CASE STUDIES IN NUTRITION IN AGRICULTURE

April 1987

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United States Department of Agriculture

A report prepared under RSSA-BST-1171-R-AG-3125-01
with the Office of Nutrition, Bureau of Science and Technology
Agency for International Development
under purchase order # 40-319R-6-00472
Case Studies in Nutrition and Agriculture

EXECUTIVE SUMMARY

Increasing interest in the potential of agricultural research and development projects to directly address problems of food consumption and nutrition of rural populations has lead to a need for a framework for developing case studies of projects that address these issues. A case study series in nutritional agriculture will allow for the documentation of projects already carriedout, provide an organizational basis for evaluating and comparing the outcomes of present and future projects, provide materials for training and workshops on the inclusion of food consumption and nutrition goals in agricultural projects, and provide guidelines for the collection of information in projects already underway or in the planning phase for use in future case studies.

Projects eligible for inclusion in the case study series are defined as specific research or applied agricultural projects that explicitly include the direct improvement of human food consumption or nutritional status in project objectives and provide identifiable mechanisms for accomplishing that goal and/or include a mechanism for project evaluation on the basis of impact on food consumption or nutritional status.

A number of aspects of project design, implementation and evaluation have been identified as important in presenting case study materials. These include:

A. Linkages between production and consumption

1. food preference, acceptability, and utilization
2. seasonality of production
3. crop mix and minor crops
4. income
5. the role of women in production
6. crop labor requirements
7. market prices and seasonality
8. problems of post-harvest storage

B. Project Type: Research, Training, Extension

1. development of intermediate technology

2. adaptive research and extension

3. extension/community development approaches

4. infrastructural development

5. training

C. The Nature of The Nutritional Component or Goals

1. problem identification

2. targeting to those at nutritional risk

3. including nutritional goals in establishing and reorganizing program priorities

4. addressing issues of acceptability and utilization

5. including nutrition in research and extension

6. using food consumption and nutrition in project evaluation

D. Degree of Integration of Nutritional Goals/Nutrition Component into Overall Project Designs

E. Size and Scope of the Project

F. Baseline Data Needs and Criteria for Evaluation

G. Geographic, Ecological, and Cultural setting of the project

Criteria for case selection include:

1. The project or program fits the definition of a case in Nutrition and Agriculture. That is, it is an agricultural research or development project that explicitly includes food consumption or nutritional goals or objectives and provides a mechanism for the implementation of those goals and the evaluation of the project on the basis of its impact on food consumption or nutritional status.

2. Sufficient information is available to describe project activities, successes, and constraints in detail.

3. The project or program addresses one or more of the linkages between agricultural production and food consumption.

4. The project or program is illustrative of a particular point along the continuum from research and technology generation to application and

extension of technology or of a level of training appropriate to that point.

5. The project or program illustrates one or more of the potential kinds of food consumption and nutrition goals or components.

6. The project or program illustrates the potential of projects of a particular scope or size.

7. The project or program has actually implemented food consumption and nutritional goals or components.

8. For applied or extension projects, project conditions are reasonably representative of the geographic or cultural region in which the project operates.

9. The project is well into the implementation phase. Priority should be given to projects that have already undergone one or more mid-project evaluations.

Case studies will follow the outline below:

I. Introduction to the case.

A. A short descriptive summary of the project or program.

B. A statement of the aims and objectives of the project or program with special reference to consumption and nutritional goals.

II. Background

A. A statement of project justification.

B. A brief historical review of project design, implementation and evaluation (depending on the stage of project development at the time of the writing of the case).

C. A brief review of relevant country, regional, or commodity statistics where appropriate.

D. A review of the social, cultural, economic, and ecological conditions that characterize the region in which the project is implemented.

III. Discussion of project type and scope.

A. The type of project will be identified with respect to

1. the degree to which it is characterized by its research or applied aspects,

2. the extent and nature of extension activities, and

3. the nature and extent of training.

B. The scope of project activities will be described with respect to

1. regional focus

2. budgetary scope

3. donor involvement

IV. Inclusion of food consumption and nutritional data in project planning and implementation.

A. the amount and types of data used

B. phase in the project during which data were collected

C. specific methods used in data collection with special reference to new or novel methods of data collection to include

1. secondary data and sources.

2. sampling frames for survey methods.

3. specific techniques and standards used for dietary intake and nutritional status data.

4. discussion of socio-economic data of importance to understanding food consumption and nutritional status.

5. data necessary for identifying key linkages between agricultural production and food consumption and nutritional status.

V Linkages Between Agricultural Production and Food Consumption

A. the kinds of information collected to identify key linkages including, as appropriate, information on

1. seasonal patterns of food use and nutritional status.

2. food utilization and quality characteristics and preferences.

3. food habits and beliefs.

4. the organization of farm and household labor.

5. the role of women and other family members in agricultural production.

6. income and expenditure patterns.

7. markets and prices.

B. identification of the linkages of importance in the project or in the project area.

C. ways in which linkages were addressed in project design and implementation.

D. identification of existing linkages which were not initially recognized or not specifically addressed by the project.

VI. Nature of the Nutritional Component or Goals

A. the timing of the inclusion of consumption and nutritional issues, in problem identification, diagnostic phase, targeting and project implementation.

B. the organizational structure through which nutritional goals were implemented; i.e., through a nutrition component (if one exists) and the ways in which it articulates with other project components or an alternative structure and the ways in which it incorporated food consumption and nutrition in agricultural work.

VII. Project Outcomes and Accomplishments

VIII. Project Constraints and Problems

IX. Conclusions and Recommendations

FORWARD

The purpose of this work is to provide an organizational framework for the preparation of case studies documenting agricultural research and development projects that explicitly address food consumption or nutritional concerns in project objectives, design, implementation, and evaluation. It is assumed that a series of case studies will be prepared over the next few years and that subsequent cases will be prepared by individuals closely associated with the projects described. To that end, this report outlines a conceptual framework for approaching the documentation of agricultural projects that include nutritional goals, proposes a format for case presentation, presents criteria for selection of appropriate projects for treatment as case studies, and suggests a set of priorities for the inclusion of subsequent cases in order to assure comparability of case studies and an even representation of projects in the completed case study series. The case studies to be generated using this format are expected to serve several purposes, including:

1. documentation of the integration of consumption and nutrition goals in agricultural projects already carried out or in progress.

2. provision of an organizational base for evaluating and comparing the outcomes of present and future projects that include consumption concerns.

3. provision of materials for training and workshops on the inclusion of consumption/nutrition goals in agricultural projects.

4. provision of guidelines for the collection of information in projects already under way or in the planning process that would facilitate their future inclusion as case studies.

These goals imply somewhat different approaches to organizing case study materials. Specifically, the needs of trainers for case material to be used in workshops and courses are expected to be somewhat different than the needs of persons using the case study materials for project documentation and development of evaluation criteria and approaches. The framework presented here is intended to offer a general approach to case study development, which is somewhat more appropriate to the needs of project documentation than for use as training materials. Some modification of the case study format will be needed to provide the most

appropriate teaching materials.

Finally, it should be emphasized that the case studies are descriptive in nature. While the documentation of specific cases may aid in the development of criteria for evaluation and the constraints to implementation of program objectives will be noted where appropriate, these case studies are not evaluative in themselves and should not be viewed as evaluations of specific programs or projects.

Two case studies based on the format developed in this document are also presented here. These are the Adaptive Crops Research and Extension Project and the International Sorghum and Millet Project. These projects represent very different ways of addressing the issues of food consumption and nutrition in agricultural research and development.

The Adaptive Crops Research and Extension project was chosen for inclusion as a Case Study in Nutrition and Agriculture for several reasons. First, it is a research and development project that aims to adapt existing technology to the needs of target farmers in order to directly impact agricultural practices and food production. Second, it combines on-station research with on-farm research to accomplish its goals, providing a potential framework for the use of a farming systems perspective in addressing consumption issues in agricultural research. Third, since its inception the project has included the improvement of the food consumption of target families among its objectives. Fourth, since about 1982 the project has explicitly included a Nutrition Component (NC). Fifth, the NC is integrated into all three phases of ACRE activity: research, extension, and training and, therefore, has the potential of addressing nutritional issues on several levels.

The work of INTSORMIL in Southern Honduras has been chosen as a Case Study in Nutrition and Agriculture for several reasons. 1) The INTSORMIL project, as a commodity based project with a world-wide scope and mandate to provide intermediate technology, is similar to the International Agricultural Research Centers (IARCs) and provides a contrast with programs and projects that address the needs and preferences of small farm families more directly. 2) INTSORMIL is a multidisciplinary project that has included a full complement of scientists: plant breeders, plant physiologists, agronomists, specialists in food utilization and nutrition, agricultural economists and social scientists. 3) INTSORMIL work in Southern Honduras has attempted to address the needs and preferences of small farm families with respect to sorghum production and consumption. 4) INTSORMIL research in Honduras has included a farming systems approach to addressing these questions.

Future case studies will be chosen to represent programs contrasting with the first two on a number of dimensions.

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LIST OF ACRONYMS

AC	Agricultural Component
ACRE	Adaptive Crops Research and Extension (Sierra Leone)
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Breeding Center
CONSUPLANE	National Planning Council of Honduras
CRSP	Collaborative Research Support Project
EI	Extension Instructor
FAO	Food and Agricuture Organization
GOH	Government of Honduras
GOSL	Government of Sierra Leone
IADP	Independent Agricultural Development Project
IARC	International Agricultural Research Center
IHAH	Honduran Institute for Anthropology and History
IITA	International Institute for Tropical Agriculture
INCAP	Institute of Nutrition of Central America and Panama
INTSORMIL	International Sorghum and Millet Program
IRRI	International Rice Research Institute
MANR	Ministry of Agriculture and Natural Resources (Sierra Leone)
MNR	Ministry of Natural Resources (Honduras)
NC	Nutrition Component (ACRE Project, Sierra Leone)
NI	Nutrition Instructor

NUC	Njala University College (Sierra Leone)
SAPLAN	Sistema de analysis Y Planificacion de Alimentacion Y Nutricion (Honduras)
SEO	Senior Extension Officer
SULSU	Southern University/Louisiana State University
USAID	United States Agency for International Development
WARDA	West African Rice Development Association

CHAPTER ONE

INTRODUCTION AND CONCEPTUAL FRAMEWORK

I. INTRODUCTION

As the failure of several decades of developmental growth to significantly improve the nutritional status of marginal rural populations has become more evident there have been a number of calls for a reevaluation of the potential for agricultural research and development projects to directly address nutritional problems of rural populations (FAO 1982, Pinstrup-Andersen 1981, USAID (1982a, 1982b, 1984a, 1984b, Swaminathan 1984). Arguments for the explicit inclusion of nutritional goals into agricultural research and development have followed two related lines.

The first is based on the realization that present approaches to improving the nutritional status of economically marginal rural people have not had and are unlikely to have a positive impact. Specific programs for nutrition, or reliance on overall economic growth to improve nutritional status have proved inefficient or inherently incapable of significantly improving the nutritional status of the large rural and urban populations at risk for malnutrition. Nutrition programs are probably best suited for the improvement of specific nutritional problems in small target groups at special risk (Pinstrup-Andersen 1981, Kennedy and Pinstrup-Andersen 1983, Beaton and Ghassimi 1979). Overall economic growth, where it has occurred, has frequently bypassed rural areas. The notion that the benefits of development will "trickle-down" to the nutritionally at risk in rural areas has not proved effective (Selowsky 1979).

The second and related line of argument is that failure in the past to explicitly include nutritional goals, or to anticipate nutritional impacts of agricultural technology, may have led to the deterioration of nutritional status in rural populations, especially for small farmers, rather than its improvement.

Hulse (1982) has recently argued that the failure to pay careful attention to the nutritional impact of food production and processing technology on the poor in less developed countries results in the formulation and implementation of food policy with little or no evidence to predict its consequences for nutritional status. Hulse was specifically addressing the area of food science and post-harvest processing, but the argument is even more applicable to production policies. Fleuret and Fleuret (1980), in a review of nutrition, consumption and agricultural development, concluded that few programs to improve the productivity of small farmers have had a positive impact on

the nutritional status of their families. Some may have even contributed to a decline in nutritional status.

Several studies of the impact of Plan Chontalpa in Tabasco, Mexico (Hernandez 1974; Dewey 1980, 1981a, 1981b) show similar results. Productivity improved dramatically, but only the nutritional status of urban populations was improved. There was no real improvement in the nutritional status of the children of farm families. Lunven (1982) has reviewed six case studies carried out by the FAO in which development efforts failed to improve nutritional status, or in fact contributed to its decline among some segments of the population. He concluded that the projects failed to take into consideration patterns of land tenure, relationships among social and economic groups, patterning of labor demands and scarcities of family labor at certain times, or the local price effects of declines in food production as a result of the promotion of cash crops. For most of the projects described those relatively better off were in fact able to improve, but the groups most at risk were either untouched or had their lot deteriorate in absolute terms as a result of increases in the price of staple foods, loss of land or loss of access to credit. Project post mortems such as these have led to an increasing realization that agricultural technology is not nutritionally neutral and the ways in which changing agricultural technology and agricultural development projects affect nutritional status are not clearly understood.

The other side of the coin is that small farmers producing crops for consumption within the household, as well as for sale, understand the need to protect family diets. They evaluate new varieties of seed and production techniques on the basis of their impact on the acceptability of the product as food, and the stability of production, as well as on their impact on yield productivity and agronomic properties. Numerous accounts exist of the rejection of improved varieties because their food quality chracteristics were unacceptable.

As a result of these arguments several international agencies have begun to reexamine the incorporation of nutrition goals in to agricultural research and development.These include the World Bank (Pinstrup-Andersen 1981), the Food and Agriculture Organization of the United Nations (Shorr 1979, FAO 1982, Mason 1984), and the US Agency for International Development (USAID 1982a, 1982b, 1984a). This interest has fostered the development of several approaches to the incorporation of food consumption and nutritional goals into agricultural research and development (Shorr 1979, Mason 1981, 1985, FAO 1982, IFAD 1983, Whelan 1983, Campbell 1984, Frankenberger 1985). In addition a number of conceptual papers addressing, in general terms, the relationships between agricultural production, agricultural change and food consumption and nutritional status have appeared (Fleuret and Fleuret 1980, Pinstrup-Andersen 1981, Bouis et al. 1985, Reutlinger 1983, Pines 1983, Longhurst 1983, Frankenberger 1985, DeWalt 1986).

Despite the existence of these various frameworks, however, there has been little documentation of agricultural projects that have already

attempted to address food consumption and nutritional issues. The case studies series to be initiated here seeks to serve that need.

II. CONCEPTUAL FRAMEWORK

The case study format and criteria for case selection that follow presuppose a common understanding of key concepts and definitions of agricultural research and development projects. The conceptual framework outlined here provides several working definitions of concepts underlying the development of the format and discusses the range of possible approaches that characterize projects appropriate for selection.

A. What Constitutes "Nutrition in Agriculture"?

For the purposes of this work, projects that represent examples of nutrition in agriculture are defined as specific research or applied agricultural projects that explicitly include the direct improvement of human food consumption or nutritional status in project objectives and provide identifiable mechanisms for accomplishing that goal and/or include a mechanism for project evaluation on the basis of impact on food consumption or nutritional status. This working definition eliminates research or development projects that imply that food consumption will be affected as a result of increased yield or improved income, but do not present a specific model for accounting for that impact, or do not allow for the evaluation of project performance on the basis of documentable changes in food consumption or nutrition.

Projects that are specifically nutritional in nature, that do not address agricultural production in some way, are also not included. Some projects may contain separate nutrition and agriculture components. These will be included if project objectives state a clear and logical relationship between components. Projects selected for treatment as case studies, then, will be projects addressing some aspect of agricultural production that also explicitly address food consumption and nutritional concerns.

The diverse nature of agricultural research and development projects suggests that the ways in which agricultural projects can address food consumption and nutrition issues are also varied. Projects can focus on one or several of the linkages between food production and consumption; they can vary in the magnitude of the interventions that they propose; they can include different kinds of nutrition research or interventions; and they can vary with respect to the timing of inclusion of consumption related interventions.

