sow depleted fields in order to produce part of their subsistence grains. Soil fertility is declining and soil erosion is becoming an ever-greater threat to the long-term survival of the ecological system (DeWalt and Alexander, 1983; Stonich, 1986). As a result, yields of the basic grains cultivated by farmers in the region are declining. In 1982, for example, the average yield of sorghum was only 0.54 t/ha; the comparable figure for maize was 0.55 t/ha,and for beans it was 0.27 t/ha.

The lowlands with higher agricultural potential are farmed for the most part by large landowners who plant commodities (such as sugar cane, cotton, melons) for export or who sow pasture for cattle (also destined for export). A few agrarian reform communities were established during the late 1970s and early 1980s but these represent only a small percentage of farmers in the region (Stonich, 1986). Members often produce cash crops on land that is worked collectively (Adelski, 1983), but each family is also usually allocated one or two hectares for cultivating grains for household needs.

Declines in food production

Growing amounts of land dedicated to commercial crop production and to pasture, coupled with the concentration of food production on small farms in a context of significant population growth has resulted in decreased per capita production of food in the region. Between 1952 and 1982, the amount of land planted in corn increased only 1% and sorghum 15%, while the amount of land sown in beans decreased to 85% of its 1952 level. Consequently, between 1952 and 1982, per capita production of corn dropped 71%, sorghum 73%, and beans 81% in the region. These regional trends were part of a larger national trend that occurred during approximately the same time period which together resulted in Honduras becoming a food deficit country. Between 1960 and 1980, imports of basic grains into Honduras rose by 2000% for maize, 330% for rice, and 200% for beans.

Micro-level production constraints

The investigation identified a number of specific production constraints for food crops. The most important of these are related to erratic rainfall patterns, declining productivity, and erosion. In the approximate order of their importance, other constraints included post-harvest losses to granary weevils, losses in the field due to birds, plant disease, and insect damage (DeWalt and DeWalt, 1982).

New varieties and technologies

Research suggests that sorghum as a monoculture does have some potential in the coastal lowlands where machinery, fertilizer, irrigation, and other inputs can be used. High-yielding hybrids might be a possible alternative to be grown along with, or in place of, the existing cash crops that are now grown by commercial farmers and by some agrarian reform communities. A few larger farmers were already experimenting with some hybrid sorghums.

The greatest research need, however, is for varieties of sorghum that can improve yields within the maize-sorghum intercropping systems in which it is already grown. Research should be focused on improving the existing *criollo* varieties. Reducing plant height (existing varieties are often 3 to 4 meters tall) may increase yields. Some existing varieties have a corneous seed that provide some resistance to the grain weevils and also produces good quality for making tortillas. These characteristics should be retained and enhanced if possible. It may be that the photosensitivity of existing varieties should also be kept because this assures that the sorghums mature after the end of the rainy season, thus minimizing crop loss due to weathering and molds caused by excessive moisture.

Varieties have another significant advantage in that they can be passed on from farmer to farmer and can be grown year after year. This is important in a country such as Honduras in which the seed multiplication and distribution system is underdeveloped. Farmers are also quite familiar with experimenting with and adopting new varieties. Data show that they are all aware of several types of native varieties and that

most are now using different varieties than they used several years ago.

The overall level of receptivity of these farmers to new technology is impressive. In addition to adopting new varieties of seed, many farmers had adopted the use of herbicides. Many had joined the grain storage cooperatives as a means of reducing post harvest losses. Thus, there is clear evidence that when technology works and is within the reach of the economic means of small farmers, it will be adopted.

Improvement in income and expenditure patterns

Despite increases in production, Honduras imports sorghum and any surplus production as a result of improved yields would find a ready market. However, storage problems result in the need to sell grain, including sorghum, soon after harvest at low prices and the need to by it back later at higher prices. Improvements in storage and storability are key to improving the flow of income and subsistence grains from sorghum production for small farmers.

The other areas of importance for small farmers have to do with the balance between the cost of production and the value of the crop produce. Resource poor farmers in Southern Honduras are frequently share croppers or tenant farmers for whom it makes no sense to invest in permanent improvements on land and who cannot afford costly inputs. Furthermore, the land they cultivate is, for the most part, located on the steep hillsides of the highland areas. Agricultural technology, then, must be cheap, appropriate, and easily accessible to improve income.

CONCLUSIONS AND RECOMENDATIONS BASED ON NUTRITIONAL SYSTEMS RESEARCH

The nutritional importance of sorghum

Most people outside of the south only know sorghum as a livestock feed. An INCAP (1969) nutritional survey, which included the south did not include sorghum in its list of human foods. When socioeconomic research was begun by INTSORMIL in 1981, nutritionists and government officials in Honduras rejected the view that humans consumed sorghum

directly. Although people in the south voiced a distinct preference for maize *tortillas*, in all the communities studied, a significant portion of the sorghum produced was used as a substitute for maize. Sorghum accounted for approximately 37% of the grains consumed as food in the study communities (Thompson et al., 1985). Sorghum is used as a substitute for maize in a number of products including the staple food - (*tortillas*), as well as gruels and porridges (*atole*), and hard biscuits (*rosquillas* and *rosquetes*). Other minor uses of sorghum include the preparation of a beverage by mixing ground, toasted sorghum with water and sugar for use as a soft drink, the occasional use of roasted sorghum as a coffee substitute, and popped sorghum, which is mixed with sugar syrup or honey to make popped sorghum balls (*alborotos*). While maize is strongly preferred for many of these products, sorghum is acceptable, and is used by most families at some time of the year (DeWalt, 1985a, 1985b).

