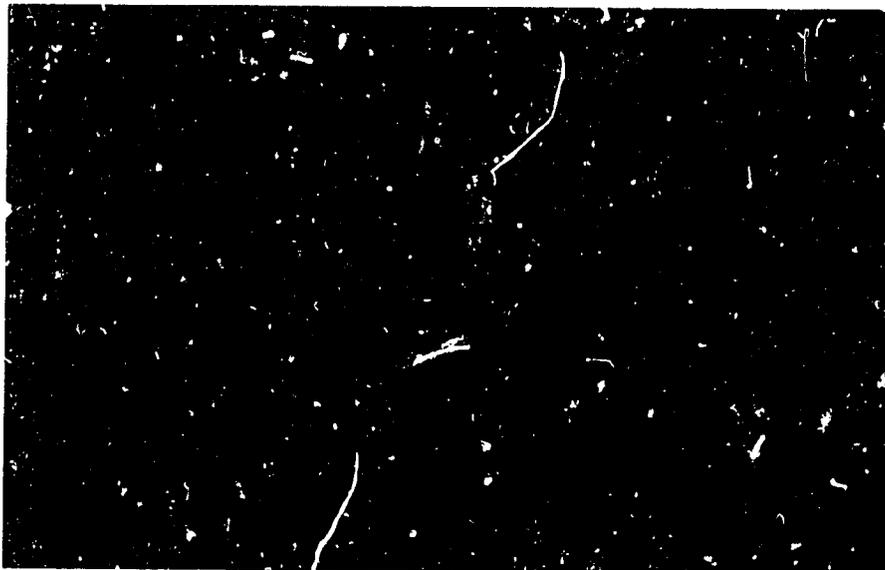


PD-110-10  
2010

686.0001/-

# AFRICAN RURAL ECONOMY PROGRAM

WORKING PAPER/DOCUMENT DE TRAVAIL



Department of Agricultural Economics  
Michigan State University  
East Lansing, Michigan 48824  
U.S.A.

Organisme Régional de  
Développement de l'Est  
Fada N'Gourma  
République de Haute-Volta

Cropping Enterprises in  
Eastern Upper Volta

Gregory C. Lassiter

Working Paper No. 35

June 1981

CROPPING ENTERPRISES IN  
EASTERN UPPER VOLTA\*

by

Gregory C. Lassiter\*\*

June 1981

\*This paper was prepared and published under Contract AID/afr-C-1314 between the U.S. Agency for International Development and the Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.

\*\*Formerly Specialist in Agricultural Production Economics, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.

## TABLE OF CONTENTS

|                                                                             | <u>Page</u> |
|-----------------------------------------------------------------------------|-------------|
| 1. INTRODUCTION . . . . .                                                   | 1           |
| 1.1 Overview of this Report . . . . .                                       | 1           |
| 1.2 Data Base . . . . .                                                     | 1           |
| 2. OVERVIEW OF CROPPING CHARACTERISTICS DURING THE 1978<br>SEASON . . . . . | 6           |
| 2.1 Household Size and Cultivated Acreage . . . . .                         | 6           |
| 2.2 The 1978 Harvest in Historical Perspective . . . . .                    | 9           |
| 2.3 Crop Yields . . . . .                                                   | 16          |
| 2.4 The Cropping Calendar . . . . .                                         | 18          |
| 2.5 Labor Use . . . . .                                                     | 21          |
| 3. CROP ENTERPRISE BUDGETS . . . . .                                        | 25          |
| 3.1 Introduction . . . . .                                                  | 25          |
| 3.2 Sorghum/Millet . . . . .                                                | 26          |
| 3.3 Maize . . . . .                                                         | 31          |
| 3.4 Groundnuts . . . . .                                                    | 31          |
| 3.5 Soybeans . . . . .                                                      | 36          |
| 3.6 Cotton . . . . .                                                        | 36          |
| 3.7 Rice . . . . .                                                          | 39          |
| 4. SUMMARY AND CONCLUSION . . . . .                                         | 42          |
| BIBLIOGRAPHY . . . . .                                                      | 44          |

## LIST OF TABLES

| <u>Number</u> |                                                                                                                                                                        | <u>Page</u> |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 1.1           | Distribution of the 480 Farm Households Surveyed<br>in 1978-79 by Zone, Village, and sub-Sample . . . .                                                                | 3           |
| 2.1           | Household Size and Cultivated Acreage . . . . .                                                                                                                        | 7           |
| 2.2           | Proportion of Cultivated Area by Major Crop and<br>Zone (in %) . . . . .                                                                                               | 8           |
| 2.3           | Breakdown of Sorghum/Millet Acreage by Primary<br>Crop and Zone (in % of each zone's Sorghum/<br>Millet acreage) . . . . .                                             | 10          |
| 2.4           | Rainfall by Zone for 1978 (in mm.) . . . . .                                                                                                                           | 12          |
| 2.5           | Proportion of Farmers Who Felt the 1978 Harvest<br>Was Better Than Average . . . . .                                                                                   | 13          |
| 2.6           | Percentage Increase in the 1978 Harvest Relative<br>to the Average Harvest for 1973-1977 . . . . .                                                                     | 15          |
| 2.7           | Yields per Hectare for Major Crops . . . . .                                                                                                                           | 17          |
| 2.8           | Primary Crop Yields in Sorghum/Millet Fields<br>(kgs./Ha.) . . . . .                                                                                                   | 19          |
| 2.9           | Average Seeding and Harvest Dates for the 1978<br>Season . . . . .                                                                                                     | 20          |
| 2.10          | General Characteristics of Major Sorghum<br>Varieties . . . . .                                                                                                        | 22          |
| 2.11          | Labor Use per Hectare for Major Crop Enterprises<br>by Month and by Activity (in worker equivalent<br>hours of family and non-family labor per hec-<br>tare) . . . . . | 23          |
| 3.1           | Crop Enterprise Budgets by Zone for Sorghum/<br>Millet . . . . .                                                                                                       | 27          |
| 3.2           | Crop Enterprise Budgets for Maize Fields . . . . .                                                                                                                     | 32          |
| 3.3           | Crop Enterprise Budgets by Zone for Groundnuts . . .                                                                                                                   | 34          |

| <u>Number</u> |                                                        | <u>Page</u> |
|---------------|--------------------------------------------------------|-------------|
| 3.4           | Crop Enterprise Budgets by Zone for Soybeans . . . . . | 37          |
| 3.5           | Crop Enterprise Budgets by Zone for Cotton . . . . .   | 38          |
| 3.6           | Crop Enterprise Budgets by Zone for Rice . . . . .     | 40          |

## FOREWARD

The African Rural Economy Program was established in 1976 as an activity of Michigan State University's Department of Agricultural Economics. The African Rural Economy Program is a successor to the African Rural Employment Research Network which functioned over the 1971-1976 period.

The primary mission of the African Rural Economy Program is to further comparative analysis of the development process in Africa with emphasis on both micro and macro level research on the rural economy. The research program is carried out by faculty and students in the Department of Agricultural Economics in cooperation with researchers in African universities and government agencies. Specific examples of ongoing research are, "Poor Rural Households, Income Distribution and Technical Change in Sierra Leone and Nigeria," "Rural and Urban Small-Scale Industry in West Africa," "Dynamics of Female Participation in the Economic Development Process in West Africa," and "The Economics of Small Farmer Production and Marketing Systems in the Sahelian Zone of West Africa."

Carl K. Eicher  
Professor of Agricultural Economics  
Michigan State University

## 1. INTRODUCTION

### 1.1 Overview of this Report

The purpose of this report is to provide a brief descriptive handbook of the major cropping enterprises used in the Eastern ORD (EORD), based on farm survey data collected during the 1978-79 agricultural year. It is hoped that the descriptive analysis presented here can contribute to a better understanding of the economic structure of the cropping components of farming systems in the region while providing a baseline by which to evaluate the future progress of the ORD's extension and development efforts.

This report is divided into three main sections. Chapter 1 describes the coverage of the survey and the data obtained. Chapter 2 presents a brief overview of cropping patterns, yields, and the timing of agricultural activities during the 1978 season. Chapter 3 presents detailed regional crop enterprise budgets for six major crop enterprises: sorghum/millet, maize, groundnuts, soybeans, cotton and rice.

### 1.2 Data Base

The results presented in this report are based on analysis of data from the 1978-79 farm survey conducted by the Bureau of Economic Analysis and Planning of the EORD in cooperation with the MSU contract team.<sup>1/</sup> During the period of May 1, 1978 to April 30, 1979, the farm survey monitored

---

<sup>1/</sup>This survey was carried out with support from contract AID/afr-C-1314 between USAID and Michigan State University.

the economic activities of 480 farm households<sup>1/</sup> selected from 27 villages.<sup>2/</sup> The sample is stratified across 12 zones that were purposively selected in order to represent the broad agro-climatic variation found in the EORD. Within each zone, a sample of agricultural households was randomly selected in order to represent the currently most common technology--hoe agriculture. In addition, a purposive sample of the most successful animal traction (ANTRAC) farm households, as identified by local extension personnel, was selected in 5 zones in order to represent the "performance frontier" or potential of this new technology.<sup>3/</sup> After attrition, the entire sample consisted of 355 randomly selected "hoe" households and 125 ANTRAC households. The distribution of these 480 households across the 27 villages and 12 agro-climatic zones of the EORD is presented in Table 1.1. Their geographical dispersion is represented in Figure 1.1.

The farm interviews covered a wide range of farm, off-farm, and household activities. The survey employed the "cost route" method of data collection, based on weekly or monthly recurrent interviews to obtain information on household resource allocation. Labor information on all farm field activities was obtained through weekly interviews of one-third of both hoe and ANTRAC households.

---

<sup>1/</sup>As unit of analysis, "farm household" is defined as all nuclear families or individuals who farm together and eat from a common granary.

<sup>2/</sup>For additional details on the objectives, structure, and methodology of the survey, see MSU Contract Team, "Six-Month Report: December 1977-May 1978", pp. 31-54.

<sup>3/</sup>Because of the newness and geographical dispersion of the program, the majority of EORD ANTRAC users in 1978 were recent adopters who had hardly begun to use their ANTRAC equipment or experience any benefits from it. For this reason, a non-random sample was used to permit a "most favorable case" evaluation of ANTRAC in order to provide an indication of ANTRAC potential under EORD conditions.

Table 1.1 DISTRIBUTION OF THE 480 FARM HOUSEHOLDS SURVEYED  
IN 1978-79 BY ZONE, VILLAGE, AND SUB-SAMPLE

| Agroclimatic Zone     | Village                  | Number of Sampled Households<br>by Sub-sample |                                |
|-----------------------|--------------------------|-----------------------------------------------|--------------------------------|
|                       |                          | Traditional<br>(TRAD)                         | Animal<br>Traction<br>(ANTRAC) |
| 1. Bogandé            | 1. Balemba               | 18                                            | -                              |
|                       | 2. Komboassi             | 18                                            | -                              |
| 2. Mani               | 3. Lanyabidi             | 18*                                           | -                              |
|                       | 4. Bomponyenga           | 18                                            | -                              |
| 3. Fièla              | 5. Dapesma               | 18                                            | -                              |
|                       | 6. Piela (ANTRAC)        | -                                             | 18                             |
| 4. Diabo              | 7. Mocontoré             | 18                                            | -                              |
|                       | 8. Lantaogo (ANTRAC)     | -                                             | 18                             |
|                       | 26. Diabo I (ANTRAC)     | -                                             | 17                             |
|                       | 27. Diabo II (ANTRAC)    | -                                             | 18                             |
| 5. Logobou            | 9. Namponkoré            | 18*                                           | -                              |
|                       | 10. Kindi Kombou         | 18*                                           | -                              |
|                       | 11. Logobou (ANTRAC)     | -                                             | 18                             |
| 6. Partéja            | 12. Bomondi              | 18*                                           | -                              |
|                       | 13. Dupcaali             | 18                                            | -                              |
| 7. Yondé              | 14. Ouobgo               | 17                                            | -                              |
|                       | 15. Kondogo              | 18*                                           | -                              |
| 8. Diapangou          | 16. Tilonti              | 18                                            | -                              |
|                       | 17. Diapangou (ANTRAC)   | -                                             | 18                             |
| 9. Botou (N. de Fada) | 18. Botou (N. de Fada)   | 18*                                           | -                              |
|                       | 19. Ougarou (N. de Fada) | 19*                                           | -                              |
| 10. Kantchari         | 20. Mantchangou          | 17                                            | -                              |
|                       | 21. Monadagou            | 18                                            | -                              |
| 11. Ougarou           | 22. Poniokondi           | 18                                            | -                              |
|                       | 23. Ougarou (ANTRAC)     | -                                             | 18                             |
| 12. Pama              | 24. Tindangou            | 16                                            | -                              |
|                       | 25. Kpcaali              | 16                                            | -                              |
| TOTAL                 |                          | 355                                           | 125                            |

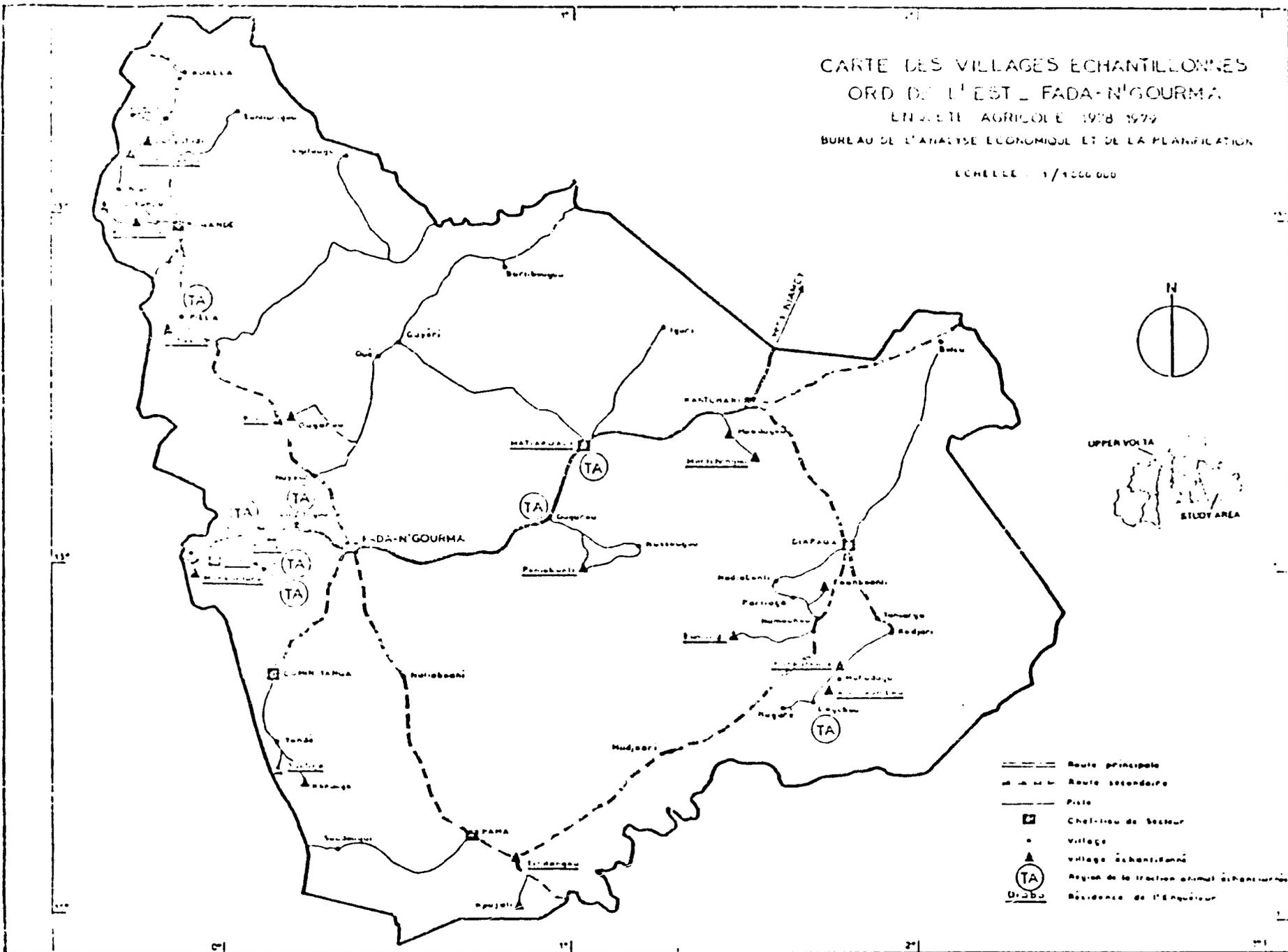
\*Village chief purposively included in sample in order to assure village support for the survey, but excluded from analysis due to non-random nature.

CARTE DES VILLAGES ECHANTILLONNES  
 ORD DE L'EST - FADA-N'GOURMA  
 ENQUETE AGRICOLE 1978-1979  
 BUREAU DE L'ANALYSE ECONOMIQUE ET DE LA PLANIFICATION

ECHELLE : 1/1000 000



4



- Route principale
- Route secondaire
- Piste
- Chef-lieu de Secteur
- Village
- Village échantillonné
- Région de la traction animale échantillonnée
- Résidence de l'Enquêteur

In order to conserve resources, certain data were collected only from random sub-samples of households in each zone. All cultivated acreage was measured for two-thirds of the households (234 hoe households and 83 ANTRAC households); only sorghum/millet acreage was measured for the remaining households. Labor, seed, fertilizer, and chemical input data were compiled for only one-third of the households (119 hoe and 41 ANTRAC). As a result, yields, harvest dates, and acreage<sup>1/</sup> data are estimated from all 480 households for sorghum/millet, but from only 317 households for all other crops. Seeding dates, labor use, and other input use are estimated from 160 households.<sup>2/</sup>

---

<sup>1/</sup>In order to permit comparisons between crops, sorghum/millet acreage is presented for only 317 households in Table 2.1.