A comprehensive case study series should be able to document examples from a range of projects. The first section of this report will outline a

series of parameters that underlie the selection and presentation of case studies in nutrition and agriculture. These provide the conceptual framework within which the case study format and selection criteria have been developed. The conceptual framework draws on the thinking of a number of individuals who have contributed to the conceptualization of nutrition in agriculture. This work is referred to where appropriate.

B. Linkages Between Production and Consumption

Agricultural projects that seek to improve food consumption and nutritional status will presumably do so by attempting to alter agricultural production in such a way as to improve the availability and consumption of food to target households. In the literature documenting the relationships between agricultural production and food consumption and nutritional status a number of interveing variables through which food consumption is linked to aspects of agricultural production have been identified. One or several of these key linkages may be addressed in project design and implementation of case study projects. A brief review of these issues is included here. Frankenberger (1985) has summarized much of the literature on linkages between agricultural production and food consumption. This synopsis draws heavily on this work. Other key works include Pinstrup-Andersen (1981), Pines (1983), Longhurst (1983), and Swaminathan (1984).

The linkages outlined below offer foci for agricultural research and development efforts by outlining specific areas that may be addressed in agricultural research. At the same time they represent areas that must be taken into consideration in order for projects to avoid negative impacts on food consumption and nutritional status.

1. Food Preference, Acceptability, and Utilization

There are countless tales of the failure of improved varieties of food crops to be adopted by farmers, or to have an impact on the diets of small farm families because the improved variety did not have acceptable food quality characteristics (Tripp 1984). In some instances the problems have to do with food qualities characterisitics. New varieties produce foods unacceptable to local tastes on the basis of flavor or texture. In other instances the cooking qualities of varieties require changes in food preparation techniques They may, for example, require a longer cooking time and hence more fuel and more of the meal-maker's time. Food crops that do not meet local preferences are unlikely to be adopted, or, to be produced as a commercial crop rather than a subsistence crop. For example, while sorghum is a food grain in Southern Honduras, introduced hybrid sorghums are grown only as a cash crop because they do not produce acceptable tortillas (DeWalt and DeWalt 1982).

A related issue is the introduction of new crops, which have potential as food crops, to areas in which they have not been traditionally used as food. Such crops are unlikely to be used as

subsistence crops if an acceptable utilization package, that is a set of preparation techniques that meet local needs, cannot be developed. Materials presented a recent roundtable dicsussion at the International Institute of Tropical Agriculture (IITA) discussed the effect of the introduction of an acceptable utilization package to accompany IITA's promotion of soybean production in communities in which soybeans are a new crop with no local tradition of consumption as a food. The results seem to be an increase in the number of farmers interested in producing soy and an increase in the proportion of production that is consumed within the household and community (IITA 1986).

2. Seasonality of Production

Due to the seasonal dimension of agricultural production, small farmers in many areas of the world experience cyclical shortages of food as well as sharp peaks in human energy expenditure. In many instances the time of peak labor demand coincides with the most critical period for food availability. As a result, local tradition in a number of regions marks an identifiable "hungry season".

Agricultural research and development projects may address problems of seasonal hunger through the introduction of crops that mature during times of shortage, improved storage of crops, or the easing of labor demands during periods of food shortage. At the same time crops and cultural practices that demand more labor during times of shortfall, or exacerbate the seasonality of production should be avoided.

3. Crop Mix and Minor Crops

Several issues dealing with crop mix may be addressed in agricultural research and development. The first is the effect of shifts from subsistence or semisubsistence agriculture to more commercial agriculture. While the nutritional impact of agricultural commercialization is under considerable debate (Bouis et.al. 1985, von Braun and Kennedy 1986) it is clear that the introduction of commercial crops can have a series of dietary impacts. While the commercial production of crops can increase income, it can also lead to a decline in crop diversity and dietary diversity, an exacerbation of the seasonality of production, increase in agricultural risk, decrease in real income, increase in local food prices, shifts in household division of labor and control over income, disruption of traditional means of food distribution and sharing, and increased pressure on land (Nietschmann 1973, Dewey 1980, 1981a, 1981b, Fleuret and Fleuret 1980, Pines 1983, Longhurst 1983, Reutlinger 1983, Bouis et al. 1985, von Braun and Kennedy 1986).

In addition to the significant shifts that result from the commercialization of agriculture, the application of some agricultural technology and cultural practices to subsistence agriculture may have a negative effect on the availability of food. The use of monocropping techniques and herbicides may eliminate or reduce the cultivation of minor

crops frequently intercropped with staples (Messer 1972, 1977). Wild food plants often grow as weeds in the disturbed soils in cultivated fields. In Central Mexico these "weeds" are called carne de la milpa (meat from the field) and constitute a crucial hungry season food (DeWalt 1983a). While minor crops and wild foods do not provide the bulk of energy and protein that staple grain and tuber crops supply, they may be the major sources of micronutrients in local diets.

On the other hand, programs that improve crop diversity and the production of minor crops such as compound (backyard) gardening can address the availability of micronutrients and have a beneficial effect on household diets.

4. Income

Many agricultural research and development projects expect to improve food consumption and nutritional status indirectly through improving the income of farm households. It must be kept in mind, however, that the relationships between agricultural income and food consumption are not straightforward. First of all, the effect of changes in agricultural production on income depend on careful evaluation of production functions. Improvements in yield as a result of new agricultural technology or improved cultural practices may not result in improved net income if the cost, in cash or labor, is greater than the value of the output. We must extend this to take into consideration social costs as well.

A major problem that has been identified with the commercialization of agriculture is that while cash income may rise real income may not rise or may even decline if the cost of purchased food is greater than the imputed value of food previously produced for home consumption or if regional declines in food production occasion a rise in the price of food (Bouis et al. 1985).

Secondly, the effect of increased income on food consumption is a function of the form of income, the lumpiness of income, and the source of income. Income in kind (ie. in the form of food) is more likely to have a positive impact on food consumption that its equivalent in cash. The regularity in the flow of income tends to be more important than the amount of income (Pines 1983, USAID Bureau 1984b). Lumpy income is more likely to be spent on non-food items. Finally, men and women have a tendency to spend income differently in many regions. Income earned and controlled by women is more likely to contribute to household food availability than income earned and controlled by men. By extension then, programs that even the flow of income, produce income in kind (improve food production) and differentially improve women's income are most likely to have a positive effect on food consumption.

5. The Role of Women in Production

"In rural economies, women are the pivot between production and consumption" (Longhurst 1983:44). In many parts of the world especially in Africa, women are responsible for the bulk of food production. As noted above, women's income is more likely to be spent on food. In addition, women also frequently provide labor for the cultivation of their husband's cash crops or hire out their labor to others. In Africa and Latin America women are actively involved in the commercialization of agricultural products. At the same time, women universally have the greatest responsibility for food preparation and child care tasks that may compete with food production and income generation for women's time. Technology that increases demands on women's time or energy is likely to diminish the amount of time available for other crucial tasks, or the technology may fail to be adopted because the labor demands cannot be met.

However, women are frequently ignored by agricultural extension services, although changes in agricultural techniques they suggest may demand more household labor, inlcluding women's labor. Community development projects promoted by home economics extension may place even greater demands on women's time unless they include the extension of labor saving techniques and devices.

6. Crop Labor Requirements

In addition to the food consumption effects associated with increases in labor demands of women, other effects associated with new crop labor requirements may also be important. Increases in labor demand and energy expenditure may not be offset by increases in income or food production. One result may be shifts in the intra-household distribution of resources and a diversion of food from less productive members of the household (children) to more economically crucial members (Fleuret and Fleuret 1980, Gross and Underwood 1971, Bouis et al. 1985).

Even more likely is that new technology or cultural practices that demand significantly more labor will not be adopted and incorporated into small farm agriculture even if there is an appreciable increase in production.

7. Market Prices and Seasonality

The importance of prices and markets is an issue that is often overlooked in agricultural research and development projects. Agricultural scientists have a tendency to overestimate the potential market for crops and the stability of prices. A market for a crop must exist and the price effects of increased or decreased production taken into account. Dramatically increased production is likely to result in a reduction in prices, differentially penalizing the small producer. In addition, a decrease in price to the consumer may be accompanied by a displacement of labor and or a reduction in real wages. Lipton and Longhurst (1985) estimate that effects of the increases in yield as a

result of the Green Revolution were offset by reductions in the price of crops and the wages of laborers/consumers. Finally, a decrease in the regional availability of foodstuffs accompanying a shift from food production to commercial cropping may raise local food prices and offset gains in income.

In addition, small farmers frequently suffer from unfavorable terms of trade with respect to national as well as international markets.

8. Problems of Post-Harvest Storage

While not strictly speaking an issue of agricultural production, problems in post harvest storage frequently affect food availability both directly by limiting the availability of home produced food, and indirectly by contributing to loss of income or lumpiness of income (when farmers need to sell the bulk of their crops immediately after harvest to minimize storage loss). In addition, these issues are often included in research and extension packages. Research and extension efforts to improve storage, either through varietal development or work on storage pests and methods of storage are likely to have an important impact on food consumption.

C. Project Type: Research, Training, Extension

Agricultural development projects can be conceptualized along a continuum that ranges from pure research to pure application (community development/extension). The nature and degree of attention to food consumption and nutrition issues in projects and programs at different points on this scale are likely (and ought to be) different in kind and scope.

On the research end are projects in basic research. Examples of this kind of research are basic studies in plant physiology, genetics, and recombinant DNA carried out in basic science departments of universities and some research institutions. Such work may eventually have an impact on agricultural technology and may even implicitly include improvement of nutrition as a long term goal but is relatively far removed from individual family diets. Potential for impact on nutrition is indirect and any assessment of this is often years or decades away. Although an evaluation of the ultimate effect of basic science research on the quality of life of humans would certainly be warranted, this kind of research falls outside the scope of the present case study series and will not be considered here.

1. Development of Intermediate Technology

Agricultural projects that are primarily oriented towards research and the development of intermediate technology (development of breeding

lines, basic descriptive work on grain quality characteristics) form a second point in the continuum from pure research to application. Examples are the International Agricultural Research Centers (IARCs), the Collaborative Research Support Projects (CRSPs), and some Agricultural Research Corporations (ARC-Sudan, INIA-Mexico). These projects frequently do not have the extension of technology within their mandate. The IARCs often describe their role as providing "intermediate technology" for further adaptation within national programs and extension services. Some centers describe their role as placing a range of goods on the shelf from which national programs can pick and choose. The commodity based Collaborative Research Support Projects are similar in scope. They are conceptualized as supporting more basic research in agriculture and the development of technology with the potential for widespread use after adaptation work is carried out in specific ecological settings.

The potential for addressing consumption and nutritional issues in these projects and programs can theoretically take several forms. The IARCs themselves view their major contribution to nutrition as coming indirectly through a general increase in the food supply and improved farm incomes as a result of improvements in yield and yield stability (Pinstrup-Andersen et. al. 1984). More directly, the IARCs and similar programs also frequently monitor the food quality characteristics and nutritional quality of new varieties of mandated commodities. It would also be possible for agencies to address several of the linkages between production and consumption previously identified (Frankenberger 1985) and outlined above, through the development of appropriate technologies. Agencies with farming systems units have the potential to accomplish this directly.

2. Adaptive Research and Extension

A number of projects can be categorized as addressing issues of local adaptation of intermediate materials provided by other researchers through further breeding and/or work with cultural practices. This type of activity would normally include the extension of research results to potential beneficiaries. In recent years many such programs employ, at least in theory, a farming systems or cropping systems approach to research and extension. Such programs should, by design, be more attentive to the specific needs and constraints of potential beneficiaries and could address the nutritional concerns of farm families directly. Many national research and extension programs are included here. Many such programs in developing countries are carried out with the assistance of bilateral or multilateral donor agencies. The Adaptive Crops Research and Extension (ACRE) Project in Sierra Leone is one such.

3. Extension/Community Development Approaches

At the most applied end of the continuum one finds programs aimed exclusively at extending existing technology and information. The extension arm of some national programs, to the extent that it is separate

from research, is an example. A number of Private Voluntary Organizations (PVOs) take this approach, using a community development framework. The amount of effort spent in developing technology is minimal. The focus of work is solving localized problems. Projects at this level would be expected to identify specific local nutritional issues and focus the development and extension of a package of technologies and/or community organizations to directly address those issues. Presumably projects would directly address one or more of the linkages between agricultural production and food consumption or direct attention to specific issues in the utilization of new or existing crops.

4. Infrastructural Development

Many projects include improvement of infrastructure. The major thrust of some project is infrastructural in nature. Projects aimed at the improvement of infrastructure should take into consideration the groups that will benefit from such changes, as well as the groups that may be displaced. Also the effects of building roads, dams, irrigation systems, ponds, etc. on the ecology and the availability of food both produced and collected should be anticipated.

5. Training

The nature of training activities overlaps the range from research to extension. The level and type of training provided is likely to be in line with project objectives. IARCs, for example, provide training at several levels in their research areas (eg. plant breeding, farming systems methodology, food crop utilization). Country based projects may provide for in- service or degree training for project personnel. Community development and extension programs are generally aimed at training community members. In projects addressing food consumption and nutrition these goals would be expected to be reflected in any training activities.

D. The Nature of The Nutritional Component or Goals

Agricultural projects can incorporate food consumption and nutritional goals and issues in several ways. Projects may use one or several of these approaches.

1. Problem Identification

An analysis of food consumption and nutritional needs may guide the identification of the specific research issues to be addressed or the nature of the project to be implemented. For agricultural research carried out on a regional or global level, such as the work of the IARCs, this may be the most important avenue of incorporation of nutritional goals.

2. Targeting to Those at Nutritional Risk

The failure of a some agricultural projects to improve nutritional status, even when nutritional goals are included, has been attributed to a failure to target projects to those at greatest risk (Hernandez et. al. 1974, Lunven 1982, Omawale 1984). One of the earliest criticisms of the Green Revolution was that, at least at the outset, Green Revolution technology was not scale neutral and favored larger farmers and those involved in crop commercialization. Through increased competition and shifts in land tenure small farmers may, in fact, have been further marginalized.

The inclusion of nutritional data in the diagnostic and planning stage of projects would allow for the targeting of programs to those at greatest nutritional risk. Nutritional criteria can be included in establishing recommendation domains, (called functional classification in the nutrition literature) and in the selection of target families or farmers. Omawale (1984) has pointed out that if agricultural programs are to have an impact on nutritional status they must be "scale biased" to meet the needs of those at greatest risk. Several of the frameworks for incorporating nutritional goals into agricultural projects have as their major thrust the development of data and criteria for targeting projects to those at greatest risk (Mason 1984, Mason et al. 1985).

3. Including Nutritional Goals in Establishing and Reorganizing Program Priorities

A number of decisions are made in the process of establishing programs' research and extension priorities. In addition, priorities are frequently reexamined and reformulated during mid-project evaluations. Food consumption and nutritional criteria may be included in the process of establishing priorities. For example, choice of commodities may be made, in part, on the basis of the importance of specific commodities in local diets, or on differences in the price elasticity of demand between demand low and high income groups (Pinstrup-Andersen 1981). In localized projects the specific problems and constraints with respect to the linkages between production and consumption noted above may be addressed directly, or food quality characteristics and local preferences may influence the choice of varieties for agronomic trials and extension.

4. Addressing Issues of Acceptability and Utilization

Issues in the acceptability of varieties of food crops and utilization may be addressed directly in research, extension and training. Projects with research components may include research on the food quality characteristics of varieties of food crops and on their utilization. This may include recipe development and testing in the laboratory. The counterpart in extension would be food demonstrations using project crops and new or improved preparation techniques. In some instances the introduction of new crops or new varieties of traditional crops may need

to be tied to the extension f a utilization package that addresses problems in preparing acceptable food products from them.

