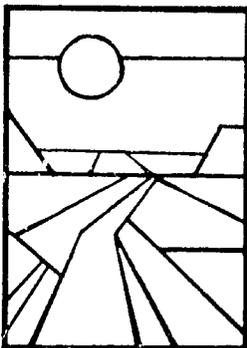
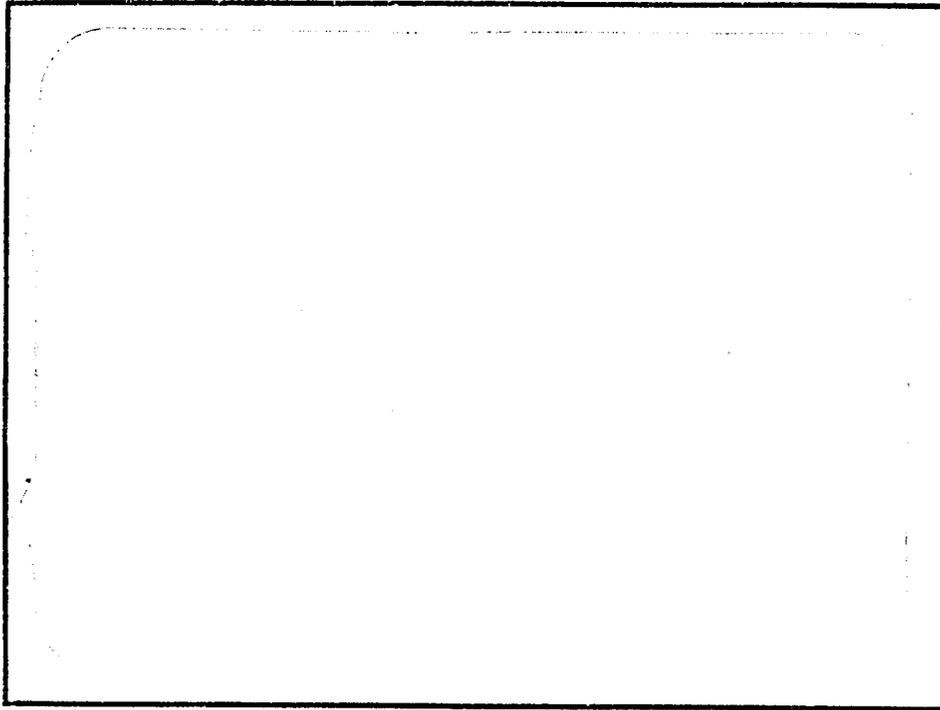


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**CROPPING SYSTEMS BUDGETS
FOR SOUTH-CENTRAL NIGER IN 1984 AND 1985**

by

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and
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1989

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FOR SOUTH-CENTRAL NIGER IN 1984 AND 1985

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SUMMARY

Cropping system enterprise budgets and mean labor time allocations are presented for manual and oxen traction in three Madarounfa villages in 1984, a drought year, and 1985, a fairly average year for millet. The principal cropping systems reported include monocropped millet and sorghum, as well as the associations millet-sorghum, millet-cowpea, millet-sorghum-cowpea, and millet-sorghum-sesame and sorghum-sesame. Cereal-legume associations were found to require more labor and to generate higher net incomes than pure cereal systems. Recommendations are made for future agronomic and socio-economic research.

RESUME

Des budgets de systèmes de cultures et des profils du temps consacré au travail agricole sont présents pour la culture manuelle et la culture attelée bovine dans trois villages de Madarounfa en 1984, année de sécheresse, et 1985, année plus normale. Les systèmes de cultures principaux qui sont discutés ici comprennent le mil et le sorgho en culture pure ainsi que les combinaisons de mil-sorgho, mil-niébé, mil-sorgho-niébé, mil-sorgho-sésame et sorgho-sésame. Il a été constaté que des associations de céréales-légumineuses exigeaient plus de main-d'oeuvre et généraient des revenus nets supérieurs aux systèmes composés exclusivement de céréales. Des propositions sont ici faites en matière de recherches agricoles et socio-économiques à venir.

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CROPPING SYSTEMS BUDGETS
FOR SOUTH-CENTRAL NIGER IN 1984 AND 1985

I. INTRODUCTION

This paper provides a set of input-output budgets and labor time profiles for the principal cropping systems of south-central Niger. These offer a frame of reference for the evaluation of new technologies developed at the National Institute of Agricultural Research of Niger (INRAN) and other regional research organizations. They also furnish a basis for mathematical modeling of crop production in this important agricultural region of Niger.

Until now, the only cropping system budgets available were "synthetic" ones (based on informed guesswork) and case studies on very small samples from a single agricultural season (Eddy, Sutter). Virtually all of these attempts were motivated by a desire to measure the profitability of the national agricultural recommendations packages. From 1977 to 1983, the General Agronomy Section of INRAN at Tarna monitored a "pilot farmer" working at the National Center of Agricultural Research there. That study generated an interesting set of time series data, but it was limited to a single farm operating under very favorable conditions (Roesch et al. and Roesch 1982a). In 1979-81, a second study was carried out to monitor the farms of two graduates of the Rural Promotion Center extension program and (in 1981) a sample of 28 farms located around those of the two ex-trainees (Roesch 1982b). This research succeeded in calculating agricultural

labor time profiles for the predominant cropping systems in the two villages studied. However, the villages were not typical of the region, one being exceptionally well connected to the extension service and unusually well-oriented towards the use of animal traction (Atchita-kofoto), and the other being situated on clay soils at the edge of a major irrigation project (Djiratawa).

Lacking more precise information, economic researchers were forced to create synthetic budgets based on hypothetical farm situations (e.g., Reaser in evaluating the potential impact of a seed multiplication project in 1980 and Ithaca International in analyzing the profitability of the agricultural recommendations packages within the Niamey Productivity Project zone). The first large-scale economic study of peasant farming in Niger was begun by ICRISAT in 1983 in four villages in the departments of Niamey and Dosso. In order to establish a data base for south-central Niger which would cover input costs, agricultural labor time, yields and net returns to the traditional small farms of the region, the Rural Economics Department of INRAN (DECOR) undertook in 1984 a study of 75 farms in three villages. The three were chosen so as to represent the three agricultural recommendation domains (or agro-ecological zones) identified in Madarounfa arrondissement by Swinton and Ly. The recommendation domains covered 1) compact soils, 2) sandy upland soils, and 3) sandy valley soils.

Objectives

This typology of farms based on recommendation domains is used here as a basis for formulating cropping systems budgets and profiles

of agricultural labor time allocation. These, in turn, are examined to identify the factors constraining and favoring different peasant cropping systems. Recommendations are then made for future agronomic research priorities. More precisely, the three principal objectives of this paper are as follows:

- a. To establish labor time profiles and per-hectare budgets for the principal cropping systems of south-central Niger.
 - (1) For 1984 and 1985,
 - (2) With and without animal traction,
 - (3) By recommendation domain.
- b. To compare the budgets and labor profiles in order to evaluate:
 - (1) Resistance to the 1984 drought,
 - (2) Profitability of animal traction,
 - (3) Differences among the recommendation domains,
 - (4) Differences by the sex of the farm worker.
- c. To propose new orientations for agronomic and economic research based on these results.

The Data

Sample Selection

The sample was drawn in two stages. Following a 1982 agreement between INRAN and the Maradi Rural Development Project, it was understood that INRAN would carry out its research program in Madarounfa arrondissement, while the Research-Development Program of the Maradi Project would concentrate on the other arrondissements of the project zone. DECOR began its Madarounfa research program in 1982

with a baseline survey of 400 farms in 40 villages chosen at random. Usable results were obtained from 348 farms in 37 villages. These provided the basis for delineating three recommendations domains according to the soil quality and depth of the water table (DECOR; Swinton and Ly).

After analyzing the baseline data, DECOR picked three villages from among the 37 that represented the three recommendation domains: Kandamao (compact soils), Maiguero (clay-sand valley soils) and Rigial Oubandawaki (very sandy upland soils). A brief census of the three villages gave an overview of the statistical universe of farms in each (Ly and Swinton). This indicated that the compact soils village (Kandamao) was chiefly inhabited by Fulanis, whereas the other two villages were virtually 100% Hausa. In order to ascertain differences in technological level between farmers trained at the Rural Promotion Centers (CPR) and their untrained counterparts, the sample drawn for the intensive survey included all ex-trainees from the three villages (divided 3, 3, and 4 per village). The other sample farms were chosen at random to make 26 farms per village, including that of the village chief (Ly and Swinton). The latter was excluded from analysis as non-representative of typical conditions.

Survey Instruments

The survey aimed to quantify both input costs and labor time expended to farm each cropping system. The two enumerators in each village interviewed farmers weekly on these topics for each parcel of land owned or worked by their households. A parcel was defined as a

piece of land belonging to or worked by a sample household and having a single cropping system. Each week the survey enumerators asked household heads about which parcels household members had worked during the past seven days. For those parcels which had been worked, they were asked about the labor contributed by each person (including temporary day laborers) and each draft animal, as well as the inputs used for each parcel for each agricultural task. Inputs measured in local units were converted to kilograms using results from a survey of local measuring units (Appendix Tables C1 and C2). Similarly, real exchange rates between Niger's official currency, the C.F.A. franc, and the Nigerian naira were monitored in three informal markets in order to calculate the conversion rates shown in Appendix Table C3. In addition to weekly interviews in the household compound, the enumerators visited each field to verify the number of parcels per field, to measure planting density, to ask questions about the cropping history of each parcel, and to make observations on its condition. At harvest, the enumerators counted the number of bundles of cereal heads (or pannicles), sacks of peanuts and other measures of other crops, and recorded the weights from a sample of ten percent of the number of measuring units of each crop (from a minimum of three to a maximum of ten). Finally, three measuring units per crop and per farm were weighed both before and after threshing in 1985 (only one unit per farm in 1984), for the purpose of calculating separate threshing coefficients for each village.

II. ANALYTICAL METHODOLOGY

Agricultural labor time allocation

The labor time allocation profiles present the number of person-hours of work for each agricultural task by the worker's sex, the village, the cropping system and the year (see Appendix). The categories labeled "men" and "women" cover all individuals over 13 years of age. The "youths" group covers workers, male or female, aged ten through thirteen. It was assumed that the amount of work done by children under ten was negligible.

After numerous discussions on various methods of weighting labor time by class of worker discussed in the literature (Norman; Ministère de la Coopération; Legal), DECOR researchers chose to weight the labor time of women and youths at 60% and 50% respectively of men's labor for agricultural tasks except planting and harvest (at which all workers are weighted equally). Assuming that such a weighting procedure was appropriate, we would expect to find a reduction in the variability of (weighted) labor time per task and crop relative to the unweighted totals. However, upon calculating mean labor time per crop, it was discovered that coefficients of variation were in fact higher for the weighted labor time means than for the unweighted ones. Hence, in this research report, only unweighted labor times are reported, leaving the reader to assign weights as he or she chooses.

Budgets

Calculation of the enterprise budgets also entailed some subjective choices of methodology. This was especially true in the analysis of production costs and returns for the peasant farm, since many of the inputs and products are not marketed. For the following analyses, we have tried to choose the most appropriate approaches given the limitations of the data.

Valuation of non-marketed inputs

Most inputs used by the farms surveyed were not marketed. Among these were family labor, draft animal labor, land, seed kept from the previous harvest, and manure from domestic animals. Had there existed a steady demand for labor allowing agricultural workers from the farm to find wage labor at any time, it would be valid to assign an opportunity cost to family labor. However, this was not the case in the villages surveyed. Krause et al. have shown that the opportunity cost of family labor varies according to the cropping cycle. Although temporary farmwork could be found at certain periods of the year, most of the time the opportunity cost of family labor was virtually nil. In the appendix budgets, we have assumed no opportunity cost, preferring to value labor by the effective hourly wage (equal to the residual net income per person-hour after subtracting other costs).

Valuing draft animal labor time is particularly complex. Theoretically, animal labor is an input in crop production. But at the same time, it is a product of the animal enterprise on the farm (along with such other products as milk, manure and meat). The two most common

draft animal species in Niger are the ox and the donkey. Among the sample villages, donkey traction was quite rare. More than 95% of animals used for draft purposes were oxen. Since oxen are highly valued for their meat, instead of depreciating with age, like most agricultural equipment, they appreciate in value until maturity. Considering the difficulty of quantifying and balancing the costs of raising livestock against the value of the various livestock products, it was decided to adopt the simplifying assumption that costs to the crop enterprise at least equalled the revenues realized through raising the oxen. Thus, the budgets do not account explicitly for the draft labor provided by farm-owned oxen.

As for other non-marketed inputs, no value was assigned to farmland belonging to the farm, since little information is available on the market for farmland. Seed kept from the previous harvest was valued at the opportunity cost of buying it at planting time. No value was placed on manure, except that which was purchased. However, an indirect cost to manure was the work incurred to spread it. All purchased inputs (including draft animal labor) were valued at the purchase cost.

Equipment depreciation

For amortization purposes, it is necessary to distinguish between hand tools and animal traction equipment. The former (which Raynaut describes in minute detail) have been assigned amortization schedules based on the results of a survey done in Tahoua by the Agricultural Machinery Section of INRAN (Stevens, Ohler and Mignolet), informally

verified at the Maradi market. As shown in Table 1, the approximate annual cost per hectare of hand tools was 350 CFA francs, assuming a farm size of four hectares. Since the useful life of most of these tools is very short, hand tool amortization was accounted in the budgets as an annual maintenance cost.

Amortization costs for draft animal equipment were estimated based on an average (animal traction) farm having a tool bar with two tools, the most common of which were the ox plow, the three-toothed cultivator and the ridger (Swinton). At the 1985 official prices, the tool bar cost 11,000 francs CFA, the plow 11,700 FCFA, the three-toothed cultivator 9,800 FCFA and the ridger 6,620 FCFA (Ministère de l'Agriculture). Assuming linear depreciation of an investment of 30,000 francs CFA over five agricultural seasons on a farm of four hectares, one obtains an annual cost of 1,500 FCFA per hectare.

Table 1: Calculation of per hectare annual depreciation of hand tools, 4-hectare farm, Madarounfa, 1984-85.

Tool	Mean number	Mean value (FCFA)	Useful life (yrs)	Value/ ha/yr (FCFA)
Planting mattock	3	300	3	75
Mattock	2	700	5	70
Hoe	3	800	4	150
Hatchet	2	600	10	30
Knife	1	400	5	20
Sickle	1	150	8	5
Total				350

* Sources: Stevens, Ohler et Mignolet; Swinton.

Yield estimation

Millet and sorghum cereal yields were estimated as follows: The mean weight of a bundle was estimated after weighing 10% of the bundles harvested from each parcel, with a minimum of three bundles and a maximum of ten per parcel. The total number of bundles harvested was then multiplied by the mean weight per bundle. This figure was divided by the surface area of the parcel to obtain the gross yield per parcel in kilograms per hectare (kg/ha). Net yield was calculated by multiplying the gross yield by the threshing coefficient established for each crop at the village level. The threshing coefficient represents the proportion of weight remaining after threshing and winnowing. Results for 1984 and 1985 are shown in Table 2. No accounting was made of the incidental harvest of wild millet nor of the

Table 2: Mean threshing coefficients for millet, sorghum, cowpea and peanut in three Madarounfa villages in 1984 and 1985.

Village and year	C R O P								
	Millet		Sorghum		Cowpea		Peanut		
	n	%	n	%	n	%	n	%	
1984									
Kandamao	26	58	18	63	0	(77)*	0	—	
Maiguéro	26	50	0	(63)*		77	0	—	
Rigial Oubandawaki	26	64	23	65		77		72	
1985									
Kandamao	25	75	25	69	7	63	0	—	
Maiguéro	77	64	44	66	6	64	9	67	
Rigial Oubandawaki	69	64	47	65	7	71	7	69	

* Figures in parentheses are estimated based on threshing coefficients established for the other villages.

N.B.: Coefficients of variation on the threshing coefficients for millet and sorghum ranged from 6% to 16%.

poor quality millet spikes, called "buku" in Hausa, which are seldom eaten, except in time of poor harvest (such as 1984).

Yields of cowpea, peanut, tobacco and sesame were estimated along the same lines as for cereal grains, except that generally the entire harvest was weighed. Gross yields covered the weight in the pod (for cowpea and peanut), while net yield is based on shelled weight. Net weights were obtained directly for sesame and tobacco. Cowpea yields are somewhat underestimated since it was common practice to harvest ripe cowpeas while still green during the "hungry season" preceeding the main harvest of cereal crops.