<sup>2/</sup>Note that the one third subsample is a subset of the two thirds subsample.

## 2. OVERVIEW OF CROPPING CHARACTERISTICS DURING THE 1978 SEASON

### 2.1 Household Size and Cultivated Acreage

Table 2.1 summarizes basic demographic and acreage information from a previous report.<sup>1/</sup> It is reproduced here to provide various measures of the regional variability in the size of the farming unit, as well as to indicate structural differences between hoe and ANTRAC farmers.<sup>2/</sup> The relative importance of the different major crops is shown in Table 2.2, which presents the proportion of cultivated acreage that each major crop occupies. Sorghum/millet<sup>3/</sup> is overwhelmingly the predominant crop in terms of acreage (83.3 percent of hoe cultivated acreage), while groundnuts and maize are the most widely cultivated secondary crops.

---

<sup>1/</sup>D. Baker and G. Lassiter, "Crop Production in the Eastern ORD," BAEP, ORD de l'Est, August 1980, Tables 2 and 3.

<sup>2/</sup>The reader should note that hoe vs. ANTRAC comparisons should not be made on the basis of "all zone" averages, as presented at the bottom of Table 2.1, since the entire hoe sample represents a different agroclimatic stratification than the ANTRAC sample. Hoe/ANTRAC comparisons may be made either within common zones or across all the five zones in which both samples occur. For an in-depth analysis of the impact of ANTRAC, see V. Barrett et al., "Animal Traction in Eastern Upper Volta: A Technical, Economic and Institutional Analysis", Department of Agricultural Economics, Michigan State University, January 1981.

<sup>3/</sup>"Sorghum/millet" refers to any combination of sorghum, millet, or Niadi (a 60 day variety of millet grown mainly in the wetter zones, such as Logobou and Pama, as a "hungry season" food crop).

TABLE 2.1  
HOUSEHOLD SIZE AND CULTIVATED ACREAGE<sup>a</sup>

| Zone          | Total Number of persons per household |        | Number of Active Workers <sup>b</sup> per Household |        | Age Household members that are active workers |        | Total Cultivated Area per household (ha.) |        | Sorghum/Millet Area per household (ha.) |        | Total Area per person (ha.) |        | Total Area per Active Worker (ha.) |        | Sorghum/Millet Area per person (ha.) |        | Sorghum/Millet Area per Active Worker (ha.) |        |
|---------------|---------------------------------------|--------|-----------------------------------------------------|--------|-----------------------------------------------|--------|-------------------------------------------|--------|-----------------------------------------|--------|-----------------------------|--------|------------------------------------|--------|--------------------------------------|--------|---------------------------------------------|--------|
|               | Hoe                                   | ANTRAC | Hoe                                                 | ANTRAC | Hoe                                           | ANTRAC | Hoe                                       | ANTRAC | Hoe                                     | ANTRAC | Hoe                         | ANTRAC | Hoe                                | ANTRAC | Hoe                                  | ANTRAC | Hoe                                         | ANTRAC |
| 1. Bogandé    | 6.21                                  | --     | 3.33                                                | --     | 53.2                                          | --     | 3.974                                     | --     | 3.470                                   | --     | 0.641                       | --     | 1.193                              | --     | 0.559                                | --     | 1.042                                       | --     |
| 2. Mani       | 7.33                                  | --     | 3.29                                                | --     | 44.9                                          | --     | 4.199                                     | --     | 3.503                                   | --     | 0.573                       | --     | 1.312                              | --     | 0.478                                | --     | 1.055                                       | --     |
| 3. Piela      | 6.33                                  | 9.83   | 2.83                                                | 4.08   | 44.7                                          | 41.6   | 3.555                                     | 5.214  | 2.805                                   | 3.893  | 0.562                       | 0.530  | 1.256                              | 1.278  | 0.443                                | 0.397  | 0.991                                       | 0.955  |
| 4. Diabo      | 6.83                                  | 11.31  | 3.08                                                | 5.20   | 45.1                                          | 46.0   | 3.998                                     | 7.236  | 3.103                                   | 5.583  | 0.585                       | 0.640  | 1.298                              | 1.392  | 0.454                                | 0.494  | 1.008                                       | 1.074  |
| 5. Logobou    | 9.48                                  | 11.83  | 4.54                                                | 4.08   | 47.9                                          | 34.5   | 4.681                                     | 5.293  | 3.617                                   | 3.585  | 0.494                       | 0.448  | 1.031                              | 1.297  | 0.382                                | 0.303  | 0.797                                       | 0.879  |
| 6. Partiaga   | 7.83                                  | --     | 3.46                                                | --     | 44.2                                          | --     | 3.664                                     | --     | 2.964                                   | --     | 0.468                       | --     | 1.059                              | --     | 0.379                                | --     | 0.857                                       | --     |
| 7. Yondé      | 5.95                                  | --     | 3.00                                                | --     | 50.4                                          | --     | 4.027                                     | --     | 3.534                                   | --     | 0.677                       | --     | 1.342                              | --     | 0.594                                | --     | 1.178                                       | --     |
| 8. Diapangou  | 7.75                                  | 13.58  | 3.33                                                | 5.00   | 43.0                                          | 36.8   | 4.122                                     | 6.999  | 3.752                                   | 5.617  | 0.532                       | 0.515  | 1.238                              | 1.400  | 0.484                                | 0.414  | 1.127                                       | 1.123  |
| 9. Sotou      | 7.61                                  | --     | 3.83                                                | --     | 50.3                                          | --     | 4.296                                     | --     | 3.783                                   | --     | 0.565                       | --     | 1.122                              | --     | 0.497                                | --     | 0.988                                       | --     |
| 10. Kantchari | 7.22                                  | --     | 3.52                                                | --     | 48.8                                          | --     | 5.184                                     | --     | 4.340                                   | --     | 0.718                       | --     | 1.473                              | --     | 0.601                                | --     | 1.233                                       | --     |
| 11. Ougarou   | 7.92                                  | 12.83  | 3.92                                                | 6.75   | 49.5                                          | 53.0   | 3.611                                     | 5.655  | 2.955                                   | 3.926  | 0.456                       | 0.441  | 0.921                              | 0.838  | 0.373                                | 0.306  | 0.754                                       | 0.582  |
| 12. Pama      | 7.36                                  | --     | 3.14                                                | --     | 43.0                                          | --     | 4.479                                     | --     | 3.602                                   | --     | 0.609                       | --     | 1.426                              | --     | 0.489                                | --     | 1.147                                       | --     |
| ALL ZONES     | 7.34                                  | 11.72  | 3.47                                                | 5.07   | 47.3                                          | 43.3   | 4.209                                     | 6.400  | 3.506                                   | 4.816  | 0.573                       | 0.546  | 1.213                              | 1.262  | 0.478                                | 0.411  | 1.010                                       | 0.950  |

<sup>a</sup>All data presented was estimated from a random 317 household subsample to which complete acreage data were available. Demographic data for the entire 473 household sample is presented.

<sup>b</sup>Defined as persons of age 15-54.

TABLE 2.2  
PROPORTION OF CULTIVATED AREA BY MAJOR CROP AND ZONE (IN %<sup>a</sup>)

| Zone          | Sorghum/Millet |        | Maize |        | Groundnuts |        | Bambara Nuts |        | Rice |        | Soybeans |        | Cotton |        | Manioc, Sweet Potato, or Yam |        | Okra |        | Diverse Crops (including Garden Crops) |        |
|---------------|----------------|--------|-------|--------|------------|--------|--------------|--------|------|--------|----------|--------|--------|--------|------------------------------|--------|------|--------|----------------------------------------|--------|
|               | Hoe            | Antrac | Hoe   | Antrac | Hoe        | Antrac | Hoe          | Antrac | Hoe  | Antrac | Hoe      | Antrac | Hoe    | Antrac | Hoe                          | Antrac | Hoe  | Antrac | Hoe                                    | Antrac |
| 1. Bogandé    | 87.3           | --     | 3.5   | --     | 9.1        | --     | 0.1          | --     | 0.1  | --     | 0        | --     | 0      | --     | 0                            | --     | 0    | --     | 0                                      | --     |
| 2. Nani       | 83.4           | --     | 3.3   | --     | 11.9       | --     | 0.4          | --     | 0    | --     | 0        | --     | 0.2    | --     | 0                            | --     | 0    | --     | 0.8                                    | --     |
| 3. Piéla      | 78.9           | 74.7   | 3.5   | 3.8    | 14.2       | 19.0   | 1.0          | 0.5    | 2.2  | 1.3    | 0.2      | 0.2    | 0      | 0      | 0                            | 0      | 0.1  | 0.1    | 0                                      | 0.5    |
| 4. Diabo      | 78.0           | 77.1   | 1.0   | 2.5    | 13.0       | 8.7    | 1.5          | 0.6    | 2.1  | 2.8    | 0.5      | 4.2    | 0      | 2.6    | 0.6                          | 0.6    | 0    | 0      | 2.3                                    | 1.0    |
| 5. Logobou    | 77.2           | 67.7   | 2.2   | 2.4    | 9.9        | 10.4   | 0.8          | 0.7    | 3.5  | 5.4    | 0.2      | 3.9    | 0.6    | 2.9    | 2.3                          | 2.2    | 2.2  | 0.6    | 1.1                                    | 3.6    |
| 6. Parriage   | 80.9           | --     | 7.5   | --     | 1.8        | --     | 0.5          | --     | 3.6  | --     | 1.0      | --     | 1.1    | --     | 1.8                          | --     | 1.2  | --     | 0.4                                    | --     |
| 7. Yondé      | 87.8           | --     | 1.5   | --     | 9.0        | --     | 1.0          | --     | 0.1  | --     | 0        | --     | 0      | --     | 0.1                          | --     | 0    | --     | 0.5                                    | --     |
| 8. Diapangou  | 91.0           | 80.3   | 3.2   | 2.9    | 1.8        | 6.8    | 0.6          | 0.4    | 0.3  | 1.3    | 0.8      | 3.8    | 0      | 0.1    | 0.4                          | 0.4    | 0.1  | 0.5    | 1.8                                    | 3.6    |
| 9. Botou      | 88.1           | --     | 3.8   | --     | 5.5        | --     | 1.1          | --     | 0.1  | --     | 0        | --     | 0.9    | --     | 0.3                          | --     | 0.1  | --     | 0.1                                    | --     |
| 10. Kantchari | 83.7           | --     | 7.3   | --     | 0.3        | --     | 0.4          | --     | 0.3  | --     | 0        | --     | 0.8    | --     | 6.2                          | --     | 0.8  | --     | 0.1                                    | --     |
| 11. Dugarou   | 81.9           | 69.4   | 11.2  | 7.9    | 1.4        | 2.0    | 0.8          | 0.4    | 1.5  | 1.5    | 0.5      | 8.4    | 0.4    | 0.3    | 0.7                          | 1.9    | 1.0  | 1.3    | 0.6                                    | 0.8    |
| 12. Pama      | 80.4           | --     | 3.6   | --     | 2.1        | --     | 1.5          | --     | 2.8  | --     | 1.1      | --     | 3.6    | --     | 3.7                          | --     | 0.5  | --     | 0.2                                    | --     |
| ALL ZONES     | 83.3           | 75.2   | 4.2   | 3.4    | 6.4        | 9.0    | 0.8          | 0.5    | 1.3  | 3.3    | 0.4      | 4.1    | 0.7    | 1.6    | 1.7                          | 0.9    | 0.6  | 0.3    | 0.6                                    | 1.6    |

<sup>a</sup>Values represent the percentage of total cultivated acreage per zone.

For the purposes of this paper, rice,<sup>1/</sup> soybeans, and cotton<sup>2/</sup> are treated as minor secondary crops. They are of interest because of their marketing potential and their acreages, which exceed 1 percent of total area in a majority of either hoe or ANTRAC zones. Tubers (manioc, sweet potatoes, and yams) and "diverse crops" (mainly garden crops for on-farm consumption) have similar average acreages but are more regionally concentrated and, except for yams, have more limited current marketing potential. Further, a lack of sufficient yield data prohibits analysis of these two enterprises for this report. Bambara nuts and okra have only insignificant acreages.

The relative importance of sorghum, millet, and Niadi (short season millet) is shown in Table 2.3. Sorghum is the preferred grain because of taste and its higher yields. It demands more rainfall and higher soil fertility than millet and is more sensitive to drought and striga. Zones with poorer soil fertility (usually due to high population density) or a recent history of drought therefore tend to place more emphasis on millet than other zones. However, the emphasis on millet is not as strongly related to rainfall as one would expect (see Table 2.4 below).

## 2.2 The 1978 Harvest in Historical Perspective

Analysis and interpretation of a single season's harvest requires a comparative context. Unfortunately, historical data on yields are virtually non-existent, rainfall data are very spotty and soil maps of sufficient detail are unavailable in the EORD. Rainfall data for the EORD are presented in

---

<sup>1/</sup>Rainfed rice only. No sampled farmers irrigated rice in 1978.

<sup>2/</sup>Almost entirely consisting of cotton production for on-farm weaving, using indigenous varieties and few chemical inputs, and providing little surplus for market sale.

TABLE 2.3  
 BREAKDOWN OF SORGHUM/MILLET ACREAGE BY PRIMARY  
 CROP AND ZONE (in % each zone's  
 Sorghum/Millet acreage)

| Zone          | Sorghum<br>Alone |        | Sorghum<br>and Millet |        | Millet<br>Alone |        | Niadi <sup>a</sup> |        |
|---------------|------------------|--------|-----------------------|--------|-----------------|--------|--------------------|--------|
|               | Hoe              | ANTRAC | Hoe                   | ANTRAC | Hoe             | ANTRAC | Hoe                | ANTRAC |
| 1. Bogandé    | 32.5             | --     | 42.6                  | --     | 25.5            | --     | 0                  | --     |
| 2. Mani       | 59.2             | --     | 26.9                  | --     | 13.9            | --     | 0                  | --     |
| 3. Piela      | 8.8              | 21.6   | 35.9                  | 27.1   | 55.3            | 51.3   | 0                  | 0      |
| 4. Diabo      | 10.8             | 24.6   | 15.3                  | 31.8   | 73.9            | 43.7   | 0                  | 0      |
| 5. Logobou    | 50.9             | 49.3   | 5.3                   | 11.7   | 11.4            | 1.0    | 32.3               | 37.9   |
| 6. Partiaga   | 70.1             | --     | 29.9                  | --     | 0               | --     | 0                  | --     |
| 7. Yondé      | 26.5             | --     | 39.9                  | --     | 33.5            | --     | 0                  | --     |
| 8. Diapangou  | 15.6             | 14.9   | 55.2                  | 52.2   | 29.2            | 32.9   | 0                  | 0      |
| 9. Botou      | 42.6             | --     | 36.8                  | --     | 20.6            | --     | 0                  | 0      |
| 10. Kantchari | 16.7             | --     | 80.8                  | --     | 2.5             | --     | 0                  | --     |
| 11. Ougarou   | 35.7             | 94.7   | 14.3                  | 3.2    | 0               | 2.1    | 0                  | 0      |
| 12. Pama      | 27.6             | --     | 50.2                  | --     | 4.1             | --     | 18.1               | --     |
| All ZONES     | 38.1             | 34.2   | 38.6                  | 28.9   | 18.5            | 32.7   | 4.8                | 4.2    |

<sup>a</sup>Any field containing Niadi (a 60-day short season millet) whether or not in association with sorghum or millet.

Table 2.4. Unfortunately, much of these rainfall data are misleading. For example, we observed a severe drought during the 1978 season in Piela, Diapangou, and Botou (north of Fada)<sup>1/</sup> but not in Logobou, Pama, Partiaga, Ougarou, and Kantchari as shown in Table 2.4. Also, Mani had one of its best harvests in over a decade while the rainfall data show below average precipitation.

One source of inconsistency between rainfall data and observed yield performance may be the underenumeration<sup>2/</sup> of rainfall data. Logobou's reported rainfall appears unreasonably low. Other stations are similarly suspect. Another source of inconsistency may be that the timing of rainfall probably had more effect on yields than total rainfall. Many stations experienced a drought from early June through mid-July. The timing and intensity of rains during this drought and at the end of the rainy season could have had a critical effect on yields. Also, in some cases the regional rain station may have been located sufficiently far from the surveyed village (Kantchari, Pama and Mani) to be unrepresentative, given the high micro-variability of tropical rain squalls.

One method for placing the 1978 season in historical perspective is to use farmers' subjective evaluations of the harvest. Table 2.5 presents the percentage of farmers<sup>3/</sup> who evaluated the 1978 harvest for each crop as

---

<sup>1/</sup>The Botou survey zone refers to the small village of Botou that is 50 km north of Fada and 25 km south of Bilanga. This should not be confused with the major village of Botou found east of Kantchari near the Niger border.