5. Including Nutrition in Research and Extension

While it is to be expected that agricultural projects would focus on the effects of changes in production that might affect nutrition, there are other factors, less associated with production that contribute to the nutritional status of small farm families. These include nutrition education and general health problems. Projects may address some of these more general nutrition issues through research and extension within the context of the project or program. For example, projects may include basic research on nutrient composition of foods and their interactions in local diets within their research program, or they may include general nutrition and health education or sanitation in extension. It would be expected, however, that such work would be carried out in addition to core activities that more directly address the links between agricultural production and food consumption.

6. Using Food Consumption and Nutrition in Project Evaluation

Projects with explicitly stated nutritional goals would be expected to include measures of the impact of projects activities on levels of food consumption and/or nutritional status in project evaluation. This presupposes, of course, that baseline studies included information on these variables before project implementation. It also demands that careful thought be given to the adoption of appropriate data for evaluation of food consumption and nutritional status and the development of acceptable methods of data collection and analysis. This will be addressed further below.

E. Degree of Integration of Nutritional Goals/Nutrition Component into Overall Project Designs

Projects and programs may integrate nutritional considerations directly into all phases of research extension and training. However, many projects may establish semi-autonomous components, such as the nutrition component of the Adaptive Crops Research and Extension (ACRE) Project in Sierra Leone. Both sorts of arrangements have costs and benefits. While it would be very desirable for food consumption and nutritional issues to be fully integrated into agricultural projects, the realities of disciplinary divisions suggest that some degree of autonomy for a nutrition component may be necessary to safeguard the integrity and continuity of nutrition related activities within projects.

The degree of autonomy for nutritional staff and the degree to which nutrition related research, extension and training are integrated into agriculturally related activities may be reflected in the organizational structure and chain of supervision and responsibility of project staff,

level of autonomy of staff of various components, types and levels of training of staff of various components, access to in-service and advanced degree training of staff, overlap in kinds of information and material used in training staff (are agricultural staff trained in nutrition and vice versa), and the nature and degree of interaction among staff. Because of the variety of ways in which integration and autonomy can be acheived in projects case studies should include a description of the factes of organization noted above and a assessment of the effectiveness of this aspect of project organization.

F. Size and Scope of the Project

Projects vary with respect to regional scope, from community level to global responsibility; budgetary level, from several thousands to many millions of dollars; and the level of donor involvement from small single, private donors, to bilateral and multilateral international donors. The ways in which projects address nutritional issues would be expected to reflect differences in scope. In addition, contrasts among projects of varying scope may be desirable.

G. Baseline Data Needs and Criteria for Evaluation

The implementation of nutritional objectives presupposes the availability of adequate information related to food consumption and/or nutritional status for project planning and evaluation. A series of data may be used to these ends. Many potential sources of data for program planning and evaluation already exist in the form of country or regional nutrition surveys, nutritional surveillance programs, national expenditure studies, etc. Valid preliminary information can be drawn from the opinion of experts. In a ddition, projects may wish to augment existing data sources with research designed to specifically meet project needs. The specific data used would depend on project objectives but might include: information from food balance sheets, income and price elasticities of demand for specific commodities and energy, diet and food consumption patterns, nutritional status, socioeconomic indicators of nutritional status, and food habits and preferences. Several reviews of nutritional data needs for agricultural projects currently exist (Mason 1983, 1984, Frankenberger 1985, O'Brien-Place n.d.).

The kinds of information used in project planning, implementation, and evaluation should be outlined and methods of data collection reviewed. Project descriptions would be expected to address such issues as the kinds of data necessary for project planning and implementation given project scope and goals; appropriate measures of food consumption and nutritional status, including the identification of appropriate standards; sampling and monitoring strategies; and the criteria for evaluation of impact.

H. Geographic, Ecological, and Cultural Zones

Food habits and nutritional problems differ in different geographic, ecological and cultural settings and it is expected that applied research, extension, and training needs and approaches would differ in different settings as well. Applied research and extension programs would be expected to take note of the ecological and cultural setting in program planning and implementation, and to include an explicit analysis of the relationships between ecological and cultural settings and probable effects of project activities on food consumption and nutritional status. Case studies should include a description of the relevant information concerning the geographical, ecological and cultural settings within which projects are impemented and review the wasy in which these factors were incorporated within project design.

CHAPTER TWO

CRITERIA FOR CASE SELECTION AND CASE STUDY FORMAT

I. CRITERIA FOR CASE SELECTION

Case studies are most properly conceptualized as presenting detailed qualitative information on a small number of phenomena, rather than information on a large number of phenomena amenable to quantitative analysis. In developing a series of case studies, criteria for selection are unlike those for selecting a sample for a survey approach. Cases are chosen on the basis of their ability to illustrate specific points, and on the depth and detail of information available for them.

This is not to say, however, that cases selected for study are chosen at whim. While the ability of a case to illustrate a particular point, and the availability of adequate information are high priorities, an attempt to sample the range of variability in phenomena is next in importance. The Conceptual Framework above outlines a series of parameters within which projects and programs with potential for selection as Case Studies in Nutrition in Agriculture can be categorized. Successful programs can potentially take many forms. It is an underlying assumption that the case study series will attempt to document programs and projects that exemplify a range of program types and scopes, and that address food consumption and nutrition in a variety of ways. Further it is expected that each case will be viewed, to some extent, on its own terms. That is, while comparison and comparative evaluation within and between categories may be a long term goal of this project, the nature and accomplishments of individual cases must be viewed within the context of project scope and the nature of the research or intervention addressed.

The range of goals of the case studies series, as outlined in the introduction to this report, suggest several additional areas of concern in case selection. Some cases may be deemed appropriate for inclusion due to their apparent usefulness in training, or because they suggest important criteria for evaluation, or because they have been especially successful or have had to deal with important problems.

Finally, it is expected that an attempt will be made to illustrate projects in a range of geographical, ecological, and cultural settings.

A. Specific Criteria

1. The project or program fits the definition of a case in Nutrition and Agriculture. That is, it is an agricultural research or development

project that explicitly includes food consumption or nutritional goals or objectives and provides a mechanism for the implementation of those goals and the evaluation of the project on the basis of its impact on food consumption or nutritional status.

2. Sufficient information is available to describe project activities, successes, and constraints in detail.

3. The project or program addresses one or more of the linkages between agricultural production and food consumption.

4. The project or program is illustrative of a particular point along the continuum from research and technology generation to application and extension of technology or of a level of training appropriate to that point.

5. The project or program illustrates one or more of the potential kinds of food consumption and nutrition goals or components.

6. The project or program illustrates the potential of projects of a particular scope or size.

7. The project or program has actually implemented food consumption and nutritional goals or components.

8. For applied or extension projects, project conditions are reasonably representative of the geographic or cultural region in which the project operates.

9. The project is well into the implementation phase. Priority should be given to projects that have already undergone one or more mid-project evaluations.

B. Priorities for Case Selection

As noted above, one of the goals of the case study series is to document as wide and as representative an array of appropriate cases as possible. For this reason, priorities for the selection of cases will change for each subsequent case, as previous cases are chosen to illustrate specific points. Selection will take place on the basis of variation among alternative types within the various parameters outlined above. Efforts should be made to document a range of program types, nutrition interventions, linkages addressed and geographic and cultural zones.

The first two cases to be developed are located in Central America and West Africa respectively. Selection of a case from Asia would appear to have priority in terms of geographic region for the third case. Case #1, the work of INTSORMIL in Honduras represents a project aimed at the

generation of intermediate technology that is regional in scope and does not directly address the extension of technology. Case #2, the ACRE project represents a project aimed at adaptive research and extension within a specific country, although it cross-cuts several groups with somewhat different food habits. A third case study would most profitably represent a small scale community development project, perhaps one implemented by a PVO.

II. CASE STUDY FORMAT

The Case Studies in Nutrition and Agriculture will follow the general format outlined below. The format is organized to emphasize several key aspects of agricultural research and development projects that address food consumption and nutritional issues. First, it is weighted toward a detailed description of the food consumption and nutritional aspects of projects. It is assumed that for the purposes of the case study series, these aspects take precedence over detailed description of the agricultural research and development activities of projects. Aspects of agricultural research are documented as they illustrate the relationships between agricultural production activities and food consumption and nutrition activities.

Second, the format is organized to emphasize the linkages between agricultural production and food consumption outlined in the conceptual framework. This has been done for two reasons: (1) to tie the case study format closely to work already carried out in Nutrition and Agriculture by the NEG, and (2) because these linkages are viewed as capturing the essential modes through which farming systems and nutrition systems are interrelated.

Third, while the format includes sections on project constraints and problems and recommendations, the case studies are meant to be primarily descriptive in nature. In preparing case studies, emphasis should be given to the concise presentation of descriptive detail.

It is expected that case study length will vary in relation to the complexity of the project or program described. However, for purposes of training and use as examples, case studies should be as concise as possible. A careful balance between inclusion of sufficient detail for purposes of illustration and the conciseness essential for efficient use must be drawn.

Outline of the Case Studies

I. Introduction to the case.

Each case study will begin with an introductory statement that will place the project in space and time and outline its major goals and objectives. This is also the section in which the most detailed description of the agricultural and nutritional issues addressed by the project should be presented.

A. A short descriptive summary of the project or program.

B. A statement of the aims and objectives of the project or program with special reference to consumption and nutritional goals.

II. Background

The Background section should provide a detailed description of relevant information on agricultural production, including livestock production; diet and nutritional status; social, economic and ecological information that have influenced (or should have influenced) project design, such as family oragnaization, migration trends, land tenure, and the role of women in agriculture.

A. A statement of project justification.

B. A brief historical review of project design, implementation and evaluation (depending on the stage of project development at the time of the writing of the case).

C. A brief review of relevant country, regional, or commodity statistics where appropriate.

D. A review of the social, cultural, economic, and ecological-conditions that characterize the region in which the project is implemented.

III. Discussion of project type and scope.

The specific type and scope of the project will be described in some detail.

A. The type of project will be identified with respect to

1. the degree to which it is characterized by its research or applied aspects,

2. the extent and nature of extension activities, and

3. the nature and extent of training.

B. The scope of project activities will be described with respect to

1. regional focus

2. budgetary scope

3. donor involvement

IV. Inclusion of food consumption and nutritional data in project planning and implementation.

The amounts and types of food consumption and nutritional data consulted and collected during the problem identification, project design, and baseline survey phases will be discussed in detail, including

A. the amount and types of data used

B. phase in the project during which data were collected

C. specific methods used in data collection with special reference to new or novel methods of data collection to include

1. secondary data and sources.

2. sampling frames for survey methods.

3. specific techniques and standards used for dietary intake and nutritional status data.

4. discussion of socio-economic data of importance to understanding food consumption and nutritional status.

5. data necessary for identifying key linkages between agricultural production and food consumption and nutritional status.

V. Linkages Between Agricultural Production and Food Consumption

The ways in which the project or program has identified and addressed key linkages between agricultural production and food consumption will be described. The identification of key linkages will be tied to specific ecological and cultural conditions, where appropriate. It is anticipated that many past and current programs and projects have not formally identified and addressed specific linkages as they are formulated in the conceptual outline. However, it is likely that one or more of the

linkages have been identified in other terms as factors affecting food intake and nutritional status or limiting agricultural potential. These may have been identified in social or ecological impact analyses and may be culled from planning and design documents.

This section will specifically address the:

A. kinds of information collected to identify key linkages including, as appropriate, information on

1. seasonal patterns of food use and nutritional status.

2. food utilization and quality characteristics and preferences.

3. food habits and beliefs.

4. the organization of farm and household labor.

5. the role of women and other family members in agricultural production.

6. income and expenditure patterns.

7. markets and prices.

B. identification of the linkages of importance in the project or in the project area.

C. ways in which linkages were addressed in project design and implementation.

D. identification of existing linkages which were not initially recognized or not specifically addressed by the project.

VI. Nature of the Nutritional Component or Goals

This section will address, in detail, the ways in which the program or project was organized to implement food consumption and nutritional goals. It will describe

A. the timing of the inclusion of consumption and nutritional issues, in problem identification, diagnostic phase, targeting and project implementation.

B. the organizational structure through which nutritional goals were implemented; i.e., through a nutrition component (if one exists) and the ways in which it articulates with other project components or an alternative structure and the ways in which it incorporated food consumption and nutrition in agricultural work.

VII. Project Outcomes and Accomplishments

This section will contain a description of project outcomes with respect to all project objectives. These may include agricultural technology developed, numbers of farmers contacted and adoption of technology, economic change, and food consumption and nutritional status. This section will emphasize the successes of the project and identify key factors in project planning, design and implementation that have contributed to project accomplishments. It is expected that this section will draw, in part, on information from project evaluations as well as on the comments and perceptions of project personnel.

VIII. Project Constraints and Problems

This section will contain a description of project problems and constraints to implementation identified through the life of the project. It would contain pertinent information from project evaluations and the assessments of project personnel. While evaluation is not a primary objective of the case studies, an identification of problem areas in project design, organization, and implementation can provide insights into potential pitfalls in subsequent programs and projects.

IX. Conclusions and Recommendations

The final section will draw on the material presented in the case study to draw more general conclusions concerning projects in nutrition in agriculture. That is, evaluation and recommendations will be phrased in terms of what lessons can be learned from this case concerning the planning, implementation and evaluation of agricultural projects that seek to directly address food consumption and nutritional issues.

CHAPTER THREE

CASE STUDY #1: THE ADAPTIVE CROP RESEARCH AND EXTENSION PROJECT

SIERRA LEONE

INTRODUCTION

The Adaptive Crops Research and Extension Project (ACRE) was designed in 1978 by personnel from the Sierra Leonean Ministry of Agriculture and Natural Resources (MANR), Njala University College, (NUC), and USAID. ACRE's purpose was to adapt and extend improved agricultural technologies to small farmers in five zones of Sierra Leone. Mandated crops include rice, cassava, sweet potatoes, cowpeas, maize, groundnuts, and some preliminary work with pigeon peas. ACRE was to accomplish this using an approach to research and extension that emphasized both on-station and on-farm research. Project headquarters were located at Njala University College (NUC) and research personnel drawn from this institution. MANR provided extension personnel and Southern University/Louisiana State University (SULSU), under a contract with USAID, provided technical assistance to the project in Sierra Leone and training for Sierra Leonean project staff in Louisiana. Funded through GOSL/MANR and USAID the ACRE project was implemented in 1979 and scheduled to terminate in December, 1986.

ACRE's basic objectives, as outlined in project documents, included (1) the generation of of low cost, appropriate technology and know-how through adaptive research trials and extension demonstrations on small farms, and (2) the development of an effective extension program for disseminating information to farmers. The ACRE project, then, emphasized adaptive research on-station, on-farm trials and demonstrations of new varieties and techniques of cultivation.

It was to be responsive to the needs of the rural small farm holder in Sierra Leone. Attention was focused on small holders farming under soil and ecological conditions characteristic of upland agriculture in the country. On-station research was to be directed at problems identified through baseline studies and continuing contact with farmers. The basic materials for research were drawn from programs which provide intermediate agricultural technology (most importantly, improved seeds) such as CIMMYT, IRRI, IITA, WARDA, and the Sierra Leonean national agricultural research program. Participating farmers were to conduct adaptive research trials and

extension demonstrations on their farms under the guidance and supervision of extension personnel.

The original design document included the improvement of food consumption and nutritional status of target farmers among its major concerns. This was to be accomplished through through the generation of increased income resulting from improved production of ACRE crops, although explicit attention to food consumption and nutrition was not part of the project document.

Some research on the food quality of ACRE crops was included from the beginning of the project. This work was carried out by staff from Njala University College (NUC) Department of Home Economics with part- time support from ACRE. At the time of the mid-term evaluation in 1981 an explicit Nutrition Component (NC) was recommended to directly address issues in food quality, food consumption and nutritional status of ACRE contact families. A project paper describing the component and budgeting monies for it was prepared and approved in 1982. The NC was to be integrated into all three phases of the ACRE project: research, extension, and training.