Calculated yields of cowpea and peanut hay underestimate the true yield because most hay was not harvested directly, but rather left in the fields to be grazed by the household livestock. By the same token, no accounting was made of stalk yields of millet and sorghum, despite the fact that these have some (slight) nutritive value for livestock and occasionally even a market value (as was the case following the drought of 1984).

Storage losses are estimated at 4% of harvest, following Giles' research results from northern Nigeria.

Valuation of the harvest

Values were estimated for the harvest by multiplying the quantity produced by the appropriate price. If all production was sold, the appropriate price was clearly the sale price. But on the farms surveyed, marketed production was only a small percentage of total production. In theory, home consumption should be valued according to

its opportunity cost, that is, the price at which the household could have sold its production had it not been consumed. In order to estimate this correctly, one must know the quantities consumed by the family, the dates of consumption, and the corresponding market prices and official prices. Since DECOR did not monitor home consumption of agricultural products, this was assumed to have taken place during the entire year following harvest. Consequently, opportunity cost was calculated as the unweighted mean market price over the twelve months following the beginning of harvest (from September through August). Since farms made most of their sales right after harvest, sale price data were not available for each crop during all months of the year. But the price difference between Maradi and the survey villages was virtually constant (Swinton et Mameane 1987a), so opportunity costs were calculated from Maradi prices minus 10 CFA francs per kilogram for the cost of transport from the village to the city. These are the prices used in the appendix budgets. Official prices were also included in the budgets (Table 3) on the assumption that farmers also had the option to sell to the government marketing agencies.

Table 3: Official grain prices in Niger in 1984 and 1985.

Product	Price (FCFA/kg)	
	1984	1985
Millet	100	70
Sorghum	100	70
Cowpea (grain)	90	100

Sources: Personal communication with OPVN, SONARA.

III. RESULTS OF THE BUDGETS AND LABOR USE PROFILES

The years 1984 and 1985 in perspective

In the uncertain climate of the Sahel, an "average cropping season" exists only in the imagination of statisticians. Each season is marked by its own idiosyncracies, of which the most important pertains to rainfall. In this respect, 1984 and 1985 make an interesting pair (Table 4). The 1984 rainy season was the driest since the beginning of systematic rainfall measurement in Maradi in 1932. Total rainfall accumulation reached only 284 millimeters (mm), less than half the annual average of 569 mm. for the 1932-84 period (Service de la Météorologie pers. comm., 1985; Koechlin). South of the city of Maradi, the rains were even worse, reaching only 238 mm at Tarna and still less in the sample villages. Worst of all, a drought spell occurred in the latter two-thirds of August, during the period when millet is flowering and is most susceptible to environmental stress. As a result, the millet harvest was damaged, along with all of the other crops that year.

By contrast, rainfall in 1985 was around 440 mm, still less than average, but typical of the 1971-84 period and adequate for a good millet harvest. However, cowpea and sorghum harvests were severely reduced by the shortness of the rainy season, which began in early July and ended in mid-September.

Table 4: Monthly rainfall in the three Madarounfa survey villages during the 1984 and 1985 rainy seasons.

Year and village	Monthly rainfall (mm)						Entire year
	May	June	July	Aug.	Sept.	Oct.	
<u>1984</u>							
Kandamao	()	(12)	78	61	65	8	(224)*
Maiguéro	()	(4)	84	57	55	15	(214)*
Rigial Oubandawaki	()	(7)	53	51	44	13	(167)*
C.N.R.A. de Tarna	13	27	133	35	30	0	238
<u>1985</u>							
Kandamao	14	38	146	146	99	0	443
Maiguéro	15	22	88	207	93	0	425
Rigial Oubandawaki	30	51	180	118	66	0	445

*Figures in parentheses indicate rainfall measured after June 21, 1984, when measurements were begun.

Yields

All crops yielded poorly in 1984. Millet, the most drought-resistant of all, yielded only a mean of 140 kilograms per hectare (kg/ha) under manual tillage and 131 kg/ha under animal traction, as is shown in Tables 5 and 6. Even in the most favorable conditions—monocropped millet with oxen traction on the sandy soils of Rigial Oubandawaki—it did not even yield 300 kg/ha. Sorghum yields were even worse: 14 kg/ha average under manual cultivation and 35 kg/ha under animal traction. Only monocropped sorghum under animal traction on the valley soils of Maiguéro gave mean yields over 100 kg/ha. Cowpea was a total failure everywhere except Rigial Oubandawaki, where mean yields were around 20 kg/ha. These are extraordinarily low figures, even given that they are certainly underestimated due to the gathering of fresh cowpeas during the hungry season. As for cash crops, sesame was the only one to give even modest yields, with averages of 33 kg/ha

under manual cultivation and 83 kg/ha under animal traction in Kandamao (see budget in Appendix). Otherwise, peanuts failed totally, and residual soil moisture was so lacking by the end of the rainy season that tobacco was not even planted on the valley soils of Manguéro.

Statistical comparisons among the different cropping systems, traction types and recommendation domains for the 1984 crop year are made difficult by very high coefficients of variation (c.v.) in almost all cases. These were caused by the large number of fields which suffered total crop losses. Cowpea was the extreme case in this respect. In Table 5, c.v.'s for cowpea under manual cultivation range from 1.56 up to 3.79. Clearly, these means are statistically no different from zero.

The 1985 rainy season was marked by a late start, with millet planting in early July, and rains ending in mid-September. As a result, the early millet yielded well, but sorghum yielded fairly well only in monocrop, and cowpea failed completely. Tables 7 and 8 give the overall mean millet yield of 339 kg/ha under manual cultivation and 568 kg/ha under animal traction. The large disparity between average yields of 500 to 700 kg/ha in the two villages with good [meaning "lighter"] soils (Manguéro and Kandamao), and yields of only 200 kg/ha in Rigial Oubandawaki suggests that the availability of adequate water that year made soil fertility the limiting factor.

Sorghum yielded an average of 78 kg/ha on the manually cultivated fields and 111 kg/ha on the animal traction fields. However, these low figures hide good yields of monocropped sorghum of 370 kg/ha in

Table 5. Mean grain yields by crop for the major cropping systems under manual cultivation in three Madarounfa villages in 1984.

Crop measured and cropping systems	Yield (kg/ha)										
	Kandamao			Maiguéro			Rigial Oub.		All vills.		
	n	Mean	c.v.	n	Mean	c.v.	n	Mean	c.v.	n	Mean
MILLET											
Millet monocrop	3	182	0.41	22	136	1.10	23	139	1.04	48	140
Millet-sorghum	5	107	0.33	14	72	1.66	24	81	0.79	43	81
Millet-cowpea	0	—	—	13	142	0.82	36	147	1.00	49	146
Mil-sorg-cowpea	<u>1</u>	<u>158</u>	—	<u>28</u>	<u>219</u>	2.56	<u>95</u>	<u>140</u>	0.75	<u>124</u>	<u>158</u>
Millet: 4 sys.	9	138	—	77	156	—	178	133	—	264	140
SORGHUM											
Sorghum monocrop	2	96	1.41	8	71	2.14	2	36	1.10	12	69
Millet-sorghum	5	20	0.77	14	3	3.01	24	15	2.26	43	12
Mil-sorg-cowpea	<u>1</u>	<u>0</u>	—	<u>28</u>	<u>8</u>	2.77	<u>95</u>	<u>11</u>	2.15	<u>124</u>	<u>10</u>
Sorghum: 3 sys.	8	37	—	50	17	—	121	12	—	179	14
COWPEA											
Millet-cowpea	0	—	—	13	15	1.56	36	12	1.59	49	13
Mil-sorg-cowpea	<u>1</u>	<u>0</u>	—	<u>28</u>	<u>2</u>	3.79	<u>95</u>	<u>21</u>	1.78	<u>124</u>	<u>17</u>
Cowpea: 2 sys.	1	0	—	41	6	—	131	19	—	173	16

N.B.: "c.v." denotes "coefficient of variation".

Table 6: Mean grain yields by crop for the major cropping systems under animal traction cultivation in three Madarounfa villages in 1984.

Crop measured and cropping systems	Yield (kg/ha)										
	Kandamao			Maiguéro			Rigial Oub.		All vills.		
	n	Mean	c.v.	n	Mean	c.v.	n	Mean	c.v.	n	Mean
MILLET											
Millet monocrop	2	198	0.66	26	140	0.72	2	280	0.32	30	153
Millet-sorghum	9	148	0.54	12	162	2.37	0	—	—	21	156
Millet-cowpea	0	—	—	7	127	0.60	2	183	0.36	9	139
Mil-sorg-cowpea	<u>6</u>	<u>102</u>	0.33	<u>3</u>	<u>133</u>	0.22	<u>4</u>	<u>88</u>	0.75	<u>13</u>	<u>105</u>
Millet: 4 sys.	17	138	—	48	143	—	8	160	—	73	131
SORGHUM											
Sorghum monocrop	10	62	1.40	6	434	1.64	0	—	—	16	202
Millet-sorghum	9	13	1.93	12	6	2.94	0	—	—	21	9
Mil-sorg-cowpea	<u>6</u>	<u>9</u>	1.99	<u>3</u>	<u>13</u>	0.73	<u>4</u>	<u>14</u>	1.28	<u>13</u>	<u>11</u>
Sorghum: 3 sys.	25	11	—	20	43	—	4	14	—	49	35
COWPEA											
Millet-cowpea	0	—	—	7	5	1.30	2	33	1.41	9	11
Mil-sorg-cowpea	<u>6</u>	<u>0</u>	0	<u>3</u>	<u>5</u>	1.15	<u>4</u>	<u>23</u>	0.63	<u>13</u>	<u>8</u>
Cowpea: 2 systems	6	0	—	10	5	—	6	26	—	22	9

Table 7: Mean grain yields by crop for the major cropping systems under manual cultivation in three Madarounfa villages in 1985.

Crop measured and cropping systems	Yield (kg/ha)										
	Kandamao			Maiguéro			Rigial Oub.			All vill.	
	n	Mean	c.v.	n	Mean	c.v.	n	Mean	c.v.	n	Mean
MILLET											
Millet monocrop	1	401	—	48	647	1.55	130	206	0.84	179	325
Millet-sorghum	7	244	0.47	10	605	0.75	36	224	0.84	53	299
Millet-cowpea	1	784	—	26	445	0.54	14	244	0.77	41	385
Mil-sorg-cowpea	<u>6</u>	<u>966</u>	1.08	<u>9</u>	<u>387</u>	0.40	<u>11</u>	<u>193</u>	1.11	<u>26</u>	<u>439</u>
Millet: 4 sys.	15	708	—	93	561	—	191	211	—	299	339
SORGHUM											
Sorghum monocrop	0	—	—	11	374	0.81	6	75	0.96	17	268
Millet-sorghum	7	61	0.49	10	109	1.64	6	10	1.49	53	35
Mil-sorg-cowpea	<u>6</u>	<u>68</u>	0.94	<u>9</u>	<u>54</u>	0.49	<u>11</u>	<u>17</u>	2.11	<u>26</u>	<u>42</u>
Sorghum: 3 sys.	13	64	—	30	190	—	53	19	—	96	78
COWPEA											
Millet-cowpea	1	0	—	26	2	3.37	14	4	3.04	41	3
Mil-sorg-cowpea	<u>6</u>	<u>0</u>	0	9	2	3.00	11	0	3.32	26	1
Cowpea: 2 sys.	7	0	—	35	2	—	25	2	—	67	2

Table 8: Mean grain yields by crop for the major cropping systems under animal traction cultivation in three Madarounfa villages in 1985.

Crop measured and cropping systems	Yield (kg/ha)										
	Kandamao			Maiguéro			Rigial Oub.			All vill.	
	n	Mean	c.v.	n	Mean	c.v.	n	Mean	c.v.	n	Mean
MILLET											
Millet monocrop	4	526	0.75	18	853	0.87	5	374	0.92	27	716
Millet-sorghum	9	524	0.54	4	273	0.20	4	136	0.87	17	374
Millet-cowpea	1	1153	—	10	435	0.25	1	466	—	12	497
Mil-sorg-cowpea	<u>10</u>	<u>548</u>	0.46	<u>6</u>	<u>725</u>	0.84	<u>3</u>	<u>377</u>	0.41	<u>19</u>	<u>577</u>
Millet: 4 sys.	24	561	—	38	482	—	13	309	—	75	568
SORGHUM											
Sorghum monocrop	4	297	0.62	3	367	—	1	0	—	8	286
Millet-sorghum	9	93	1.24	4	24	0.45	4	33	0.76	17	63
Mil-sorg-cowpea	<u>10</u>	<u>93</u>	0.80	<u>6</u>	<u>71</u>	0.50	<u>3</u>	<u>55</u>	1.30	<u>19</u>	<u>80</u>
Sorghum: 3 sys.	23	128	—	13	125	—	8	37	—	44	111
COWPEA											
Millet-cowpea	1	0	—	10	0	0	1	0	—	12	0
Mil-sorg-cowpea	<u>10</u>	<u>1</u>	2.06	<u>6</u>	<u>0</u>	0	<u>3</u>	<u>0</u>	0	<u>19</u>	<u>1</u>
Cowpea: 2 sys.	11	1	—	16	0	—	4	0	—	31	0

Maiguéro and 300 kg/ha in Kandamao. On the valley soils, monocropped sorghum is sowed at a much higher planting density (around 9000 hills per hectare) than the dune sorghum, which is planted in association with millet at a density of only some 2000 hills/ha (Swinton, 1985). Hence monocropped sorghum tends to out-yield intercropped sorghum. Cowpeas yielded nothing, due partly to the shortness of the season, but also to insect attacks.

As for the cash crops, sesame yielded more or less the same as in 1984, 94 kg/ha under manual cultivation and 48 kg/ha under animal traction cultivation (see appendix budget). By contrast, tobacco yielded very well in Maiguéro, giving an average of 526 kilograms of dried leaves per hectare (see appendix budget). All tobacco was hand cultivated. Very little peanut was planted in 1985, since farmers lacked seed and the money with which to buy it. Coefficients of variation in 1985 were lower in general than in 1984, but they were still high, often greater than 0.50 for millet and higher still for sorghum and cowpea. Hence, it was impossible to draw statistical conclusions as to the effect of the source of traction power. It is clear, however, that millet and sorghum yields were significantly higher in Kandamao and Maiguéro than in Rigial Oubandawaki.

Among the millet systems, there appeared to be little difference between the yields of intercropped millet and monocropped millet. This is understandable, since farmers tended not to vary planting density between monocropped and intercropped millet, both being sown at roughly 4000 hills per hectare. By contrast, sorghum was planted two to four times more densely in pure crop than in association (4400 hills/ha versus 1900 and

1200 hills/ha in association with millet and millet-cowpea, respectively (Swinton 1985)). Sorghum yielded dramatically better under monocropped conditions.

The distribution of cropping systems

A great variety of cropping systems are practiced in the three sample villages. The survey encountered 37 different crop associations in 1984 and 33 in 1985. However, only five accounted for 75% of the total planted area. These were monocropped millet, monocropped sorghum, millet-sorghum, millet-cowpea, and millet-sorghum-cowpea. In the village of Kandamao, sesame-based systems—particularly millet-sorghum-sesame and sorghum-sesame—played an equally important role, so they are considered (jointly) as a sixth system in that village.

This report focuses on the principal systems. Among these, there were clear differences from 1984 to 1985. The number of fields planted to pure millet increased 22.5%, while the number of fields planted to millet-sorghum-cowpea systems and "other systems" (other than the six main ones) dropped 17.7% and 6.2% respectively, as shown in Table 9. These figures are strongly influenced by the village of Rigial Oubandawaki, which has the largest number of parcels of land. In both Maiguéro and Rigial Oubandawaki, there was a sharp increase in the number of monocropped millet fields, accompanied by a drop in millet-sorghum-cowpea fields. The trend in Kandamao was opposite, however, with an increase in the number of fields planted to sorghum and millet-sorghum-cowpea. How can these changes be explained? The answer is not

Table 9: Percentage frequency of cropping systems in three Madarounfa villages in 1984 and 1985.