<sup>2/</sup>One rainfall station's low estimate (not reported here) resulted from the extension agent taking vacation in August and reporting no rainfall while away.

<sup>3/</sup>Includes both hoe and ANTRAC farmers. For each crop, estimates were based only on farmers who actually grew that crop.

TABLE 2.4  
RAINFALL BY ZONE FOR 1978 (IN mm.)<sup>a</sup>

| Zone          | March<br>&<br>April | May | June | July | August | September | October | Total<br>For<br>1978 | Estimated<br>Longterm<br>Average <sup>b</sup> | % Change<br>From<br>Longterm<br>Average |
|---------------|---------------------|-----|------|------|--------|-----------|---------|----------------------|-----------------------------------------------|-----------------------------------------|
| 1. Bogande    | 91                  | 55  | 89   | 178  | 133    | 87        | 10      | 644                  | 690                                           | - 6.7                                   |
| 2. Mani       | 57                  | 29  | 93   | 145  | 149    | 79        | 4       | 558                  | 610                                           | - 8.5                                   |
| 3. Piela      | 85                  | 65  | 91   | 98   | 113    | 87        | 11      | 549                  | 750                                           | -26.8                                   |
| 4. Diabo      | 27                  | 82  | 175  | 178  | 126    | 127       | 61      | 776                  | 880                                           | -11.8                                   |
| 5. Logobou    | 20                  | 102 | 132  | 90   | 153    | 15        | 0       | 512                  | 960                                           | -46.7                                   |
| 6. Partiaga   | 29                  | 125 | 134  | 61   | 195    | 105       | 5       | 656                  | 900                                           | -27.2                                   |
| 7. Yondé      | 101                 | 137 | 116  | 128  | 224    | 136       | 19      | 861                  | 900                                           | - 4.3                                   |
| 8. Diapangou  | 55                  | 103 | 125  | 122  | 123    | 114       | 31      | 672                  | 910                                           | -26.2                                   |
| 9. Botou      | 61                  | 50  | 133  | 107  | 137    | 164       | 5       | 658                  | 858                                           | -23.3                                   |
| 10. Kantchari | 0                   | 52  | 178  | 105  | 155    | 191       | 18      | 698                  | 870                                           | -19.8                                   |
| 11. Ougarou   | 13                  | 100 | 126  | 114  | 181    | 127       | 14      | 703                  | 880                                           | -20.1                                   |
| 12. Pama      | 101                 | 84  | 94   | 60   | 290    | 85        | 18      | 731                  | 1060                                          | -31.0                                   |

<sup>a</sup>From "Rapport Technique: Campagne 1978-79," BPA, ORD de l'Est, 1979. Zonal rainfall data represent averages from regional rain stations: Bogande (Diaka + Kossoukou); Mani (Diaka + Dakiri); Piela (Piela); Diabo (Diabo; + M. Lantaogo, Saatinga, + Tangaye); Logobou (Logobou); Partiaga (Namoundou + Partiaga); Yondé (Yondé); Diapangou (Tangaye + Tibga); Botou north of Fada (Bilanga + Yamba); Kantchari (Kantchari); Ougarou (Matiacpali due to serious underreporting at the Ougarou station); and Pama (Pama).

<sup>b</sup>From J. Weldring "Synthese sur les Amenagements Hydro-Agricoles dans l'ORD de l'Est, Fada N'Gourma," Direction du Fonds de Developement Rural, Ouagadougou, May 1979, pp. 5-6. These figures were taken from an uncited 1974 S.A.E.D. report and probably represent 20 year rainfall estimates extrapolated from a few national rainfall stations from similar latitudes. In cases where Weldring did not present an estimate for a survey village, regional averages were used: Bogandé (Bogandé + Thion); Mani (Coala); Botou (Bilanga + Yamba); and Diapangou (Fada).

Table 2.5 PROPORTION OF FARMERS WHO FELT THE 1978 HARVEST WAS BETTER THAN AVERAGE

| Zone                   | Sorghum | Millet | Niadi          | Maize | Groundnuts | Bambara Nuts | Cowpeas | Soybeans | Sesame | Cotton | Rice | All Crops <sup>b</sup> | Rank for All Crops |
|------------------------|---------|--------|----------------|-------|------------|--------------|---------|----------|--------|--------|------|------------------------|--------------------|
| 1. Bogandé             | 6       | 28     | x <sup>a</sup> | 6     | 19         | x            | 3       | x        | 4      | 10     | x    | 29                     | 8                  |
| 2. Mani                | 79      | 85     | x              | 46    | 66         | 44           | 33      | x        | 29     | 46     | x    | 74                     | 1                  |
| 3. Piéla               | 19      | 26     | x              | 7     | 31         | 6            | 10      | x        | 12     | x      | x    | 21                     | 9                  |
| 4. Diabo               | 68      | 61     | x              | 50    | 48         | 44           | 42      | 56       | x      | 54     | 25   | 61                     | 3                  |
| 5. Logobou             | 52      | 63     | 53             | 27    | 37         | 44           | 51      | 18       | x      | 10     | 18   | 52                     | 4                  |
| 6. Partiaga            | 46      | 25     | x              | 44    | 33         | x            | 20      | 10       | x      | x      | 74   | 36                     | 6                  |
| 7. Yondé               | 3       | 3      | x              | 15    | 14         | 17           | 3       | x        | x      | x      | x    | 15                     | 10                 |
| 8. Diapangou           | 0       | 3      | x              | 9     | 4          | x            | 0       | 8        | x      | x      | x    | 6                      | 12                 |
| 9. Botou               | 3       | 0      | x              | 3     | 3          | 0            | 15      | x        | 5      | 10     | x    | 7                      | 11                 |
| 10. Kantchari          | 21      | 33     | x              | 41    | 58         | 46           | 26      | x        | x      | 25     | x    | 29                     | 7                  |
| 11. Ougarou            | 89      | 57     | x              | 56    | 47         | 44           | 18      | 55       | x      | x      | 38   | 67                     | 2                  |
| 12. Pama               | 81      | 25     | 6              | 13    | 24         | 0            | 36      | 8        | x      | 6      | 5    | 45                     | 5                  |
| ALL ZONES <sup>c</sup> | 41      | 36     | 30             | 28    | 32         | 31           | 23      | 30       | 13     | 23     | 32   | 36                     |                    |

<sup>a</sup>x = less than 10 farmers cultivated this crop.

<sup>b</sup>Weighted average with sorghum and millet each given a 40 percent weight and the simple mean of all other crops given a 20 percent weight.

<sup>c</sup>Mean of producing zones only.

being "better than average." While the meaning of "better than average" is problematic, particularly since farmers tend to give overly pessimistic responses,<sup>1/</sup> Table 2.5 still provides useful information for making zonal comparisons for individual crops. Further, when zones are ranked according to an "all crops" composite value, these rankings are far more consistent with field observation than were the rainfall data. Only Diabo (ranked 3rd for all crops) stands out as having a more favorable rating than its 1978 harvest would merit.<sup>2/</sup>

Table 2.6 helps put the 1978 harvest in context by relating it to the average harvest for the 1973-77 period. Since no other historical harvest data exist, Table 2.6 was calculated on the basis of farmers' estimates of each crop's total harvest for each year from 1973 to 1978. Though a surprising number of farmers could estimate the past 5 years' harvests, limited data make estimates possible in only 9 of the 12 zones.<sup>3/</sup> In general, yields were higher in 1978 than the 1973-77 average, as one would expect. Further, the relative performance of the different zones is consistent with field observation and farmers' subjective evaluations of the 1978 harvest.

---

<sup>1/</sup>Over all zones, only 36 percent of farmers evaluated the all crop harvest as above average. However, compared to recent years which were plagued by drought, 1978 was clearly an above average year for the region as a whole, which is supported by Table 2.6 below.

<sup>2/</sup>Diabo farmers' favorable evaluation of the 1978 harvest may reflect how devastated by drought the area was as recently as 1977.

<sup>3/</sup>While the absolute annual harvest quantities may be difficult to estimate accurately for many crops, the procedure only analyzes relative changes in harvests. Further, the end of year recall method of harvest measurement appears to be a reasonably accurate, low cost survey procedure.

Table 2.6 PERCENTAGE INCREASE IN THE 1978 HARVEST RELATIVE  
TO THE AVERAGE HARVEST FOR 1973-1977<sup>a</sup>

| Zone                   | Sorghum          | Millet          | Maize | Groundnuts | Cowpeas | Sesame |
|------------------------|------------------|-----------------|-------|------------|---------|--------|
| 1. Bogandé             | - 4              | 52              | -24   | 3          | -23     | -21    |
| 2. Mani                | 108              | 191             | 26    | 109        | - 6     | 46     |
| 3. Piela               | x <sup>b</sup>   | -12             | -55   | 19         | 11      | 2      |
| 4. Logobou             | 15               | 26 <sup>d</sup> | 4     | -23        | 57      | X      |
| 5. Partiaga            | 33               | - 6             | 41    | X          | 6       | X      |
| 6. Diapangou           | 8                | -38             | -19   | -42        | 13      | X      |
| 7. Botou (N. Fada)     | -47 <sup>e</sup> | X               | -56   | X          | X       | X      |
| 8. Kantchari           | 39               | 194             | 51    | X          | 30      | X      |
| 9. Ougarou             | 168              | X               | 45    | X          | -36     | X      |
| ALL ZONES <sup>c</sup> | 51               | 50              | 11    | 19         | 10      | 4      |

<sup>a</sup>Based on farmers' recall of annual harvests from 1973-78. These data reflect changes in acreages as well as yields.

<sup>b</sup>X = less than 12 farmers reporting.

<sup>c</sup>Mean of all households reporting.

<sup>d</sup>Refers to Niadi only.

<sup>e</sup>Sorghum plus millet.

### 2.3 Crop Yields

Crop harvests were measured by three alternative methods during the 1978-79 farm survey: (1) yield plots, (2) monthly recall of each field's off-take, and (3) end-of-season recall of total annual production. In a previous report, [Baker and Lassiter, pp. 39-44], the yield plot method was discussed and its preliminary estimates were presented. Subsequent analysis of the yield estimates based on both field off-take and end-of-season recall have led us to believe that the yield plot method seriously overestimated crop yields.<sup>1/</sup> As a result, revised yield estimates are presented in Table 2.7. These revised estimates represent averages of the estimates of both the field off-take and the end-of-season recall method.

The yields in Table 2.7 clearly reflect certain general characteristics of the 1978 season, such as the serious drought that affected Piela, Diapangou, and Botou. Low sorghum/millet yields were experienced in zones which put greater emphasis on millet, such as Bogandé, Yondé and Diabc. Excellent yields were experienced in Ougarou and Mani.

Crop yields are generally low which reflects, in large part, the low level of soil fertility that is characteristic of the bush fallow system. Yields vary dramatically between zones which is largely attributable to differences in rainfall and soil. A smaller but appreciable amount of zonal yield variation is due to both sampling and measurement error, which is more marked for secondary crops than for sorghum/millet. Unfortunately, such zonal yield variation makes intrazonal comparisons difficult on the basis of a single season's data.

---

<sup>1/</sup> Probable causes of yield plot overestimation are: (1) failure to account for the yield-reducing "border effect," (2) harvest exaggeration by farmers who harvest beyond the true boundary of the plot, and (3) plot location bias due to field staff placing plots in either the most productive fields or the most productive portions of a given field.

Table 2.7 YIELDS PER HECTARE FOR MAJOR CROPS<sup>A</sup>

| Zone          | Sorghum,<br>Millet and,<br>Wizdi |                  | Maize              |        | Groundnuts       |        | Soybeans       |        | Cotton |        | Rice             |        |
|---------------|----------------------------------|------------------|--------------------|--------|------------------|--------|----------------|--------|--------|--------|------------------|--------|
|               | Hoe                              | ANTRAC           | Hoe                | ANTRAC | Hoe              | ANTRAC | Hoe            | ANTRAC | Hoe    | ANTRAC | Hoe              | ANTRAC |
| 1. Bogandé    | 243                              | -                | 420                | -      | 289              | -      | x <sup>d</sup> | -      | X      | -      | X                | -      |
| 2. Mani       | 991                              | -                | 963                | -      | 407              | -      | X              | -      | X      | -      | X                | -      |
| 3. Piéla      | 159                              | 170              | 123                | 124    | 328              | 203    | X              | X      | X      | X      | 268 <sup>b</sup> | X      |
| 4. Diabo      | 274 <sup>b</sup>                 | 307 <sup>b</sup> | 1,539 <sup>c</sup> | 884    | 78               | 237    | X              | 329    | X      | 236    | 379 <sup>c</sup> | 563    |
| 5. Logobou    | 517 <sup>b</sup>                 | 516 <sup>b</sup> | 940                | 1,189  | 359              | 357    | X              | 42     | 70     | 103    | 401              | 212    |
| 6. Parriaga   | 748                              | -                | 451                | -      | 192              | -      | 238            | -      | X      | -      | 1,597            | -      |
| 7. Yondé      | 257                              | -                | 842                | -      | 180              | -      | X              | -      | X      | -      | X                | -      |
| 8. Diapangou  | 172                              | 287              | 1,125              | 1,306  | 259 <sup>c</sup> | 465    | X              | 843    | X      | X      | X                | 220    |
| 9. Botou      | 328                              | -                | 910                | -      | 199              | -      | X              | -      | 288    | -      | X                | -      |
| 10. Kantchari | 690                              | -                | 255                | -      | 371 <sup>c</sup> | -      | X              | -      | 230    | -      | X                | -      |
| 11. Ougarou   | 1,405                            | 1,258            | 412                | 679    | 140 <sup>c</sup> | 1,079  | X              | 571    | X      | X      | 923 <sup>c</sup> | 1,063  |
| 12. Pama      | 796                              | -                | 806                | -      | 362              | -      | 527            | -      | 122    | -      | 1,549            | -      |
| All Zones     | 547                              | 450              | 588                | 76     | 287              | 299    | 378            | 437    | 145    | 203    | 982              | 717    |

<sup>a</sup>Estimated for fields in which the given crop was predominate. Estimates represent the average of two alternative harvest estimation methods: (1) end of season recall of total annual production and (2) monthly recall of field off-take. Sorghum/millet yields are calculated from the entire sample of 473 households (an additional 7 purposively selected village chiefs were excluded). Other crop yields are based on a randomly chosen 313 household sub-sample.

<sup>b</sup>Based on end of season recall only.

<sup>c</sup>Based on less than 1 hectare of cropped area.

<sup>d</sup>x = acreage too small to permit estimation.

Table 2.8 presents the yields of sorghum, millet, and Niadi in grain fields. While the aggregated nature of this table obscures a slight stratification bias (more millet data come from the dryer zones while more sorghum and all Niadi data come from wetter zones), it clearly shows the higher yields of sorghum versus millet. Note that Niadi proves to be a productive crop when the yield of relay cropped sorghum is counted.

#### 2.4 The Cropping Calendar

The timing of individual cropping activities is a key factor in determining the success of a farmer's total crop production efforts in an area like the EORD, though climatic and technical limitations can greatly reduce farmers' flexibility in allocating their labor. The short rainy season, characterized by sporadic drought particularly in May and June, forces farmers to race to get crops planted as quickly as possible. By late June, weeding requirements are so demanding that the household labor supply is working to capacity.

Table 2.9 presents the average seeding and harvest dates for 8 crops. Seeding dates<sup>1/</sup> generally vary between early June and mid-July, with sorghum seeded earliest and cotton and bambara nuts seeded latest. With the exception of maize which is harvested as an important "hungry season" food crop in early September, there is little variation in the harvest dates of other crops. Both seeding and harvest dates vary across zones for each crop in accordance with each zone's rainfall patterns. While their zonal differences generally follow historical patterns for the on-set and end of the rainy season, seeding dates are greatly influenced by local drought patterns.

---

<sup>1/</sup> Seeding dates represent weighted average dates for all seeding and reseeded activities (weighted by the quantities of seed used). Since some early seedings completely fail, particularly for sorghum and millet, these average dates are slightly earlier than the "effective" seeding date.