The overall goals of the nutrition component were to:

(1) Improve the nutritional status of the 20,000 ACRE farm families in the five ACRE project zones with special emphasis given to small children and pregnant or lactating women;

(2) Encourage growth, preservation and storage of nutritious foods in the rural households;

(3) Identify and introduce appropriate labor saving devices for use by rural women;

(4) Train field staff in the use of appropriate methods for the most effective delivery of information to rural women; and

(5) Strengthen the Home Economics Department of Njala University College.

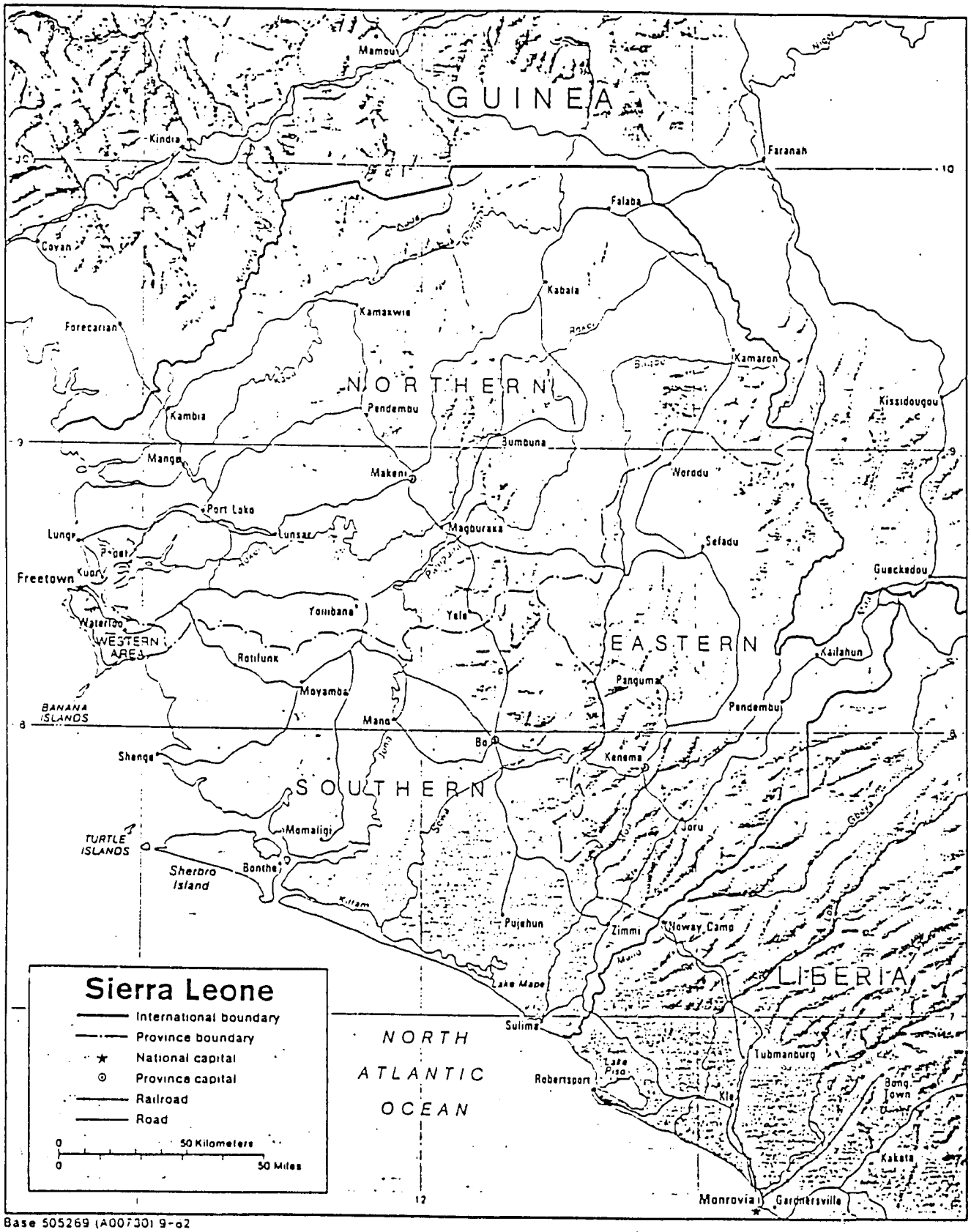
The Nutrition Component was organized parallel to ACRE's Agricultural Component (AC) with basic research supporting extension activities. Details of organization and specific activities for both the NC and AC will be discussed below.

BACKGROUND

Sierra Leone

Sierra Leone is a small country of approximately 3.5 million inhabitants located on the West African coast between 7 and 10 degrees north of the equator (see map, Figure 3.1). It has a tropical savanna climate with distinct dry and rainy seasons. In most of the country the wet season

FIGURE 3.1



MAP OF SIERRA LEONE

Source: U.S. Government Central Intelligence Agency 1982

occurs from May through November. Sierra Leone covers about 7.2 milion has. of which about 1.8 million has. are arable. About 80% of cultivatable land is upland and 20% is lowland, and includes inland valley swamps, bolilands (grasslands which are flooded during the rainy season and harden during the dry seasons), riverine grasslands, and mangrove swamps. Swamp soils cover much of the lowland areas while in upland areas soils tend to be ferralitic, leached and acid. These soils become light and workable under cultivation, depending on burned vegetation for their fertility.

The economically most important products of Sierra Leone are minerals with diamonds chief among these. However, a large proportion of Sierra Leoneans continue to be engaged in agriculture, although the percentage appears to be declining. In 1970 about 71.5% of the economically active population was reported to be farmers, by 1983 this percentage had dropped to about 62.3%. Currently, about 61% of the total population depends on agriculture (FAO 1985).

Agricultural activity centers around rice farming. Cash crops include coffee, cacao, palm kernels, piassava and ginger, all grown by small-scale farmers. Upland farming generally follows a bush-fallow system in which, ideally, land is cultivated 1 to 2 years and then left fallow for 10 to 15 years. Due to population pressure and competition for land to produce export crops fallow time appears to be dropping steadily. Lowland agriculture is of several types. The most important is the intensive cultivation of paddy rice in the inland valley swamps.

Access to land for small farmers is generally through tribal authority. Village chiefs distribute land annually to both women and men. However, informants reported that land was often allocated to women after the men's allocations had been made. Agricultural labor is performed by both men and women. As in many other areas of West Africa women provide the greater share of the labor for food crops. Women's contribution to agricultural labor is further increased with male labor migration to mining areas.

The population is divided among several cultural/ethnic groups. A Creole population descended from slaves repatriated during the early 19th century is centered around the Freetown area. The two largest ethnic groups in Sierra Leone are the Mende (34.4% of the population) and the Temne (31.3%). There are about 18 other ethnic groups represented in the country. Although the official language is English, Krio (an English based creole) is the lingua franca. Approximately 50% of the people follow traditional religions, nearly 40% are Muslim, mainly in the north, and Christians account for almost 10%. Women head approximately ten percent of rural households.

Nutritional Status in Sierra Leone

The Sierra Leone National Nutrition Survey (GOSL/UCLA 1978), based on a national sample of children under the age of five years, concluded that:

1. in the country as whole, 24.2% of young children were chronically undernourished (under 90% of standard height for age);

2. 3% of young children were acutely undernourished (under 80% of standard weight for height);

3. 30% of young children were underweight (under 80% of standard weight for age)

4. all forms of undernutrition in young children were lowest in Freetown and lower in urban areas than in rural areas; a sample of advantaged children showed little evidence of poor growth using international standards; the northern part of the country was identified as having the greatest nutritional problems;

5. almost 60% of children in Sierra Leone were anemic (as defined by haemoglobin values < 10 Gm% for children 6-23 months, and < 11 Gm% for children 24-59 months);

6. the prevalence of undernutrition appears to peak between 9 and 23 month age;

7. child mortality rates were higher in those families that have an undernourished child;

8. maternal malnutrition, as defined by arm wasting, was about 6%, however, it was almost twice that high in pregnant women;

9. improvement in a child's diet might be realized by the combination of an improved inta-family distribution of existing foods and, in some areas, by increased availability of foods.

A survey of Songo and Tombo villages (including Mende, Temne and Creole ethnic groups) conducted in 1984 concluded that 25.9% of the children under five surveyed were suffering from chronic undernutrition (height/age < 90% of standard). Of those for whom documentation of date of birth was available, 21% were found to be chronically undernourished. Ten percent of children were suffering from acute undernutrition (weight for height < 80% of standard). A survey of six communities in the Safroko Limba chiefdom conducted by Meals for Millions in 1982 (MFM 1983) showed rates of chronic undernutrition up to 40% among children under five years of age in this region of Northern Sierra Leone.

The existing studies of nutritional status are in general agreement concerning nutrition in Sierra Leone. At least one fifth of children under five show signs of chronic undernutrition, although a much smaller number (between 3 and 10 percent) show signs of acute malnutrition. Children and women in rural areas are at greater risk than in urban areas, and the northern section of the country has the highest degree of under nutrition, perhaps up to 40% of children under five years of age. Furthermore, similar

results from surveys conducted over a decade suggest that the problem has remained relatively constant.

While some data exist on nutritional status as noted above, relatively few are available for food intake. The FAO (1983) estimates that 2002 Kcal./person were available in 1964-65 and that this figure had declined to 1936 Kcal/person in 1980-82. Of those, 1845 Kcal. are estimated to be available from vegetable foods and only 91 Kcal. are available from animal products. Rice is the most important food stuff and may contribute up to 88% of energy consumed (Thompson-Clewry 1966 cited in Kolasa 1978). It is certainly the preferred staple. Cassava and sweet potatoes constitute the second most important food stuffs. Production, and very likely the consumption, of these roots and tubers is increasing (FAO 1985). A variety of other foods, used as relishes with rice, foofoo (boiled, pounded cassava), or pounded sweet potato, are available in markets or from kitchen gardens. These include agusi (bitter melon of which the seeds are used), tomatoes, green and purple eggplant, okra, bitter leaves, sorrel, jackato, cassava leaves, sweet potato leaves, pumpkin, palm oil, avocados, pears, cucumbers, green corn, groundnuts, beans, plums, green and dried peppers, onions, fish, sugar, etc.

Kolasa (1978), after reviewing information available in 1978 on diet in Sierra Leone, concludes that little is known about food use in Sierra Leone and even less is understood about the factors that contribute to undernutrition among small farm families. Declining availability of food and large post-harvest storage losses appear to be the most important factors contributing to malnutrition. Problems of seasonal hunger appear to occur during the rainy season, immediately prior to harvest, although the clinic data to support this assumption may be biased by differences in clinic attendance patterns which decline during the rainy season. Other factors noted as potential contributors are unequal distribution of food within households, lack of appropriate weaning foods, food taboos affecting children and women, women headed households and increasing work loads for women, and the effects of shifts from subsistence to cash cropping. Some observers suggest that the cultivation of kitchen gardens providing vegetables for home consumption may be declining. While there is some reason to suspect all of these factors as contributing, unfortunately, there has been no clear empirical support for their relative importance (Kolasa 1978).

A study carried out by Michigan State University (Smith et al. 1981a, 1981b, Strauss et al. 1981) using data collected in 1974-75 shows that households that produce much of their own food consume more of a diverse assortment of foods than households that purchase more of their food, and that a high degree of market orientation reduces the consumption of cassava, sorghum, and all other cereals except rice. The authors suggest that a greater dependency on the market may adversely affect nutritional status.

ACRE PROJECT SCOPE AND ORGANIZATIONAL STRUCTURE

The Adaptive Crops Research and Extension Project was originally funded through loans and grants for a total of about 6 million dollars. The

Project Paper Amendment which created the Nutritional Component authorized an additional allocattion to support those activicies.

ACRE's mandate is to meet the needs of small farmers practicing upland agriculture on a national level. In practice ACRE conducts on- farm trials and provides agricultural and nutrition extension in a twenty-five mile radius around each of the five ACRE implementation zones of Kabala, Kenema, Makini, Njala, and RoKupr (see map p.). In each zone a number of farmers have been identified for participation in on-farm trials and demonstrations. These are ACRE contact farmers. A larger number of farmers have received ACRE planting kits and have attended extension demonstrations and classes. These are classified as interested farmers. ACRE staff estimate that there are about 1,000 contact farmers and up to 20,000 interested farmers overall. These are divided among zones as shown in Table I below.

TABLE I

ACRE CONTACT FARMERS AND INTERESTED FARMERS BY ZONE

	Kabala	Kenema	Makini	Njala	RoKupr
Contact farmers	207	225	225	224	225
Interested Farmers	4306	3344	3657	5022	6257

Source: ACRE 1984

Administrative Organization of ACRE

As noted above the ACRE project is divided into two components: Agriculture and Nutrition, and covers three aspects of each: research, extension, and training. Immediately below the office of ACRE Project Director, the project is divided administratively between research and extension with a full-time coordinator for each. The Coordinator of Research is responsible for the administration of research efforts by part-time NUC/ACRE staff and full- time and expatriate staff for both nutrition and agriculture. The Coordinator of Extension is responsible for the administration of extension activities, both in nutrition and agriculture. His staff includes a Senior Extension Officer (SEO) for each of the five ACRE zones. Each SEO in turn supervises nine Extension Instructors (EIs) and two Nutrition Instructors (NIs) per zone. An expatriate extension specialist provided by SULSU serves as a counterpart to the Director of Extension.

The ACRE nutritionist occupies a line parallel to the coordinators. She supervises the substantive work of the NIs and participates in organizing nutrition research but is responsible directly to the office of the ACRE Project Director.

ACRE Agricultural Research and Extension

The ACRE project agricultural component is organized around three stages of activity:

1) On-station research includes plant variety trials, fertilizer trials, soil fertility trials and weed control trials. This research is carried out by full-time ACRE research staff and and part-time staff from NUC.

2) On-farm trials are designed by the research staff and planted in farmers fields under the supervision of the extension staff.

3) Extension demonstrations are conducted on farmers' fields under the supervision of the extension staff on the basis of successful on-farm trials.

Because ACRE agricultural research depends on both on-station and on-farm trials, ACRE research and extension staff must work together. The interaction necessary for the planning of on-farm research should take place at the annual work plan meeting. Ideally, during this meeting SEOs meet with ACRE/NUC research staff to evaluate the pevious year's research and establish the research agenda for the coming year.

However, the fuel shortage of the last few years has prevented the full participation of extension staff and as a consequence extension staff and research staff seem unaware of each other's research activities.

ACRE mandated commodities are rice, cassava, sweet potatoes, maize, cowpeas, and groundnuts. Some preliminary work has also been done on pigeon peas. Through the years ACRE has concentrated most heavily on rice research, as rice is the most important staple of the Sierra Leonean diet. Crops of secondary priority for ACRE are cassava, cowpea and sweet potato. In addition, some work has been done with maize, groundnuts, and pigeon peas.

ACRE on-farm research and extension have centered around work with contact farmers. Contact farmers are selected on the basis of interest, leadership, and the accessiblity of their land to other farmers for demonstration purposes. ACRE staff admit that because of these criteria the more prosperous and cooperative farmers are more likely to participate in on-farm trials and demonstrations. Few contact farmers are women, although some effort has been made to incorporate more women farmers into ACRE activities. On-farm trials are conducted using the contact farmers' land, labor, and usual cultural practices (with the addition of any practices

required by the trial) and are supervised by the EIs. Data from trials are collected by the EIs and sent to Njala for analysis.

Training Opportunities in ACRE

The ACRE project offers several kinds of training to project personnel. In-service training for two days each month and two weeks each year for extension staff (EIs, NIs, SEOs) was part of project implimentation plans. This training was to provide additional information and refresher courses for staff. At least one module on food consumption and nutritional status was presented to agricultural extension staff. This was carried out until the fuel shortage made it impossible for staff to travel to Njala for the courses. Some effort was made by NC staff to travel to field sites, although this too became impossible.

Advanced training at SULSU has been available for a number of project staff. Several staff members have studied for one or two years in the United States. Staff receiving training in Louisiana have included the Coordinator of extension, SEOs and the ACRE project nutritionist.