Cropping system	Village and year							
	Kandamao		Maiguéro		Rigial Oub.		All vills.	
	1984 n=73	1985 n=88	1984 n=195	1985 n=206	1984 n=247	1985 n=281	1984 n=515	1985 n=575
	----- percent -----							
Monocrops								
Millet	6.8	6.8	25.6	35.4	12.1	51.5	16.5	39.0
Sorghum	16.4	6.8	7.7	7.3	1.2	2.5	5.8	4.9
Crop assoc.								
Millet-sorg.	20.5	21.6	13.8	7.3	11.3	14.9	13.6	13.2
Millet-cowpea	0.0	2.3	9.2	17.5	18.2	6.0	12.2	9.6
Mil-sorg-cowp.	9.6	13.2	17.9	8.7	33.5	5.7	26.4	8.7
M-S-ses/S-ses	15.1	14.7	0.0	0.0	0.0	0.0	2.1	2.3
Other crop sys.	31.6	24.8	21.7	14.6	13.1	7.5	19.3	13.1
Fallow	0.0	1.1	3.9	9.2	5.9	11.5	4.1	9.2

obvious. But certain elements may have played a part. First, after the disastrous 1984 season, few farmers had the means to buy cowpea and peanut seed, both of which were difficult to obtain and quite expensive in the local markets (Swinton and Mamane 1987a and 1987b). However, the increase in the area planted to monocropped millet in 1985 is hardly reason to believe that a definitive change in cropping practices has taken place in the region.

The inputs used were limited almost exclusively to land, labor and seed. The scarce incidence of mineral fertilizer and fungicide use was even lower in 1985 than it had been in 1984. This observation is supported by the Monitoring and Evaluation Unit (USE) of the Maradi Project, which found that only 3.5% of the planted area was receiving fertilizer in 1985 in seven surveyed villages, including villages where no fertilizer was used at all.

Net income from different cropping systems

Various approaches exist for evaluating production results from mixed crop systems. Agronomists commonly aggregate crop grain yields by weight to judge performance of a cropping system. However, this procedure does not take into account the economic value of grain from different species. Moreover, it ignores the value of marketed by-products, such as the forage hay from cowpea and peanut. Marketed commodities were the basis for the net income calculations presented here.

Tables 10 and 11 summarize the net income per hectare calculated for the 85 cropping system budgets detailed in the appendices. Table 10 is calculated from local market prices for agricultural products, while Table 11 is based on official prices. For by-products, such as cowpea hay, there is no official price, so in Table 11 by-product value is not counted. The budgets cover the five principal cropping systems for two cultivation practices (manual and draft animal power) in the three villages in 1984 and 1985. Budgets for the combined cropping systems millet-sorghum-sesame and sorghum-sesame are given for Kandamao in 1984 and 1985 and a budget for tobacco in Maiguéro in 1985.

Due to the high variability of yields (see Tables 5-8) in both 1984 and 1985, the net revenue results at local prices show no statistically significant difference in profitability between the two traction types, manual and oxen. In 1985, the oxen traction systems appeared to be more profitable than manual cultivation, but there were many exceptions.

In both years, the millet-sorghum-cowpea association gave the highest mean net incomes, while pure sorghum gave the lowest. In 1984

Table 10: Mean net income per hectare at local prices for the major cropping systems in 1984 and 1985 by type of traction in three Madarounfa villages.

Village and cropping system	Year and traction type			
	1984		1985	
	Manual	Oxen	Manual	Oxen
- - - - thousands of CFA francs - - - -				
Kandamao				
Millet	28,0	27,8*	13,7*	16,6
Sorghum	12,7*	6,3	—	7,3
Millet-sorghum	19,0	22,3	9,5	19,2
Millet-cowpea	—	—	26,9*	39,3*
Millet-sorghum-cowpea	24,4*	14,9	36,0	20,6
M-Sor-sesame/Sor-sesame	16,5	26,7	25,1*	23,7
Maiguéro				
Millet	18,4	17,8	21,9	26,9
Sorghum	8,3	17,1	10,8	9,7
Millet-sorghum	10,3	22,8	24,0	7,6
Millet-cowpea	26,2	16,2	14,9	13,0
Millet-sorghum-cowpea	32,6	20,1	13,2	29,7
Rigial Oubandawaki				
Millet	20,3	41,5*	5,8	9,7
Sorghum	4,4*	—	1,4	(2,5)*
Millet-sorghum	12,9	—	5,8	1,7
Millet-cowpea	24,2	36,0*	7,4	15,8*
Millet-sorghum-cowpea	27,7	20,0	5,1	16,6
All villages				
Millet	19,9	20,1	10,2	22,2
Sorghum	8,4	9,8	7,4	6,9
Millet-sorghum	12,7	22,6	9,7	12,4
Millet-cowpea	24,7	20,6	12,6	15,4
Millet-sorghum-cowpea	28,8	17,7	15,1	22,8

* These figures represent samples from fewer than three fields.
 Figures in parentheses indicate net losses.

Table 11: Mean net income per hectare at official prices for the major cropping systems in 1984 and 1985 by traction type in three Madarounfa villages.

Village and cropping system	Year and traction type			
	1984		1985	
	Manual	Oxen	Manual	Oxen
- - - - thousands of CFA francs - - - -				
Kardamao				
Millet	16,7	15,4*	26,0*	32,8
Sorghum	8,4*	3,5	—	17,0
Millet-sorghum	11,4	12,5	19,0	38,4
Millet-cowpea	—	—	51,0*	74,7*
Millet-sorghum-cowpea	14,6*	8,2	67,9	40,4
M-S-sesame/S-sesame	11,9	22,5	35,5*	40,4
Maiguéro				
Millet	9,9	9,1	41,8	53,1
Sorghum	5,1	10,4	23,0	21,6
Millet-sorghum	5,6	12,5	46,1	16,8
Millet-cowpea	13,4	7,7	28,1	25,5
Millet-sorghum-cowpea	18,4	10,7	25,2	49,5
Rigial Oubandawaki				
Millet	11,6	24,0*	12,1	21,2
Sorghum	2,8*	—	3,8	(2,5)*
Millet-sorghum	7,1	—	13,0	7,0
Millet-cowpea	13,3	16,4*	14,5	26,1*
Millet-sorghum-cowpea	13,6	8,2	11,2	24,8
All villages				
Millet	11,1	10,5	20,1	44,2
Sorghum	5,3	5,8	16,2	16,2
Millet-sorghum	7,2	12,5	20,1	25,9
Millet-cowpea	13,3	9,7	24,0	29,6
Millet-sorghum-cowpea	14,6	8,8	29,5	40,8

* These figures represent samples of less than three fields. Figures in parentheses indicate net losses.

mean net income ranged from 8,400 CFA francs per hectare for manually cultivated monocropped sorghum to 28,800 FCFA per hectare for the millet-sorghum-cowpea association, also manually cultivated. In 1985, monocropped sorghum was even less profitable, yielding only 6,900 FCFA under oxen traction (and 7,400 FCFA with manual cultivation) compared with 22,800 FCFA for millet-sorghum-cowpea with oxen traction.

Surprisingly, net incomes with local prices were lower in a good production year for millet (1985), than in the year that gave the worst yields in recent memory (1984). The seeming contradiction is explained by the fact that market prices of millet plummeted in 1985. After the 1984 harvest, at the end of October, millet was selling for 140 FCFA/kg in Maradi, whereas a year later it sold for only 60 FCFA/kg (and the price subsequently fell to half that) (Swinton and Mamane 1987a). But it is a mistake to confuse net cash income at local prices with the true value of agricultural production to the household. This distinction is discussed further in connection with Table 12.

Net income calculated from official prices, Table 11, reflects somewhat better the difference in physical output between the two seasons since official millet and sorghum prices dropped only 30%, whereas market prices fell 77% and 75% respectively. Official cowpea prices rose 11% from 1984 to 1985 (Table 3) while market prices fell 22%. Cowpea yields were so low that this confounding effect is negligible. Because market prices for cereals went from well above official prices to well below them from 1984 to 1985, net incomes at official prices went from poorer than at market prices in 1984 to much better in 1985. Mean net revenues at official prices ranged from 5,300 FCFA

(monocropped sorghum under manual cultivation) to 14,600 FCFA (millet-sorghum-cowpea) in 1984. By contrast, in 1985 mean net revenues ranged from 16,200 FCFA for monocropped sorghum up to 48,800 FCFA for the millet-sorghum-cowpea association with oxen traction.

Despite seemingly large differences in mean net income at official prices among some of the millet-based cropping systems (Table 11), only monocropped sorghum gave statistically significantly different (lower) net returns than the rest. As before, this is due to the high variability of yields, such that in both years standard deviations in crop yields typically exceeded 50% of the mean (see Tables 5-8). Monocropped sorghum was less profitable by far than millet systems in both years. However, as noted elsewhere, neither 1984 nor 1985 was a good sorghum year. Hence it should not be surprising that the sorghum systems did not do well, either in yield by weight or in net income.

Net incomes compared with household needs

At the risk of stating the obvious, farm households in fact fared much better in 1985, despite the low prices. This is because they are joint production and consumption units. Since Madarounfa households consume most of their production, the true net income is not the monetary value of net production minus cash costs. Rather it is the value of net production minus cash costs and the in-kind costs that supported the labor force, that is, the household and their draft animals. By this measure, shown in Table 12, no cropping system met the needs of a farm household of average size and land endowment in 1984. By contrast, in 1985, despite the failure of the cowpea crop, the

Table 12: Cropping system revenues relative to subsistence needs for the median farm household in 1984 and 1985 in three Madarounfa villages.

Year and item	Unit of measure	Cropping system				
		Pure millet	Pure sorghum	Mil-sorg	Mil-cowpea	Mil-sor-cowpea
1984						
Mean revenue/hectare	FCFA	20,000	18,000	15,900	24,100	27,700
Median farm size ¹	ha	4.6	4.6	4.6	4.6	4.6
Mean farm income	FCFA	92,000	82,800	73,140	110,860	127,420
Mean household size	person	7	7	7	7	7
Cereal needs/person	kg	220	220	220	220	220
Mean local mil. price	FCFA/kg	165	165	165	165	165
Mean household needs	FCFA	254,100	254,100	254,100	254,100	254,100
Surplus (income-needs) ²	FCFA	-162,100	-171,300	-180,960	-143,240	-126,680
1985						
Mean revenue/hectare	FCFA	11,800	7,200	10,400	13,200	18,400
Median farm size ¹	ha	4.6	4.6	4.6	4.6	4.6
Mean farm income	FCFA	54,280	33,120	47,840	60,720	84,640
Mean household size	person	7	7	7	7	7
Cereal needs/person	kg	220	220	220	220	220
Mean local mil. price	FCFA/kg	38	38	38	38	38
Mean household needs	FCFA	58,520	58,520	58,520	58,520	58,520
Surplus (income-needs) ²	FCFA	-4,240	-25,400	-10,680	2,200	26,120

¹Mean farm size was 5.5 hectares (Swinton 1985).

²Mean cash costs were negligible.

millet-sorghum-cowpea and millet-cowpea systems generated a modest surplus.

Effective returns to family labor

Tables 13 and 14 present the effective returns to labor instead of land. In general, the calculated effective wages based on local prices were little different from the hourly wages paid to day laborers (see Appendix Table C4). Effective wages were higher overall in 1984 than in 1985. As explained earlier, this does not mirror true circumstances for subsistence farms. But it does show the consequences of the policy of controlled official prices. If farmers were forced to accept official prices for their output in years of bad harvest, such as 1984, they would be hit even harder by the drought. The market reflex of increasing prices benefitted producers, compensating slightly for the production shortfall. On the other hand, in a good crop year like 1985, official prices would leave producers considerably better off than market prices. Obviously, the effect on the consumer is the opposite. For the household, the net effect depends on the net balance of marketed production and consumption. If the farm household can meet its subsistence needs from its own production with a marketable surplus left over, then it is a net producer, and the net effect of price policy favors producers. If not, the net effect favors consumers. In 1984, the median farm was a net consumer of agricultural goods, whereas in 1985, the median farm producing millet-sorghum-cowpea and millet-cowpea was a net producer (Table 12).

Table 13: Effective hourly wage at local prices for the major cropping systems in 1984 and 1985 by traction type in three Madarounfa villages.

Village and cropping system	Year and traction type			
	1984		1985	
	Manual	Oxen	Manual	Oxen
	- - - - - FCFA/person-hour - - - - -			
Kandamao				
Millet	226	232*	47*	187
Sorghum	58*	43	—	33
Millet-sorghum	179	153	37	106
Millet-cowpea	—	—	152	244*
Millet-sorghum-cowpea	280*	108	133	98
M-S-sesame/S-sesame	110	202	139*	86
Maiguéro				
Millet	130	116	92	128
Sorghum	41	75	56	68
Millet-sorghum	99	159	104	49
Millet-cowpea	155	100	83	57
Millet-sorghum-cowpea	193	147	68	119
Rigial Oubandawaki				
Millet	122	149*	34	42
Sorghum	37*	—	14	*(192)
Millet-sorghum	63	—	36	10
Millet-cowpea	126	92*	35	61*
Millet-sorghum-cowpea	128	112	28	92
All villages				
Millet	131	126	54	114
Sorghum	44	55	46	42
Millet-sorghum	80	157	52	71
Millet-cowpea	133	97	66	68
Millet-sorghum-cowpea	140	118	74	105

*These figures represent samples of fewer than three fields. Figures in parentheses indicate net losses.

Table 14: Effective hourly wage at official prices for major cropping systems in 1984 and 1985 by traction type in three Madarounfa villages.

Village and cropping system	Year and traction type			
	1984		1985	
	Manual	Oxen	Manual	Oxen
	----- FCFA/person-hour -----			
Kandamao				
Millet	135	128*	89*	369
Sorghum	39*	24	—	77
Millet-sorghum	108	86	73	212
Millet-cowpea	—	—	288	464*
Millet-sorghum-cowpea	168*	59	251	192
M-S-sesame/S-sesame	79	170	197*	147
Maiguéro				
Millet	70	59	176	253
Sorghum	25	46	119	151
Millet-sorghum	54	87	200	108
Millet-cowpea	79	48	157	111
Millet-sorghum-cowpea	109	78	134	199
Rigial Oubandawaki				
Millet	70	86*	71	93
Sorghum	24*	—	28	*(192)
Millet-sorghum	35	—	81	40
Millet-cowpea	69	42*	68	100*
Millet-sorghum-cowpea	63	46	63	138
All villages				
Millet	73	66	106	227
Sorghum	28	33	100	98
Millet-sorghum	45	87	107	149
Millet-cowpea	72	46	126	130
Millet-sorghum-cowpea	71	59	145	188

* These figures represent samples of fewer than three fields. Figures in parentheses indicate net losses.

Labor time

The global labor use figures by cropping system in Table 15 show a progression of magnitude from pure cereal systems to cereal-legume associations. With few exceptions, the pure millet, pure sorghum and millet-sorghum association required 150-190 person-hours of work per hectare. By contrast, the millet-cowpea and millet-sorghum-cowpea systems took 190 to 220 person-hours per hectare due to the increased work required by the legume crop at planting and at harvest. Because coefficients of variation ranged from 0.35 to 1.19 in 1984 and from 0.36 to 1.12 in 1985 (Appendix B), there were no clear differences among cereal systems and among cereal-legume associations (which fits Legal's findings from the same region).

Labor time increased for all cropping systems except monocropped sorghum between 1984 and 1985. The increase was caused by greater weeding time (due to the better rains of 1985) and added harvest work caused by higher yields. The increase in labor time does not count supplementary time for the men to build granaries, which took an average of 40 man-hours per granary (survey of 26 granaries, dry season 1985-86). Also, these figures do not take into account time spent traveling to the field, typically 0.3 to 0.5 hours per visit in Maiguéro and Rigial Oubandawaki (Swinton). This comes to fifteen hours per field per season, assuming a six hour day and 30 days of work per field during the cropping season.

Again, there was no statistically significant difference in labor time between the two traction methods, by hand and with draft animals. In fact, it appears that animal traction was used for very few field

Table 15: Mean labor time per hectare for the major cropping systems in 1984 and 1985 by traction type in three Madarounfa villages.

Village and cropping system	Year and traction type			
	1984		1985	
	Manual	Oxen	Manual	Oxen
	- - - - - person-hours per hectare - - - -			
Kandamao				
Millet	124	120*	291*	89
Sorghum	218*	147	—	222
Millet-sorghum	106	146	260	181
Millet-cowpea	—	—	177*	161*
Millet-sorghum-cowpea	87*	138	271	210
M-S-sesame/S-sesame	150	132	180*	104
Maiguéro				
Millet	142	154	238	210
Sorghum	203	228	193	143
Millet-sorghum	104	143	231	155
Millet-cowpea	169	162	179	230
Millet-sorghum-cowpea	169	137	195	249
Rigial Oubandawaki				
Millet	166	279*	171	229
Sorghum	119*	—	100	13*
Millet-sorghum	204	—	161	177
Millet-cowpea	192	390*	213	260*
Millet-sorghum-cowpea	217	179	179	180
All villages				
Millet	152	160	189	195
Sorghum	192	177	162	166
Millet-sorghum	159	144	187	174
Millet-cowpea	186	213	191	227
Millet-sorghum-cowpea	205	150	204	217

* These figures represent samples of fewer than three fields.

operations. As Table 16 indicates, animal labor hours were chiefly spent on soil preparation before planting. This conforms with Legal's results in a 1984 study of seven animal traction farms in southern Maradi. Since the critical labor bottleneck occurs at the first weeding, and since animal traction was rarely employed for this task, it would appear that saving labor was not the main motivation for farmers to use animal traction. It may have been either to improve soil preparation or to reduce the difficulty of work.