TABLE 2.8  
 PRIMARY CROP YIELDS IN SORGHUM/MILLET FIELDS  
 (Kqs./Ha.)

| Crop            | Field Type       |        |                       |        |                 |        |       |        |
|-----------------|------------------|--------|-----------------------|--------|-----------------|--------|-------|--------|
|                 | Sorghum<br>alone |        | Sorghum<br>and Millet |        | Millet<br>alone |        | Niadi |        |
|                 | Hoe              | Antrac | Hoe                   | Antrac | Hoe             | Antrac | Hoe   | Antrac |
| Sorghum         | 753              | 811    | 346                   | 177    | --              | --     | 324   | 361    |
| Millet          | --               | --     | 173                   | 211    | 276             | 209    | 68    | 17     |
| <u>Niadi</u>    | --               | --     | --                    | --     | --              | --     | 253   | 443    |
| All Grain Total | 753              | 811    | 516                   | 389    | 276             | 209    | 645   | 821    |

TABLE 2.9  
AVERAGE SEEDING AND HARVEST DATES<sup>a</sup> FOR THE 1978 SEASON

| Zone               | Sorghum      |              | Millet <sup>e</sup> |              | Maize             |                  | Groundnuts        |              | Bambara Nuts      |              | Rice              |                   | Soybeans          |                    | Cotton            |                    |
|--------------------|--------------|--------------|---------------------|--------------|-------------------|------------------|-------------------|--------------|-------------------|--------------|-------------------|-------------------|-------------------|--------------------|-------------------|--------------------|
|                    | Seed-<br>ing | Harv-<br>est | Seed-<br>ing        | Harv-<br>est | Seed-<br>ing      | Harv-<br>est     | Seed-<br>ing      | Harv-<br>est | Seed-<br>ing      | Harv-<br>est | Seed-<br>ing      | Harv-<br>est      | Seed-<br>ing      | Harv-<br>est       | Seed-<br>ing      | Harv-<br>est       |
| 1. Bogandé         | 6/13         | 10/30        | 6/17                | 11/1         | 6/23              | 9/16             | 7/1               | 10/28        | x                 | x            | x                 | x                 | x                 | x                  | x                 | x                  |
| 2. M'ni            | 5/15         | 11/25        | 6/27                | 11/20        | 6/22 <sup>b</sup> | 10/11            | 6/22              | 10/12        | x                 | x            | x                 | x                 | x                 | x                  | x                 | x                  |
| 3. Piela           | 5/8          | 11/22        | 6/18                | 11/20        | x <sup>d</sup>    | x                | 7/1               | 11/13        | x                 | x            | x                 | x                 | x                 | x                  | x                 | x                  |
| 4. Diabo           | 5/28         | 10/18        | 5/18                | 11/27        | 6/7 <sup>c</sup>  | 9/4 <sup>c</sup> | 6/14              | 10/25        | 7/1 <sup>c</sup>  | 10/17        | 6/13 <sup>c</sup> | 10/22             | 6/28 <sup>c</sup> | 10/4 <sup>c</sup>  | 6/24 <sup>c</sup> | 10/31 <sup>c</sup> |
| 5. Logobou         | 5/29         | 11/17        | 5/28                | 11/7         | 6/4               | 9/7              | 6/9               | 10/7         | 7/31 <sup>c</sup> | 11/2         | 6/22              | 11/4              | 7/26 <sup>c</sup> | 11/15 <sup>c</sup> | x                 | 3/12 <sup>c</sup>  |
| 6. Partiaga        | 6/22         | 11/24        | 7/4                 | 11/29        | 7/9               | 9/26             | 7/16 <sup>b</sup> | 10/29        | 7/30 <sup>b</sup> | 11/10        | 6/22              | 11/18             | x                 | 11/18              | x                 | x                  |
| 7. Yondé           | 5/24         | 10/18        | 6/7                 | 12/10        | 5/17 <sup>b</sup> | 8/31             | 6/16              | 10/20        | 7/17              | 10/31        | x                 | x                 | x                 | x                  | x                 | x                  |
| 8. Diapangou       | 6/3          | 11/11        | 6/1                 | 11/23        | 6/21 <sup>c</sup> | 9/7 <sup>c</sup> | 6/17              | 10/2         | x                 | x            | x                 | x                 | x                 | 10/21 <sup>c</sup> | x                 | x                  |
| 9. Botou (N. Fada) | 5/24         | 11/13        | 5/30                | 11/8         | 6/10              | 9/3              | x                 | 10/1         | x                 | 10/16        | x                 | x                 | x                 | x                  | 6/11 <sup>b</sup> | 10/21              |
| 10. Kantchari      | 6/24         | 11/16        | 6/8                 | 11/16        | 6/5               | 9/1              | x                 | x            | x                 | 10/21        | x                 | x                 | x                 | x                  | x                 | 11/12              |
| 11. Ougarou        | 6/1          | 11/17        | 6/8 <sup>c</sup>    | 11/9         | 6/17              | 9/18             | 7/5 <sup>c</sup>  | 10/18        | x                 | 10/19        | 6/18 <sup>c</sup> | 11/6 <sup>c</sup> | x                 | 11/9 <sup>c</sup>  | x                 | x                  |
| 12. Pama           | 5/27         | 11/8         | 5/14                | 11/7         | 6/16              | 8/23             | 6/21              | 9/28         | 7/18 <sup>b</sup> | 10/23        | 6/20              | 10/31             | 6/28 <sup>b</sup> | 10/13              | 7/30              | 11/29              |
| ALL ZONES          | 6/4          | 11/12        | 6/8                 | 11/16        | 6/17              | 5/7              | 6/22              | 11/1         | 7/17              | 10/26        | 6/16              | 11/6              | 7/9 <sup>c</sup>  | 10/28              | 7/12              | 11/13              |

<sup>a</sup>Calculated for fields in the hoe agriculture sample in which the given crop was predominant. Harvest dates are based on 240 hoe households. Seeding dates are based on 120 hoe households.

<sup>b</sup>Less than 1 hectare of valid data.

<sup>c</sup>Due to low acreage in hoe sample, ANTRAC sample data used.

<sup>d</sup>x = insufficient data to permit estimation.

<sup>e</sup>Excluding Niadi.

Table 2.10 presents the seeding and harvest dates for the 9 most common sorghum varieties. Some varieties, such as Dimoani (which includes red sorghum) and Osoango provide short season crops for certain zones. In addition, Niadi (short season millet) provides an important short season cropping alternative in Logobou (seeding on 5/25; harvest on 8/28) and Pama (seeding on 5/23; harvest on 7/26).

## 2.5 Labor Use

Family labor is the major input in farming in the EORD. The use of chemical fertilizer or insecticide is extremely uncommon. Even animal traction was uncommon in 1978 except a limited number of areas with intensive extension programs. Wage labor represented less than 0.5 percent of agricultural labor among all surveyed farmers. Approximately 10 percent of labor used on surveyed farms originated from "invitations de culture."<sup>1/</sup>

The intensity and timing of total labor use (including both family and non-family labor) is summarized in Table 2.11 for the 6 crop enterprises. Note that hoe and ANTRAC sample means are not strictly comparable because of their different regional stratifications [see footnote 2, page 6 above]. For both hoe and ANTRAC samples, the table shows that peak labor requirements occur during the early June to mid-August seeding and weeding season. The harvest does not represent a peak labor period. Rice is the most labor intensive crop in the hoe sample and second only to groundnuts among ANTRAC

---

<sup>1/</sup>"Invitation" refers to a festive work party organized by a farmer, usually when he falls behind in his weeding, for which the invitees are paid in food and drink.

TABLE 2.10  
GENERAL CHARACTERISTICS OF MAJOR SORGHUM VARIETIES<sup>a</sup>

| Variety Code <sup>b</sup> | Gourmantche Name                | Moré Name               | Yield per Hectare <sup>c</sup> |                                                           | Average date <sup>d</sup> of: |         | % of Sorghum acreage in which this variety is present | Zones of Primary Usage <sup>f</sup> by order of importance |
|---------------------------|---------------------------------|-------------------------|--------------------------------|-----------------------------------------------------------|-------------------------------|---------|-------------------------------------------------------|------------------------------------------------------------|
|                           |                                 |                         | Of this Variety                | Of other associated sorghums or millets in the same field | Seeding                       | Harvest |                                                       |                                                            |
| 1                         | Sucodi                          | --                      | 386                            | 98                                                        | May 30                        | Nov. 23 | 9.0                                                   | Logobou                                                    |
| 2                         | Dimoani, Dimoanmoanga, Dimoanga | Kazinga (Red Sorghum)   | 248                            | 126                                                       | May 29                        | Oct. 24 | 23.1                                                  | Pama, Bogandé, Yondé, Diabo                                |
| 3                         | Conluoli, Belko                 | Belko                   | 545                            | 148                                                       | June 2                        | Nov. 18 | 13.7                                                  | Kantchari, Mani, Yondé                                     |
| 4                         | Dagbani, Digbenti, Osansan-calo | --                      | 259                            | 561                                                       | June 7                        | Oct. 27 | 1.2                                                   | Logobou <sup>g</sup>                                       |
| 5                         | Cuadi                           | Baninga (White Sorghum) | 329                            | 266                                                       | June 7                        | Nov. 11 | 22.1                                                  | Kantchari, Diapangou, Partiaga, Ougarou                    |
| 6                         | Osoango                         | Karaaga                 | 93                             | 463                                                       | May 26                        | Sept. 4 | 2.7                                                   | Pama <sup>h</sup> , Diapangou <sup>h</sup>                 |
| 8                         | Papienli, Biadi-pieni           | --                      | 715                            | 136                                                       | June 7                        | Nov. 22 | 15.4                                                  | Ougarou, Logobou, Partiaga                                 |
| 10                        | Litandi-jali                    | --                      | 165                            | 130                                                       | May 24                        | Nov. 13 | 8.0                                                   | Botou (N. Fada)                                            |
| 11                        | Diedaan-Kan-Fiagi, Muabidi      | --                      | 974                            | 53                                                        | June 22                       | Nov. 16 | 5.4                                                   | Mani                                                       |

<sup>a</sup>This local variety classification system was provided by R.A. Swanson and is summarized on pages 122-129 of "Gourmantche Agriculture, Part II: Cultivated Plant Resources and Field Management", Integrated Rural Development Project, Eastern ORD, Upper Volta, April 30, 1979, by Richard Alan Swanson.

<sup>b</sup>From Swanson, pp. 122-124.

<sup>c</sup>Yield estimated for the entire sample from sorghum fields in which this variety was present and thus represents this variety's yield in association with whatever other sorghum varieties may have been present in the field.

<sup>d</sup>Due to the low occurrence of certain varieties, estimates are based on the entire (hoe + ANTRAC) sample.

<sup>e</sup>Based on approximately 1580 hectares of sorghum fields from the entire sample, the 399 ha. of millet fields are not counted.

<sup>f</sup>Zones where the average sorghum acreage containing this variety is at least 1.0 hectare per household.

<sup>g</sup>Represents only 0.3 ha. per household but this represents 93% of the entire sample's use of this variety.

<sup>h</sup>Less than 0.5 ha. per household.

TABLE 2.11  
LABOR USE PER HECTARE FOR MAJOR CROP ENTERPRISES BY  
MONTH AND BY ACTIVITY (in worker equivalent<sup>a</sup>  
hours of family and non-family labor  
per hectare)

| Period or Activity            | Crop Enterprises |        |       |        |            |        |                  |        |        |        |                  |                  |           |        |
|-------------------------------|------------------|--------|-------|--------|------------|--------|------------------|--------|--------|--------|------------------|------------------|-----------|--------|
|                               | Sorghum/Millet   |        | Maize |        | Groundnuts |        | Soybeans         |        | Cotton |        | Rice             |                  | All Crops |        |
|                               | Hoe              | ANTRAC | Hoe   | ANTRAC | Hoe        | ANTRAC | Hoe              | ANTRAC | Hoe    | ANTRAC | Hoe              | ANTRAC           | Hoe       | ANTRAC |
| May 1 - 28                    | 45               | 46     | 11    | 21     | 32         | 4      | 10               | 0      | 10     | 17     | 112              | 59               | 42        | 38     |
| May 29 - June 25              | 139              | 104    | 318   | 113    | 113        | 40     | 142              | 23     | 61     | 55     | 259              | 132              | 140       | 93     |
| June 25 - July 23             | 145              | 107    | 306   | 237    | 205        | 127    | 192              | 65     | 157    | 170    | 322              | 148              | 156       | 113    |
| July 24 - Aug. 20             | 127              | 102    | 208   | 96     | 189        | 166    | 423              | 105    | 257    | 187    | 163              | 207              | 137       | 113    |
| Aug. 21 - Sept. 17            | 74               | 60     | 128   | 62     | 97         | 97     | 129              | 44     | 71     | 113    | 100              | 73               | 79        | 64     |
| Sept. 18 - Oct. 15            | 36               | 29     | 84    | 34     | 195        | 81     | 93               | 98     | 122    | 39     | 106              | 54               | 50        | 43     |
| Oct. 16 - Nov. 12             | 83               | 62     | 62    | 16     | 134        | 332    | 61               | 78     | 73     | 83     | 97               | 51               | 85        | 84     |
| Nov. 13 - Dec. 10             | 64               | 79     | 14    | 11     | 93         | 17     | 23               | 1      | 172    | 109    | 106              | 66               | 66        | 67     |
| Dec. 11 - Jan. 1              | 7                | 9      | 1     | 0      | 17         | 0      | 2                | 0      | 15     | 1      | 46               | 25               | 11        | 13     |
| Jan. 8 - Apr. 30 <sup>b</sup> | 11               | 13     | 4     | 0      | 4          | 0      | 0                | 0      | 2      | 0      | 3                | 30               | 11        | 14     |
| Total <sup>c</sup>            | 731              | 611    | 1147  | 589    | 1077       | 862    | 1075             | 416    | 940    | 775    | 1314             | 845              | 777       | 642    |
| Tillage                       | 471              | 378    | 763   | 397    | 549        | 301    | 664              | 188    | 483    | 426    | 709              | 519              | 483       | 365    |
| Seeding                       | 55               | 47     | 139   | 93     | 62         | 101    | 156              | 67     | 105    | 95     | 155              | 114              | 62        | 60     |
| Harvest                       | 155              | 149    | 187   | 98     | 428        | 451    | 144              | 113    | 308    | 198    | 193              | 82               | 174       | 169    |
| Other                         | 50               | 37     | 58    | 1      | 38         | 9      | 112 <sup>e</sup> | 48     | 45     | 57     | 257 <sup>d</sup> | 131 <sup>d</sup> | 58        | 47     |

<sup>a</sup>See Table 3.1, footnote f for the definition of worker equivalent hour.

<sup>b</sup>A 112 day period. All other periods are 28 days. Excludes the clearing of new fields.

<sup>c</sup>Total hours may differ slightly from the sum of hours across periods due to rounding errors plus slight differences in sample size by period.

<sup>d</sup>Mainly threshing.

<sup>e</sup>Includes clearing of new fields.

farmers. Sorghum/millet are the least labor intensive crops, requiring only 731 worker equivalent<sup>1/</sup> hours per hectare.

The majority of labor for most crop enterprises is used for tillage (either plowing, weeding, or ridging, whether by hand or with ANTRAC). Maize requires proportionally more tillage than other crops, probably because of the higher fertility of maize fields which stimulates weed growth. Groundnuts, cotton, and rice (when threshing is included) entail proportionally high harvest labor use. Rice tillage requirements are high as well due to the close plant spacing.

---

<sup>1/</sup>See footnote f, Table 3.1 for the worker equivalency conversion coefficients.

### 3. CROP ENTERPRISE BUDGETS

#### 3.1 Introduction

This chapter presents crop enterprise budgets by zone for sorghum/millet, maize, groundnuts, soybeans, cotton, and rice. Few of these enterprises are commonly based upon inter-cropping though a farmer's field can often consist of a mosaic of sole-cropped sub-plots. True inter-cropping mixtures do consist of combinations of sorghum + millet or Niadi + cowpea or sesame, and of maize + cotton or tobacco (relay cropped). However, due to the high incidence of sub-plot fields, the crop enterprise budgets are presented here as if they were inter-cropped in order to include the production of the minor sub-plots. Thus for each enterprise, yields are presented for each primary and major secondary crop. In addition, the value of production is summarized for all primary crops, major secondary crops, and minor secondary crops.

The budget data are generally presented only for zones in which the survey obtained yield data for at least one hectare of the crop in question. Since labor, seeding, and other input data were collected only for one-third of the households, such data are occasionally insufficient to support a zonal estimate. In such cases, the corresponding hoe or ANTRAC sample mean value is substituted (such substitutions are always footnoted). Hoe and ANTRAC sample mean values represent weighted averages of all enterprise acreage in the given sample, which implicitly gives greater geographical weight to zones where the given enterprise is most common.

Prices used to value both production and seed represent average prices realized by all farmers in both samples during the 1978-79 year. All non-family labor is valued at 31.6 FCFA per worker equivalent hour, the average cost of wage labor for both samples.<sup>1/</sup> The reader should note that these values are seldom realized in cash since less than 8 percent of crop production is sold, less than 10 percent of seed is purchased, and less than 5 percent of non-family labor is paid in cash.

### 3.2 Sorghum/Millet

Table 3.1 presents the crop enterprise budget for sorghum/millet, the major crop enterprise in the EORD. Sorghum is clearly the dominant crop in this enterprise, but both millet and cowpeas make a major contribution in terms of value. The use of purchased agricultural inputs is extremely low, except for fungicide seed treatment among ANTRAC households. While the use of organic fertilizer (of on-farm origin) is common, the use of chemical fertilizer is extremely uncommon. Even in the few cases when chemical fertilizer was used, its average application rate is so low as to suggest only farmer experimentation on a small proportion of "fertilized" acreage. The employment of non-family labor is fairly consistent across zones and between the two samples. However, family labor inputs are lower for ANTRAC households than for hoe households in similar zones.

In general, both the variable and fixed costs of sorghum/millet production are low. Of these, the real cash costs of production are insignificant, except for ANTRAC-related expenses. Overall, total costs amount to only 10.2 percent of the value of output for the hoe sample and 20.9 percent for the ANTRAC sample.

---

<sup>1/</sup>This assumes that the real cost of invitation labor is similar to that of labor paid in cash, probably a reasonable assumption given the fairly high cost of invitations and the low productivity of such labor.