Project documentation (ACRE 1981, Sevenhuysen 1984) make it clear that the justification for the development of a Nutrition Component for ACRE was drawn directly from the National Nutrition Survey and studies of diet and factors affecting food consumption noted above (GOSL/UCLA 1978, Kolasa et al. 1978, Smith et al. 1981a, 1981b, Strauss et al. 1981). Those studies emphasized the increased risk of undernutrition for rural populations, and especially for women and children. They particularly pointed out food production, storage, seasonality, and socio-economic factors as contributors to chronic malnutrition.

In addition, project planning and implementation documents draw on insights from general studies of agricultural production and food consumption. The ACRE Project Paper amendment (1981) establishing the Nutrition Component notes that "World wide experience has demonstrated that efforts to increase food production and income do not automatically reduce malnutrition or improve food consumption by low income groups." This Paper identifies marketing and distribution, processing and storage of foods, food consumption, and biological utilization of foods as issues in addition to food production that are important in establishing good nutritional status.

FOOD CONSUMPTION AND NUTRITIONAL DATA USED IN PROJECT PLANNING

Nutrition Baseline Study

In 1982 a baseline survey of food use, diet, food preparation, and socio-economic aspects of nutrition was conducted by NUC/ACRE staff with the assistence of the AID/REDSO nutrition officer.

The baseline study had the following goals:

1. To provide detailed information on food consumption, preparation, conservation, and processing and relate it to nutritional health health status of target farm families especially vulnerable groups of young children and their mothers in the five ACRE zones.

2. To compare nutritional factors in the five ACRE zones.

3. To provide information about associations between nutrition status and food production, consumption, health and certain socio-economic factors.

4. To establish baseline data on selected indicators of nutrition status especially consumption patterns in order to monitor impact.

Fifteen female household heads were interviewed in each zone for a total sample of seventy-five households. The interviews included questions on household characteristics, education of the household head, child feeding habits, maternal diet, social information, food preparation methods, storage methods, and uses of the foodcrops of interest to ACRE. Although the survey goals included the generation of information on nutritional status and the factors that affect it no anthropometric or biochemical data for the assessment of nutritional status were included. Nor were any quantitative estimates of food intake obtained making this objective difficult to attain. Due to the nature of the survey instruments and problems with coding and analysis, the data have never been fully analyzed. Some descriptive information can be obtained from the questionnaires and some of the data have been hand tabulated. The baseline has provided some information on differences in food preparation and diets in the ACRE zones. It does not provide enough precise data to serve as a baseline for project evaluation, however.

In addition to formal surveys and analyses of secondary data, the ACRE/NC has a limited amount of information available from the NIs field notes. The care with which these notes are kept and the extent to which they are available to the ACRE nutritionist and research staff are unclear. However, some information has been generated and used. Several ACRE/NC research projects were prompted by questions from contact families. Also, additional information on crop utilization and storage coming from contact families via the NIs has been noted.

NIs also collect information on the weight of children as part of their growth monitoring activities. With careful interpretation these data might serve as a source of nutritional status data for project evaluation.

LINKAGES BETWEEN AGRICULTURAL PRODUCTION AND FOOD CONSUMPTION

ACRE agricultural and nutrition/foods research has explicitly identified and addressed several linkages between production and food consumption. The choice of rice as the crop with highest priority reflects the importance of rice in the diets of both small farmers and the urban poor. Cassava and sweet potatoes, although less preferred, are also dietary staples. Studies of food production and consumption suggest that these crops, especially rice, have a higher income elasticity of demand in the lowest income groups.

Seasonality

Studies of diet and nutritional status which provided data for planners of the ACRE project suggested that a pre-harvest hungry season may exist during the rainy season. Thus the adaptation of short duration crops, specifically sweet potato, has also been a priority in order to provide crops that mature during the hungry season. Problems of post-harvest loss in sweet potatoes have been identified as a major constraint to consumption of this food. Several researchers from both the Agricultural and Nutrition Components, including an expatriate agronomist, have been working with sweet potato storage. Recent work of ACRE/NUC nutrition staff has addressed methods of processing tubers into flours that can be stored for long periods of time.

Utilization

The incorporation of the nutrition component formalized attention to the cooking qualities, utilization, and acceptability of ACRE crops. Some of the work in cooking quality has also influenced agricultural research. Food quality work in cassava, sweet potatoes, and cowpeas has identified varieties that have poor cooking qualities as well as varieties that have acceptable cooking qualities. The extent to which this information has been incorporated into research priorities is unclear, however. Varieties identified as have poor cooking qualities continue to be researched and are used in on-farm testing and demonstrations.

Crop Mix and Minor Crops

The importance of secondary food crops as supplements to rice and tuber based diets has been addressed in the work of nutrition component staff. NIs promote the cultivation of household gardens as part of their work.

Household Labor and the Role of Women

ACRE has not addressed problems in the allocation of labor. Although ACRE staff, both extension staff and research, recognize that much agricultural labor is performed by women, and furthermore that women often manage their own fields, ACRE has been relatively unsuccessful in incorporating women farmer in on-farm trials and demonstrations. EIs are all men, which makes it difficult for them to work directly with women farmers in this predominantly muslim culture. Some EIs have found, however, that the Nutrition Instructors can accompany them when talking with women. The more general issue, however, is that many of the cultural practices promoted by ACRE require a greater input of labor to achieve increases in yield. The importance of labor constraints in agriculture has become increasingly apparent to some ACRE staff as an explanation for the failure of farmers to adopt improved cultural practices despite the fact that improved yield can be demonstrated in on-farm trials.

THE ACRE NUTRITION COMPONENT

From its inception the ACRE project has had the improvement of food consumption and nutritional status of ACRE families as an objective. The mid-term evaluation of ACRE recommended that this objective be addressed directly through the addition of a nutrition component to ACRE. A project paper amendment prepared in 1981 outlined the nutrition component and authorized monies for its implementation. The project paper amendment notes that the causes of malnutrition in Sierra Leone are not only related to food production, but include social and economic causes as well. However, ACRE agricultural activities are likely to affect only a small part of the problem of malnutrition. The nutrition component, then was established to improve the likelihood that ACRE activities would address the most important aspects of issues in food production, and also address some of the the other factors thought to be important, such as education of women to prepare and use the most nutritious foods, community development activities to improve sanitation and general health in order to improve the biological utilization of nutrients from foods, and to develop methods of saving women's labor time. (Specific objectives are outlined in the introduction, above). To address these objectives the ACRE nutrition component was organized to carry out basic research in nutritional quality, utilization, acceptibility and storage of ACRE crops. An extension program to bring information to farm families and to promote community development was established. ACRE nutrition research is conducted primarily by part- time ACRE/NUC staff from the NUC Department of Home Economics. Research staff include specialists in food quality, food processing, and recipe development as well as in general nutrition. A full-time ACRE nutritionist has responsibilities for coordinating the relationhips between ACRE nutrition research and extension. She plans and supervises the substantive work of the Nutrition Instructors, as well. A Community Development Nutrition specialist was also appointed.

Nutrition Component Research

Some research on the food quality of ACRE crops had begun even before the formal approval of a Nutrition Component in 1981. ACRE/NUC staff were

conducting cooking trials and acceptability trials using ACRE varieties virtually from the beginning of the project. The ACRE Coordinator of Research characterizes this work as investigating important characterisitcs of ACRE crops on a basis other than yield.

Research on cooking qualities of crops has included studies of the boiling charateristics of cassava clones, processing and storage characterisitcs of sweet potato clones, and cooking and processing properties of cowpea varieties. On the basis of these studies the NC has recommended that the promotion of several varieties of cassava be discontinued.

It was found that the sweet potato varieties most acceptable to consumers were not those with the best storage characteristics. However, consumers appear to accept poorer storage in those varieties because they are early maturing and provide food during the rainy season.

Difficulties in dehulling and processing some varieties of cowpea found in laboratory studies suggested that only one of the ACRE test varieties had acceptable cooking qualities and othe varieties would require that alternative processing methods accompany their promotion.
Researchers have also been able to address an issue raised by contact households. Women maintained that the leaves of sweet potato plants that had received chemical fertilizer required more time to cook than those that had not been fertilized. Laboratory research by NUC/ACRE staff has failed to support this impression. The critical variable appears to be the stage of maturity of the leaf when consumed.

By 1982 ACRE/NUC staff had also begun developing recipes for use with ACRE crops. Some of the recipes developed promote alternative preparation techniques for crops, other suggest specific uses for ACRE crops, such as the preparation of balanced baby foods using these foods. Recipe development contiues to be one of the key activities carried out by ACRE/NUC Home Economics Staff. Several lines of research have addressed problems of storage and post-harvets loss including some research on the home production of flours from cassava and sweet potatoes and the shelf lives of alternative products.

Current laboratory research includes a project using flours of cassava, cowpea and maize in the preparation of composite flours with wheat. This work is supported by the FAO.

ACRE Nutrition Extension

While the research activities of the NC were under way by 1982, the NC extension program was not fully implemented until 1983. Nutrition Instructors were recruited late in 1983 and started a two week induction class in January of 1984. NIs were all women, most quite young, with varying degrees of training prior to accepting positions as NIs. Several had training in home economics or nursing, but most came to ACRE with

minimal secondary education. The two week training period was seen as clearly too short, but NIs were to come into Njala periodically for further in-service training. Ten NIs were recruited in all, two for each zone.

Like the EIs, NIs were to develop a group of contact households in their village of residence and in nearby villages. Criteria for NC contact households are similar to those for AC contact farmers. However, since young children and pregnant and lactating women were known to be at highest risk, the NIs focus on households that contain individuals from these categories. AC and NC contact households may overlap but this is not necessarily so. The NIs also have a category of 'interested households' that includes households of women who attend demonstrations and receive recipes, etc., but with whom the NI does not work as closely as with contact households. Because of their smaller numbers NIs have many fewer contact and interested households than the EIs.

In order to fulfill their objective of improving the nutritional status of ACRE contact families the NIs were instructed to carry out the following duties in the field:

1. monitoring the growth of young children in contact families by weighing children in contact families on a monthly basis.

2. demonstrate cooking methods and recipes using ACRE crops developed through ACRE research at Njala.

3. promote and offer technical assistence in the cultivation of home gardens.

4. encourage improved sanitation in contact villages through community development activities such as improving the water supply, encouraging the use of plate racks and clotheslines, and the use of latrines for the disposal of wastes.

5. teaching nutrition education classes.

6. teaching use of oral rehydration therapy for the management of diarrhea.

In essence, the work of the NIs is to extend the information, recipes, improved processing and storage techniques generated through research at NUC, to ACRE contact households. At the same time the recognition that many other factors may affect the nutritional status of households in the five ACRE zones, is reflected in the emphasis on general nutrition education and community development efforts.

Gladys Foday, ACRE Nutrition Instructor - Konabu Village

In April of 1986 the author was able to spend a brief period of time with Francis Ngebeh, SEO for Kenema zone and Gladys Foday, an ACRE NI in the Kenema zone. While the work of any NI is not likely to be representative of

all ACRE nutrition extension, a brief sketch of Mrs. Foday's work is presented here to add texture to the discussion of ACRE extension activities.

At the time of the visit Francis Ngebeh had been SEO in Kenema zone for only a month. Previously he was SEO in another zone and then spent some time at LSU in training. In discussing the work of the NIs he was able to draw on experiences from both zones. In the Kenema zone EIs are currently working with about 52 contact farmers and 41 interested farmers with whom they conducted some demonstrations and trials. He estimated that the two NIs each worked with about seven contact farmers.

In Kenema zone the EIs and NIs cooperate closely with the Eastern Area Agricultural Development Project, an Independent Agricultural Development Project (IADP) funded by the World Bank. The IADP has seed and credit and ACRE provides other planting material and extension. ACRE agricultural extension in Kenama zone promotes rice as its first priority. Cassava, sweet potato and groundnut are also promoted. There is some work on cowpea, but cowpea competes for labor with the major cash crops of the region -- cocoa and coffee. Consequently, there is little interest in cowpea cultivation among farmers.

In this zone there have been some cooperative demonstration fields. The community cultivates a demonstration field cooperatively under the supervision of ACRE EIs and then uses the proceeds from the sale of the crop for community projects. In one instance the community used the funds to build a mosque.

Because the fuel shortage has prohibited him from traveling to visit EIs and NIs in the field, Mr. Ngebeh took our trip to Konabu village to see Mrs. Foday as an opportunity to visit the village for the first time since assuming the post of SEO.

Gladys Foday has been working with ACRE since 1983. She came to ACRE with a general primary and secondary education and received a two week training course when she began working with ACRE. Mrs. Foday was able to attend monthly in-service training sessions until the gasoline shortage that began in 1984 made travel to Njala impossible. At the time of the interview Mrs. Foday had just returned from a six month maternity leave. (Several other NIs were currently on maternity leave or about to go on leave).

Mrs. Foday is headquartered in Konabu village. Her work extends to three other nearby villages as well. A fifth village, which she characterizes as having been the most cooperative, had been part of her region but it burned down while she was on leave and its population has scattered. In all, Mrs. Foday has six contact families. Most of the other families in the four villages are classified as "interested", that is, they attend nutrition education classes and food demonstrations when they are held. Mrs. Foday visits the villages for which she is responsible on a motor bike, when gasoline is available. When there is no gasoline she goes on foot.

The projects that Mrs. Foday has been promoting include the construction of compost fences, clothes lines, plate racks, improvement of the the village well and encouraging the use of latrines. Her encouragement of latrines has not met with much cooperation. She feels the reasons are economic, households cannot afford the expense of constructing latrines.

Before taking maternity leave she had established a committee of men and women to improve village sanitation. Among other things she had gotten the village to build a concrete collar around the village well. With her own funds she had purchased a rubber bucket to dip out water and had encouraged villagers to sweep around the well weekly. She also encouraged women to sweep their houses daily. She noted that they would do this when she nagged but would leave it undone if she didn't go out of her way to check on them. She was very disappointed to find on her return to Konabu village that the committee has ceased to function and villagers had stopped cleaning around the well and sweeping their homes. She threatened to leave the village and was promised that well cleaning would resume. Mrs. Foday is frustrated that she needs to spend so much energy in urging villagers to carry out these tasks. As an ACRE extensionist she feels that she can only encourage. Other government representatives have greater authority and can use more forceful means to elicit cooperation. She did note that women are more cooperative than men and she was somewhat encouraged that a new village chief, who is a woman, had been named during her leave.

Mrs. Foday carries out food demonstrations about once a month in each village. She had demonstrated making rice pap for children, fresh maize and bean jollof rice, bean pudding with broad beans, maize and beans with fresh maize, cassava-fish cake, sweet potato cake and cassava chips. Lack of funds has resulting in a lack of utensils and materials for demonstrations, however. Mrs. Foday has sometimes had to buy supplies out of her own pocket and use her own utensils for demonstrations.

She reports that villagers like food demonstrations best of all of her activities and fight to try the food afterwards, but she also believes that they try the recipes at home. People do expect to get things from her. Other groups that demonstrate food preparation then distribute the foods. Villagers expect ACRE to do the same. This was also a problem with growth monitoring. Mrs. Foday weighs children in contact and interested families every month. Other groups that monitor children's growth also distribute donated food to children. Initially mothers expected Mrs. Foday to distribute food to children. Now, however, they accept growth monitoring for its own sake.

Mrs. Foday reports that she has a good working relationship with the EI for her area. She invites the EI to all of her demonstrations and meetings and he often comes. She accompanies him when he visits women farmers. Were he to go alone their husbands would object. With Mrs. Foday's presence husbands don't mind and the EI can successfully work with women. Mrs. Foday says she works "hand-in-hand" with the EI.

One project they have worked on together is back-yard gardens. Most families have a back-yard garden or a garden area in their fields. Gardens

usually contain, sweet potato, cassava, maize eggplant, peppers, and leafy vegetables. She currently works with five gardens in Konabu. The major problem is with seeds. Households are supposed to keep seed from the harvest for replanting in the next cycle but they are always short. Mrs. Foday can provide seed from ACRE crops, which she, in turn, gets from the EI, but there are other crops for which people want seed she cannot provide.