It does appear, however, that fields worked with animal traction used less labor on the first weeding (although this difference was not significant at a 95% confidence level). Surprisingly, despite the peak labor demand at the time of first weeding, most of the animal traction tillage took place during field preparation. Typically, the fields worked with draft animals were plowed before planting, whereas hand-cultivated fields were not. It may be that plowing had the effect of reducing the subsequent work needed for the first weeding; otherwise, it is difficult to explain why the animal traction fields required less labor at first weeding, considering that oxen were hardly ever used for the first weeding and cultivation.

Table 16 shows a sharp increase in the total amount of labor used between 1984 and 1985. This is especially evident at harvest, and in some cases for the weeding and cultivations. These results are directly tied to the improved rainfall and higher millet yields of 1985.

The differences in animal traction use from one year to the other were quite interesting. Both for 1984 and for 1985, there was no

Table 16: Labor time for the major cropping systems broken down by task and traction type for 1984 and 1985 on 75 farms in three Madarounfa villages.

Cropping system and farming task.	Year and traction type					
	1984			1985		
	Manual	Oxen	Manual	Oxen	Manual	Oxen
	person- hours/ha	person- hours/ha	animal- hours/ha	person- hours/ha	person- hours/ha	animal- hours/ha
Monocropped Millet						
Field prep. & plow.	17	21	10	6	41	21
Manure spreading	0	2	2	6	3	4
Planting & replant.	21	15	—	15	18	—
1st weeding/cultiv.	73	74	7	89	39	1
Other weeding	20	26	4	42	51	1
Harvest	21	22	1	32	45	0
TOTAL	152	160	24	189	195	28
Monocropped Sorghum						
Field prep. & plow.	24	28	11	4	29	23
Manure spreading	—	—	—	0	—	—
Planting & replant.	36	12	—	25	20	—
1st weeding/cultiv.	91	76	8	84	44	0
Other weeding	30	29	0	9	48	—
Harvest	12	32	4	40	26	—
TOTAL	192	177	24	162	166	23
Millet-sorghum						
Field prep. & plow.	13	31	12	8	26	14
Manure spreading	0	5	1	4	2	2
Planting & replant.	17	17	0	22	13	—
1st weeding/cultiv.	89	51	8	86	56	6
Other weeding	24	24	1	33	39	6
Harvest	15	17	0	34	37	0
TOTAL	159	144	23	187	174	29
Millet-cowpea						
Field-prep. & plow.	16	28	6	9	37	19
Manure spreading	1	0	—	4	4	3
Planting & replant.	20	26	—	18	20	—
1st weeding/cultiv.	78	72	14	75	66	1
Other weeding	45	53	—	52	63	2
Harvest	26	33	2	33	38	1
TOTAL	186	213	22	191	227	26
Millet-sorghum-cowpea						
Field prep. & plow.	16	12	4	6	16	10
Manure spreading	0	—	—	7	6	1
Planting & replant.	21	21	—	24	16	1
1st weeding/cultiv.	83	54	6	69	71	5
Other weeding	54	22	1	50	43	3
Harvest	32	41	2	50	65	2
TOTAL	205	150	14	204	217	22

significant difference in labor time between the fields tilled by hand and those tilled with oxen. Labor time spent on the oxen traction fields was actually higher in half the cases. Coefficients of variation were around 50% (see appendix tables), indicating that the differences in means have no statistical significance. However, it is quite likely that animal traction work demands less exertion than manual field cultivation. Any improvement in the timeliness of field operations was not rewarded by higher yields.

Despite the lack of differences in mean global labor time between manual cultivation and draft animal cultivation, there were striking differences according to worker sex. As Table 17 indicates, women worked more on the manual cultivation fields (except those in monocropped sorghum), while men did most of their work on animal traction fields. As a group, youths (both boys and girls from 10 to 13 years) worked less than adults, but they tended to work more on the animal traction fields. This is probably due to the need to have two people to lead a team of oxen: one to hold the cultivating equipment and the other (often a boy) to lead the oxen down the rows.

How to explain the fact that women do most of the manual cultivation? One hypothesis is that women were more likely to work their private fields (gamana), while men did the greater part of their work on collective family fields (gandu). Collective fields may have been more likely to benefit from animal traction if the farm had the means. But according to Legal, there was no significant difference in overall labor time between collective fields and private ones.

The mean labor allocations presented here are lower than those for similar tasks in comparable studies, as can be seen from Table 18.

Table 17: The division of agricultural labor by sex and age group and by traction type for the major cropping systems in 1985 in three Madarounfa villages.

Village and cropping system	Traction method							
	Manual				Oxen			
	n	Men	Women	Youths	n	Men	Women	Youths
----- percent -----				----- percent -----				
Kandamao								
Millet	1	3	97	0	4	60	37	3
Sorghum	0	—	—	—	4	63	5	32
Millet-sorghum	7	44	49	7	9	57	28	15
Millet-cowpea	1	92	7	1	1	86	10	4
Millet-sorghum-cowpea	6	73	27	0	10	63	20	16
M-S-sesame/S-sesame	2	50	24	26	8	82	10	8
Maiguéro								
Millet	48	26	55	19	18	51	39	10
Sorghum	11	50	44	6	3	47	38	15
Millet-sorghum	10	41	43	16	4	39	45	16
Millet-cowpea	26	29	62	9	10	37	53	10
Millet-sorghum-cowpea	9	22	76	2	6	47	43	9
Rigial Oubandawaki								
Millet	129	25	62	13	5	71	19	10
Sorghum	6	51	42	7	1	42	16	42
Millet-sorghum	36	40	48	12	4	73	16	11
Millet-cowpea	14	36	51	13	1	46	25	30
Millet-sorghum-cowpea	11	25	63	12	3	63	21	16
All villages								
Millet	178	25	60	15	27	56	35	9
Sorghum	17	50	44	6	8	58	16	26
Millet-sorghum	53	41	47	12	17	57	29	14
Millet-cowpea	41	33	57	10	12	41	47	12
Millet-sorghum-cowpea	26	38	56	5	19	58	29	13

Table 18: Labor time data compared for monocropped millet in three studies in the Sahelo-Sudanian zone of West Africa.

Farming activity	Information source				
	Burkina Faso 1980 ¹	Northern Nigeria ² (no date)	Maradi ³ 1984	Maradi ⁴ 1984 1985	
	- - - - - person-hours - - - - -				
Field preparation	56	—	15	17	12
Planting	79	56	23	21	15
Maintenance	416	280	159	93	131
Harvest	92	140	43	21	32
TOTAL	643	476	245	152	189
Coef. of variation			(0.52)	(0.71)	(1.12)

1. McIntire, p.15; Mossi Plateau, both manual and animal traction.
2. Mémento de l'Agronome 1980, cited in Legal (p.10), no date given.
3. Legal, p.13, both manual and draft animal cultivation.
4. This study, manual cultivation only.

Legal's data, which comes from the same region during 1984, is insignificantly different since his labor time means are within one standard deviation of the results reported here. Eddy's study of 16 Hausa farms in Kao, Niger in 1976 found similarly low labor use, 258 hours/ha (c.v. = 0.69) in a year with 210 mm rain (Eddy 1979: 444). However, it is worth wondering why mean labor times reported from studies in Burkina Faso and northern Nigeria should be so much higher than those in Maradi. Unfortunately, the data from Nigeria are accompanied by neither the reference year nor the farming situation (research station or actual village fields). Nonetheless, it is true that northern Nigeria receives more rainfall than southern Niger. This was especially true for the period preceding the droughts of the past 15 years. Furthermore, the Nigerian data were measured in work-days, and it may be that these represent fewer than seven hours of work per day.

In the case of Burkina Faso, it may be that the labor times are higher because 1) the soils of the Mossi Plateau are lateritic and harder to work than the sandy soils of southern Maradi, 2) rainfall is higher and the cropping season longer, which would tend to require more weeding and offer higher yields, and 3) farm sizes are smaller (2.6 to 3.4 hectares versus means of 4.0 to 8.5 hectares among the farms surveyed in Madarounfa), and hence perhaps more intensively worked.

IV. IMPLICATIONS FOR AGRICULTURAL RESEARCH

The information presented here provides a solid data base on costs, returns and labor time allocation for the most common cropping systems in the surveyed villages in 1984 and 1985. As such, they may be used for the development of input-output models of farm management in the region. Such models make possible the testing of potentially valuable new technologies in the context of existing production systems.

But these budgets and labor time profiles bring up as many questions as they provide answers. They suggest a range of research topics in agronomy, economics and sociology. The following are several suggestions for research.

Agronomic research

The budget analysis results confirm the appeal of cereal-legume crop associations. The economic value of such cropping systems lies in the multiplicity of their products and by-products, which reduces the risk of a total failure due to climatic or marketing misfortunes. At the low planting densities practiced by peasant farmers, there was no significant reduction in cereal yields when legumes are added to the system. Hence, it would be desirable to continue research on cereal-legume systems, particularly on planting density (with and without mineral fertilizer supplements) in order to determine the level at which the trade-off begins between yields of cereals and of legumes. In collaboration with economic researchers, optimal planting densities

should be determined, according to the expected prices of products and by-products from the crop mixture.

Crop yields from 1984 and 1985 were clearly affected by weather circumstances according to the level of crop development. For example, neither cowpeas nor sorghum yielded well in either year. Notwithstanding, crop associations including these two are quite common. According to informal farmer interviews, one reason for including sorghum in cropping systems is that it performs well when the rainy season runs late, since it takes advantage of soil moisture available after millet spikes have already matured. It would be desirable to better understand how the different components of existing cropping systems perform according to the interaction of soil moisture levels with crop life cycles. Might it become feasible to determine expected optimal cropping systems according to the planting date and the rate of advance of the monsoon rains? Once the necessary field trials have been executed, results might be incorporated into a risk programming model to analyze the advantages of one system compared with another according to the likelihood of different rainfall patterns.

The survey encountered very low levels of mineral fertilizer use, considerably lower than the levels identified during the 1982 baseline survey (Ly and Swinton, 1984; Swinton and Ly, 1986). Indeed, there was even a decline in fertilizer use from 1984 to 1985 on the surveyed farms. One explanation is that farmers have found too much variability in yields resulting from the recommended levels of fertilization. Are there fertilization methods with lower variance in expected yields that might better serve low income farmers who cannot afford to sustain (avoidable) losses?

Animal traction was chiefly employed in field preparation, and used very little for cultivation during the growing season. Yet INRAN has already demonstrated the appeal of using draft animals for the whole range of field cultivation tasks. What seems to be needed is experimentation using several levels of animal traction use evaluated not only by measuring yields, but also by monitoring labor time and effort level. An appropriate experimental design might include the following treatments: field preparation alone, field preparation and first weeding, field preparation and all weedings, and all field cultivation tasks. Such a trial should account for the cost of feeding and caring for the draft animals needed to do the field work.

Economic research

Although these budgets and labor time allocation data provide an image of typical economic returns to the major cropping systems of three Madarounfa villages in 1984 and 1985, they do not explain why the situation is as it is. What explains the enormous variation in labor time allocation and in yields? Why do some fields yield well (given the weather), while others failed totally? To find answers to this kind of question, more advanced analyses are needed.

One possible approach would be to carry out econometric analyses. Using multiple regression techniques, progress could be made in determining the independent variables that best explain the observed structure of yields and net returns. Given the variety and complexity of the factors that influence yields, it is desirable to identify the ones that weigh most heavily in the production functions of each cropping system. These factors should then become research topics

themselves. The variables that should be examined in any regression analyses include the following: the quantity and seasonal distribution of rainfall, the date at which each field task was executed (including the interaction of these variables with the rainfall variables), the amount of work done per task, the source of agricultural power (draft or manual), fertilizer use and field size, to mention a few.

In order to construct valid production functions for cropping systems in a climate as fickle as Niger's, it would be desirable to establish a time series of input-output data on a limited number of farms. In order to do this at a reasonable cost, the data from the 1984 and 1985 field surveys could be used to identify the most typical farms in the village samples. That way, monitoring a small number (say, two to five per village) would not draw too heavily on INRAN's resources if experienced enumerators were used. Another question raised by this study is whether farmers chose cropping systems because they promised the best expected returns, or rather because there were no alternatives. Do farmers choose freely to grow a millet-sorghum intercrop under manual cultivation because they consider it the best cropping system for their fields given timing of the first planting rain? Or do they choose it because they lack the cash to buy peanut seed and cannot afford draft animals?

DECOR has already undertaken a worthwhile approach to answering this kind of question by modeling the cropping activities of a typical farm. This permits studying the farm as a unit, so that desirable combinations of crop associations and technologies can be studied in relation to the available resources, production coefficients,

subsistence needs, input costs, and agricultural product prices.

Building useful models of rainfed agricultural production will require no small number of additional agronomic trials and econometric analyses to furnish the technical coefficients needed on the performance of different crops and technologies under different rainfall conditions.

A more sociological approach to these same questions would be to discuss them with farmers and extension agents. Why is animal traction so little used for cultivation of standing crops? Why the decline in fertilizer and fungicide use since 1982? Why the tendency for women to work chiefly in fields without draft animal power? Why the low levels of labor allocation relative to those in neighboring countries?

Despite the subjectivity and lack of statistical reliability from group discussions, they have the great advantage of being more open and flexible to unexpected ideas than preconceived questionnaires. They can also set the scene for more detailed studies of previously unrecognized but important phenomena.

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APPENDIX A

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet monocrop
Traction: Manual
Year: 1984

Item	Unit of measure	V I L L A G E			All vills.
		Kandamao N = 3	Maiguéro 22	Rigial O. 23	
EXPENSES					
Cash outlays					
Cash outlays	FCFA/ha	0	1,360	20	633
Seeds	FCFA/ha	450	1,390	1,270	1,270
Fungicide	FCFA/ha	0	70	10	37
Fertilizer	FCFA/ha	0	0	90	43
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	0	0	0	0
Total cash expenses	FCFA/ha	800	3,170	1,740	2,333
In-kind labor					
Family labor	hours	124	142	166	152
Draft animal labor	hours	0	0	1	0
Storage loss (4% yield)	kg/ha	7	5	6	6
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	30,030	22,440	22,935	23,152
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	0	0	0
Gross income (local prices)	FCFA/ha	30,030	22,440	22,935	23,152
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	18,200	13,600	13,900	14,031
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/ha	18,200	13,600	13,900	14,031
NET INCOME					
Per hectare (local prices)	FCFA/ha	28,000	18,400	20,300	19,900
Per hectare (off. prices)	FCFA/ha	16,700	9,900	11,600	11,100
Effect. wage (local prices)	FCFA/hr	226	130	122	131
Effect. wage (off. prices)	FCFA/hr	135	70	70	73

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg - - - - -		- kg/ha - - - - -			
Millet (grain)	165	100	182	136	139	140
Sorghum (grain)	146	100				0
Cowpea (grain)	208	90				0
Cowpea (hay)	60	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet monocrop
Traction: Bovine
Year: 1984

Item	Unit of measure	V I L L A G E			All vills. 30
		Kandamao N = 2	Maiguéro 26	Rigial O. 2	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	1,670	860	0	857
Seeds	FCFA/ha	50	1,490	700	1,340
Fungicide	FCFA/ha	0	150	0	130
Fertilizer	FCFA/ha	0	0	320	21
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	1,500	1,500	1,500	1,500
Total cash expenses	FCFA/ha	3,570	4,350	2,870	4,198
In-kind labor					
Family labor	hours	120	154	279	160
Draft animal labor	hours	5	25	16	24
Storage loss (4% yield)	kg/ha	8	6	11	6
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	32,670	23,100	46,200	25,278
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	0	0	0
Gross income (local prices)	FCFA/ha	32,670	23,100	46,200	25,278
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	19,800	14,000	28,000	15,320
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/ha	19,800	14,000	28,000	15,320
NET INCOME					
Per hectare (local prices)	FCFA/ha	27,800	17,800	41,500	20,100
Per hectare (off. prices)	FCFA/ha	15,400	9,100	24,000	10,500
Effect. wage (local prices)	FCFA/hr	232	116	149	126
Effect. wage (off. prices)	FCFA/hr	128	59	86	66