TABLE 3.1  
CROP ENTERPRISE BUDGETS BY ZONE FOR SORGHUM/MILLET<sup>a</sup>  
(in units per hectare)

|                                                   | Ali<br>Hoe<br>Zones | All<br>AN-<br>TRAC<br>Zones | Bo-<br>gande<br>Hoe | Mani<br>Hoe | Piela<br>Hoe     | AN-<br>TRAC      | Diabo<br>Hoe     | AN-<br>TRAC      | Logobou<br>Hoe   | AN-<br>TRAC      | Par-<br>tiaga<br>Hoe | Yonde<br>Hoe | Diapangou<br>Hoe | AN-<br>TRAC | Botou<br>Hoe | Kant-<br>chari<br>Hoe | Ougarou<br>Hoe | AN-<br>TRAC | Pama<br>Hoe |
|---------------------------------------------------|---------------------|-----------------------------|---------------------|-------------|------------------|------------------|------------------|------------------|------------------|------------------|----------------------|--------------|------------------|-------------|--------------|-----------------------|----------------|-------------|-------------|
| <b>Yields (Kgs/ha.)<sup>b</sup>:</b>              |                     |                             |                     |             |                  |                  |                  |                  |                  |                  |                      |              |                  |             |              |                       |                |             |             |
| <b>Primary Crops</b>                              |                     |                             |                     |             |                  |                  |                  |                  |                  |                  |                      |              |                  |             |              |                       |                |             |             |
| Sorghum                                           | 421                 | 283                         | 154                 | 864         | 43               | 81               | 154              | 165              | 374              | 357              | 720                  | 52           | 59               | 105         | 229          | 415                   | 1403           | 1215        | 620         |
| Millet                                            | 116                 | 103                         | 88                  | 126         | 115              | 89               | 119              | 142              | 54               | 12               | 28                   | 205          | 114              | 182         | 99           | 277                   | 2              | 44          | 139         |
| Miadi                                             | 11                  | 13                          | 0                   | 0           | 0                | 0                | 0                | 0                | 89               | 147              | 0                    | 0            | 0                | 0           | 0            | 0                     | 0              | 0           | 7           |
| SUBTOTAL                                          | 547                 | 450                         | 243                 | 991         | 159              | 170              | 274 <sup>g</sup> | 307 <sup>g</sup> | 517 <sup>g</sup> | 516 <sup>g</sup> | 748                  | 257          | 372              | 287         | 328          | 690                   | 1405           | 1258        | 796         |
| <b>Major Secondary Crops<sup>c</sup></b>          |                     |                             |                     |             |                  |                  |                  |                  |                  |                  |                      |              |                  |             |              |                       |                |             |             |
| Cowpea                                            | 3                   | 56                          | 21                  | 12          | 11               | 16               | 67               | 53               | 125              | 63               | 17                   | 64           | 75               | 109         | 54           | 69                    | 16             | 22          | 69          |
| Sesame                                            | 2                   | 1                           | 13                  | 7           | 4                | 7                | 0                | 0                | 0                | 0                | 0                    | 0            | 0                | 0           | 0            | 0                     | 0              | 0           | 0           |
| <b>Input Use:</b>                                 |                     |                             |                     |             |                  |                  |                  |                  |                  |                  |                      |              |                  |             |              |                       |                |             |             |
| Seed rate for grains<br>(Kgs/ha.)                 | 11.4                | 10.3                        | 5.1                 | 17.2        | 12.0             | 6.6              | 8.1              | 9.4              | 10.4             | 12.6             | 11.4 <sup>k</sup>    | 5.7          | 8.1              | 10.5        | 11.1         | 8.1                   | 11.6           | 13.0        | 11.8        |
| Seed rate for cowpeas<br>(Kgs/ha.)                | 1.2                 | 1.7                         | 0.5                 | 0.5         | 0.5 <sup>l</sup> | 0.5 <sup>l</sup> | 6.1              | 1.0              | 1.8              | 1.0              | 0.4                  | 0.7          | 1.4              | 3.2         | 1.1          | 1.2 <sup>k</sup>      | 3.5            | 3.2         | 1.0         |
| % of grain seed treated<br>with fungicide         | 16.2                | 53.8                        | 0                   | 30.3        | 7.2              | 14.6             | 2.7              | 45.0             | 23.2             | 31.9             | 18.6                 | 7.9          | 8.3              | 70.0        | 18.9         | 0                     | 85.8           | 100.0       | 11.7        |
| % of cowpea seed treated<br>with fungicide        | 15.1                | 52.8                        | 0                   | 43.7        | X <sup>m</sup>   | X                | 0                | 31.4             | 20.6             | 0                | 8.5                  | 17.1         | 0                | 59.3        | 10.2         | X                     | 84.3           | 100.0       | 2.1         |
| % of area fertilized<br>organically <sup>d</sup>  | 21.1                | 15.2                        | 51.8                | 4.1         | 0                | 26.4             | 25.8             | 17.3             | 26.2             | 10.7             | 3.9                  | 21.8         | 8.4              | 17.0        | 25.2         | 5.1                   | 27.3           | 1.0         | 39.5        |
| % of area fertilized<br>chemically <sup>e</sup>   | 0.2                 | 7.6                         | 0                   | 2.2         | 0                | 0                | 0                | 16.9             | 0                | 2.8              | 0                    | 0            | 0                | 0           | 0            | 0                     | 0              | 0           | 0           |
| Family Labor (W.E. <sup>f</sup><br>hours/ha.)     | 671                 | 538                         | 862                 | 629         | 671 <sup>P</sup> | 538 <sup>P</sup> | 682              | 490 <sup>X</sup> | 669              | 463              | 540                  | 645          | 718              | 571         | 660          | 779                   | 679            | 622         | 533         |
| Non Family Labor (W.E. <sup>g</sup><br>hours/ha.) | 60                  | 73                          | 43                  | 65          | 60 <sup>P</sup>  | 73 <sup>F</sup>  | 26               | 44 <sup>X</sup>  | 55               | 121              | 74                   | 99           | 107              | 54          | 48           | 38                    | 55             | 92          | 59          |
| TOTAL Labor (W.E.<br>hours/ha.)                   | 731                 | 611                         | 905                 | 694         | 731 <sup>P</sup> | 611 <sup>P</sup> | 708              | 534 <sup>X</sup> | 724              | 584              | 614                  | 744          | 825              | 625         | 708          | 817                   | 734            | 714         | 592         |
| <b>Value of Output<sup>h</sup>:</b>               |                     |                             |                     |             |                  |                  |                  |                  |                  |                  |                      |              |                  |             |              |                       |                |             |             |
| Primary Crops                                     | 24289               | 20475                       | 11057               | 45091       | 7234             | 7735             | 12467            | 13969            | 23524            | 23478            | 34034                | 11694        | 7826             | 13059       | 14924        | 31395                 | 63928          | 57239       | 36218       |
| Major Secondary<br>Crops                          | 3958                | 4127                        | 2293                | 1313        | 1002             | 1578             | 4872             | 3864             | 9128             | 4577             | 1261                 | 4667         | 5483             | 8005        | 3953         | 5015                  | 1171           | 1622        | 5036        |

TABLE 3.1 (Continued)

|                                                                | All<br>Hoe<br>Zones | All<br>AN-<br>TRAC<br>Zones | Bo-<br>gande<br>Hoe | Niadi<br>Hoe | Piela<br>Hoe     | AN-<br>TRAC       | Diabo<br>Hoe | AN-<br>TRAC | Logobou<br>Hoe | AN-<br>TRAC | Par-<br>tiaga<br>Hoe | Yonde<br>Hoe | Diapangou<br>Hoe | AN-<br>TRAC | Botou<br>Hoe | Kant-<br>chari<br>Hoe | Ougarou<br>Hoe | AN-<br>TRAC | Pama<br>Hoe |
|----------------------------------------------------------------|---------------------|-----------------------------|---------------------|--------------|------------------|-------------------|--------------|-------------|----------------|-------------|----------------------|--------------|------------------|-------------|--------------|-----------------------|----------------|-------------|-------------|
| <b>Value of Output</b> <sup>h,i</sup> (Cont)                   |                     |                             |                     |              |                  |                   |              |             |                |             |                      |              |                  |             |              |                       |                |             |             |
| Minor Secondary Crops                                          | 624                 | 102                         | 119                 | 16           | 118              | 0                 | 200          | 148         | 798            | 0           | 627                  | 746          | 124              | 0           | 40           | 235                   | 0              | 281         | 4438        |
| SUBTOTAL                                                       | 29481               | 24704                       | 12469               | 46420        | 8355             | 9313              | 17545        | 17981       | 33450          | 28055       | 35922                | 17107        | 13433            | 21064       | 18917        | 36645                 | 65099          | 59142       | 45692       |
| <b>Variable Costs</b>                                          |                     |                             |                     |              |                  |                   |              |             |                |             |                      |              |                  |             |              |                       |                |             |             |
| Seed <sup>j</sup>                                              | 607                 | 593                         | 269                 | 819          | 583 <sup>n</sup> | 337 <sup>n</sup>  | 961          | 501         | 605            | 647         | 548 <sup>n</sup>     | 311          | 471              | 712         | 586          | 456 <sup>n</sup>      | 784            | 826         | 610         |
| Chemical Fertilizer,<br>Fungicide, & Insec-<br>ticide          | 82                  | 317                         | 0                   | 165          | 36               | 72                | 13           | 335         | 115            | 177         | 92                   | 39           | 41               | 347         | 94           | 0                     | 425            | 500         | 58          |
| Non-household labor <sup>r</sup>                               | 1896                | 2307                        | 1359                | 2054         | 1896             | 2307 <sup>p</sup> | 822          | 1390        | 1738           | 3824        | 2338                 | 3128         | 3381             | 1706        | 1517         | 1201                  | 1738           | 2907        | 1864        |
| ANTRAC feeding and<br>maintenance expenses <sup>s</sup>        | --                  | 675                         | --                  | --           | --               | 631               | --           | 718         | --             | 631         | --                   | --           | --               | 631         | --           | --                    | --             | 718         | --          |
| <b>Fixed Costs</b>                                             |                     |                             |                     |              |                  |                   |              |             |                |             |                      |              |                  |             |              |                       |                |             |             |
| Depreciation and repairs<br>on hand tools                      | 433                 | 442                         | 421                 | 391          | 638 <sup>p</sup> | 624 <sup>p</sup>  | 580          | 440         | 422            | 380         | 494                  | 402          | 694              | 453         | 347          | 456                   | 451            | 450         | 307         |
| Depreciation and repairs<br>on ANTRAC equipment <sup>q,d</sup> | --                  | 1009                        | --                  | --           | --               | 954               | --           | 1064        | --             | 954         | --                   | --           | --               | 954         | --           | --                    | --             | 1064        | --          |
| <b>Performance Measures</b>                                    |                     |                             |                     |              |                  |                   |              |             |                |             |                      |              |                  |             |              |                       |                |             |             |
| Gross Margin per hec-<br>tare <sup>v</sup>                     | 26896               | 20812                       | 11841               | 43382        | 5840             | 5966              | 15749        | 15037       | 30992          | 22776       | 32944                | 13629        | 9540             | 17668       | 16720        | 34988                 | 62152          | 54191       | 43160       |
| Net Margin per ha <sup>w</sup>                                 | 26463               | 19361                       | 11420               | 42991        | 5202             | 4388              | 15169        | 13533       | 30570          | 21442       | 32450                | 13227        | 8846             | 16261       | 16373        | 34532                 | 61701          | 52677       | 42853       |
| Net Margin per WE hour<br>of family labor                      | 39.4                | 36.0                        | 13.2                | 68.3         | 7.8              | 8.2               | 22.2         | 27.6        | 45.7           | 46.3        | 60.1                 | 20.5         | 12.3             | 28.5        | 24.8         | 44.3                  | 90.9           | 84.7        | 80.4        |

<sup>d</sup>Fields in which any combination of sorghum, millet, or Niadi is predominant.

<sup>b</sup>All weights are in terms of the threshed, hulled, or shelled equivalents for each crop. Yields are calculated without respect to actual crop presence. For example, a cowpea yield of 53 Kgs per hectare represents the average contribution of cowpea to the grain production enterprise, taking into account that cowpea is not always included in this enterprise. While this understates the potential yield of cowpea as an enterprise itself, it correctly measures its average importance to grain production.

<sup>c</sup>Yield estimates for primary crops represent the average of two alternative harvest estimation methods: end of season recall and field off-take. Yields for secondary crops are estimated by the field off-take method only. Other crops occasionally occur in grain fields but typically as subplots or border delimiters rather than in a true mixture with grain.

<sup>d</sup>Mainly by corralling small ruminants or cattle in a field.

<sup>e</sup>Mainly cotton fertilizer (18 - 35 - 0) applied at a average rate of only 19 Kgs/ha. in those fields fertilized.

TABLE 3.1 (Continued)

<sup>f</sup>W.E. hours = worker equivalent hours. The following conversion coefficients, based on the subjective evaluations of 72 representative men and women from the 12 sample zones, were used.

| <u>Worker Equivalent (WE) Conversion Coefficients</u> |                |                |              |
|-------------------------------------------------------|----------------|----------------|--------------|
| <u>Worker Category</u>                                | <u>Tillage</u> | <u>Harvest</u> | <u>Other</u> |
| 1. Males age 0-14                                     | 0.31           | 0.86           | 0.96         |
| 2. Females age 0-14                                   | 0.71           | 0.91           | 0.88         |
| 3. Males age 15-54                                    | 1.00           | 1.00           | 1.00         |
| 4. Females age 15-54                                  | 0.86           | 1.04           | 0.97         |
| 5. Males age 55+                                      | 0.58           | 0.59           | 0.59         |
| 6. Females age 55+                                    | 0.46           | 0.61           | 0.59         |

<sup>g</sup>Based on the end of season recall estimation method only.

<sup>h</sup>All values are in FCFA. The average 1978 exchange rate was approximately 220 FCFA = \$1.00.

<sup>i</sup>Prices used represent the weighted average selling price realized by sample households during the 1978-79 survey period per Kg. of threshed, shelled, or hulled crop equivalent, as shown below:

| <u>Crop</u>  | <u>Price/Kg</u> |
|--------------|-----------------|
| Sorghum      | 45.5            |
| Millet       | 45.5            |
| Niadi        | 45.5            |
| Maize        | 39.6            |
| Groundnuts   | 68.9            |
| Bambara Nuts | 59.0            |
| Cowpeas      | 73.2            |
| Soybeans     | 72.4            |
| Sesame       | 57.6            |
| Cotton       | 67.4            |
| Rice         | 90.2            |

<sup>j</sup>Value of seed for primary crops plus major secondary crops only.

<sup>k</sup>Due to data errors for this zone, the sample mean value (for either Hoe or ANTRAC) was used.

<sup>l</sup>Due to data errors for this zone, the regional mean value was used.

<sup>m</sup>x = data unreliable due to a small number of valid observations.

<sup>n</sup>Corrected for seeding rate data errors noted above.

<sup>o</sup>Organic fertilizer not valued. The average application of fertilizer (18 - 35 - 0) on fields where it is used is only 19.0 Kgs/ha. for sorghum/millet fields (versus 50.3 Kgs/ha. for cotton and 25.9 Kgs/ha. for all other crops). Fertilizer was priced at 35 FCFA/kg. Prices per Kg for other chemical inputs are: fungicide ("Thloral") at 1400 FCFA; HCH ("acracide") and silo fumigant ("Gamagran") at 235 FCFA; and cotton insecticide at 340 FCFA. To show the relative importance of these inputs of the "Hoe" sample mean of 81.5 FCFA for such inputs, 1.3 FCFA was for chemical fertilizer, 74.2 FCFA for fungicide, and only 6.0 FCFA for all other chemicals.

TABLE 3.1 (Continued)

<sup>P</sup>Due to lack of labor data during May and June 1978, sample mean values are used.

<sup>Q</sup>Approximately 90% of non family labor is "invitation" (festive work party) labor to which payment is the food and beer consumed on the spot.

<sup>R</sup>Valued at the average hourly rate of 31.6 FCFA that was paid to field wage labor in both samples.

<sup>S</sup>Represent total household value allocated to each crop enterprise proportionally to plowed acreage. Average values for oxen zones and donkey zones are used (See Barrett et. al., Table 5.2).

<sup>T</sup>Represents total household depreciation allocated to each crop enterprise proportionally to the allocation of labor.

<sup>U</sup>Animal depreciation (or appreciation) is not included.

<sup>V</sup>Total value of output less variable costs.

<sup>W</sup>Total value of output less both variable and fixed costs.

<sup>X</sup>Lantaoyc only.

By all performance measures - gross margin<sup>1/</sup> per hectare, net margin<sup>2/</sup> per hectare, and net margin per hour of family labor - the returns to sorghum/millet production are low. Returns per hour average only 39.4 FCFA for hoe farmers and only 36.0 FCFA for ANTRAC farmers.<sup>3/</sup> In addition, these returns vary greatly across zones, primarily due to the high variability of yields.

### 3.3 Maize

Table 3.2 presents the maize enterprise budget. Maize is grown primarily to provide an early grain harvest during the "hungry period" in early September when food stocks are short. Typically, maize occupies the richer, more fertilized soils surrounding the compound. Soil fertility is maintained by organic manure. Table 3.2 shows that the returns to land (net margin per hectare) are higher for maize than for sorghum/millet. Returns to labor are higher as well in the ANTRAC sample but lower for hoe farmers. Across zones, the returns to labor are quite variable. Although returns to maize are high, the area planted is small and most of the production is consumed at harvest.