Mrs. Foday appears to be energetic and committed to her work in Konabu village. Despite complaints that villagers need to be cajoled in to cooperation in projects in community sanitation, she does seem to have the respect of community members. One of the women from an "interested" household with whom she has worked expressed the feeling that Mrs. Foday's help with her undernourished child had saved his life. Also Mrs. Foday seems to have a good working relationhip with the EI for her area. They appear to collaborate on a number of projects and her presence makes it possible for the EI to work with women farmers. Finally, the SEO for Kenema zone expresses interest in the work of the NIs and has a good knowledge of what their activities are and should be, although he admits a lack of substantive knowledge in the area of nutrition.

ACRE PROJECT OUTCOMES AND ACCOMPLISHMENTS

The ACRE project has accomplished a number of things. Adaptive research has been carried out with several crops. Rice has been ACRE's first priority, as it is the most important staple of the Sierra Leone diet. However, there has been little success with rice variety trials. According to the director of research, Dr. Edward Rhodes this is partially due to the inherent difficulty of working with rice as a crop. More importantly, however, currently cultivated rice varieties, even though labelled 'traditional' were derived from improved forms. Therefore, the difference in yields between ACRE varieties and those currently cultivated is relatively small.

The most successful research is that which concerns cassava, sweet potatoes and cowpeas. IITA varieties have been screened for adaptation to Sierra Leonean conditions and several have been found to produce yields significantly better than traditional varieties of these crops. A short duration variety of sweet potato has enjoyed special popularity among ACRE contact farmers. Some work is also being conducted on maize and groundnuts.

Other ACRE research activities appear to have been less successful, on the whole. Improved cultural practices, such as weeding and fertilizer use have not been adopted by farmers, although on-farm trials and demonstrations indicate that these practices improve yield.

The ACRE nutrition component has implemented a number of its objectives. Research on the utilization and acceptability of ACRE crops and recipe development has continued. A baseline study of food use and crops utilization has been carried out and the extension program, organized around the work of Nutrition Instructors in the ACRE extension zones, has been

operating since 1984. The work of researchers in the nutrition component has contributed to and understanding of the importance of cooking quality, food preferences, and storage characteristics for the acceptablility of ACRE varieties. Several ACRE varieties have been identified as more acceptable and several have been identified as unacceptable. To some extent, the research carried out in the quality labs appears to have some impact on agricultural research priorities. A greater impact can be seen in the extension component where the recommendations of the food quality researchers are reinforced by the extension instructors who are in direct contact with the farmers. Recommendations for crop use and recipes developed in the food labs form the basis of much of the work of the nutrition extension staff -- the Nutrition Instructors (NI). It is not clear, however, that food quality research has had an impact on the priorities of on-station research.

A good deal of work has been done on recipe development to meet nutritional needs of households in the five ACRE zones using ACRE crops. Especially important is the development of weaning foods which can address the needs of the children found in the National Nutrition Survey to be most at risk.

Work on food preservation and storage has addressed a major constraint for food availability in small farm families. At the same time this research does not seem to have been incorporated into the nutrition extension work.

A baseline survey of food use and processing was conducted by the nutrition component staff in 1982-83. While these data have never been fully analyzed, they have provided some information on food use and processing for the five zones.

Another issue is the extent to which ACRE agricultural research is designed to address consumption issues identified by the project design staff and the baseline survey. Several aspects of agricultural research do appear to do this. For example, the director of research states that the heavy priority placed on rice research is in response to heavy dietary reliance on rice as a staple grain. Issues of seasonal hunger are addressed through research on short duration sweet potatoes that mature during the period of greatest nutritional stress. Cassava and sweet potatoes, next in importance in ACRE research after rice, are crops produced primarily by women for household subsistence. (ACRE agricultural extension appears to have little contact with women farmers directly.) In terms of understanding and using information on the the allocation of household labor ACRE has had less success. In fact poor adoption of many ACRE promoted technologies (row planting, fertilizer use, weeding) may be due, in part, to the increase in labor, especially women's labor, that they demand.

Nutrition Extension has been in the field since 1984. Despite some turn over in staff both full-time staff at Njala and field staff, work in nutrition extension has been carried out. Interviews with SEOs revealed a fair understanding of the work of the NIs, even though SEOs emphasized that they they little training in nutrition and food consumption issues. The

nutrition extension staff are enthusiastic, despite problems in traveling within their zones and to Njala for training.

The inclusion of female nutrition extension staff has enhanced the ability of agricultural extension to work with women farmers. Also emphasis of nutrition component staff on gardening has focused some attention to secondary crop production within ACRE, although it is unclear the extent to which gardening activities have been evaluated in light of their relationship to the rest of the farming system.

ACRE PROJECTS CONSTRAINTS

ACRE in general, and the Nutrition Component in particular have not been without problems. Some, like the fuel shortage, are clearly out of the project's control, others are administrative and organizational in nature and still others have to do with the nature and the extent of funding for project components.

Fuel Shortage

The fuel shortage that has plagued Sierra Leone since 1984 has had a profound effect on the entire project. The work of all extension staff and on-farm research has been severly hampered. Supervision of EIs and NIs by SEOs is very limited. Field staff can no longer travel to Njala for in-service training and ACRE/NUC research staff cannot travel to field sites to supervise on-farm research. SEOs were unable to attend even the annual work plan conference, the context in which they are able to communicate the needs of farmers to ACRE research staff. Limited, or nonexistant access to in-service training has effected Nutrition Component staff more severely because they were more poorly trained than agricultural extension staff to begin with. In addition, difficulty in obtaining inputs such as fertilizer and lack of fuel for their transport to contact farmers has hampered trials and demonstrations and delayed planting dates far beyond those used by farmers using traditional methods of cultivation. Several staff memebers questioned the feasibility and wisdom of recommending fertilizer use for any crop in Sierra Leone for these reasons. Furthermore, inputs such as fertilizer generally require farmers to arrange credit. ACRE does not provide agricultural credit, but extension personnel will help in arranging credit through other agencies.

Training

In general, training efforts in the nutrition component appear to have been less successful than in the agricultural component. Only one of the nutrition staff has received master's level training. The baseline training of the NIs appears to have been less than the EIs from the outset, yet in-service training of the NIs has not been more intensive to compensate for this. Also, while EIs have received some training in nutrition, which is

very important, NIs have not received parallel training in agricultural production.

An evaluation of ACRE nutrition extension conducted in 1984 concludes that nutrition extension staff needed training in (a) future planning techniques (long range and short term planning, (b) preparation of appropriate instructional materials, (c) selection of appropriate teaching strategies, (d) development of simple easy to read bulletins for use by the NIs, and (e) writing lessons that are appropriate for the content of instructions to be covered. Such training, however, was not made available.

Equipment and Resources

A review of ACRE NC laboratory capabilities conducted in 1983 (Augustin 1983) noted that ACRE-NC work in recipe development and assessment of varieties suffered from lack of facilities for nutrient analyses at NUC. The report recommended that ACRE was in need of

1. Better equipped and more spacious facilities for the Home Economics food technology laboratory designed for recipe and cooking methods development as well as home-type storage studies tied in with the capability to do general chemical and microbiological analyses; and

2. A nutrient analysis laboratory capable of running proximate composition including caloric values, as well as chemical and microbiological vitamin assays. (Augustin 1983:8)

Funding needs were estimated at $216,920 for the first year of operation. While staff deemed capable of running a lab were available funding for a lab was never established. NC staff and the Coordinator of Research agree that the lack of laboratory facilities has hampered the ACRE-NC's ability to carry out some of its objectives. It should be noted, however, that a later evaluation concluded that the resources necessary for a laboratory would be more effectively allocated to improved training of extension staff.

In general, there is an unequal division of resources within the ACRE project. Research staff appear to have greater access to vehicles and fuel. Extension staff have less access to resources and the nutrition staff, within extension, have less access than agricultural staff. As a result, the ACRE nutritionist does not have direct access to a vehicle or fuel. She is less able to supervise her staff than her counterparts in the agricultural component.

Integration of Agricultural and Nutrition Components

The organizational structure of ACRE is such that resposibility for direct supervision of the work of the NI's is somewhat ambiguous. The Senior Extension Officers (SEOs) have responsibility for the supervision of both NIs and EIs in their zones, but they have little training in nutrition. The

NIs are also supervised by the ACRE nutritionist who reports not to the Director of Extension but to the Project Director. The fuel shortage and lack of vehicle for the ACRE nutritionist only further complicates the problems of supervision.

However, the integration of nutrition and agricultural extension appears to be better on the ground than it would seem from an inspection of the organizational chart or project documentation. Both SEO's interviewed had a pretty good understanding of the work of the NIs. Both also stated that NIs and EIs frequently work together in the field. The NI in Konabu village, Kenema zone, reports that she and the EI have solved the problem of husbands' objections to a male EI working with women farmers by including the NI in interactions with women. NIs and EIs often work together on home gardening projects. In those areas where they haven't worked together reports are that promotion of gardening has been less effective.

Integration of Research and Extension

Finally, the relationhips between research and extension in the ACRE project as a whole are problematical. In fact, nutrition research in ACRE seems to pretty well tied into nutrition extension, however, the relationships between on-station and off-station research in agriculture are less clear. Extension staff seemed uncertain about the nature of on-station reseach priorities and activities. Some staff noted that on- station researchers insist in researching technology that extension staff feels is inappropriate for small farmers in Sierra Leone. It is unclear, then, the extent to which farmers' needs and preferences influence the nature of research questions.

CONCLUSIONS AND RECOMMENDATIONS

The Adaptive Crops Research and Extension Project is one of the few agricultural research and development projects that has directly addressed food consumption and nutritional goals through the implementation of a nutrition component. It is clear that the design of a nutrition component allowed the project to focus food consumption and nutrition activities and allowed research and extension staff some degree of autonomy within the project. Furthermore, the overall focus of the ACRE project on adaptive research and extension using on-farm as well as on-station research should have provided a vehicle for the incorporation of farmers needs and preferences in both production and consumption into research priorities and activities. In fact this did take place, although not to the extent that could have been possible. Efforts were hampered by a nation-wide shortage of fuel, but also by a distribution of resources within the project that favored on-station research over on-farm research and nutrition extension. Also the establishment of a more autonomous nutrition component has obscured the relationships among a number of production practices and food consumption, however. That is, issues of labor demand, women's labor and crop mix have not necessarily been seen as affecting food consumption and

nutrition and appropriate targets of research, although they might have been. However, it seems clear that the work of the Nutrition Component has been one of the most important factors focusing ACRE researchers on problems important to resource poor farmers in ACRE districts.

A greater overlap in the training of field staff might have been desirable. Agricultural staff did have some in-service training in nutritional issues, but nutrition extension staff have not had parallel training in agricultural production, even though they are to promote gardening.

CHAPTER FOUR

CASE STUDY # 2: THE INTERNATIONAL SORGHUM AND MILLET PROJECT

HONDURAS

INTRODUCTION

The International Sorghum and Millet Program (INTSORMIL) is one of several Collaborative Research Support Projects (CRSPs) funded through the U.S. Agency for International Development (USAID) as part of the Title XII legislation. The CRSPs were set up as a mechanism to promote the collaboration of US scientists and Third World scientists in agricultural research that might have a positive effect on the economic well-being and health of poor populations within developing countries. INTSORMIL's mandate is to increase the production and consumption of sorghum and millet world-wide. It has had both a basic science orientation and an orientation towards the development of intermediate level technology with respect to the enhancement of production of sorghum and millet. INTSORMIL is a research organization and funding is through research grants from USAID/Washington through the Bureau of Science and Technology.

INTSORMIL was funded in 1979 with grants totaling over $ 14 million by 1986. It is a consortium of seven universities and about 40 U.S. based investigators with a number of collaborators. Most of the principal investigators are agro-biological scientists. Plant breeders make up the greater share, along with plant physiologists, entomologists, plant pathologists, and agronomists. There is a food utilization group that includes cereal chemists and biochemists. Until 1986, when such finding was drastically reduced, about 12% of project funds went to socio-economic scientists, including economists, rural sociologists and anthropologists, primarily to carry out farming systems and food consumption research.

Like the other CRSP's, INTSORMIL's research is expected to be collaborative in nature. INTSORMIL scientists carry out some basic research in the United States and collaborate on specific projects with investigators in 10 host countries. In addition, integrated programs with a wide range of disciplines represented have been carried out in the Sudan and Honduras.

BACKGROUND

INTSORMIL Work in Honduras

INTSORMIL began work in Honduras in 1981, operating under collaborative agreements with the Ministry of Natural Resources (MRN) of the Government of Honduras (GOH) and the Honduran National Institute of History and Anthropology (INAH). US institutions involved in INTSORMIL/Honduras have included Mississippi State University, the University of Kentucky and Texas A and M University. USAID/Honduras also participates.

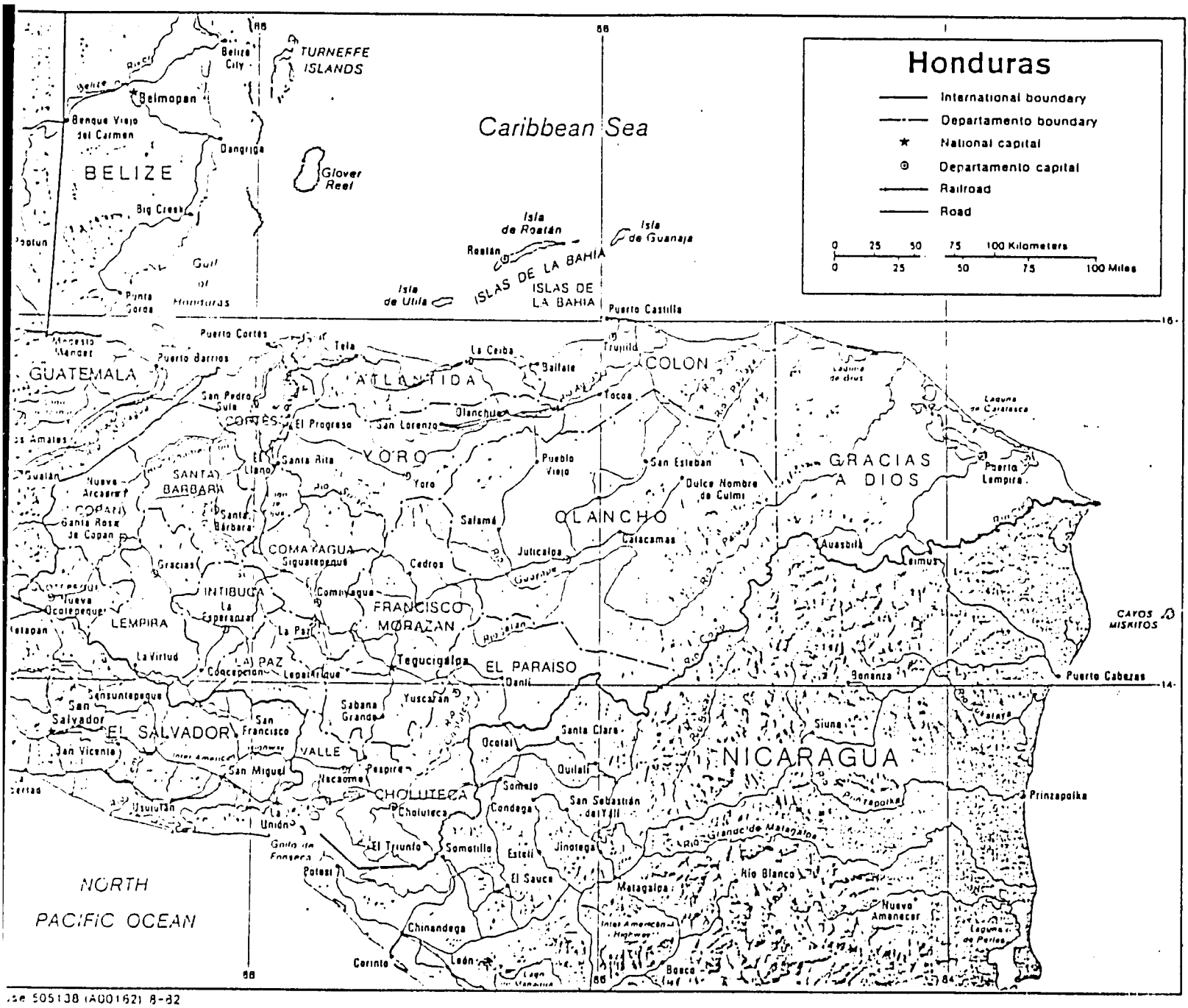
The Honduras project is one of INTSORMIL's core collaborative projects. The project focuses on work in sorghum breeding conducted jointly between the MRN and sorghum breeders from Texas A & M University. INTSORMIL work began with farming systems research and food consumption and nutritional surveys in June of 1981. A sorghum breeder from Texas was stationed at the agricultural experiment station at La Lujosa in the Southern Honduran department of Choluteca from 1981 to 1986. In 1986 he moved the base of operations to the Pan American School at El Zamorano. The sorghum breeder has worked closely with the head of the Honduran national sorghum program. Supporting farming systems research has been carried out by social scientists and nutritionists from the University of Kentucky and Mississipi State University since 1981. Entomological research has been carried out by scientists from Mississippi State and Texas A & M University, the latter is the lead institution and research coordinator for INTSORMIL work in Honduras.