Considerable intra-regional and intra-community diversity existed in terms of the extent to which particular communities and households relied on sorghum as a human food (Stonich, 1986). Some families reported using sorghum to make *tortillas* for up to nine month of the year while others reported that they were forced to use sorghum only a few weeks per year. Sorghum use tended to be greater in the highlands than in the lowlands, specially among tenant farmers and sharecroppers. During drought years (such as 1982 and 1983) when most of the maize crop was lost, the use of sorghum for human food increased in both the highland and lowland areas.

Therefore, increased sorghum production would be likely to differentially benefit the poorest of the poor because it is consumed regularly by the most impoverished families and by there entire population during times of food scarcity and economic stress.

Nutritional status of children and households

Analysis of anthropometric surveys demonstrated that about 60% of children under 60 months of age are below 95% of standard height for age, thereby suggesting some degree of undernutrition. In some communities in the lowlands up to 95%

of children showed some degree of growth failure. The amount of acute malnutrition, represented by weight for height below 90% of standard, also varied among communities, but was much lower, usually less than 15% of children.

The children of tenant farmers and households headed by single women were at greater nutritional risk than the children of landowners as measured both by analysis of diets and of nutritional status. The amount of land cultivated per person by households was positively associated with the extent to which households were able to meet food needs.

Energy or protein as the limiting nutrient

Dietary analyses indicated that calorie intake was more limited than protein intake, supporting similar studies done among other rural Central American populations (Valverde et al., 1975; Sellers, 1984). While up to 60% of households in some communities, failed to meet their calculated requirement for energy, almost all exceeded their requirement for protein, even when the lower protein quality of grain based diets was taken into consideration.

LINKS BETWEEN AGRICULTURAL PRODUCTION AND NUTRITION

Seasonal patterns of food use and nutritional status

For resource-poor farm families food scarcity is greatest in June-immediately before the first maize crop is harvested. At that time, families report using sorghum that was either saved from their own production or purchased (because it is usually cheaper than maize). These problems of food scarcity are essentially economic; the poor cannot afford to purchase grain at precisely the time that they need it most.

The predicament is exacerbated by the storage problems for both sorghum and maize. Sorghum is quite susceptible to insect damage during storage using traditional methods. The several varieties of higher-yielding sorghum that have been introduced in the region have much poorer storage properties than many of the existing land races. In order to diminish the risk of storage loss, farmers tend to sell introduced varieties before traditional ones as

a cash crop immediately after the harvest. As a result, households cannot store the grain for their own consumption and must sell their harvest when prices are at their lowest. Improvement in the storage properties of sorghum or better means of storage would permit house holds to reserve more sorghum for home consumption and would also regulate the flow of income from sales over time.

WOMEN AND THE HOUSEHOLD ECONOMY

Although women in southern Honduras are only infrequently involved in the labor necessary to cultivate field crops, they do have multiple roles in agriculture, cash earning activities, home maintenance, and child care (Fordham et al., 1985). There are distinct areas of farm decision making in which men and women each play paramount roles. Adult males have primary responsibility for deciding about the timing and nature of operations related to the cultivation of field crops (corn, sorghum, beans), other cash crops (sugar cane, sesame, etc.), and the maintenance and sale of large livestock. While women contribute most of the labor in processing these field crops for consumption and for the market, the allocation of labor is determined by the male or by a male relative. Women generally have virtual autonomy, however, in decisions pertaining to the cultivation of legumes, vegetables, fruits and root crop grown in the house gardens for home consumption and for sale in domestic markets, and in the raising and selling of small animals and animal products. Moreover, decisions about family food consumption and nutrition lie solely within the domain of women. Sixty percent of women who planted house gardens said that they had fairly regular access to a pool of family labor. This labor pool was made up of an assortment of male and female relatives. Male farmers do not make all decisions nor do they accurately represent the interest and intentions of other members of the farm household (Stonich, 1988).

INTSORMIL has not directly addressed the issues of concern to women, and it is unclear whether breeding activities directed towards an improvement in yield of traditional varieties would alter labor demands for either men or women. Increased availability of grain for feeding small animals might improve women's ability to generate income through animal production and the sale of animal products.

In the commercial agricultural sector in the lowlands, women generate income through agricultural wage labor. The reliance of land-poor and landless workers (both in the lowlands and in the highlands) on wage labor suggests that any "improvements" that reduce labor requirements for agricultural production, such as development of a hybrid feed grain sorghum for the lowlands that would be harvested by machine, could be devastating for both men and women.

CONCLUSIONS

Concerns with food consumption and nutrition were incorporated into the first phase of INTSORMIL research in Honduras. The focus of the CRSP on food quality sorghums in food deficit countries in part targeted the project towards those at greatest nutritional risk. Data generated during the diagnostic phase identified specific groups at nutritional risk and outlined the factors involved in predicting risk. Data were also provided to identify the grain quality characteristics important in acceptability of improved varieties of sorghum. The primary sorghum breeder for INTSORMIL in Honduras has included many of the criteria identified by these data in the organization of his breeding program.

Unfortunately, INTSORMIL social science projects were reduced in number and scope and eventually eliminated in 1986. One result is that the planned monitoring and evaluation of the impact of INTSORMIL sponsored research in Honduras will not be carried out. Though several new varieties of sorghum have been released since 1985, it is unclear whether these have met with acceptance among farmers and their families, whether their productivity is better than traditional varieties, and whether they have had any effect on the nutritional status of farm families. Thus, it is impossible to say what the longer-term results of the socioeconomic research have been. Although it has affected the work of those INTSORMIL scientists who have been working in Honduras, and trough them it has affected the work of the Consortium of Latin American Sorghum Investigators (CLAIS) working in other Central American countries, it is not known whether the ultimate and most important client group has been reached--small farmers and their families.

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