### 3.4 Groundnuts

Although groundnut production is commercially important in the EORD, Table 3.3 reveals that the returns to both land and labor were quite low in 1978. Because groundnuts are typically grown on poorer soils and fertilizer use (both organic and chemical) is so insignificant, yields are poor.

---

<sup>1/</sup>Value of output less variable costs.

<sup>2/</sup>Value of output less both variable and fixed costs.

<sup>3/</sup>These exceed the rural agricultural wage rate of 31.6 FCFA/hour, however rural wage labor opportunities are so uncommon that few farmers could consider wage labor as a viable alternative to farming.

TABLE 3.2  
CROP ENTERPRISE BUDGETS FOR MAIZE FIELDS  
(in units per hectare)

|                                                  | All<br>Hoe<br>Zones | All<br>AN-<br>TRAC<br>Zones | Bo-<br>gande<br>Hoe | Mani<br>Hoe | Piela<br>Hoe      | AN-<br>TRAC      | Diabo<br>Hoe       | AN-<br>TRAC      | Logobou<br>Hoe | AN-<br>TRAC      | Par-<br>tiaga<br>Hoe | Yonde<br>Hoe      | Diapangou<br>Hoe | AN-<br>TRAC | Botou<br>Hoe | Kant-<br>chari<br>Hoe | Ougarou<br>Hoe | AN-<br>TRAC | Pama<br>Hoe      |
|--------------------------------------------------|---------------------|-----------------------------|---------------------|-------------|-------------------|------------------|--------------------|------------------|----------------|------------------|----------------------|-------------------|------------------|-------------|--------------|-----------------------|----------------|-------------|------------------|
| <b>Yields (Kgs/ha.)<sup>a</sup></b>              |                     |                             |                     |             |                   |                  |                    |                  |                |                  |                      |                   |                  |             |              |                       |                |             |                  |
| Primary Crop:                                    |                     |                             |                     |             |                   |                  |                    |                  |                |                  |                      |                   |                  |             |              |                       |                |             |                  |
| Maize                                            | 588                 | 727                         | 420                 | 963         | 123               | 124              | 1539 <sup>c</sup>  | 884              | 940            | 1189             | 451                  | 842               | 1135             | 1306        | 910          | 255                   | 412            | 679         | 806              |
| Major Secondary Crops                            |                     |                             |                     |             |                   |                  |                    |                  |                |                  |                      |                   |                  |             |              |                       |                |             |                  |
| Sorghum/Millet                                   | 224                 | 298                         | 21                  | 24          | 39                | 50               | 32 <sup>c</sup>    | 44               | 313            | 43               | 520                  | 90                | 199              | 327         | 3            | 273                   | 123            | 759         | 429              |
| Tobacco                                          | 83                  | 9                           | 0                   | 74          | 10                | 10               | 82 <sup>c</sup>    | 17               | 1120           | 23               | 4                    | 0                 | 19               | 0           | 1            | 32                    | 6              | 0           | 14               |
| Rice                                             | 21                  | 0                           | 0                   | 0           | 0                 | 0                | 0                  | 0                | 146            | 0                | 57                   | 0                 | 0                | 0           | 0            | 0                     | 0              | 0           | 40               |
| <b>Input Use</b>                                 |                     |                             |                     |             |                   |                  |                    |                  |                |                  |                      |                   |                  |             |              |                       |                |             |                  |
| Maize seed rate<br>(Kgs/ha.)                     | 22.3                | 20.0                        | 9.8                 | 26.8        | 28.5              | 15.1             | 58.5               | 20.7             | 27.5           | 37.0             | 12.8                 | 27.7              | 20.3             | 31.3        | 38.6         | 5.5                   | 32.6           | 14.4        | 52.6             |
| % of maize seed treated                          | 9.9                 | 45.1                        | 0                   | 20.7        | 0                 | 0                | 0                  | 15.0             | 5.0            | 0                | 2.1                  | 0                 | 7.6              | 13.4        | 4.0          | 0                     | 49.9           | 99.1        | 0                |
| % of area fertilized<br>organically <sup>b</sup> | 76.6                | 37.9                        | 88.0                | 46.5        | 67.3              | 43.2             | 47.3               | 34.4             | 76.4           | 29.6             | 85.7                 | 100.1             | 58.1             | 46.5        | 92.5         | 64.3                  | 95.7           | 37.4        | 57.9             |
| % of area fertilized<br>chemically               | 1.5                 | 2.0                         | 0                   | 0           | 0                 | 0                | 0                  | 0                | 0              | 0                | 1.8                  | 0                 | 0                | 0           | 0            | 0                     | 0              | 5.4         | 0                |
| Family Labor (W.E.<br>hours/ha.)                 | 1100                | 579                         | 1724                | 631         | 1100 <sup>e</sup> | 579 <sup>e</sup> | 687                | 316 <sup>f</sup> | 1321           | 747 <sup>c</sup> | 779                  | 1429 <sup>c</sup> | 843 <sup>c</sup> | 769         | 1490         | 1380                  | 580            | 570         | 973 <sup>c</sup> |
| Non family labor (W.E.<br>hours/ha.)             | 47                  | 10                          | 0                   | 128         | 47 <sup>e</sup>   | 10 <sup>e</sup>  | 0                  | 5 <sup>f</sup>   | 10             | 104 <sup>c</sup> | 84                   | 0 <sup>c</sup>    | 0 <sup>c</sup>   | 4           | 37           | 6                     | 117            | 0           | 0 <sup>c</sup>   |
| TOTAL labor                                      | 1147                | 589                         | 1724                | 759         | 1147 <sup>e</sup> | 589 <sup>e</sup> | 687                | 321 <sup>f</sup> | 1331           | 851 <sup>c</sup> | 863                  | 1429 <sup>c</sup> | 843 <sup>c</sup> | 773         | 1527         | 1386                  | 697            | 570         | 973 <sup>c</sup> |
| <b>Value of Output</b>                           |                     |                             |                     |             |                   |                  |                    |                  |                |                  |                      |                   |                  |             |              |                       |                |             |                  |
| Maize                                            | 23285               | 31561                       | 16632               | 38135       | 4871              | 4910             | 60944 <sup>c</sup> | 35006            | 37224          | 47084            | 17860                | 33343             | 44946            | 51718       | 36036        | 10098                 | 16315          | 26888       | 31918            |
| Major Secondary Crops <sup>d</sup>               | 12087               | 13570                       | 936                 | 1108        | 1753              | 2291             | 2011 <sup>c</sup>  | 1457             | 14253          | 1971             | 36905                | 9231              | 9047             | 14892       | 158          | 12452                 | 5585           | 34549       | 23137            |
| Minor Secondary Crops                            | 1364                | 825                         | 4559                | 2327        | 844               | 0                | 1690 <sup>c</sup>  | 0                | 566            | 47               | 1218                 | 0                 | 0                | 0           | 1214         | 282                   | 1014           | 762         | 3116             |
| SUBTOTAL                                         | 36736               | 45956                       | 22127               | 41570       | 7468              | 7201             | 64645 <sup>c</sup> | 36463            | 52043          | 49102            | 55983                | 42574             | 53993            | 66610       | 37408        | 22832                 | 22914          | 62199       | 58171            |
| <b>Variable Costs</b>                            |                     |                             |                     |             |                   |                  |                    |                  |                |                  |                      |                   |                  |             |              |                       |                |             |                  |
| Seed                                             | 1483                | 1231                        | 519                 | 1074        | 1386              | 2579             | 2318               | 532              | 1249           | 1684             | 2735                 | 1095              | 803              | 1445        | 1529         | 220                   | 1293           | 910         | 2084             |
| Chemical inputs                                  | 63                  | 241                         | 0                   | 102         | 0                 | 0                | 0                  | 74               | 25             | 0                | 81                   | 0                 | 38               | 66          | 20           | 0                     | 247            | 540         | 0                |
| Non Household labor                              | 1486                | 316                         | 0                   | 4045        | 1485              | 316              | 0                  | 158              | 316            | 3286             | 2654                 | 0                 | 0                | 126         | 1169         | 190                   | 3697           | 0           | 0                |
| ANTRAC Expenses                                  | 0                   | 823                         | 0                   | 0           | 0                 | 770              | 5                  | 876              | 0              | 770              | 0                    | 0                 | 0                | 770         | 0            | 0                     | 0              | 876         | 0                |
| <b>Fixed Costs</b>                               |                     |                             |                     |             |                   |                  |                    |                  |                |                  |                      |                   |                  |             |              |                       |                |             |                  |
| Depreciation and repairs<br>on tools             | 679                 | 397                         | 803                 | 428         | 679 <sup>e</sup>  | 397 <sup>e</sup> | 563                | 244              | 776            | 553              | 695                  | 772               | 709              | 561         | 748          | 774                   | 428            | 359         | 505              |
| Depreciation and repairs<br>on ANTRAC equipment  | 0                   | 1231                        | 0                   | 0           | 0                 | 1164             | 0                  | 1298             | 0              | 1164             | 0                    | 0                 | 0                | 1164        | 0            | 0                     | 0              | 1298        | 0                |

Table 3.2 (Continued)

|                                             | All<br>Hoe<br>Zones | All<br>AN-<br>TRAC<br>Zones | Bo-<br>gande<br>Hoe | Mani<br>Hoe | Piela<br>Hoe | AN-<br>TRAC | Diabo<br>Hoe | AN-<br>TRAC | Loqobou<br>Hoe | AN-<br>TRAC | Par-<br>tiaga<br>Hoe | Yonde<br>Hoe | Diapangou<br>Hoe | AN-<br>TRAC | Botou<br>Hoe | Kant-<br>chari<br>Hoe | Ougarou<br>Hoe | AN-<br>TRAC | Pama<br>Hoe |
|---------------------------------------------|---------------------|-----------------------------|---------------------|-------------|--------------|-------------|--------------|-------------|----------------|-------------|----------------------|--------------|------------------|-------------|--------------|-----------------------|----------------|-------------|-------------|
| <b>Performance Measures</b>                 |                     |                             |                     |             |              |             |              |             |                |             |                      |              |                  |             |              |                       |                |             |             |
| Net Margin per hectare                      | 33025               | 41717                       | 20805               | 35921       | 3918         | 1975        | 61764        | 32861       | 49677          | 41645       | 49818                | 40707        | 52443            | 62478       | 33942        | 21648                 | 17249          | 58216       | 55582       |
| Net Margin per H.E.<br>hour of family labor | 30.0                | 72.1                        | 12.1                | 56.9        | 3.6          | 3.4         | 89.9         | 104.0       | 37.6           | 55.7        | 64.0                 | 28.5         | 62.2             | 81.2        | 22.8         | 15.7                  | 29.7           | 102.1       | 57.1        |

<sup>d</sup>See footnotes b and c, Table 3.1.

<sup>b</sup>Mainly the manual application of animal manure and compound wastes.

<sup>c</sup>Based on less than 1 hectare of cropped area.

<sup>d</sup>Tobacco is not valued since most production is consumed directly within the household.

<sup>e</sup>See footnote p, Table 3.1.

<sup>f</sup>Lantaogo only.

TABLE 3.3  
CROP ENTERPRISE BUDGETS BY ZONE<sup>a</sup> FOR GROUNDNUTS  
(In units per hectare)

|                                                 | All<br>Hoe<br>Zones | All<br>AN-<br>TRAC<br>Zones | Bo-<br>gande<br>Hoe | Mani<br>Hoe | Piela<br>Hoe      | AN-<br>TRAC       | Dialo<br>Hoe | AN-<br>TRAC      | Logobou<br>Hoe | AN-<br>TRAC | Par-<br>tlaga<br>Hoe | Yonde<br>Hoe | Diapangou<br>ANTRAC | Botou<br>Hoe | Ougarou<br>Hoe    | ANTRAC | Pama<br>Hoe |
|-------------------------------------------------|---------------------|-----------------------------|---------------------|-------------|-------------------|-------------------|--------------|------------------|----------------|-------------|----------------------|--------------|---------------------|--------------|-------------------|--------|-------------|
| <b>Yields (Kgs/ha.)<sup>b</sup></b>             |                     |                             |                     |             |                   |                   |              |                  |                |             |                      |              |                     |              |                   |        |             |
| Primary Crop:<br>Groundnuts                     | 287                 | 299                         | 289                 | 407         | 328               | 203               | 78           | 237              | 359            | 351         | 192                  | 180          | 466                 | 199          | 440 <sup>c</sup>  | 1079   | 362         |
| Major Secondary Crop:<br>Sorghum/Millet         | 21                  | 2                           | 4                   | 0           | 0                 | 0                 | 0            | 1                | 34             | 8           | 12                   | 1            | 0                   | 0            | 0                 | 0      | 0           |
| <b>Input Use</b>                                |                     |                             |                     |             |                   |                   |              |                  |                |             |                      |              |                     |              |                   |        |             |
| Groundnut seed rate<br>(Kgs/ha.)                | 21.6                | 18.0                        | 8.0                 | 21.4        | 45.3              | 10.8              | 21.4         | 21.0             | 13.5           | 24.0        | 21.3                 | 5.3          | 15.9                | 23.5         | X                 | 9.3    | 16.6        |
| % of seed treated                               | 14.9                | 25.3                        | 0                   | 20.2        | 11.8              | 11.7              | 0            | 18.3             | 25.3           | 45.8        | 3.7                  | 41.9         | 17.3                | 5.2          | 0                 | 73.8   | 29.8        |
| % of area fertilized<br>organically             | 4.5                 | 1.4                         | 0                   | 0           | 0                 | 0                 | 15.4         | 3.5              | 0              | 0           | 2.9                  | 3.7          | 0                   | 0            | 72.5              | 0      | 27.8        |
| % of area fertilized<br>chemically              | 0                   | 0                           | 0                   | 0           | 0                 | 0                 | 0            | 0                | 0              | 0           | 0                    | 0            | 0                   | 0            | 0                 | 0      | 0           |
| Family labor (W.E.<br>hours/ha.)                | 930                 | 684                         | 1388                | 1195        | 930 <sup>e</sup>  | 684 <sup>e</sup>  | 516          | 736 <sup>f</sup> | 855            | 668         | 782                  | 731          | 586                 | 891          | 930 <sup>d</sup>  | 822    | 405         |
| Non family labor<br>(W.E. hours/ha.)            | 147                 | 179                         | 117                 | 138         | 147 <sup>e</sup>  | 179 <sup>e</sup>  | 84           | 119 <sup>f</sup> | 268            | 309         | 68                   | 133          | 188                 | 193          | 147 <sup>d</sup>  | 28     | 0           |
| TOTAL labor (W.E.<br>hours/ha.)                 | 1077                | 862                         | 1505                | 1333        | 1077 <sup>e</sup> | 862 <sup>e</sup>  | 600          | 854 <sup>f</sup> | 1123           | 977         | 850 <sup>c</sup>     | 864          | 774                 | 1084         | 1077 <sup>d</sup> | 850    | 405         |
| <b>Value of Output</b>                          |                     |                             |                     |             |                   |                   |              |                  |                |             |                      |              |                     |              |                   |        |             |
| Groundnuts                                      | 19774               | 20601                       | 19912               | 28042       | 22599             | 13987             | 5374         | 16329            | 24735          | 24184       | 13229                | 12402        | 32107               | 13711        | 30316             | 74343  | 24942       |
| Sorghum/Millet                                  | 962                 | 77                          | 166                 | 0           | 0                 | 0                 | 0            | 52               | 3844           | 382         | 538                  | 64           | 0                   | 0            | 0                 | 0      | 0           |
| Minor Secondary Crops                           | 666                 | 169                         | 25                  | 662         | 0                 | 0                 | 34           | 0                | 28             | 0           | 5244                 | 2541         | 1407                | 502          | 0                 | 0      | 74          |
| SUBTOTAL                                        | 21402               | 20847                       | 20103               | 28704       | 22599             | 13987             | 5408         | 16381            | 28607          | 24784       | 19011                | 15007        | 33514               | 14213        | 30316             | 74343  | 25016       |
| <b>Variable Costs</b>                           |                     |                             |                     |             |                   |                   |              |                  |                |             |                      |              |                     |              |                   |        |             |
| Seed                                            | 1522                | 1278                        | 605                 | 2166        | 3161              | 790               | 1477         | 1524             | 944            | 1655        | 1579                 | 470          | 1098                | 1619         | 1522 <sup>d</sup> | 641    | 1148        |
| Chemical Inputs                                 | 74                  | 125                         | 0                   | 100         | 58                | 58                | 0            | 91               | 125            | 227         | 18                   | 207          | 86                  | 26           | 0                 | 365    | 148         |
| Non household labor                             | 4645                | 5656                        | 3697                | 4361        | 4645              | 5656 <sup>e</sup> | 2654         | 3760             | 8469           | 9764        | 2149                 | 4203         | 5941                | 6099         | 4645              | 885    | 0           |
| ANTRAC Expenses                                 | 0                   | 983                         | 0                   | 0           | 0                 | 930               | 0            | 1046             | 0              | 930         | 0                    | 0            | 930                 | 0            | 0                 | 1046   | 0           |
| <b>Fixed Costs</b>                              |                     |                             |                     |             |                   |                   |              |                  |                |             |                      |              |                     |              |                   |        |             |
| Depreciation and Re-<br>pairs on tools          | 638                 | 624                         | 701                 | 752         | 638 <sup>e</sup>  | 624 <sup>e</sup>  | 492          | 674              | 655            | 635         | 684                  | 467          | 624 <sup>d</sup>    | 531          | 638 <sup>d</sup>  | 536    | 210         |
| Depreciation and Repairs<br>on ANTRAC equipment | 0                   | 1471                        | 0                   | 0           | 0                 | 1391              | 0            | 1551             | 0              | 1391        | 0                    | 0            | 1391                | 0            | 0                 | 1551   | 0           |

TABLE 3.3 (Continued)

|                                           | All<br>Hoe<br>Zones | All<br>AN-<br>TRAC<br>Zones | Bo-<br>gande<br>Hoe | Mani<br>Hoe | Piela<br>Hoe | AN-<br>TRAC | Diabo<br>Hoe | AN-<br>TRAC | Logobou<br>Hoe | AN-<br>TRAC | Par-<br>tiaga<br>Hoe | Yonde<br>Hoe | Diapangou<br>ANTRAC | Botou<br>Hoe | Ougarou<br>Hoe | ANTRAC | Pama<br>Hoe |
|-------------------------------------------|---------------------|-----------------------------|---------------------|-------------|--------------|-------------|--------------|-------------|----------------|-------------|----------------------|--------------|---------------------|--------------|----------------|--------|-------------|
| <b>Performance Measures</b>               |                     |                             |                     |             |              |             |              |             |                |             |                      |              |                     |              |                |        |             |
| Net margin per hectare                    | 14523               | 10711                       | 15100               | 21325       | 14097        | 4538        | 785          | 7735        | 18414          | 9582        | 14581                | 9660         | 23444               | 5938         | 23511          | 69319  | 23510       |
| Net margin per W.E. hours of family labor | 15.6                | 15.7                        | 10.9                | 17.8        | 15.2         | 6.6         | 1.5          | 10.5        | 21.5           | 14.3        | 18.6                 | 13.2         | 40.0                | 6.7          | 25.3           | 84.3   | 58.0        |

<sup>a</sup>Presented only for zones in which valid data exists for at least 1 hectare of cultivated area. Diapangou (hoe) and Kantchari (hoe) are thus excluded.