Southern Honduras

Honduras lies in the middle of the five small republics that stretch along the Central American Isthmus from Mexico to Panama (see map, Figure 4.1). It occupies an area of approximately 43,277 square miles and is the second largest of the Central American Republics. Population in 1978 was 3.4 million people, with an average population density of 78.6 persons/square mile. Although this is lower than other Central American republics, only about 5% of the total land available is cultivated (Durham 1979) because of the rugged topology. Despite the small proportion of arable land, the economy of Honduras is predominantly agricultural. Agriculture accounted for 27% of the gross domestic product and 75% of exports and employed 61% of the labor force in 1984 (World Bank 1986). Bananas, coffee, livestock, and forest products are the major sources of export income. Other export crops include cotton, melons and sugar. Subsistence crops include the four "basic grains" corn, sorghum, rice, and beans. Squash, melons, and fruit trees (especially mangos) are also widely grown. The industrial sector is very small and per capita GNP is the second lowest in the Western Hemisphere, $ 700/capita in 1984 (World Bank 1986).

Large commercial farms produce most of the items marked for export while the production of basic food crops is carried out by small farmers cultivating marginal lands using traditional technology. Traditional

FIGURE 4.1



MAP OF HONDURAS

Source: U.S. Government Central Intelligence Agency 1982

farmers have received a very small percentage of credit and other forms of agricultural assistance and the production of basic grains has not kept pace with demand. Tables 4.1 and 4.2 provide production and demand data for the four basic food crops; corn, sorghum, beans and rice. These tables demonstrate four trends:

1. The area of cultivation of each basic food has increased.

2. Production yields per hectare have declined steadily.

3. Demand for all staple crops has increased.

4. Decreasing yield with growing national demand has resulted in the increasing inability of Honduras to meet domestic demand through internal production.

These trends have prompted the United Nations to identify Honduras as a "food priority country".

Southern Honduras was selected as an INTSORMIL core site because it is an area in which sorghum has been an element of farming systems for at least 100 years. Furthermore, it is one of the few areas in the Western Hemisphere in which sorghum is used as a human food as well as feed for animals. Finally, as noted above, Honduras is the second poorest country in the Western Hemisphere.

National surveys of nutritional status carried out by INCAP in 1966 (1969) and the National Planning Council of Honduras (CONSUPLANE) in 1979 estimated that over 70% of children suffer from undernutrition (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. Of all the regions in the country, Southern Honduras was found to have poorest nutritional status.

Food balance data from the nation as a whole indicate trends seen in other Third World countries experiencing declines in nutritional well-being. The country uses much of its cropland to produce commodities for export. In addition to exporting bananas and other tropical fruits, Honduras has been converting more of its land into pasture to raise beef cattle for export. While beef production rose by 230% between 1960 and 1979, per capita consumption of beef in Honduras actually declined by 20% (DeWalt 1983). During this same time period, imports of basic grains rose by almost 2000% for corn, 330% for rice, and 200% for beans.

Farming Systems in Honduras

There are several types of agricultural production in Honduras. Commercial production of export crops, in part controlled by multinational corporations, characterizes the North and South coastal areas. These commercial crops include bananas, cotton, sugar and beef. Peasant agriculture in the interior highland areas focuses more on subsistence

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 4.1

PRODUCTION AND DEMAND OF BEANS AND RICE

BEANS

Year	Area Cultivated (hectares)	Production Metric Tons	Yield Metric Tons per Hectare	Internal Demand	Production Minus Demand
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.

TABLE 4.2

crops. Larger commercial production of subsistence crops for internal markets characterizes several interior departments, such as Olancho. More recently, a few agrarian reform communities have combined cooperative production of commercial crops with the production of subsistence crops.

In the sorghum producing areas of Southern Honduras two major zones exist: 1) the lowland, coastal plain in which large landholders produce export crops employing a large number of landless laborers, and agrarian reform communities practice cooperative cultivation; and 2) the highland regions in which average land holdings are smaller, and large landholders rent or sharecrop land to small landholders and landless cultivators.

Farming systems research conducted by INTSORMIL researchers identified two distinct groups of cultivators for whom improved sorghum might be beneficial. These included small holders and tenant farmers in the highlands who produce sorghum for home consumption and sell their surplus when available; and agrarian reform communities in the lowlands for whom commercial production of sorghum for domestic markets might provide an alternative to cotton production.

Agricultural production including sorghum is quite distinct in each of the zones (see Figure 4.2 for a cropping systems diagram). In the highlands slash and burn or shifting cultivation is practiced on the steep hillsides. Fallow land enters the cropping cycle through a method of "slash and mulch". In the first year of the cycle (Figure 4.2) brush and trees are cut in July and August, during the rainy season. Corn and sorghum are sown during this cropping season, called the postrera, with the cut brush serving as a mulch. In the second year the brush is burned at the end of the dry season and corn, sorghum or other crops are planted. Corn and sorghum are frequently planted together in the same hill or in alternating furrows. The rationale is that the sorghum, which is photo-periodic and matures in December, will not begin to enter full growth until the corn is harvested in July. In good years both corn and sorghum are harvested. In those years in which drought destroys the corn crop, the more drought tolerant sorghum still usually produces a crop. In some of the higher communities beans are also intercropped with grains.

In the third year of the cultivation cycle corn and sorghum are again planted. In recent years pasture grass is often planted during this third year. After the third year of cultivation the field is either allowed to revert to fallow for five or six years, or it is allowed to go to pasture grass for the grazing of beef cattle. Recently the increasing cultivation of pasture grasses has resulted in the transformation of land formerly planted to annual crops into permanent pasture. One of the results of the disappearance of fallow land is a decrease in the amount of land available to landless farmers through rental or tenancy arrangements. Many farmers with access to a small amount of land are now sowing grain crops for more than three years or shortening the amount of time land is left fallow. Soil erosion and depletion are becoming more serious.

In the lowlands large landholders raise export crops and cattle using the labor of landless workers. Some land owners allow laborers to

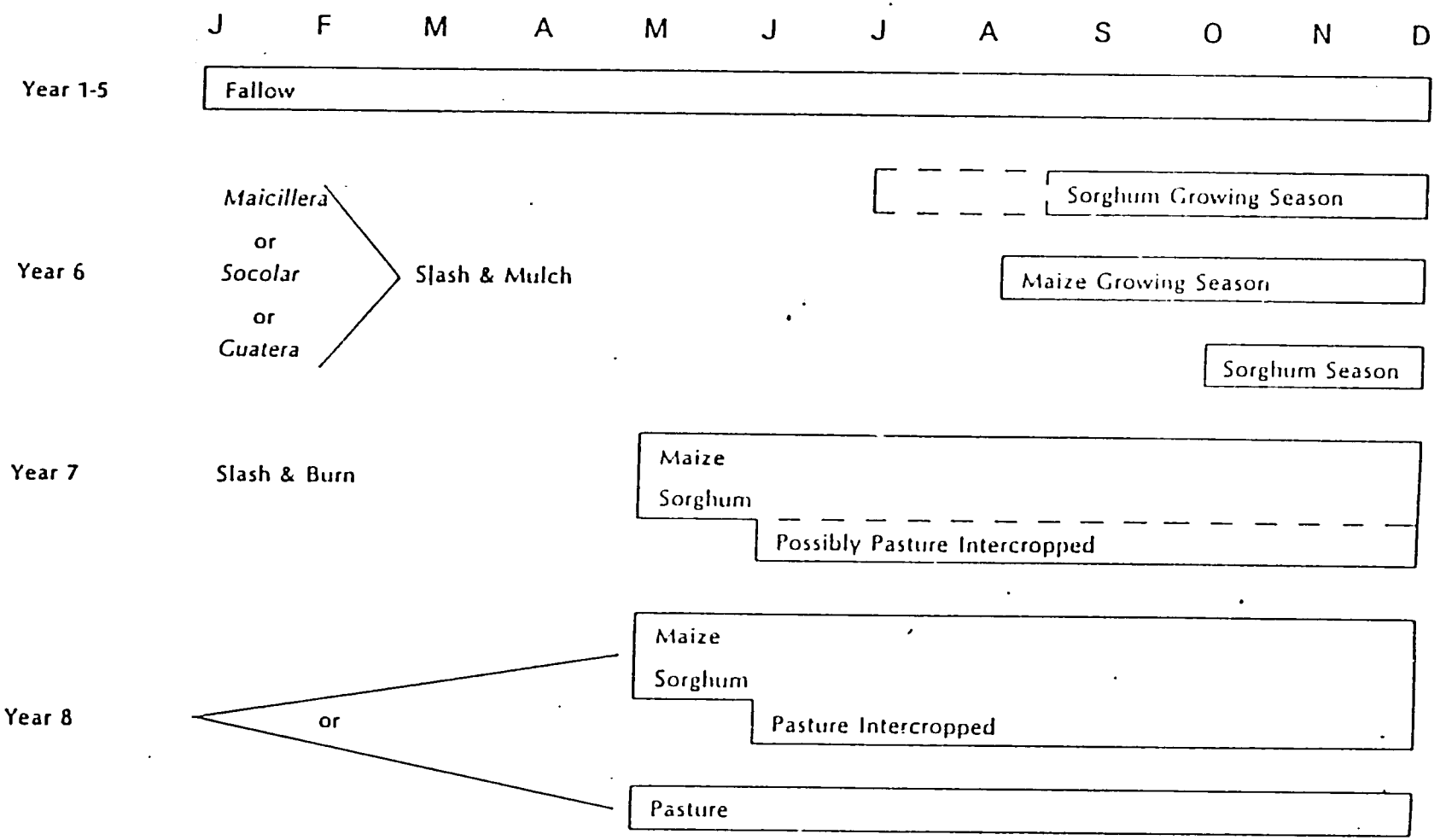


FIGURE 4.2 .

Fallow and Alternative Cropping Cycles from Pespire in 1981

cultivate small plots of land for their own subsistence, although as uncultivated land disappears and pastures increase this practice is disappearing as well. Some agrarian reform communities have been granted land. These asentamientos (settlements) usually cultivate cash crops communally and give small plots of land to individuals to cultivate for their subsistence needs. Subsistence plots are often planted to corn and sorghum. Agrarian reform communities as well as private landholders in the southern coastal plain grow cotton as an important export crop. There is increasing concern world-wide as well as by the cultivators themselves regarding the environmental and health effects of the heavy pesticide use in cotton production. Commercial production of sorghum might provide an alternative in these areas.

While large commercial agriculture relies on hired labor, subsistence production in the highlands and within agrarian reform communities relies on household labor. In the highlands labor supplies limit the amount of land that households can cultivate. In fact, the high demand for labor contributes to both the tenancy arrangements found there. Those with larger land holdings prefer to rent or sharecrop land rather than hire labor to cultivate it, and increasingly hillside land is dedicated to permanent pasture, as cattle production is much less labor intensive. Most agricultural labor in the highlands is done by men. Women seldom engage in agricultural labor, but are heavily involved in the processing of crops for home consumption as well as sale, and in the marketing of crops. Women appear to control much of the commercial activities within and between communities.

PROJECT TYPE AND SCOPE

INTSORMIL is primarily a research project with some graduate training of foreign scientists in the US and a few US students in areas important to problems in developing countries. Its mandate is to conduct basic research in the production and consumption of sorghum and millet on a world-wide basis. The goal is to improve the production and consumption of food quality sorghum and millet with an emphasis on resource-poor farmers. A good deal of the research conducted by INTSORMIL is carried out in the United States. However, a number of investigators do work collaboratively with scientists in developing countries and there are several programs in host countries. Although INTSORMIL's mandate is world-wide, realistically the program has focused on several areas of the world in which research efforts are concentrated and INTSORMIL personnel are stationed in host countries. These include Honduras, Southern South America (CIAT), the Sudan, and Botswana.

Work in Honduras has concentrated on sorghum breeding aimed at developing improved varieties of food quality sorghum adapted to Honduran conditions. Breeding efforts have included work with existing land races widely used by small farmers in Southern Honduras and adaptation of improved materials from other regions. The goal is to provide materials that can be released for further testing in the Central American region and that can also be incorporated into the Honduran national sorghum

program. INTSORMIL has no extension function in Honduras. Materials that are incorporated into the national program do, however, enter the extension system.

INTSORMIL's training function has been included the graduate training of Honduran sorghum scientists and several US social science students.

According to the Five-Year Report (INTSORMIL 1985), the annual budget for sorghum breeding research was $120,000 from INTSORMIL through Texas A and M University; $50,000 from the Government of Honduras in the form of personnel, experiment station facilities and land; and $30,000 provided by AID/Honduras. In addition, INSORMIL also funded farming systems research and food consumption research through the University of Kentucky and Mississippi State University, and the work of entomologists, agronomists, and plant pathologists through a number of collaborating institutions.

INCLUSION OF FOOD CONSUMPTION AND NUTRITION DATA

INTSORMIL work in Southern Honduras began in 1981 with the collection of food consumption and nutritional status data in several sorghum growing regions. Surveys were conducted by researchers from the University of Kentucky and Mississippi State University in collaboration with the Honduran Institute for Anthropology and History (IHAH) and the Ministry for Natural Resources (MRN) of the Government of Honduras (GOH). Surveys were eventually conducted in 12 communities in 4 municipios (counties) representing different ecological and economic conditions. Seven communities in the foot-hills were surveyed in 1981, three lowland communities and a community in the highlands were added in 1982. In 1982-83 12 months of ethnographic research were conducted in two more highland communities by a single researcher. The survey instrument was also administered to random samples of households in those communities.

Children under 60 months of age in sample households were weighed and measured in 1981 and 1982. Children in three foothill communities and three lowland communities were weighed and measured again in May of 1983.

The objectives of the nutrition surveys were to:

1. document the extent to which sorghum was used as human food in Southern Honduras;

2. document the extent of nutritional problems in sorghum growing areas of Southern Honduras and identify the groups most at risk for malnutrition;

3. identify the factors contributing to malnutrition that might be addressed through agricultural research;

4. document traditional methods of sorghum utilization and identify the grain quality characteristics important in the acceptability of new sorghum varieties;

5. analyze the "nutritional system" within the context of the farming system in order to predict the effects of the introduction of new agricultural technology on food consumption and nutritional status;

6. provide baseline information on food consumption and nutritional status for the eventual evaluation of the project.

7. address questions concerning special nutritional issues with respect to sorghum, ie, the utility of breeding for protein quality and content, and the potential effect of sorghum on ascorbic acid nutrition.