Crop	MEAN PRICES AND YIELDS BY CROP					
	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	165	100	198	140	280	153
Sorghum (grain)	146	100				0
Cowpea (grain)	208	90				0
Cowpea (hay)	60	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Sorghum monocrop
 Traction: Manual
 Year: 1984

Item	Unit of measure	V I L L A G E			All vills.
		Kandamao N =	Maiguéro 2	Rigial 8	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	0	0	0	0
Seeds	FCFA/ha	420	1,250	260	950
Fungicide	FCFA/ha	0	70	0	47
Fertilizer	FCFA/ha	0	0	0	0
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	0	0	0	0
Total cash expenses	FCFA/ha	770	1,670	610	1,347
In-kind labor					
Family labor	hours	218	203	119	192
Draft animal labor	hours	0	0	5	1
Storage loss (4% yield)	kg/ha	4	3	1	3
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	0	0	0	0
Sorghum (grain)	FCFA/ha	14,016	10,366	5,256	10,123
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	0	0	0
Gross income (local prices)	FCFA/ha	14,016	10,366	5,256	10,123
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	0	0	0	0
Sorghum (grain)	FCFA/ha	9,600	7,100	3,600	6,933
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/ha	9,600	7,100	3,600	6,933
NET INCOME					
Per hectare (local prices)	FCFA/ha	12,700	8,300	4,400	8,400
Per hectare (off. prices)	FCFA/ha	8,400	5,100	2,800	5,300
Effect. wage (local prices)	FCFA/hr	58	41	37	44
Effect. wage (off. prices)	FCFA/hr	39	25	24	28

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg - - - - -		- kg/ha - - - - -			
Millet (grain)	165	100				0
Sorghum (grain)	146	100	96	71	36	6
Cowpea (grain)	208	90				0
Cowpea (hay)	60	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Sorgho pur
 Traction: Bovine
 Year: 1984

Item	Unit of measure	V I L L A G E			All vills. 15
		Kandamao N = 10	Maiguéro 5	Rigial O. 0	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	0	830		277
Seeds	FCFA/ha	580	1,260		840
Fungicide	FCFA/ha	0	130		43
Fertilizer	FCFA/ha	0	0		0
Tool maintenance	FCFA/ha	350	350		350
Equip. depreciation	FCFA/ha	1,500	1,500		1,500
Total cash expenses	FCFA/ha	2,430	4,070		3,010
In-kind labor					
Family labor	hours	147	228		177
Draft animal labor	hours	10	48		24
Storage loss (4% yield)	kg/ha	2	6		4
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	0	0		0
Sorghum (grain)	FCFA/ha	9,052	22,046		13,383
Cowpea (grain)	FCFA/ha	0	0		0
Cowpeaa (hay)	FCFA/ha	0	0		0
Gross income (local prices)	FCFA/ha	9,052	22,046		13,383
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	0	0		0
Sorghum (grain)	FCFA/ha	6,200	15,100		9,167
Cowpea (grain)	FCFA/ha	0	0		0
Gross income (off. prices)	FCFA/ha	6,200	15,100		9,167
NET INCOME					
Per hectare (local prices)	FCFA/ha	6,300	17,100		9,800
Per hectare (off. prices)	FCFA/ha	3,500	10,400		5,800
Effect. wage (local prices)	FCFA/hr	43	75		55
Effect. wage (off. prices)	FCFA/hr	24	46		33

MEAN PRICES AND YIELDS BY CROPS

Crop	P R I C E		Y I E L D		
	Local	Off.	Kandamao	Maiguéro	Rigial O. All vills.
	- FCFA/kg - - - - -		- kg/ha - - - - -		
Millet (grain)	165	100			0
Sorghum (grain)	146	100	62	151	92
Cowpea (grain)	208	90			0
Cowpea (hay)	60	0			0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: millet-sorghum
Traction: Manual
Year: 1984

Item	Unit of measure	V I L L A G E			All vills. 43
		Kandamao N = 5	Maiguéro 14	Rigial O. 24	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	0	210	290	230
Seeds	FCFA/ha	430	930	1,430	1,140
Fungicide	FCFA/ha	0	70	0	23
Fertilizer	FCFA/ha	0	0	0	0
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	0	0	0	0
Total cash expenses	FCFA/hr	780	1,560	2,070	1,743
In-kind labor					
Family labor	hours	106	104	204	159
Draft animal labor	hours	0	0	0	0
Storage loss (4% yield)	kg/ha	5	3	4	4
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	17,655	11,880	13,365	13,380
Sorghum (grain)	FCFA/ha	2,920	438	2,190	1,704
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	0	0	0
Gross income (local prices)	FCFA/ha	20,575	12,318	15,555	15,085
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	10,700	7,200	8,100	8,100
Sorghum (grain)	FCFA/ha	2,000	300	1,500	1,167
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/ha	12,700	7,500	9,600	9,277
NET INCOME					
Per hectare (local prices)	FCFA/ha	19,000	10,300	12,900	12,700
Per hectare (off. prices)	FCFA/ha	11,400	5,600	7,100	7,200
Effect. wage (local prices)	FCFA/hr	179	99	63	80
Effect. wage (off. prices)	FCFA/hr	108	54	35	45

Crop	MEAN PRICES AND YIELDS BY CROP					
	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
- FCFA/kg -		- kg/ha -				
Millet (grain)	165	100	107	72	81	81
Sorghum (grain)	146	100	20	3	15	12
Cowpea (grain)	208	90				0
Cowpea (hay)	60	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum
 Traction: Animal
 Year: 1984

Item	Unit of measure	V I L L A G E			All vills.
		Kandamao N =	Maiguéro 9	Rigial O. 12	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	350	220		276
Seeds	FCFA/ha	730	1,430		1,120
Fungicide	FCFA/ha	0	130		74
Fertilizer	FCFA/ha	0	40		23
Tool maintenance	FCFA/ha	350	350		350
Equip. depreciation	FCFA/ha	1,500	1,500		1,500
Total cash expenses	FCFA/ha	2,930	3,670		3,343
In-kind labor					
Family labor	hours	146	143		144
Draft animal labor	hours	7	35		23
Storage loss (4% yield)	kg/ha	6	7		7
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	24,420	26,730		25,740
Sorghum (grain)	FCFA/ha	1,898	876		1,314
Cowpea (grain)	FCFA/ha	0	0		0
Cowpea (hay)	FCFA/ha	0	0		0
Gross income (local prices)	FCFA/ha	26,310	27,606		27,054
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	14,800	16,200		15,600
Sorghum (grain)	FCFA/ha	1,300	600		900
Cowpea (grain)	FCFA/ha	0	0		0
Gross income (off. prices)	FCFA/ha	16,100	16,800		16,500
NET INCOME					
Per hectare (local prices)	FCFA/ha	22,300	22,800		22,600
Per hectare (off. prices)	FCFA/ha	12,500	12,500		12,500
Effect. wage (local prices)	FCFA/hr	153	153		157
Effect. wage (off. prices)	FCFA/hr	86	87		87

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	165	100	148	162		156
Sorghum (grain)	146	100	13	6		9
Cowpea (grain)	208	90				0
Cowpea (hay)	60	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-cowpea
Traction: Manual
Year: 1984

Item	Unit of measure	V I L L A G E			All vills.
		Kandamao N = 0	Maiguéro 13	Rigial O. 36	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha		0	30	22
Seeds	FCFA/ha		1,160	1,480	1,400
Fungicide	FCFA/ha		10	10	10
Fertilizer	FCFA/ha		0	0	0
Tool maintenance	FCFA/ha		350	350	350
Equip. depreciation	FCFA/ha		0	0	0
Total cash expenses	FCFA/ha		1,520	1,870	1,782
In-kind labor					
Family labor	hours		169	192	186
Draft animal labor	hours		1	1	1
Storage loss (4% yield)	kg/ha		8	7	7
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha		23,430	24,255	24,036
Sorghum (grain)	FCFA/ha		0	0	0
Cowpea (grain)	FCFA/ha		3,120	2,496	2,662
Cowpea (hay)	FCFA/ha		2,340	420	929
Gross income (local prices)	FCFA/ha		28,890	27,171	27,627
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha		14,200	14,700	14,567
Sorghum (grain)	FCFA/ha		0	0	0
Cowpea (grain)	FCFA/ha		1,350	1,080	1,152
Gross income (local prices)	FCFA/ha		15,550	15,780	15,719
NET INCOME					
Per hectare (local prices)	FCFA/ha		26,200	24,200	24,700
Per hectare (off. prices)	FCFA/ha		13,400	13,300	13,300
Effect. wage (local prices)	FCFA/hr		155	126	133
Effect. wage (off. prices)	FCFA/hr		79	69	72

Crop	MEAN PRICES AND YIELDS BY CROP				
	P R I C E		Y I E L D		
	Local	Off.	Kandamao	Maiguéro	Rigial O. All vills.
	- FCFA/kg - - - - -		- kg/ha - - - - -		
Millet (grain)	165	100	142	147	146
Sorghum (grain)	146	100			0
Cowpea (grain)	208	90	15	12	13
Cowpea (hay)	60	0	39	7	15

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-cowpea
 Traction: Oxen
 Year: 1984

Item	Unit of measure	V I L L A G E			All vills.
		N =	0	7	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha		1,440	0	1,120
Seed	FCFA/ha		1,530	2,020	1,640
Fungicide	FCFA/ha		20	0	16
Fertilizer	FCFA/ha		40	180	71
Tool maintenance	FCFA/ha		350	350	350
Equip. depreciation	FCFA/ha		1,500	1,500	1,500
Total cash expenses	FCFA/ha		4,880	4,050	4,697
In-kind outlays					
Family labor	hours		162	390	213
Draft animal labor	hours		18	36	22
Storage loss (4% yield)	kg/ha		5	12	7
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha		20,955	30,195	23,008
Sorghum (grain)	FCFA/ha		0	0	0
Cowpea (grain)	FCFA/ha		1,040	6,864	2,334
Cowpea (hay)	FCFA/ha		0	4,680	1,040
Gross income (local prices)	FCFA/ha		21,995	41,739	26,383
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha		12,700	18,300	13,944
Sorghum (grain)	FCFA/ha		0	0	0
Cowpea (grain)	FCFA/ha		450	2,970	1,010
Gross income (off. prices)	FCFA/ha		13,150	21,270	14,954
NET INCOME					
Per hectare (local prices)	FCFA/ha		16,200	36,000	20,600
Per hectare (Off. prices)	FCFA/ha		7,700	16,400	9,700
Effect. wage (local prices)	FCFA/hr		100	92	97
Effect. wage (off. prices)	FCFA/hr		48	42	46

Crop	MEAN PRICES AND YIELDS BY CROP					
	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
- FCFA/kg -		- kg/ha -				
Millet (grain)	165	100		127	183	139
Sorghum (grain)	146	100				0
Cowpea (grain)	208	90		5	33	11
Cowpea (hay)	60	0		0	78	17

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum-cowpea
Traction: Manual
Year: 1984

Item	Unit of measure	V I L L A G E			All vills.	
		N =	Kandamao 1	Maiguéro 28		Rigial O. 95
EXPENSES						
Cash outlays						
Wage labor	FCFA/ha		0	1,440	180	463
Seed	FCFA/ha		240	1,780	2,200	2,106
Fungicide	FCFA/ha		0	40	10	17
Fertilizer	FCFA/ha		0	0	0	0
Tool maintenance	FCFA/ha		350	350	350	350
Equip. depreciation	FCFA/ha		0	0	0	0
Total cash expenses	FCFA/ha		590	3,610	2,760	2,936
In-kind outlays						
Family labor	hours		87	169	217	205
Draft animal labor	hours		0	0	2	2
Storage loss (4% yield)	kg/ha		6	9	9	9
INCOME AT LOCAL PRICES						
Millet (grain)	FCFA/ha		26,070	36,135	23,100	26,067
Sorghum (grain)	FCFA/ha		0	1,168	1,606	1,494
Cowpea (grain)	FCFA/ha		0	416	4,368	3,440
Cowpea (hay)	FCFA/ha		0	0	2,640	2,023
Gross income (local prices)	FCFA/ha		26,070	37,719	31,714	33,024
INCOME AT OFFICIAL PRICES						
Millet (grain)	FCFA/ha		15,800	21,900	14,000	15,798
Sorghum (grain)	FCFA/ha		0	800	1,100	1,023
Cowpea (grain)	FCFA/ha		0	180	1,890	1,489
Gross income (off. prices)	FCFA/ha		15,800	22,880	16,990	18,310
NET INCOME						
Per hectare (local prices)	FCFA/ha		24,400	32,600	27,700	28,800
Per hectare (Off. prices)	FCFA/ha		14,600	18,400	13,600	14,600
Effect. wage (local prices)	FCFA/hr		280	193	128	140
Effect. wage (off. prices)	FCFA/hr		168	109	63	71

Crop	MEAN PRICES AND YIELDS BY CROP					
	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	165	100	158	219	140	158
Sorghum (grain)	146	100	0	8	11	10
Cowpea (grain)	208	90	0	2	21	17
Cowpea (hay)	60	0	0	0	44	34

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum-cowpea
 Traction: Oxen
 Year: 1984

Item	Unit of measure	V I L L A G E				All O. vills. 13
		N =	6	3	4	
EXPENSES						
Cash outlays						
Wage labor	FCFA/ha	0	1,080	0	249	
Seed	FCFA/ha	640	830	1,710	1,020	
Fungicide	FCFA/ha	0	0	20	6	
Fertilizer	FCFA/ha	0	0	0	0	
Tool maintenance	FCFA/ha	350	350	350	350	
Equip. depreciation	FCFA/ha	1,500	1,500	1,500	1,500	
Total cash expenses	FCFA/ha	2,490	3,760	3,580	3,125	
In-kind outlays						
Family labor	hours	138	137	179	150	
Draft animal labor	hours	9	20	16	14	
Storage loss (4% yield)	kg/ha	4	6	7	6	
INCOME AT LOCAL PRICES						
Millet (grain)	FCFA/ha	16,830	21,945	14,520	17,300	
Sorghum (grain)	FCFA/ha	1,314	1,898	2,044	1,673	
Cowpea (grain)	FCFA/ha	0	1,040	4,784	1,712	
Cowpea (hay)	FCFA/ha	0	0	3,240	997	
Gross income (local prices)	FCFA/ha	18,144	24,883	24,588	21,682	
INCOME AT OFFICIAL PRICES						
Millet (grain)	FCFA/ha	10,200	13,300	8,800	10,485	
Sorghum (grain)	FCFA/ha	900	1,300	1,400	1,146	
Cowpea (grain)	FCFA/ha	0	450	2,070	741	
Gross income (off. prices)	FCFA/ha	11,100	15,050	12,270	12,372	
NET INCOME						
Per hectare (local prices)	FCFA/ha	14,900	20,100	20,000	17,700	
Per hectare (Off. prices)	FCFA/ha	8,200	10,700	8,200	8,800	
Effect. wage (local prices)	FCFA/hr	108	147	112	118	
Effect. wage (off. prices)	FCFA/hr	59	78	46	59	

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	165	100	102	133	88	105
Sorghum (grain)	146	100	9	13	14	11
Cowpea (grain)	208	90	0	5	23	8
Cowpea (hay)	60	0	0	0	54	17

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum-sesame/sorghum-sesame
 Traction: Manual and oxen
 Year: 1984

Item	Unit of measure	Village of Kandamao	
		Manual N = 4	Oxen 9
EXPENSES			
Cash outlays			
Wage labor	FCFA/ha	0	0
Seed	FCFA/ha	1,780	1,740
Fungicide	FCFA/ha	0	0
Fertilizer	FCFA/ha	0	0
Tool maintenance	FCFA/ha	350	350
Equipment depreciation	FCFA/ha	0	1,500
Total cash expenses	FCFA/ha	2,130	3,590
In-kind outlays			
Family labor	hours	150	132
Draft animal labor	hours	0	12
Storage loss (4% yield)	kg/ha	4	7
INCOME AT LOCAL PRICES			
Millet (grain)	FCFA/ha	11,385	1,980
Sorghum (grain)	FCFA/ha	876	11,680
Sesame (grain)	FCFA/ha	7,128	17,928
Gross income (local prices)	FCFA/ha	19,389	31,588
INCOME AT OFFICIAL PRICES			
Millet (grain)	FCFA/ha	6,900	1,200
Sorghum (grain)	FCFA/ha	600	8,000
Sesame (grain)	FCFA/ha	7,128	17,928
Gross income (off. prices)	FCFA/ha	14,628	27,128
NET INCOME			
Per hectare (local prices)	FCFA/ha	16,500	26,700
Per hectare (off. prices)	FCFA/ha	11,900	22,500
Effect. wage (local prices)	FCFA/hr	110	202
Effect. wage (off. prices)	FCFA/hr	79	170