<sup>b</sup>See footnotes b and o, Table 3.1.

<sup>c</sup>Based on less than 1 hectare of cropped area.

<sup>d</sup>Sample mean value used due to lack of sufficient data.

<sup>e</sup>See footnote p, Table 3.1.

<sup>f</sup>Lantaogo only.

Below normal rainfall in June and early July further contributed to reducing yields in 1978. Low yields are most marked in Piela and Diabo, the most important groundnut production zones in the EORD. Groundnuts employ more non-family labor than other enterprises. This plus high seed costs leads to substantially higher input costs than for other crops.

### 3.5 Soybeans

Soybeans are a minor crop in the EORD which was introduced during the seventies. The returns to soybean production, shown in Table 3.4, are similar to those of sorghum/millet, but these returns are highly variable across zones. Soybeans are used primarily for the local manufacture of soumbala, a fermented spice that typically was made from locust beans prior to the introduction of soybeans. As a result, soybeans represent a specialty crop for those farmers who participate in a soumbala manufacture and marketing system, which is profitable though limited in size. The major constraint on the expansion of soybean production is the lack of a reliable alternative market at remunerative prices.

### 3.6 Cotton

The cotton enterprise, as described in Table 3.5, represents the traditional system of producing cotton for off-season weaving by family members but not for direct sale. The traditional system is based on low input use. Cotton is late seeded and receives little maintenance. Consequently, both yields and returns are extremely low by West African standards. No 1978 sample farmers participated in an intensive CFDT cotton production program such as that found in the Diapaga region.

TABLE 3.4  
CROP ENTERPRISE BUDGETS BY ZONE<sup>a</sup> FOR SOYBEANS  
(in units per hectare)

|                                              | All<br>Hoe<br>Zones | All<br>ANTRAC<br>Zones | Diabo<br>ANTRAC  | Logo-<br>bou<br>ANTRAC | Par-<br>tiaga<br>Hoe | Dia-<br>pangou<br>ANTRAC | Ouga-<br>rou<br>ANTRAC | Pama<br>Hoe |
|----------------------------------------------|---------------------|------------------------|------------------|------------------------|----------------------|--------------------------|------------------------|-------------|
| <b>Yields (Kgs/ha.)<sup>b</sup></b>          |                     |                        |                  |                        |                      |                          |                        |             |
| Primary Crop:                                |                     |                        |                  |                        |                      |                          |                        |             |
| Soybeans                                     | 378                 | 437                    | 329              | 42                     | 238                  | 843                      | 571                    | 527         |
| Major Secondary Crops:                       |                     |                        |                  |                        |                      |                          |                        |             |
| Sorghum/Millet                               | 57                  | 0                      | 0                | 0                      | 16                   | 0                        | 0                      | 126         |
| Groundnuts                                   | 16                  | 5                      | 10               | 0                      | 68                   | 0                        | 0                      | 0           |
| <b>Input Use</b>                             |                     |                        |                  |                        |                      |                          |                        |             |
| Seed rate (Kgs/ha.)                          | 70.5                | 17.6                   | 13.9             | 43.0                   | 78.8                 | 24.0                     | 10.8                   | 69.9        |
| % seed treated                               | 20.7                | 62.7                   | 75.0             | 7.0                    | 0                    | 33.3                     | 80.2                   | 47.2        |
| % area fertilized organically                | 39.2                | 5.7                    | 0                | 43.7                   | 0                    | 0                        | 2.3                    | 60.7        |
| % area fertilized chemically                 | 0                   | 1.1                    | 2.9              | 0                      | 0                    | 0                        | 0                      | 0           |
| Family labor (W.E. hours/ha.)                | 981                 | 389                    | 551 <sup>f</sup> | 338                    | 961                  | 357                      | 389                    | 1112        |
| Non family labor (W.E. hours/ha.)            | 94                  | 27                     | 20 <sup>f</sup>  | 101                    | 54                   | 18                       | 11                     | 134         |
| TOTAL labor                                  | 1075                | 416                    | 571 <sup>f</sup> | 439                    | 1015                 | 375                      | 400                    | 1246        |
| <b>Value of Output</b>                       |                     |                        |                  |                        |                      |                          |                        |             |
| Primary Crops                                | 27367               | 31639                  | 23820            | 3041                   | 17231                | 61033                    | 41340                  | 38155       |
| Major Secondary Crops                        | 3739                | 332                    | 693              | 0                      | 5403                 | 0                        | 0                      | 5722        |
| Minor Secondary Crops                        | 1066                | 14                     | 0                | 0                      | 456                  | 0                        | 54                     | 2247        |
| S TOTAL                                      | 32172               | 31985                  | 24513            | 3041                   | 23090                | 61033                    | 41394                  | 46124       |
| <b>Variable Costs</b>                        |                     |                        |                  |                        |                      |                          |                        |             |
| Seed                                         | 5129                | 1280                   | 1007             | 3137                   | 5702                 | 1736                     | 784                    | 6115        |
| Chemical Inputs                              | 103                 | 320                    | 398              | 35                     | 0                    | 165                      | 397                    | 234         |
| Non-household labor                          | 2970                | 853                    | 632              | 3192                   | 1706                 | 569                      | 348                    | 4234        |
| ANTRAC expenses                              | 0                   | 1036                   | 1102             | 969                    | 0                    | 969                      | 1102                   | 0           |
| <b>Fixed Costs</b>                           |                     |                        |                  |                        |                      |                          |                        |             |
| Depreciation and repairs on tools            | 636                 | 330                    | 406              | 285                    | 208 <sup>c</sup>     | 272                      | 252                    | 647         |
| Depreciation and repairs on ANTRAC equipment | 0                   | 1549                   | 1633             | 1464                   | 0                    | 1464                     | 1633                   | 0           |
| <b>Performance Measures</b>                  |                     |                        |                  |                        |                      |                          |                        |             |
| Net margins per hectare                      | 23334               | 26613                  | 19335            | -6041                  | 15474                | 55858                    | 36878                  | 34894       |
| Net margins per W.E. hours of family labor   | 23.8                | 68.4                   | 35.1             | -17.9                  | 16.1                 | 156.5                    | 94.8                   | 31.4        |

<sup>a</sup>Presented only for zones in which valid yield data exists for at least 1 hectare of cultivated area.

<sup>b</sup>See footnotes b and o, Table 3.1.

<sup>c</sup>Based on less than 1 hectare of cropped area.

<sup>d</sup>Sample mean value used due to lack of sufficient data.

<sup>e</sup>See footnote p, Table 3.1.

<sup>f</sup>Lantaogo only.

TABLE 3.5  
CROP ENTERPRISE BUDGETS BY ZONE<sup>a</sup> FOR COTTON  
(in units per hectare)

|                                              | All<br>Hoe<br>Zones | All<br>ANTRAC<br>Zones | Diabo<br>ANTRAC   | Logobou<br>Hoe   | Logobou<br>ANTRAC | Botou<br>Hoe      | Kant-<br>chari<br>Hoe | Pama<br>Hoe |
|----------------------------------------------|---------------------|------------------------|-------------------|------------------|-------------------|-------------------|-----------------------|-------------|
| <u>Yields (Kgs/ha.)<sup>b</sup></u>          |                     |                        |                   |                  |                   |                   |                       |             |
| Primary Crop:                                |                     |                        |                   |                  |                   |                   |                       |             |
| Cotton                                       | 145                 | 203                    | 236               | 70               | 103               | 288               | 230                   | 122         |
| <u>Input Use</u>                             |                     |                        |                   |                  |                   |                   |                       |             |
| Seed rate (Kgs/ha.)                          | 9.5                 | 10.7                   | 10.9              | 10.4             | X                 | 8.6               | 6.1                   | 11.3        |
| % seed treated                               | 68.7                | 79.3                   | 80.0              | 25.4             | X                 | 64.5              | 0                     | 100.0       |
| % area fertilized organically                | 18.6                | 1.3                    | 0                 | 25.4             | X                 | 0                 | 0                     | 24.7        |
| % area fertilized chemically                 | 0                   | 37.4                   | 38.6              | 0                | X                 | 0                 | 0                     | 0           |
| Family labor (W.E. hours/ha.)                | 885                 | 709                    | 717 <sup>f</sup>  | 1390             | 709 <sup>d</sup>  | 1405 <sup>c</sup> | 655 <sup>c</sup>      | 964         |
| Non family labor (W.E. hours/ha.)            | 55                  | 66                     | 68 <sup>f</sup>   | 125              | 66 <sup>d</sup>   | 43 <sup>c</sup>   | 0 <sup>c</sup>        | 80          |
| TOTAL labor                                  | 940                 | 775                    | 785 <sup>f</sup>  | 1515             | 785 <sup>d</sup>  | 1448 <sup>c</sup> | 655 <sup>c</sup>      | 1044        |
| <u>Value of Output</u>                       |                     |                        |                   |                  |                   |                   |                       |             |
| Primary crop                                 | 9773                | 13682                  | 1590 <sup>e</sup> | 4718             | 6942              | 19411             | 15502                 | 8223        |
| All secondary crops                          | 394                 | 1026                   | 1362              | 2751             | 0                 | 0                 | 3101                  | 0           |
| SUBTOTAL                                     | 10167               | 14708                  | 17268             | 7469             | 6942              | 19411             | 18603                 | 8223        |
| <u>Variable Costs</u>                        |                     |                        |                   |                  |                   |                   |                       |             |
| Seed                                         | 639                 | 721                    | 732               | 702              | 721 <sup>c</sup>  | 581               | 418                   | 760         |
| Chemical inputs                              | 340                 | 1051                   | 1076              | 126              | 1051              | 319               | 0                     | 495         |
| Non-household labor                          | 1738                | 2086                   | 2149              | 3950             | 2086              | 1359              | 0                     | 2528        |
| ANTRAC expenses                              | 0                   | 1124                   | 1180              | 0                | 1038              | 0                 | 0                     | 0           |
| <u>Fixed Costs</u>                           |                     |                        |                   |                  |                   |                   |                       |             |
| Depreciation and repairs in tools            | 556                 | 593                    | 712               | 556 <sup>d</sup> | 593 <sup>d</sup>  | 709 <sup>c</sup>  | 556 <sup>d</sup>      | 542         |
| Depreciation and repairs on ANTRAC equipment | 0                   | 1659                   | 1749              | 0                | 1569              | 0                 | 0                     | 0           |
| <u>Performance Measures</u>                  |                     |                        |                   |                  |                   |                   |                       |             |
| Net margins per hectare                      | 6894                | 7474                   | 9670              | 2135             | -116              | 16443             | 17629                 | 3898        |
| Net margins per W.E. hours of family labor   | 7.8                 | 10.5                   | 13.5              | 1.5              | -0.2              | 11.7              | 26.9                  | 4.0         |

<sup>a</sup>Presented only for zones in which valid yield data exists for at least one hectare of cultivated area.

<sup>b</sup>See footnotes b and o, Table 3.1.

<sup>c</sup>Based on less than one hectare of cropped area.

<sup>d</sup>Sample mean values used due to lack of sufficient data.

<sup>e</sup>See footnote p, Table 3.1.

<sup>f</sup>Lantaogo only.

### 3.7 Rice

The rice production enterprise, presented in Table 3.6, provided the highest returns of all crops in 1978. Due to the high value and yield of rice, the returns per hectare were quite high for both the hoe and ANTRAC samples. Despite the high labor requirement, the returns to labor were over twice those of sorghum/millet production. These results were quite variable across zones, primarily because of rainfall patterns. Due to low rainfall, low returns were experienced in Logobou, where rice is important commercially.

EORD rice production in 1978 was based almost entirely on rainfed rice grown on bas-fond land where rainfall run-off accumulates.<sup>1/</sup> This production system incurs minimal costs except for seed. Though it requires special bas-fond land, Weldring [1979] has shown that only a small proportion of such land was cultivated in 1978. Expansion of this rice production system would not be difficult technically. The major constraint on rice production is the lack of an outside market since the local demand for rice is extremely small. Due to problems of transport and milling, EORD rice could not compete with imported rice on the Ouagadougou or Niamey markets in 1978.

---

<sup>1/</sup>The economics of various EORD rice production systems for the 1980 season is currently being studied by Pascal Fotzo of Michigan State University under Contract AID/afr-C-1314.

TABLE 3.6  
CROP ENTERPRISE BUDGETS BY ZONE<sup>a</sup> FOR RICE  
(units per hectare)

|                                              | All<br>Hoe<br>Zones | All<br>ANTRAC<br>Zones | Piela<br>Hoe      | Diabo<br>Hoe       | Diabo<br>ANTRAC | Logobou<br>Hoe    | Logobou<br>ANTRAC | Par-<br>tiaga<br>Hoe | Dia-<br>pangou<br>ANTRAC | Ougarou<br>Hoe    | Ougarou<br>ANTRAC | Pama<br>Hoe |
|----------------------------------------------|---------------------|------------------------|-------------------|--------------------|-----------------|-------------------|-------------------|----------------------|--------------------------|-------------------|-------------------|-------------|
| <b>Yields (Kgs/ha.)<sup>b</sup></b>          |                     |                        |                   |                    |                 |                   |                   |                      |                          |                   |                   |             |
| Primary Crop:                                |                     |                        |                   |                    |                 |                   |                   |                      |                          |                   |                   |             |
| Rice                                         | 982                 | 717                    | 268 <sup>c</sup>  | 379 <sup>d</sup>   | 563             | 401               | 212               | 1597                 | 220                      | 923 <sup>d</sup>  | 1063              | 1649        |
| Major Secondary Crop:                        |                     |                        |                   |                    |                 |                   |                   |                      |                          |                   |                   |             |
| Sorghum/Millet                               | 13                  | 4                      | 0                 | 0                  | 6               | 0                 | 0                 | 9                    | 0                        | 29                | 4                 | 37          |
| Maize                                        | 64                  | 4                      | 0                 | 0                  | 0               | 0                 | 0                 | 123                  | 0                        | 0                 | 13                | 0           |
| <b>Input Use</b>                             |                     |                        |                   |                    |                 |                   |                   |                      |                          |                   |                   |             |
| Seed rate (Kgs/ha.)                          | 58.9 <sup>g</sup>   | 30.3                   | 53.7              | 91.9               | 24.3            | 58.9 <sup>e</sup> | 30.3              | 66.4                 | X                        | 58.1              | 37.3              | 51.0        |
| % seed treated                               | 27.0                | 25.6                   | 0                 | 0                  | 35.4            | 25.9              | 1.2               | 0                    | X                        | 3.7               | 33.2              | 71.4        |
| % area fertilized organically                | 3.2                 | 1.9                    | 0                 | 0                  | 0               | 0                 | 0                 | 0                    | 0                        | 45.8              | 1.7               | 0           |
| % area fertilized chemically                 | 0                   | 0                      | 0                 | 0                  | 0               | 0                 | 0                 | 0                    | 0                        | 0                 | 0                 | 0           |
| Family labor (W.E. hours/ha.)                | 1232                | 771                    | 1232 <sup>h</sup> | 1100 <sup>d</sup>  | 480             | 931               | 607               | 1173                 | 771 <sup>e</sup>         | 1232 <sup>e</sup> | 1278              | 1433        |
| Non family labor (W.E. hours/ha.)            | 82                  | 6                      | 82 <sup>h</sup>   | 0 <sup>d</sup>     | 4               | 19                | 6                 | 307                  | 6 <sup>e</sup>           | 82 <sup>e</sup>   | 9                 | 0           |
| TOTAL labor                                  | 1314                | 777                    | 1314 <sup>h</sup> | 1100 <sup>d</sup>  | 484             | 950               | 613               | 1480                 | 777 <sup>e</sup>         | 1314 <sup>e</sup> | 1287              | 1433        |
| <b>Value of Output</b>                       |                     |                        |                   |                    |                 |                   |                   |                      |                          |                   |                   |             |
| Primary Crop                                 | 88576               | 64673                  | 24174             | 34186 <sup>d</sup> | 50783           | 36170             | 19122             | 144049               | 19844                    | 83255             | 95883             | 148740      |
| Major Secondary Crops                        | 3127                | 166                    | 0                 | 0                  | 289             | 0                 | 0                 | 5299                 | 0                        | 11355             | 169               | 5958        |
| Minor Secondary Crops                        | 254                 | 0                      | 805               | 0                  | 0               | 0                 | 0                 | 0                    | 0                        | 0                 | 0                 | 952         |
| SUBTOTAL                                     | 91957               | 64839                  | 24979             | 34186 <sup>d</sup> | 51072           | 36170             | 19122             | 149348               | 19844                    | 94610             | 96052             | 155650      |
| <b>Variable Costs</b>                        |                     |                        |                   |                    |                 |                   |                   |                      |                          |                   |                   |             |
| Seed                                         | 5499 <sup>g</sup>   | 2735                   | 4841              | 8289               | 2190            | 5313 <sup>f</sup> | 2729              | 6032                 | 5944 <sup>e</sup>        | 6344              | 3366              | 4790        |
| Chemical inputs                              | 134                 | 127                    | 0                 | 0                  | 175             | 128               | 6                 | 0                    | 134 <sup>e</sup>         | 18                | 164               | 353         |
| Non-household labor                          | 2591                | 190                    | 2591              | 0                  | 126             | 600               | 190               | 9701                 | 190                      | 2591              | 284               | 0           |
| ANTRAC expenses                              | 0                   | 863                    | 0                 | 0                  | 918             | 0                 | 807               | 0                    | 807                      | 0                 | 918               | 0           |
| <b>Fixed Costs</b>                           |                     |                        |                   |                    |                 |                   |                   |                      |                          |                   |                   |             |
| Depreciation and Repairs on tools            | 778                 | 626                    | 778 <sup>e</sup>  | 901                | 464             | 554               | 399               | 1191                 | 626 <sup>e</sup>         | 778 <sup>e</sup>  | 812               | 744         |
| Depreciation and Repairs on ANTRAC equipment | 0                   | 1253                   | 0                 | 0                  | 1361            | 0                 | 1220              | 0                    | 1220                     | 0                 | 1361              | 0           |