Sample Communities

Communities for survey research were chosen to represent the variety of ecological and economic zones that characterize the sorghum producing areas of Southern Honduras. Researchers from the University of Kentucky surveyed the following:

1. three agrarian reform communities in the municipio of Nacaome located in the lowland coastal plain where commercial agriculture and cattle raising predominate, and in which sorghum is produced as a commercial crop and as an insurance crop to provide subsistence grains in years in which the corn crop fails;

2. four communities in municipio of Pespire, in the foothill region, where predominantly low technology subsistence agriculture is practiced by small farmers, often tenant farmers or sharecroppers, on the steep hillsides;

3. three communities higher up in the mountains, in the municipios of Pespire and La Venta where beans are included in the interplanting system.

Researchers from Mississippi State University worked in a lowland community which was not an agrarian reform community, and two communities in the municipio of El Corpus, one at an intermediate altitude, the other in the highlands.

Farming Systems and Ethnographic Research

Food consumption research was included in farming systems surveys in the study communities. This included heavy reliance on ethnographic research methods. Ethnographic approaches to data collection include a variety of techniques aimed at generating qualitative information. They include observation, participation in the activities under observation and open-ended, informal interviews with key informants. Ethnographic research focused on the identification of alternative food resources, particularly the following: an analysis of household agricultural production. including gardening, fruit trees, and small animals; a survey of markets and shops and current food prices in the communities; identification of informal

marketing of food within in communities; documentation of the availability of programs providing food such as food-for-work projects and child feeding centers; and the identification of wild food resources and their use.

The ethnographic phase also included the mapping of communities and interviews concerning food use in general; the acceptability and preparation of foods, especially sorghum; and the allocation of household and agricultural tasks among household members, with an emphasis on women's labor. Several group interviews were conducted at meetings of homemakers clubs. Group interviews with homemaker clubs proved to be one of the most efficient ways to collect background information.

Survey Research

Surveys were carried out with random samples of households in study communities. For information on food consumption and nutrition, female household heads were interviewed. Survey interviews covered household and backyard food production; household composition; household economic resources other than agriculture; recalls of foods used within the household from various sources over the last week; usual use of key foods focusing on sorghum and other basic grains; methods of preparation of basic grains especially sorghum; task allocation within the household; twenty-four hour recall of the activities of the interviewee; and a twenty-four hour recall of household meals.

Results of Food Consumption and Nutrition Surveys

Several detailed reports of survey results are available (Futrell et al. 1982, DeWalt and DeWalt 1982, DeWalt 1983, DeWalt 1985, Thompson et al. 1985, Stonich 1986). The results will be summarized here.

1. At least 60% of children under 60 months of age are below 95% of standard weight for age 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 (weight for height below 90% of standard) also varied among communities, but was much lower, usually affecting less than 15% of children.

2. The children of tenant farmers and single women were at greater nutritional risk than the children of landowners as determined both by analyses of diets and of nutritional status. Households cultivating less land per person were less likley to be able to meet their food needs.

3. Analyses of diets showed that energy was the limiting nutrient in inadequate diets. While a large percentage of families 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.

4. Although sorghum was not reported in dietary surveys carried out by INCAP in 1966, and widespread use of sorghum was denied by staff of the National Planning Council, who carried out a 1979 nutrition survey in Honduras, sorghum accounted for approximately 37% of the grains used in the study communities. Some families used sorghum 9 months of the year as the basic tortilla grain. Sorghum use was greater in the highlands, among tenant farmers, share croppers and those with less land, and during drought years in both the highland and lowland areas.

5. Sorghum is used as a substitute for maize in a number of products including the basic staple food - tortillas, as well as gruels and porridges (atole), and hard biscuits (rosqillas and rosquettes). Other minor uses of sorghum include the preparation of a beverage by mixing ground, toasted sorghum with water and sugar, and popped sorghum, which is mixed with sugar syrup or honey to make popped sorghum balls.

6. While maize is preferred for many of these products, sorghum is acceptable. However, people feel that sorghum is less satisfying (filling) than maize and that it is "cooler" than maize in essential quality and therefore not appropriate for nursing mothers to consume.

7. Sorghum preparation almost always begins with heating the grain in an alkaline bath using either ashes or lime (nixtamalization), the pericarp is washed off and the softened grain ground wet into a dough (masa). The masa is then either patted into tortillas and baked on a griddle, mixed with boiling water or milk and cooked into a porridge, or mixed with other ingredients to make biscuits and other dishes. These are essentially the same steps used to prepare maize although the cooking time during the nixtamalization process is shorter for sorghum than for maize.

LINKAGES

The diagnostic surveys noted above identified key factors in the linkages between agricultural production and nutritional status in Southern Honduras. Of course, not all factors could be addressed through a commodity based research program like INTSORMIL. However, information was generated that influenced agricultural research.

Seasonal Patterns of Food Use and Nutritional Status

Southern Honduras has two growing seasons during the rainy season which extends from May through November. The first, the primaria, begins with the planting of maize and sorghum in early May and ends with a maize harvest in July, during the canicula, a (usually) short dry period, that

falls in the middle of the rainy season. Maize will not survive the canicula but the more drought tolerant sorghum will survive. Sorghum is photoperiodic 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 canicula. A second planting of maize may be made and both grain and forage sorghums may be planted at this time. The leanest time of the year falls in June, just before the first maize crop is harvested. This is the time of year that families report using sorghum, either purchased or from their own production of the year before. Many families purchase sorghum at this time because it is cheaper than maize.

Problems of scarcity are largely economic in nature. The poor cannot afford to purchase grain at precisely the time they need it most. However, the situation is exacerbated by the storage problems for both sorghum and maize. The focus will be on sorghum here. Sorghum is quite susceptible to insect damage during storage using traditional methods. The several introduced higher yielding varieties of sorghum have much poorer storage properties than many of the existing landraces. For this reason introduced varieties tend to be sold as a cash crop immediately after harvest to eliminate the risk of storage loss for the producer. This means that households cannot store the grain for their own consumption and they must sell their harvest when prices are at their lowest. Improvement in the storage properties, or improved means of storage, would allow households to retain more sorghum for home consumption and also to smooth out the flow of income from sales of sorghum over a longer period of time.

INTSORMIL entomologists have been working on low cost improvements in sorghum storage. In addition, the sorghum breeder has included storage properties in some of his breeding program. This and several other aspects of grain quality found to be important are addressed through his emphasis on maintaining a breeding program using traditional landraces as well as a focus on germplasm from "exotic" sources in worldwide collections.

Utilization and Grain Quality Characteristics

The food consumption surveys identified a number of products made from sorghum and the grain qualities important for them. In addition the surveys addressed several issues surrounding the nutritional qualities of sorghum as a human food.

Nutritional issues. Three questions surrounding the nutritional effects of sorghum in human diets were raised by INTSORMIL and other scientists. The first concerns the desirability of breeding sorghum for higher quality protein, that is, for higher lysine content. Earlier analysis of world nutritional needs had focused on the importance of several essential amino acids as limiting the protein quality of grain-based diets. However, more recent research (WHO 1973) argues that energy, not protein or amino acids, is the limiting nutrient in most

diets. Data cited above from the food consumption studies shows that this is true for Honduras. While many families failed to meet energy requirements, almost all met protein requirements. The desirability of directing resources to breeding for protein quality was seen as marginal for INTSORMIL work in Honduras.

The second issue has to do with the digestibility of sorghum protein. Research with small children had shown that protein digestibility for sorghum prepared by grinding and boiling was very poor, resulting in deterioration of the nutritional status of children (McClean et al. 1982). However, INTSORMIL and other research on sorghum preparation techniques suggested that in traditional settings sorghum is usually subjected to more elaborate preparation techniques. For example, in Southern Honduras most sorghum based dishes are prepared from grain that has undergone heating in an alkaline medium using either lime or ashes (nixtamalization). It was known that this process improves the nutritional quality of corn but the effect on sorghum is less clear. INTSORMIL food utilization specialists have been testing some traditional sorghum products for protein digestibility with preliminary results suggesting that these techniques improve digestibility. Serna-Saldivar et al. (n.d.), working with young pigs, have demonstrated that protein digestibility of pearled sorghum subjected to cooking in a lime solution is equivalent or better than that of similarly prepared maize.

Finally, research with guinea pigs (Klopfenstein et al. 1981, 1983) suggests that sorghum based diets increase the requirement of ascorbic acid. Earlier studies (INCAP 1966, SAPLAN 1981) suggested that diets in Southern Honduras were already deficient in ascorbic acid. The University of Kentucky research team found a wider use of ascorbic acid containing wild fruits than had been reported previously, suggesting sufficient availability of ascorbic acid in the diet. Researchers from Mississippi State University, however, did not report the same level of use of wild fruits in the communities they surveyed. The potential impact of increasing consumption of sorghum in Southern Honduras with respect to ascorbic acid nutrition is unclear from these data. However, there was no evidence of frank vitamin C deficiency diseases during survey periods.

Acceptability. Sorghum has probably been a part of diets in Southern Honduras for about 100 years. The criollo (i.e. landrace) grains used have been selected for their appropriateness as food as well as for their agronomic qualities. A wide variety of products are made from sorghum. Many of these are sorghum equivalents of foods also prepared from maize. Maize is clearly preferred for all of these products. Grain quality characteristics important for sorghum acceptability are those that make the resulting products most like products made from maize. The most important of these are a light color, lighter density and bland flavor. Quick cooking time is also important as a means of saving fuel, although all sorghums cook more quickly than corn.

Researchers from Mississippi State University and the Ministry of Natural Resources have collaborated with sorghum breeders to test sorghum

varieties for cooking properties and acceptability. These properties are incorporated into the breeding programs.

A second area of acceptability of sorghum that was investigated had to do with a different "quality" of sorghum. In the indigenous food classification system found in Central America in which foods (as well as illnesses and medicines) are classified as having an essential quality that can range from hot to cold, sorghum is considered to be "cooler" in essential quality than is maize, which is considered neutral. Although not all people still continue to follow the hot/cool classification system of foods that is traditional in this area, some people reported that nursing women should not eat sorghum tortillas because the excess coolness could cause the nursing child to become ill. Several nursing women were preparing sorghum tortillas for their families and maize tortillas for themselves. Although not considered appropriate for nursing mothers, foods prepared from sorghum are considered appropriate for children, and children consume all the products made.

Even though they are considered appropriate and acceptable, sorghum tortillas are considered less filling than tortillas prepared from maize. A common formula reported is that five sorghum tortillas are as filling as four maize tortillas. This may relate to the issue of the digestibility of sorghum, although this is unclear.

Despite the clear preference for maize, however, sorghum provided a clearly acceptable alternative that was used when economic or ecological conditions limited the availability of corn.

Household Labor and the Role of Women

Women are only infrequently involved in agricultural labor in the subsistence agriculture found in the highlands. Women will help during times of heavy labor demand, such as harvest, but they do not provide much other labor. However, women are involved in food preparation and marketing, and small animal production in order to generate income. For these reasons women prefer quick cooking varieties that are easily ground into dough. INTSORMIL has not directly addressed the issues of concern to women although it is unclear that 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.

In the commercial agricultural sector in the lowlands women often work as agricultural wage laborers. The reliance of landless workers in the lowlands on wage labor suggests that any "improvements" that reduce labor requirements for agricultural production, such as development of a commercially viable feed grain sorghum that could be mechanically cultivated and harvested would be devastating for women as well as men who rely on wage labor.

Income and Expenditure Patterns

Despite increases in production Honduras imports sorghum. Surplus production as a result of improved yields would find a ready market. At the same time problems in storage noted above result in the need to sell grains, including sorghum, soon after harvest at low prices and buy them back later at higher prices. Improvements in storage and storability are keys to improving the flow of income and subsistence grains from sorghum production for small farmers. As noted above, these issues are addressed by sorghum researchers.

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 produced. 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 their land and who cannot afford costly inputs. Furthermore the land they cultivate is, for the most part, he steep hillsides of the highland areas. Agricultural technology, then, must be cheap and easily accessible to improve income. INTSORMIL breeding efforts have been, at least in part, directed towards improvement of existing traditional varieties already known to be usable to resource poor farmers.

The Potential Effects of Changes in Sorghum Prices on Nutrition

The consumption survey demonstrated that the poor (tenant farmers) used sorghum as a subsistence grain more often than landholders, and that farmers in the lowlands used sorghum during lean times of the year or in lean years. Although this was not studied directly, this suggests that the elasticity of demand for sorghum is higher among those at greatest nutritional risk. Decreases in price as a result of increases in production are likely to differentially affect the nutritional status of the poor as compared with those less poor. From this point of view, any improvement in the availability of food quality sorghums in Southern Honduras is likely to have a positive impact on the nutritional status of the landless and resource poor farmers as a result of price effects. The choice of sorghum as a commodity for research in Southern Honduras directly addressed this need.

THE ROLE OF FOOD CONSUMPTION AND NUTRITION RESEARCH

Concerns with food consumption and nutrition were incorporated into the farming systems research 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 sorghum breeder included many of the concerns raised by these data in the organization of his breeding program.

The organization of the CRSP is such that each investigator operates independently with his or her own budget. There is some attempt to coordinate efforts through lead institutions which have responsibilities for specific countries and country coordinators. In part, the sorghum breeder stationed in Honduras coordinated the visits of consulting scientists, including the researchers that conducted the farming systems research. However, even the food consumption and nutrition surveys were conducted by research teams from two different institutions, operating with separate budgets and research designs. Information was exchanged through technical reports, consultation in the field during research periods and through annual investigator's meetings. The articulation of food consumption and nutrition research and agricultural research was no looser than the articulation of other research components. However, this arrangement does not represent the most efficient manner in which to transfer information important to the planning and implementation of agricultural research priorities.

OUTCOMES AND ACCOMPLISHMENTS

The work of INTSORMIL in Honduras demonstrates a methodology for generating the kinds of data important in planning agricultural research priorities and directions. The information generated has had some impact on INTSORMIL breeding research in Honduras. Sorghum breeding efforts have included work with existing landraces already selected for the consumption preferences of rural Hondurans and adapted to the methods of cultivation practiced by resource-poor farmers in the highlands. This work is in addition to the more conventional work with improved materials. As part of the breeding program testing for acceptability was conducted with several varieties before their release. Also some research has been directed to improving sorghum storage systems, with basic research on the insects that account for much of the post-harvest loss. It is unclear whether improved varieties that have been released have had an impact on sorghum production, however.

PROJECT CONSTRAINTS AND PROBLEMS

The major constraint in the conduct of the project has been the loose articulation of independent research programs among the scientists involved. Closer collaboration would have been desirable.

Social science research was not seen as having as high a priority as other research within INTSORMIL. Through the life of the project funds for social science studies were reduced and eventually eliminated. One result is that a planned evaluation of the impact of INTSORMIL sponsored research on production and consumption in Honduras will not be carried out. This includes a follow-up of the food consumption and nutrition research conducted in 1981-83.

Continued attention to food consumption and nutrition research was further hampered by the failure of the scientists involved to recruit

appropriate Honduran counterparts to continue the research. Several US students were trained in methods for conducting food consumption and nutrition research within a farming systems framework but no Honduran students could be identified for such training. Honduras suffers from a dearth of trained personnel, especially in the social sciences and nutrition even at the lowest levels of training. Several Honduran students were trained in biological sciences.

As a research entity INTSORMIL is not directly involved with the extension of research results. Access to extension occurs through the normal relationships between INTSORMIL collaborators in MNR and MNR's extension service. In essence INTSORMIL has no formal influence on the extension of research results or responsibility for the materials once they are released to national programs. In this sense INTSOMIL's involvement is similar to that of the IARC's. In practice some interaction occurs as a result of contact between the INTSORMIL breeder and staff of MNR.

CONCLUSIONS AND RECOMMENDATIONS

The INTSORMIL program in Honduras generated an approach to including appropriate information on food consumption and nutritional status in directing basic agricultural research in a commodity focused project. In some sense it can serve as a model for the generation of research necessary for including food consumption and nutritional goals in agricultural research projects. At the same time, the structure of the project with independent researchers with their own budgets has hampered collaboration among scientists. Finally, the elimination of social science from the CRSP has made it impossible to continue input and monitoring through the continued implementation of the project and in project evaluation.

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