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D	
	Local	Off.	Manual	Oxen
	- FCFA/kg - - - - -		- kg/ha - - - - -	
Millet (grain)	165	100	69	12
Sorghum (grain)	146	100	6	80
Sesame (grain)	216	216	33	83

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet monocrop
Traction: Manual
Year: 1985

Item	Unit of measure	V I L L A G E			All vills.	
		N =	Kandamao 1	Maiguéro 48		Rigial O. 130
EXPENSES						
Cash outlays						
Wage labor	FCFA/ha		0	50	110	93
Seed	FCFA/ha		600	1,260	1,280	1,270
Fungicide	FCFA/ha		0	0	0	0
Fertilizer	FCFA/ha		0	0	0	0
Tool maintenance	FCFA/ha		350	350	350	350
Equip. depreciation	FCFA/ha		0	0	0	0
Total cash expenses	FCFA/ha		950	1,660	1,740	1,713
In-kind outlays						
Family labor	hours		291	238	171	189
Draft animal labor	hours		0	0	0	0
Storage loss (4% yield)	kg/ha		16	26	8	13
INCOME AT LOCAL PRICES						
Millet (grain)	FCFA/ha		15,238	24,586	7,828	12,363
Sorghum (grain)	FCFA/ha					
Cowpea (grain)	FCFA/ha					
Cowpea (hay)	FCFA/ha					
Gross income (local prices)	FCFA/ha		15,238	24,586	7,828	12,363
INCOME AT OFFICIAL PRICES						
Millet (grain)	FCFA/ha		28,070	45,290	14,420	22,774
Sorghum (grain)	FCFA/ha					
Cowpea (grain)	FCFA/ha					
Gross income (off. prices)	FCFA/ha		28,070	45,298	14,420	22,774
NET INCOME						
Per hectare (local prices)	FCFA/ha		13,700	21,900	5,800	10,200
Per hectare (Off. prices)	FCFA/ha		26,000	41,800	12,100	20,100
Effect. wage (local prices)	FCFA/hr		47	92	34	54
Effect. wage (off. prices)	FCFA/hr		89	176	71	106

Crop	MEAN PRICES AND YIELDS BY CROP					
	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	38	70	401	647	206	325
Sorghum (grain)	36	70				0
Cowpea (grain)	162	100				0
Cowpea (hay)	35	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-monocrop
 Traction: Oxen
 Year: 1985

Item	Unit of measure	V I L L A G E			All
		Kandamao N = 4	Maiguéro 18	Rigial 5	O. vills. 27
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	140	930	1,180	860
Seed	FCFA/ha	560	1,400	930	1,230
Fungicide	FCFA/ha	0	0	0	0
Fertilizer	FCFA/ha	0	0	0	0
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	1,500	1,500	1,500	1,500
Total cash expenses	FCFA/ha	2,550	4,180	3,960	3,940
In-kind outlays					
Family labor	hours	89	210	229	195
Draft animal labor	hours	12	34	17	28
Storage loss (4% yield)	kg/ha	21	34	15	29
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	19,988	32,414	14,212	27,202
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	0	0	0
Gross income (local prices)	FCFA/ha	19,988	32,414	14,212	27,202
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	36,820	59,710	26,180	50,110
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/ha	36,820	59,710	26,180	58,110
NET INCOME					
Per hectare (local prices)	FCFA/ha	16,600	26,900	9,700	22,200
Per hectare (Off. prices)	FCFA/ha	32,800	53,100	21,200	44,200
Effect. wage (local prices)	FCFA/hr	198	128	42	114
Effect. wage (off. prices)	FCFA/hr	369	253	93	227

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	38	70	526	853	374	716
Sorghum (grain)	36	70				0
Cowpea (grain)	162	100				0
Cowpea (hay)	35	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Sorghum monocrop
Traction: Manual
Year: 1985

Item	Unit of measure	V I L L A G E			All vills.
		N =	Kandamao 0	Maiguéro 11	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha		0	0	0
Seed	FCFA/ha		1,800	870	1,490
Fungicide	FCFA/ha		0	0	0
Fertilizer	FCFA/ha		0	0	0
Tool maintenance	FCFA/ha		350	350	350
Equip. depreciation	FCFA/ha		0	0	0
Total cash expenses	FCFA/ha		2,150	1,220	1,840
In-kind outlays					
Family labor	hours		193	100	162
Draft animal labor	hours		0	0	0
Storage loss (4% yield)	kg/ha		15	3	0
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha		0	0	0
Sorghum (grain)	FCFA/ha		13,464	2,700	9,665
Cowpea (grain)	FCFA/ha		0	0	0
Cowpea (hay)	FCFA/ha		0	0	0
Gross income (local prices)	FCFA/ha		13,464	2,700	9,665
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha		0	0	0
Sorghum (grain)	FCFA/ha		26,180	5,250	18,793
Cowpea (grain)	FCFA/ha		0	0	0
Gross income (off. prices)	FCFA/ha		26,180	5,250	18,793
NET INCOME					
Per hectare (local prices)	FCFA/ha		10,800	1,400	7,400
Per hectare (Off. prices)	FCFA/ha		23,000	3,800	16,200
Effect. wage (local prices)	FCFA/hr		56	14	46
Effect. wage (off. prices)	FCFA/hr		119	38	100

Crop	MEAN PRICES AND YIELDS BY CROP				
	P R I C E		Y I E L D		
	Local	Off.	Kandamao	Maiguéro	Rigial O. All vills.
	- FCFA/kg -		- kg/ha -		
Millet (grain)	38	70	374	75	0
Sorghum (grain)	36	70			0
Cowpea (grain)	162	100			0
Cowpea (hay)	35	0			0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Sorghum monocrop
 Traction: Oxen
 Year: 1985

Item	Unit of measure	V I L L A G E			All vills.
		Kandamao N = 4	Maiguéro 3	Rigial O. 1	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	0	0	0	0
Seed	FCFA/ha	2,090	2,280	670	1,130
Fungicide	FCFA/ha	0	0	0	0
Fertilizer	FCFA/ha	0	0	0	0
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	1,500	1,500	1,500	1,500
Total cash expenses	FCFA/ha	2,940	3,030	2,520	2,980
In-kind outlays					
Family labor	hours	222	143	13	166
Draft animal labor	hours	16	40	4	23
Storage loss (4% yield)	kg/ha	12	15	0	11
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	0	0	0	0
Sorghum (grain)	FCFA/ha	10,692	13,212	0	10,301
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	0	0	0
Gross income (local prices)	FCFA/ha	10,692	13,212	0	10,301
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	0	0	0	0
Sorghum (grain)	FCFA/ha	20,790	25,690	0	20,029
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/hr	20,790	25,690	0	20,029
NET INCOME					
Per hectare (local prices)	FCFA/ha	7,300	9,700	(2,500)	6,300
Per hectare (Off. prices)	FCFA/ha	17,000	21,600	(2,500)	16,200
Effect. wage (local prices)	FCFA/ha	33	68	(192)	42
Effect. wage (off. prices)	FCFA/hr	77	151	(192)	98

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg - - - - -		- kg/ha - - - - -			
Millet (grain)	38	70				0
Sorghum (grain)	36	70	297	367	0	286
Cowpea (grain)	162	100				0
Cowpea (hay)	35	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum
Traction: Manual
Year: 1985

Item	Unit of measure	V I L L A G E			All vills.
		Kandamao N = 7	Maiguéro 10	Rigial O. 36	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	0	0	410	278
Seed	FCFA/ha	1,190	1,490	1,950	1,760
Fungicide	FCFA/ha	0	0	0	0
Fertilizer	FCFA/ha	0	0	0	0
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	0	0	0	0
Total cash expenses	FCFA/ha	1,540	1,840	2,710	2,388
In-kind outlays					
Family labor	hours	260	231	161	187
Draft animal labor	hours	0	0	0	0
Storage loss (4% yield)	kg/ha	12	29	9	13
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	9,272	22,990	8,512	11,344
Sorghum (grain)	FCFA/ha	2,196	3,924	360	1,285
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	0	0	0
Gross income (local prices)	FCFA/ha	11,468	26,914	8,872	12,619
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	17,080	42,350	15,680	20,897
Sorghum (grain)	FCFA/ha	4,270	7,630	700	2,479
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/ha	21,350	49,980	16,380	23,376
NET INCOME:					
Per hectare (local prices)	FCFA/ha	9,500	24,000	5,800	9,700
Per hectare (Off. prices)	FCFA/ha	19,000	46,100	13,000	20,100
Effect. wage (local prices)	FCFA/hr	37	104	36	52
Effect. wage (off. prices)	FCFA/hr	73	200	81	107

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	38	70	244	605	224	299
Sorghum (grain)	36	70	61	109	10	35
Cowpea (grain)	162	100				0
Cowpea (hay)	35	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum
Traction: Oxen
Year: 1984

Item	Unit of measure	V I L L A G E			All vills.	
		N =	9	4		4
EXPENSES						
Cash outlays						
Wage labor	FCFA/ha		0	100	1,420	376
Seed	FCFA/ha	1,260		1,140	1,120	1,190
Fungicide	FCFA/ha	0		0	0	0
Fertilizer	FCFA/ha	0		0	0	0
Tool maintenance	FCFA/ha	350		350	350	350
Equip. depreciation	FCFA/ha	1,500		1,500	1,500	1,500
Total cash expenses	FCFA/ha	3,110		3,170	4,390	3,416
In-kind outlays						
Family labor	hours	181		155	177	174
Draft animal labor	hours	32		36	13	29
Storage loss (4% yield)	kg/ha	25		12	7	17
INCOME AT LOCAL PRICES						
Millet (grain)	FCFA/ha	19,912		10,374	5,168	14,199
Sorghum (grain)	FCFA/ha	2,348		864	1,188	2,255
Cowpea (grain)	FCFA/ha	0		0	0	0
Cowpea (hay)	FCFA/ha	0		0	0	0
Gross income (local prices)	FCFA/ha	23,260		11,238	6,356	16,454
INCOME AT OFFICIAL PRICES						
Millet (grain)	FCFA/ha	36,680		19,110	9,520	26,155
Sorghum (grain)	FCFA/ha	6,510		1,680	2,310	4,385
Cowpea (grain)	FCFA/ha	0		0	0	0
Gross income (off. prices)	FCFA/ha	43,190		20,790	11,830	30,541
NET INCOME						
Per hectare (local prices)	FCFA/ha	19,200		7,600	1,700	12,400
Per hectare (Off. prices)	FCFA/ha	38,400		16,800	7,000	25,900
Effect. wage (local prices)	FCFA/hr	106		49	10	71
Effect. wage (off. prices)	FCFA/hr	212		108	40	149

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	38	70	524	273	136	374
Sorghum (grain)	36	70	93	24	33	63
Cowpea (grain)	162	100				0
Cowpea (hay)	35	0				0

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-cowpea
Traction: Manual
Year: 1985

Item	Unit of measure	N =	V I L L A G E			All vills.
			Kandamao 1	Maiguéro 26	Rigial O. 14	
EXPENSES						
Cash outlays						
Wage labor	FCFA/ha		0	20	0	13
Seed	FCFA/ha		1,370	1,610	1,950	1,720
Fungicide	FCFA/ha		0	0	0	0
Fertilizer	FCFA/ha		0	0	0	0
Tool maintenance	FCFA/ha		350	350	350	350
Equip. depreciation	FCFA/ha		0	0	0	0
Total cash expenses	FCFA/ha		1,720	1,980	2,300	2,083
In-kind outlays						
Family labor	hours		177	179	213	191
Draft animal labor	hours		0	0	0	0
Storage loss (4% yield)	kg/ha		31	18	10	16
INCOME AT LOCAL PRICES						
Millet (grain)	FCFA/ha		29,792	16,910	9,272	14,616
Sorghum (grain)	FCFA/ha		0	0	0	0
Cowpea (grain)	FCFA/ha		0	324	648	427
Cowpea (hay)	FCFA/ha		0	315	210	271
Gross income (local prices)	FCFA/ha		29,792	17,549	10,130	15,314
INCOME AT OFFICIAL PRICES						
Millet (grain)	FCFA/ha		54,880	31,150	17,000	26,924
Sorghum (grain)	FCFA/ha		0	0	0	0
Cowpea (grain)	FCFA/ha		0	207	400	263
Gross income (off. prices)	FCFA/ha		54,800	31,350	17,480	27,188
NET INCOME						
Per hectare (local prices)	FCFA/ha		26,900	14,900	7,400	12,600
Per hectare (Off. prices)	FCFA/ha		51,000	28,100	14,500	24,000
Effect. wage (local prices)	FCFA/hr		152	83	35	66
Effect. wage (off. prices)	FCFA/hr		288	157	68	126

Crop	MEAN PRICES AND YIELDS BY CROP					
	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
- FCFA/kg - - - - -			- kg/ha - - - - -			
Millet (grain)	38	70	784	445	244	385
Sorghum (grain)	36	70				0
Cowpea (grain)	162	100	0	2	4	3
Cowpea (hay)	35	0	0	9	6	8

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-cowpea
Traction: Oxen
Year: 1985

Item	Unit of measure	V I L L A G E			All
		Kandamao N =	Maiguéro 1	Rigial 10	O. vills. 1
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	0	843	1,430	188
Seed	FCFA/ha	900	1,830	1,910	1,760
Fungicide	FCFA/ha	0	0	0	0
Fertilizer	FCFA/ha	0	0	0	0
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	1,500	1,500	1,500	1,500
Total cash expenses	FCFA/ha	2,750	3,763	5,190	3,798
In-kind outlays					
Family labor	hours	161	230	260	227
Draft animal labor	hours	30	24	44	26
Storage loss (4% yield)	kg/ha	46	18	23	21
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	43,814	16,530	17,708	18,902
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Cowpea (hay)	FCFA/ha	0	910	4,130	1,103
Gross income (local prices)	FCFA/ha	43,814	17,440	21,838	20,004
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	80,710	30,450	32,620	34,819
Sorghum (grain)	FCFA/ha	0	0	0	0
Cowpea (grain)	FCFA/ha	0	0	0	0
Gross income (off. prices)	FCFA/ha	80,710	30,450	32,628	34,819
NET INCOME					
Per hectare (local prices)	FCFA/ha	39,300	13,000	15,800	15,400
Per hectare (Off. prices)	FCFA/ha	74,700	25,500	26,100	29,600
Effect. wage (local prices)	FCFA/hr	244	57	61	68
Effect. wage (off. prices)	FCFA/hr	464	111	100	130

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- - - - - kg/ha - - - - -			
Millet (grain)	38	70	1,153	435	466	497
Sorghum (grain)	36	70				0
Cowpea (grain)	162	100				0
Cowpea (hay)	35	0	0	26	118	32

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum-cowpea
Traction: Manual
Year: 1985

Item	Unit of measure	V I L L A G E			All O. vills. 26
		Kandamao N = 6	Maiguéro 9	Rigial 11	
EXPENSES					
Cash outlays					
Wage labor	FCFA/ha	0	0	40	17
Seed	FCFA/ha	1,230	3,250	2,570	2,460
Fungicide	FCFA/ha	0	0	0	0
Fertilizer	FCFA/ha	0	0	0	0
Tool maintenance	FCFA/ha	350	350	350	350
Equip. depreciation	FCFA/ha	0	0	0	0
Total cash expenses	FCFA/ha	1,580	3,600	2,960	2,827
In-kind outlays					
Family labor	hours	271	195	179	204
Draft animal labor	hours	0	0	0	0
Storage loss (4% yield)	kg/ha	41	18	9	20
INCOME AT LOCAL PRICES					
Millet (grain)	FCFA/ha	36,708	14,706	7,334	16,664
Sorghum (grain)	FCFA/ha	2,448	1,944	612	1,497
Cowpea (grain)	FCFA/ha	0	324	0	112
Cowpea (hay)	FCFA/ha	0	490	490	377
Gross income (local prices)	FCFA/ha	39,156	17,464	8,436	18,650
INCOME AT OFFICIAL PRICES					
Millet (grain)	FCFA/ha	67,620	27,090	13,510	30,698
Sorghum (grain)	FCFA/ha	4,760	3,780	1,190	2,910
Cowpea (grain)	FCFA/ha	0	200	0	69
Gross income (off. prices)	FCFA/ha	72,380	31,070	14,700	33,577
NET INCOME					
Per hectare (local prices)	FCFA/ha	36,000	13,200	5,100	15,100
Per hectare (Off. prices)	FCFA/ha	67,900	26,200	11,200	29,500
Effect. wage (local prices)	FCFA/hr	133	68	28	74
Effect. wage (off. prices)	FCFA/hr	251	134	63	145