TABLE 3.6 (Continued)

|                                              | All<br>Hoe<br>Zones | All<br>ANTRAC<br>Zones | Piela<br>Hoe | Diabo<br>Hoe | Diabo<br>ANTRAC | Logobou<br>Hoe | Logobou<br>ANTRAC | Par-<br>tiaga<br>Hoe | Dia-<br>pangou<br>ANTRAC | Ougarou<br>Hoe | Ougarou<br>ANTRAC | Pama<br>Hoe |
|----------------------------------------------|---------------------|------------------------|--------------|--------------|-----------------|----------------|-------------------|----------------------|--------------------------|----------------|-------------------|-------------|
| <u>Performance Measures</u>                  |                     |                        |              |              |                 |                |                   |                      |                          |                |                   |             |
| Net margin per hectare                       | 82955               | 59045                  | 16769        | 24996        | 45838           | 29573          | 13771             | 132434               | 10923                    | 84879          | 89147             | 149763      |
| Net margin per W.E. hours of<br>family labor | 67.3                | 76.6                   | 13.6         | 22.7         | 95.5            | 31.8           | 22.7              | 112.9                | 14.2                     | 68.9           | 69.8              | 104.5       |

<sup>d</sup>Presented only for zones in which valid yield data exists for at least 1 hectare of cultivated area.

<sup>b</sup>See footnotes b and o, Table 3.1.

<sup>c</sup>Based on end of season recall only.

<sup>d</sup>Based on less than 1 hectare of cultivated area.

<sup>e</sup>Sample mean value used due to lack of sufficient data.

<sup>f</sup>Corrected as noted in footnote e.

<sup>g</sup>Excluding Logobou due to data error.

<sup>h</sup>See footnote p, Table 3.1.

#### 4. SUMMARY AND CONCLUSIONS

This report provides 1978 technical and economic data for six crop enterprises for 12 hoe and 5 ANTRAC agroclimatic zones of the EORD. These data were collected in a farm level survey which interviewed 480 farmers throughout the 1978-79 agricultural year. The purpose of the report is to provide baseline data by which to design and evaluate future development interventions.

The report provides two levels of descriptive analysis. In Chapter 2, an overview of the 1978 season is provided to describe the major characteristics of EORD agriculture while providing an historical context for evaluating economic performance. Unfortunately little useful background data on yields, soils, or rainfall exist for the EORD. This represents a key data deficiency that needs to be rectified in the future in order to allow the ORD to monitor production trends and to identify the impact of development interventions.

The second level of analysis is based on detailed crop enterprise budgets that are provided for six crops for each survey zone. These budgets demonstrate the low productivity of agriculture in the EORD. The lowest productivity is found in cotton and groundnuts, both of which are crops that typically generate more substantial income elsewhere in West Africa. Maize and soybeans have slightly higher productivity. Maize provides little marketable surplus above consumption needs and soybean production is limited by the size of the soumbala market. Rice has the highest productivity but its production is seriously curtailed by the

lack of marketing outlets. Most striking of all is the low productivity of sorghum/millet production. Yields are both low and unstable due to variability in rainfall patterns. As the staple food crop, this low and unstable productivity explains why farmers must concentrate so heavily on sorghum/millet production.

Except for ANTRAC, strikingly few technical interventions were being designed or promoted for hve agriculture in the EORD in 1978. In order to increase agricultural productivity, the EORD needs to push aggressively on developing the bio-chemical half of an ANTRAC based technical package over the next ten years. Because farmers must now commit such a large proportion of their resources to staple food production, most technology development efforts should be aimed at sorghum and millet.

## BIBLIOGRAPHY

- Baker, D. and Lassiter, G. "Crop Production in the Eastern ORD," BAEP, ORD l'Est, August, 1980.
- Barrett, V.; Lassiter G.; Wilcock, D.; Baker, D.; and Crawford, E. "Animal Traction in Eastern Upper Volta: A Technical, Economic, and Institutional Analysis," Department of Agricultural Economics, Michigan State University, January, 1981.
- MSU Contract Team. "Six-Month Report: December 1977 - May 1978," 1978.
- ORD de l'Est. "Rapport Technique: Campagne 1978-79," BPA, ORD de l'Est, 1979.
- Swanson, R.A. "Gourmantche Agriculture, Part II: Cultivated Plant Resources and Field Management," Integrated Rural Development Project, Eastern ORD, Upper Volta, 1979.
- Weldring, J. "Synthese sur les Amenagements Hydro-Agricoles dans l'ORD de l'Est, Fada N'Gourma," Direction du Fonds de Developpement Rural, Ouagadougou, 1979.

AFRICAN RURAL EMPLOYMENT/ECONOMY PAPERS

- \*AREP No. 1 Derek Byerlee and Carl K. Eicher, "Rural Employment, Migration and Economic Development: Theoretical Issues and Empirical Evidence from Africa," 1972.
- AREP No. 2 Derek Byerlee, "Research on Migration in Africa: Past, Present and Future," 1972.
- AREP No. 3 Dunstan S.C. Spencer, "Micro-Level Farm Management and Production Economics Research Among Traditional African Farmers: Lessons from Sierra Leone," 1972.
- AREP No. 4 D.W. Norman, "Economic Analysis of Agricultural Production and Labour Utilization Among the Hausa in the North of Nigeria," 1973.
- AREP No. 5 Carl Liedholm, "Research on Employment in the Rural Non-farm Sector in Africa," 1973.
- \*AREP No. 6 Gordon Gemmill and Carl K. Eicher, "A Framework for Research on the Economics of Farm Mechanization in Developing Countries," 1973.
- AREP No. 7 Francis Sulemanu Idachaba, "The Effects of Taxes and Subsidies on Land and Labour Utilization in Nigerian Agriculture," 1973.
- \*AREP No. 8 D.W. Norman, "Methodology and Problems of Farm Management Investigations: Experiences from Northern Nigeria," 1973.
- AREP No. 9 Derek Byerlee, "Indirect Employment and Income Distribution Effects of Agricultural Development Strategies: A Simulation Approach Applied to Nigeria," 1973.
- \*AREP No. 10 Sunday M. Essang and Adewale F. Mabawonku, "Determinants and Impact of Rural-Urban Migration: A Case Study of Selected Communities in Western Nigeria," 1974.
- \*AREP No. 11 Enyinna Chuta and Carl Liedholm, "The Role of Small-Scale Industry in Employment Generation and Rural Development: Initial Research Results from Sierra Leone," 1975.
- AREP No. 12 Tesfai Teclé, "The Evolution of Alternative Rural Development Strategies in Ethiopia: Implications for Employment and Income Distribution," 1975.
- AREP No. 13 Derek Byerlee, Joseph L. Tommy and Habib Fatooh, "Rural-Urban Migration in Sierra Leone: Determinants and Policy Implications," 1976.
- AREP No. 14 Carl Liedholm and Enyinna Chuta, "The Economics of Rural and Urban Small-Scale Industries in Sierra Leone," 1976.
- AREP No. 15 Dunstan S.C. Spencer, Ibi I. May-Parker and Frank S. Rose, "Employment, Efficiency and Income in the Rice Processing Industry of Sierra Leone," 1976.
- AREP No. 16 Robert P. King and Derek Byerlee, "Income Distribution, Consumption Patterns and Consumption Linkages in Rural Sierra Leone," 1977.
- AREP No. 17 Adewale F. Mabawonku, "An Economic Evaluation of Apprenticeship Training in Western Nigerian Small-Scale Industry," 1979.
- \*AREP No. 18 Peter J. Matlon, "Income Distribution Among Farmers in Northern Nigeria: Empirical Results and Policy Implications," 1979.
- AREP No. 19 James E. Kocher, "Rural Development and Fertility Change in Tropical Africa: Evidence from Tanzania," 1979.
- +AREP No. 20 Christopher L. Delgado, "The Southern Fulani Farming System in Upper Volta: A Model for the Integration of Crop and Livestock Production in the West African Savannah," 1979.
- +AREP No. 21 David W. Norman, David H. Pryor and Christopher J.N. Gibbs, "Technical Change and the Small Farmer in Hausaland, Northern Nigeria," 1979.

+Also available in French.

\*English version out of print.

#French version out of print.

A limited number of the papers may be obtained free from the African Rural Economy Program, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan 48824, U.S.A.

AFRICAN RURAL EMPLOYMENT/ECONOMY PAPERS  
- CONTINUED -

AREP No. 22 John W. Hanson, "Is the School the Enemy of the Farm? The African Experience," 1980.

AREP No. 23 Gail Kostinko and Josue Dione, "An Annotated Bibliography of Rural Development in Senegal: 1975-1980," 1980.

AFRICAN RURAL EMPLOYMENT/ECONOMY WORKING PAPERS

- \*WP No. 1 "African Rural Employment Study: Progress Report and Plan of Work, 1972-1976," May 1974.
- \*WP No. 2 Dean Linsenmeyer, "An Economic Analysis of Maize Production in the Kasai Oriental Region of Zaire: A Research Proposal," May 1974.
- \*WP No. 3 Hartwig de Haen, Derek Byerlee and Dunstan S.C. Spencer, "Preliminary Formulations of Policy Models of the Sierra Leone Economy Emphasizing the Rural Sector," November 1974.
- \*WP No. 4 Enyinna Chuta and Carl Liedholm, "A Progress Report on Research on Rural Small-Scale Industry in Sierra Leone," November 1974.
- \*WP No. 5 "Plan of Work for the IDR/MSU Research Program in the Ada District of Ethiopia," November 1974.
- \*WP No. 6 William A. Ward, "Incorporating Employment into Agricultural Project Appraisal: A Preliminary Report," February 1975.
- +\*WP No. 7 Eric F. Tollens, "Problems of Micro-Economic Data Collection on Farms in Northern Zaire," June 1975.
- \*WP No. 8 "Annual Report for Period July 1, 1974 - June 30, 1975--Rural Employment in Tropical Africa: A Network Approach," 1975.
- \*WP No. 9 Carl K. Eicher, Merritt W. Sargent, Edouard K. Tapsoba and David C. Wilcock, "An Analysis of the Eastern ORD Rural Development Project in Upper Volta: Report of The M.S.U. Mission," January 1976.
- \*WP No. 10 Tom Zalla, "A Proposed Structure for the Medium-Term Credit Program in the Eastern ORD of Upper Volta," February 1976.
- \*WP No. 11 Dunstan S.C. Spencer, "African Women in Agricultural Development: A Case Study in Sierra Leone," April 1976.
- \*WP No. 12 Derek Byerlee, Joseph L. Tommy and Habib Fatooh, "Rural-Urban Migration in Sierra Leone: Determinants and Policy Implications," June 1976.
- \*WP No. 13 Dunstan S.C. Spencer, Ibi May-Parker and Frank S. Rose, "Employment Efficiency and Incomes in the Rice Processing Industry of Sierra Leone," June 1976.
- \*WP No. 14 Carl Liedholm and Enyinna Chuta, "An Economic Analysis of Small-Scale Industry in Sierra Leone," June 1976.
- \*WP No. 15 Dunstan S.C. Spencer and Derek Byerlee, "Technical Change, Labor Use and Small Farmer Development: Evidence from Sierra Leone," August 1976.
- \*WP No. 16 Mark D. Newman and David C. Wilcock, "Food Self-Sufficiency, Marketing and Reserves in the Sahel: A Working Bibliography," September 1976.
- +\*WP No. 17 Gretchen Walsh, "Access to Sources of Information on Agricultural Development in the Sahel," December 1976.
- \*WP No. 18 Dean A. Linsenmeyer, "Economic Analysis of Alternative Strategies for the Development of Sierra Leone Marine Fisheries," December 1976.
- \*WP No. 19 Dunstan S.C. Spencer and Derek Byerlee, "Small Farms in West Africa: A Descriptive Analysis of Employment, Incomes and Productivity in Sierra Leone," February 1977.
- +\*WP No. 20 Derek Byerlee, Carl K. Eicher, Carl Liedholm and Dunstan S.C. Spencer, "Rural Employment in Tropical Africa: Summary of Findings," February 1977.

+Also available in French.  
 \*English version out of print.  
 #French version out of print.

A limited number of the papers may be obtained free from the African Rural Economy Program, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan 48824, U.S.A.

AFRICAN RURAL EMPLOYMENT/ECONOMY WORKING PAPERS  
- CONTINUED -

- \*WP No. 21 Robert P. King, "An Analysis of Rural Consumption Patterns in Sierra Leone and Their Employment and Growth Effects," March 1977.
- +\*WP No. 22 Tom Zalla, Ray B. Diamond and Mohinder S. Mudahar, "Economic and Technical Aspects of Fertilizer Production and Use in West Africa," July 1977.
- \*WP No. 23 Mark D. Newman, "Changing Patterns of Food Consumption in Tropical Africa: A Working Bibliography," January 1978.
- \*WP No. 24 David C. Wilcock, "The Political Economy of Grain Marketing and Storage in the Sahel," February 1978.
- \*WP No. 25 Enyinna Chuta, "The Economics of the Gara (Tie-Dye) Cloth Industry in Sierra Leone," February 1978.
- \*WP No. 26 Derek Byerlee, Carl K. Eicher, Carl Liedholm and Dunstan S.C. Spencer, "Employment-Output Conflicts, Factor Price Distortions and Choice of Technique: Empirical Results from Sierra Leone," April 1979.
- \*WP No. 27 Dunstan S.C. Spencer, Derek Byerlee and Steven Franzel, "Annual Costs, Returns, and Seasonal Labor Requirements for Selected Farm and Non-farm Enterprises in Rural Sierra Leone," May 1979.
- #\*\*WP No. 28 Steven Franzel, "An Interim Evaluation of Two Agricultural Production Projects in Senegal: The Economics of Rainfed and Irrigated Agriculture," June 1979.
- \*WP No. 29 Peter Matlon, Thomas Eponou, Steven Franzel, Derek Byerlee and Doyle Baker, "Poor Rural Households, Technical Change, and Income Distribution in Developing Countries: Two Case Studies From West Africa," August 1979.
- WP No. 30 Enyinna Chuta, "Techniques of Production, Efficiency and Profitability in the Sierra Leone Clothing Industry," January 1980.
- WP No. 31 Jean Pierre Rigoulot, "An Analysis of Constraints on Expanding Rice Output in the Casamance Region of Senegal," August 1980.
- WP No. 32 Amadou D. Niane, "Supply and Demand of Millet and Sorghum in Senegal," September 1980.
- WP No. 33 Ibrahima Sene, "Farmers' Behavior Towards New Technology: The Senegalese Case," December 1980.
- +WP No. 34 Merritt W. Sargent, John A. Lichte, Peter J. Matlon and Roger Bloom, "An Assessment of Animal Traction in Francophone West Africa," March 1981.
- WP No. 35 Gregory C. Lassiter, "Cropping Enterprises in Eastern Upper Volta," June 1981.