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	38	70	966	387	193	439
Sorghum (grain)	36	70	68	54	17	42
Cowpea (grain)	162	100	0	2	0	1
Cowpea (hay)	35	0	0	14	14	11

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum-cowpea
Traction: Oxen
Year: 1985

Item	Unit of measure	V I L L A G E			All O. vills. 19	
		N =	Kandamao 10	Maiguéro 6		Rigial O. 3
EXPENSES						
Cash outlays						
Wage labor	FCFA/ha		0	270	0	85
Seed	FCFA/ha		940	1,890	2,430	1,480
Fungicide	FCFA/ha		0	10	0	3
Fertilizer	FCFA/ha		0	0	0	0
Tool maintenance	FCFA/ha		350	350	350	350
Equip. depreciation	FCFA/ha		1,500	1,500	1,500	1,500
Total cash expenses	FCFA/ha		2,790	4,020	4,280	3,418
In-kind outlays						
Family labor	hours		210	249	180	217
Draft animal labor	hours		18	33	16	22
Storage loss (4% yield)	kg/ha		26	38	24	29
INCOME AT LOCAL PRICES						
Millet (grain)	FCFA/ha		20,824	27,550	14,326	21,922
Sorghum (grain)	FCFA/ha		3,348	2,556	1,980	2,882
Cowpea (grain)	FCFA/ha		162	0	0	0
Cowpea (hay)	FCFA/ha		0	4,970	5,495	2,437
Gross income (local prices)	FCFA/ha		24,334	35,076	21,801	27,326
INCOME AT OFFICIAL PRICES						
Millet (grain)	FCFA/ha		38,360	50,750	26,390	40,383
Sorghum (grain)	FCFA/ha		6,510	4,970	3,850	5,604
Cowpea (grain)	FCFA/ha		100	0	0	53
Gross income (off. prices)	FCFA/ha		44,970	55,720	30,240	46,039
NET INCOME						
Per hectare (local prices)	FCFA/ha		20,600	29,700	16,600	22,800
Per hectare (Off. prices)	FCFA/ha		40,400	49,500	24,800	40,800
Effect. wage (local prices)	FCFA/hr		98	119	92	105
Effect. wage (off. prices)	FCFA/hr		192	199	138	188

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D			
	Local	Off.	Kandamao	Maiguéro	Rigial O.	All vills.
	- FCFA/kg -		- kg/ha -			
Millet (grain)	38	70	548	725	377	577
Sorghum (grain)	36	70	93	71	55	80
Cowpea (grain)	162	100	1	0	0	1
Cowpea (hay)	35	0	0	142	157	70

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Millet-sorghum-sesame/sorghum-sesame
 Traction: Manual and oxen
 Year: 1985

Item	Unit of measure	Village of Kandamao	
		Manual N = 2	Oxen 8
EXPENSES			
Cash outlays			
Wage labor	FCFA/ha	1,900	10
Seed	FCFA/ha	1,520	2,460
Fungicide	FCFA/ha	0	0
Fertilizer	FCFA/ha	0	0
Tool maintenance	FCFA/ha	350	350
Equipment depreciation	FCFA/ha	0	0
Total cash expenses	FCFA/ha	3,870	4,320
In-kind outlays			
Family labor	hours	180	275
Draft animal labor	hours	0	46
Storage loss (4% yield)	kg/ha	17	23
INCOME AT LOCAL PRICES			
Millet (grain)	FCFA/ha	9,158	15,352
Sorghum (grain)	FCFA/ha	3,348	4,788
Sesame (grain)	FCFA/ha	17,672	9,024
Gross income (local prices)	FCFA/ha	30,178	29,164
INCOME AT OFFICIAL PRICES			
Millet (grain)	FCFA/ha	16,870	28,280
Sorghum (grain)	FCFA/ha	6,510	9,310
Sesame (grain)	FCFA/ha	17,672	9,024
Gross income (off. prices)	FCFA/ha	41,052	46,614
NET INCOME			
Per hectare (local prices)	FCFA/ha	25,100	23,700
Per hectare (off. prices)	FCFA/ha	35,500	40,400
Effect. wage (local prices)	FCFA/hr	139	86
Effect. wage (off. prices)	FCFA/hr	197	147

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D	
	Local	Off.	Manual	Oxen
	- FCFA/kg - - - - -		- - - - - kg/ha - - - - -	
Millet (grain)	38	70	241	404
Sorghum (grain)	36	70	93	133
Sesame (grain)	188	188	94	48

MEAN CROPPING SYSTEMS BUDGETS

Cropping system: Tobacco

Traction: Manual

Year: 1985

Item	Unit of measure	Village of Maiguero Manual N = 7
EXPENSES		
Cash outlays		
Wage labor	FCFA/ha	3,340
Seed	FCFA/ha	22,000
Fungicide	FCFA/ha	0
Fertilizer	FCFA/ha	0
Tool maintenance	FCFA/ha	350
Equipment depreciation	FCFA/ha	0
Total cash expenses	FCFA/ha	25,690
In-kind outlays		
Family labor	hours	180
Draft animal labor	hours	0
Storage loss (4% yield)	kg/ha	0
INCOME AT LOCAL PRICES		
Millet (grain)	FCFA/ha	0
Sorghum (grain)	FCFA/ha	0
Cowpea (grain)	FCFA/ha	0
Tobacco (leaves)	FCFA/ha	105,200
Gross income (local prices)	FCFA/ha	105,200
INCOME AT DEFICIAL PRICES		
Millet (grain)	FCFA/ha	0
Sorghum (grain)	FCFA/ha	0
Cowpea (grain)	FCFA/ha	0
Tobacco (leaves)	FCFA/ha	105,200
Gross income (off. prices)	FCFA/ha	105,200
NET INCOME		
Per hectare (local prices)	FCFA/ha	75,300
Per hectare (off. prices)	FCFA/ha	75,300
Effect. wage (local prices)	FCFA/hr	418
Effect. wage (off. prices)	FCFA/hr	418

MEAN PRICES AND YIELDS BY CROP

Crop	P R I C E		Y I E L D
	Local	Off.	Manual
	- FCFA/kg - - - - -		kg/ha - - - - -
Millet (grain)	38	70	0
Sorghum (grain)	36	70	0
Cowpea (grain)	162	100	0
Tobacco (leaves)	200	200	526

APPENDIX B

MEAN LABOR ALLOCATION

Cropping system: Millet monocrop
Traction: Manual
Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total	c.v. Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamò							
Field prep. and plowing	3	8	0	0	8	29	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	3	10	7	0	1	26	
1st weeding/cultivation	3	31	16	4	50	32	
Other weeding	1	12	10	6	28	—	
Harvest	3	20	3	0	2	27	
Total	3	80	35	10	124	32	
Maiguéro							
Field prep. and plowing	21	21	1	0	23	80	
Manure spreading	2	0	0	0	0	122	
Planting and replanting	22	10	7	2	20	76	
1st weeding/cultivation	21	38	26	8	71	56	
Other weeding	5	0	12	1	13	69	
Harvest	18	7	8	0	15	105	
Total	22	77	53	11	142	55	
Rigial Oubandawaki							
Field prep. and plowing	20	12	0	1	12	114	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	23	11	10	1	22	118	
1st weeding/cultivation	22	36	4	0	79	75	
Other weeding	11	16	9	1	26	56	
Harvest	21	17	8	1	27	116	2 1
Total	23	93	66	7	166	83	2 1
All three villages							
Field prep. and plowing	44	16	0	0	17	97	
Manure spreading	2	0	0	0	0	122	
Planting and replanting	48	11	8	2	21	99	
1st weeding/cultivation	36	37	32	5	73	67	
Other weeding	17	8	10	1	20	56	
Harvest	42	13	8	1	21	114	2 0
Total	48	85	58	9	152	71	2 0

MEAN LABOR ALLOCATION

Cropping system: Millet monocrop
Traction: Oxen
Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha		
Kandamao								
Field prep. and plowing	2	7	0	1	9	5	1	0
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	2	3	5	2	10	111	0	—
1st weeding/cultivation	2	43	0	12	54	71	0	—
Other weedings	1	17	0	0	17	—	1	4
Harvest	2	22	8	0	30	17	0	—
Total	2	92	13	15	120	32	2	5
Maiguero								
Field prep. and plowing	26	18	0	5	22	67	18	11
Manure spreading	5	2	0	0	2	109	3	3
Planting and replanting	26	5	2	0	15	57	0	—
1st weeding/cultivation	25	38	27	8	73	73	14	8
Other weedings	15	9	7	8	24	122	4	3
Harvest	24	11	5	2	18	66	2	0
Total	26	85	45	24	154	62	26	26
Rigial Oubandawaki								
Field prep. and plowing	2	7	0	6	13	94	0	—
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	2	9	11	7	27	111	0	—
1st weeding/cultivation	2	57	49	11	117	4	1	1
Other weedings	2	33	23	3	58	102	1	8
Harvest	2	35	29	0	64	71	2	7
Total	2	141	112	26	279	9	2	16
All three villages								
Field prep. and plowing	30	16	0	4	21	71	19	10
Manure spreading	5	1	0	0	2	109	3	2
Planting and replanting	30	8	5	2	15	68	0	—
1st weeding/cultivation	29	39	27	8	74	69	15	7
Other weedings	19	11	8	7	26	118	6	4
Harvest	28	13	7	2	22	80	4	1
Total	30	89	47	24	160	60	30	24

MEAN LABOR ALLOCATION

Cropping system: Sorghum monocrop
 Traction: Manual
 Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - -				- - - hrs/ha		
Kandamao								
Field prep. and plowing	2	46	0	0	46	54		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	2	7	16	4	25	63		
1st weeding/cultivation	2	74	0	30	104	23		
Other weeding	1	22	0	10	32	—		
Harvest	1	10	0	0	10	—		
Total	2	158	16	44	218	20		
Maiguero								
Field prep. and plowing	7	19	4	0	23	66		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	7	23	18	4	46	82		
1st weeding/cultivation	7	9	75	15	99	69		
Other weeding	4	5	17	2	24	74		
Harvest	3	4	8	0	12	122		
Total	8	60	122	21	203	58		
Rigial Oubandawaki								
Field prep. and plowing	1	4	0	0	4	—		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	2	3	1	0	4	18		
1st weeding/cultivation	2	23	15	7	45	91		
Other weeding	1	27	15	10	53	—		
Harvest	2	13	0	0	13	132	1	5
Total	2	70	32	17	119	117	1	5
All three villages								
Field prep. and plowing	10	21	3	0	24	69		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	11	17	15	4	36	101		
1st weeding/cultivation	11	22	53	16	91	69		
Other weeding	6	11	14	5	30	60		
Harvest	6	6	5	0	12	115	1	1
Total	12	78	89	24	192	57	1	1

MEAN LABOR ALLOCATION

Cropping system: Sorghum monocrop
 Traction: Oxen
 Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha		
Kandamao								
Field prep. and plowing	10	19	0	1	20	77	9	8
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	10	8	3	1	12	84	0	—
1st weeding/cultivation	10	65	2	9	76	100	1	1
Other weeding	8	23	0	0	23	147	2	1
Harvest	5	16	0	0	16	64	0	—
Total	10	131	5	11	147	78	10	10
Maiguero								
Field prep. and plowing	5	26	1	15	42	66	4	16
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	3	11	0	0	11	43	0	—
1st weeding/cultivation	6	24	30	19	76	35	3	20
Other weeding	4	15	20	6	40	83	0	—
Harvest	5	48	5	6	58	104	2	12
Total	6	127	56	50	228	37	6	48
Rigial Oubandawaki								
Field prep. and plowing	0	—	—	—	—	—	0	—
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	0	—	—	—	—	—	0	—
1st weeding/cultivation	0	—	—	—	—	—	0	—
Other weeding	0	—	—	—	—	—	0	—
Harvest	0	—	—	—	—	—	0	—
Total	0	—	—	—	—	—	0	—
All three villages								
Field prep. and plowing	15	22	0	6	28	87	13	11
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	13	9	2	0	12	74	0	—
1st weeding/cultivation	15	50	12	13	76	82	4	8
Other weeding	12	20	7	2	29	116	2	0
Harvest	10	28	2	2	32	106	2	4
Total	16	128	24	24	177	62	16	24

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum
Traction: Manual
Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing	5	9	0	0	9	57	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	5	10	9	3	21	48	
1st weeding/cultivation	5	26	7	4	36	42	
Other weedings	5	15	1	2	18	75	
Harvest	5	178	6	0	22	40	
Total	5	76	22	9	106	39	
Maiguero							
Field prep. and plowing	13	11	0	0	11	76	
Manure spreading	4	1	0	0	1	62	
Planting and replanting	13	6	6	2	14	47	
1st weeding/cultivation	13	26	32	4	62	41	
Other weedings	3	4	1	0	5	100	
Harvest	10	8	4	0	11	138	
Total	14	55	43	6	104	41	
Rigial Oubandawaki							
Field prep. and plowing	22	15	0	0	15	81	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	24	10	6	2	19	74	
1st weeding/cultivation	22	57	46	13	117	177	
Other weedings	13	13	22	3	38	66	
Harvest	24	7	8	0	16	70	1 2
Total	24	103	83	18	204	123	1 2
All three villages							
Field prep. and plowing	40	13	0	0	13	81	
Manure spreading	4	0	0	0	0	62	
Planting and replanting	42	9	7	2	17	64	
1st weeding/cultivation	40	43	37	9	89	174	
Other weedings	21	10	12	2	24	87	
Harvest	38	9	6	0	15	85	1 0
Total	43	83	62	13	159	119	1 0

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum
Traction: Oxen
Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha		
Kandamao								
Field prep. and plowing	9	12	0	1	13	51	8	5
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	9	10	9	2	21	67	1	0
1st weeding/cultivation	9	36	5	5	46	39	1	0
Other weeding	9	26	4	8	37	134	3	1
Harvest	9	21	7	0	29	78	1	0
Total	9	105	25	16	146	56	9	7
Maiguero								
Field prep. and plowing	12	32	2	10	44	79	11	18
Manure spreading	5	5	1	2	8	105	2	2
Planting and replanting	9	9	5	1	14	62	0	—
1st weeding/cultivation	13	33	9	12	55	66	9	13
Other weeding	5	7	5	3	14	111	2	1
Harvest	7	3	4	0	7	70	0	—
Total	13	8	26	28	143	44	12	35
Rigial Oubandawaki								
Field prep. and plowing	0	—	—	—	—	—	0	—
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	0	—	—	—	—	—	0	—
1st weeding/cultivation	0	—	—	—	—	—	0	—
Other weeding	0	—	—	—	—	—	0	—
Harvest	0	—	—	—	—	—	0	—
Total	0	—	—	—	—	—	0	—
All three villages								
Field prep. and plowing	21	23	2	6	31	100	19	12
Manure spreading	5	3	0	11	5	105	2	1
Planting and replanting	18	9	7	1	17	63	1	0
1st weeding/cultivation	21	34	7	9	51	58	10	8
Other weeding	14	15	4	5	24	123	5	1
Harvest	16	11	6	0	17	90	1	0
Total	21	95	26	23	144	48	21	23

MEAN LABOR ALLOCATION

Cropping system: Millet-cowpea
Traction: Manual
Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha		
Kandamao								
Field prep. and plowing	0	—	—	—	—	—		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	0	—	—	—	—	—		
1st weeding/cultivation	0	—	—	—	—	—		
Other weeding	0	—	—	—	—	—		
Harvest	0	—	—	—	—	—		
Total	0	—	—	—	—	—		
Maiguero								
Field prep. and plowing	13	18	0	5	23	107		
Manure spreading	3	1	1	0	2	22		
Planting and replanting	13	5	7	3	14	54		
1st weeding/cultivation	13	19	50	4	72	50		
Other weeding	10	7	21	3	32	59		
Harvest	11	9	12	5	26	76	3	1
Total	13	59	90	20	169	34	3	1
Rigial Oubandawaki								
Field prep. and plowing	35	14	0	0	14	101		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	36	10	8	4	22	134		
1st weeding/cultivation	36	24	49	8	81	66		
Other weeding	29	15	27	8	50	72		
Harvest	36	7	17	1	26	83	8	1
Total	36	70	101	21	192	69	8	1
All three villages								
Field prep. and plowing	48	15	0	2	16	107		
Manure spreading	3	0	0	0	1	22		
Planting and replanting	49	9	8	4	20	129		
1st weeding/cultivation	49	23	49	7	78	63		
Other weeding	39	13	26	7	45	72		
Harvest	47	8	15	2	26	80	11	1
Total	49	67	98	21	186	63	11	1

MEAN LABOR ALLOCATION

Cropping system: Millet-cowpea
Traction: Oxen
Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -					hrs/ha	
Kandamao								
Field prep. and plowing	0	—	—	—	—	—	0	—
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	0	—	—	—	—	—	0	—
1st weeding/cultivation	0	—	—	—	—	—	0	—
Other weedings	0	—	—	—	—	—	0	—
Harvest	0	—	—	—	—	—	0	—
Total	0	—	—	—	—	—	0	—
Maiguero								
Field prep. and plowing	7	23	0	3	26	88	6	6
Manure spreading	2	0	0	0	1	60	0	—
Planting and replanting	7	19	6	0	25	125	0	—
1st weeding/cultivation	7	33	30	4	67	62	0	—
Other weedings	5	17	4	0	20	111	0	—
Harvest	7	13	10	0	22	105	0	—
Total	7	105	49	8	162	51	7	18
Rigial Oubandawaki								
Field prep. and plowing	2	35	0	0	35	134	0	—
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	2	16	8	4	28	46	0	—
1st weeding/cultivation	2	66	8	12	87	16	2	26
Other weedings	2	119	3	47	170	62	0	—
Harvest	2	34	36	1	71	96	2	9
Total	2	270	55	64	390	9	2	36
All three villages								
Field prep. and plowing	9	26	0	3	28	93	6	6
Manure spreading	2	0	0	0	0	60	0	—
Planting and replanting	9	19	6	1	26	107	0	—
1st weeding/cultivation	9	41	25	6	72	52	5	14
Other weedings	7	39	4	11	53	124	0	—
Harvest	9	17	15	0	3	100	2	2
Total	9	142	51	20	213	58	9	22

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum-cowpea
Traction: Manual
Year: 1984

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha		
Kandamao								
Field prep. and plowing	1	4	0	0	1	—		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	1	9	9	6	23	—		
1st weeding/cultivation	1	18	6	3	27	—		
Other weedings	1	10	0	0	10	—		
Harvest	1	18	5	0	23	—		
Total	1	58	20	9	87	—		
Maiguero								
Field prep. and plowing	26	13	1	1	14	63		
Manure spreading	4	2	0	0	2	84		
Planting and replanting	28	9	8	3	19	59		
1st weeding/cultivation	28	40	34	12	86	63		
Other weedings	15	7	14	9	30	68		
Harvest	25	9	8	1	17	61		
Total	28	79	65	25	169	47		
Rigial Oubandawaki								
Field prep. and plowing	92	13	0	3	16	98		
Manure spreading	0	—	—	—	—	—		
Planting and replanting	95	8	10	4	22	102		
1st weeding/cultivation	95	23	47	12	82	83		
Other weedings	78	16	34	10	61	77		
Harvest	95	12	21	3	36	112	26	2
Total	95	73	113	31	217	77	26	2
All three villages								
Field prep. and plowing	119	13	0	2	16	93		
Manure spreading	4	0	0	0	0	84		
Planting and replantin	124	8	9	4	21	96		
1st weeding/cultivation	124	27	44	12	83	79		
Other weedings	94	14	29	10	54	77		
Harvest	121	11	18	2	32	113	26	2
Total	124	74	101	30	205	74	26	2

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum-cowpea
 Traction: Oxen
 Year: 1984

Village and task	Number of fields	PERSONS				OXEN	
		Men	Women	Youths	Total c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing	6	6	0	0	6	53	4 6
Manure spreading	0	—	—	—	—	—	9 —
Planting and replanting	6	11	11	2	23	45	0 —
1st weeding/cultivation	6	37	8	0	46	50	1 0
Other weedings	4	13	0	0	13	150	2 3
Harvest	6	27	22	1	50	93	0 —
Total	6	95	42	2	138	27	6 9
Maiguero							
Field prep. and plowing	3	12	0	9	21	64	3 7
Manure spreading	0	—	—	—	—	—	0 —
Planting and replanting	3	8	7	2	17	27	0 —
1st weeding/cultivation	3	33	14	4	50	12	3 9
Other weedings	2	10	2	0	12	42	0 —
Harvest	3	22	14	0	38	29	2 3
Total	3	86	36	15	137	1	3 20
Rigial Oubawaki							
Field prep. and plowing	4	14	0	0	15	62	0 —
Manure spreading	0	—	—	—	—	—	0 —
Planting and replanting	4	9	6	6	21	74	0 —
1st weeding/cultivation	4	34	24	11	70	73	4 12
Other weedings	4	16	17	9	42	53	0 —
Harvest	4	15	10	6	31	21	3 4
Total	4	89	56	33	179	49	4 16
All three villages							
Field prep. and plowing	13	10	0	2	12	80	7 4
Manure spreading	0	—	—	—	—	—	0 —
Planting and replanting	13	10	9	3	21	50	0 —
1st weeding/cultivation	13	36	14	4	54	58	8 6
Other weedings	10	13	6	3	22	87	2 1
Harvest	13	22	16	2	41	78	5 2
Total	13	91	45	14	150	35	13 14

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum-sesame/sorghum-sesame
 Traction: Manual and oxen
 Year: 1984

Means of traction, village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total	c.v.	Fields
		- - - hours/hectare - - % -				hrs/ha	
Manual: Kandamao							
Field prep. and plowing	4	18	0	0	18	67	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	4	18	7	1	27	10	
1st weeding/cultivation	4	65	0	4	69	61	
Other weedings	1	5	0	0	5	—	
Harvest	4	30	1	0	31	55	
Total	4	136	9	6	150	30	
Oxen: Kandamao							
Field prep. and plowing	9	22	2	0	24	89	9 12
Manure spreading	0	—	—	—	—	—	0 —
Planting and replanting	9	14	7	1	22	81	1 1
1st weeding/cultivation	8	31	7	6	45	65	0 —
Other weedings	2	3	0	0	3	125	0 —
Harvest	7	29	9	0	38	116	0 —
Total	9	100	24	8	132	66	9 12

MEAN LABOR ALLOCATION

Cropping system: Millet monocrop
Traction: Manual
Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing	0	—	—	—	—	—	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	1	5	14	0	18	—	
1st weeding/cultivation	1	5	145	0	150	—	
Other weedings	1	0	45	0	45	—	
Harvest	1	0	77	0	77	—	
Total	1	9	282	0	291	—	
Maignero							
Field prep. and plowing	31	9	1	0	10	151	
Manure spreading	1	0	0	0	0	—	
Planting and replanting	48	7	8	4	19	96	
1st weeding/cultivation	44	22	73	31	126	214	
Other weedings	32	7	20	8	35	60	
Harvest	46	16	28	3	47	148	1 0
Total	48	61	131	46	238	157	1 0
Rigial Oubandawaki							
Field prep. and plowing	83	4	0	0	5	80	
Manure spreading	42	2	5	1	8	120	
Planting and replanting	129	4	6	3	13	73	
1st weeding/cultivation	127	16	49	10	75	50	
Other weedings	93	9	27	8	45	92	
Harvest	129	7	18	1	26	78	9 0
Total	129	42	106	23	171	58	9 0
All three villages							
Field prep. and plowing	112	5	1	0	6	137	
Manure spreading	43	1	4	1	6	120	
Planting and replanting	177	5	7	3	15	86	
1st weeding/cultivation	172	17	56	16	89	166	
Other weedings	126	9	26	8	42	86	
Harvest	176	9	21	2	32	130	10 0
Total	178	47	114	29	189	112	10 0

MEAN LABOR ALLOCATION

Cropping system: Millet monocrop
Traction: Oxen
Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total c.v.	Fields	Hours	
		- - - hours/hectare - - % -				hrs/ha		
Kandamao								
Field prep. and plowing	2	3	0	0	3	72	4	12
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	4	3	4	0	7	48	0	—
1st weeding/cultivation	4	16	21	3	39	64	0	—
Other weeding	3	5	0	0	5	79	0	—
Harvest	3	27	8	0	35	13	0	—
Total	4	53	33	3	89	52	4	12
Maiguero								
Field prep. and plowing	18	32	11	10	54	72	17	26
Manure spreading	3	1	0	0	1	56	3	6
Planting and replanting	17	10	6	2	17	91	0	—
1st weeding/cultivation	11	11	17	3	32	62	0	—
Other weeding	17	32	21	3	56	74	3	2
Harvest	17	22	27	1	50	115	0	—
Total	18	108	82	20	210	57	18	34
Rigial Oubandawaki								
Field prep. and plowing	4	14	0	9	23	64	1	5
Manure spreading	2	9	0	2	11	88	1	3
Planting and replanting	4	8	14	5	26	94	0	—
1st weeding/cultivation	4	50	8	6	63	60	2	6
Other weeding	4	59	13	0	72	72	0	—
Harvest	5	24	9	0	33	74	2	3
Total	5	163	43	22	229	63	4	17
All three villages								
Field prep. and plowing	24	25	8	9	41	82	22	21
Manure spreading	5	2	0	0	3	117	4	4
Planting and replanting	26	8	7	2	18	98	0	—
1st weeding/cultivation	19	19	16	4	39	64	2	1
Other weeding	24	33	16	2	51	85	3	1
Harvest	25	23	21	1	45	106	2	0
Total	27	110	68	18	195	62	26	28

MEAN LABOR ALLOCATION

Cropping system: Sorghum monocrop
Traction: Manual
Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total	c.v.	Fields Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing	0	—	—	—	—	—	—
Manure spreading	0	—	—	—	—	—	—
Planting and replanting	0	—	—	—	—	—	—
1st weeding/cultivation	0	—	—	—	—	—	—
Other weeding	0	—	—	—	—	—	—
Harvest	0	—	—	—	—	—	—
Total	0	—	—	—	—	—	—
Maiguero							
Field prep. and plowing	4	5	0	0	5	110	
Manure spreading	0	—	—	—	—	—	—
Planting and replanting	11	18	15	1	33	148	
1st weeding/cultivation	10	37	50	10	97	87	
Other weeding	2	3	2	0	5	45	
Harvest	9	34	19	2	54	121	
Total	11	96	86	12	193	75	
Rigial Oubandawaki							
Field prep. and plowing	3	4	0	0	4	19	
Manure spreading	0	—	—	—	—	—	—
Planting and replanting	6	3	4	1	8	90	
1st weeding/cultivation	5	30	25	5	60	57	
Other weeding	4	7	10	0	17	75	
Harvest	5	7	3	1	12	72	
Total	6	51	42	7	100	66	
All three villages							
Field prep. and plowing	7	4	0	0	4	101	
Manure spreading	0	—	—	—	0	—	—
Planting and replanting	17	13	11	1	25	170	
1st weeding/cultivation	15	34	42	8	84	86	
Other weeding	6	4	4	0	9	60	
Harvest	14	25	14	2	40	145	
Total	17	81	71	10	162	83	

MEAN LABOR ALLOCATION

Cropping system: Sorghum monocrop
Traction: Oxen
Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -					hrs/ha	
Kandamao								
Field prep. and plowing	4	19	0	1	20	53	4	16
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	4	12	7	5	24	55	0	—
1st weeding/cultivation	4	37	4	30	72	45	0	—
Other weedings	3	44	0	27	71	77	0	—
Harvest	4	29	0	6	35	67	0	—
Total	4	141	11	70	222	34	4	16
Maiguero								
Field prep. and plowing	3	30	0	21	51	107	3	40
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	3	11	7	0	19	68	0	—
1st weeding/cultivation	1	0	19	0	19	—	0	—
Other weedings	2	8	24	0	32	72	0	—
Harvest	3	19	4	0	23	45	0	—
Total	3	68	54	21	143	41	3	40
Rigial Oubandawaki								
Field prep. and plowing	0	—	—	—	—	—	0	—
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	1	1	2	1	5	—	0	—
1st weeding/cultivation	1	4	0	4	8	—	1	4
Other weedings	0	—	—	—	—	—	0	—
Harvest	0	—	—	—	—	—	0	—
Total	1	5	2	5	13	—	1	4
All three villages								
Field prep. and plowing	7	21	0	8	29	111	7	23
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	8	11	6	3	20	65	0	—
1st weeding/cultivation	6	19	9	16	44	62	1	0
Other weedings	5	25	9	14	48	79	0	—
Harvest	7	21	1	3	26	63	0	—
Total	8	97	26	43	166	56	9	23

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum
Traction: Manual
Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total	c.v. Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing	6	15	0	0	15	84	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	7	24	21	1	46	100	
1st weeding/cultivation	7	48	85	8	141	26	
Other weedings	3	5	2	3	11	62	
Harvest	7	22	19	6	47	72	
Total	7	114	127	18	260	41	
Maiguero							
Field prep. and plowing	7	7	0	0	8	76	
Manure spreading	1	0	0	0	0	—	
Planting and replanting	10	8	7	5	20	56	
1st weeding/cultivation	10	36	52	15	103	106	
Other weedings	7	24	21	12	57	47	
Harvest	10	19	19	5	43	75	
Total	10	95	99	37	231	54	
Rigial Oubandawaki							
Field prep. and plowing	25	6	0	1	7	88	
Manure spreading	12	1	4	1	6	112	
Planting and replanting	36	7	7	4	19	67	
1st weeding/cultivation	35	31	32	8	70	65	
Other weedings	25	10	17	4	31	41	
Harvest	35	9	18	2	29	66	3 0
Total	36	64	78	20	161	48	3 0
All three villages							
Field prep. and plowing	38	7	0	0	8	88	
Manure spreading	13	1	3	1	4	117	
Planting and replanting	53	10	9	4	22	96	
1st weeding/cultivation	52	34	43	9	86	76	
Other weedings	35	12	16	5	33	56	
Harvest	52	12	18	3	34	72	3 0
Total	53	76	88	23	187	52	3 0

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum
Traction: Oxen
Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha		
Kandamao								
Field prep. and plowing	9	17	11	2	30	148	8	17
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	9	6	5	1	12	57	0	—
1st weeding/cultivation	9	30	17	12	58	72	1	9
Other weeding	6	17	7	10	35	94	3	7
Harvest	9	34	10	2	46	72	0	—
Total	9	104	50	27	181	45	9	32
Maiguero								
Field prep. and plowing	4	20	7	8	36	74	4	20
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	4	6	5	2	13	49	0	—
1st weeding/cultivation	4	14	22	9	46	52	2	3
Other weeding	2	12	15	5	32	37	3	11
Harvest	4	8	20	1	29	18	2	1
Total	4	61	69	25	155	21	4	36
Rigial Oubandawaki								
Field prep. and plowing	4	7	0	0	7	82	1	1
Manure spreading	2	9	0	0	9	104	1	8
Planting and replanting	4	7	5	5	16	63	0	—
1st weeding/cultivation	4	40	9	12	61	36	2	3
Other weeding	4	46	8	2	56	51	1	0
Harvest	4	20	7	1	27	30	1	0
Total	4	129	29	19	177	37	4	13
All three villages								
Field prep. and plowing	17	16	7	3	26	136	13	14
Manure spreading 2	2	0	0	0	2	104	1	—
Planting and replanting	17	6	5	2	13	55	0	—
1st weeding/cultivation	17	28	16	11	56	59	5	6
Other weeding	12	23	9	7	39	67	7	6
Harvest	17	24	12	1	37	68	3	0
Total	17	100	50	25	174	38	17	29

MEAN LABOR ALLOCATION

Cropping system: Millet-cowpea
 Traction: Manual
 Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kardamao							
Field prep. and plowing	1	3	0	0	3	—	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	1	20	9	2	31	—	
1st weeding/cultivation	1	66	0	0	66	—	
Other weeding	1	52	0	0	52	—	
Harvest	1	22	3	0	25	—	
Total	1	163	13	2	177	—	
Maiguero							
Field prep. and plowing	24	11	1	0	12	119	
Manure spreading	0	0	2	0	2	110	
Planting and replanting	26	6	9	2	17	58	
1st weeding/cultivation	25	15	51	8	74	47	
Other weeding	23	9	32	4	44	63	
Harvest	26	10	18	1	29	83	
Total	26	52	112	16	179	43	
Rigial Oubandawaki							
Field prep. and plowing	7	4	0	0	4	80	
Manure spreading	4	5	3	0	8	48	
Planting and replanting	14	6	8	4	18	57	
1st weeding/cultivation	14	24	40	13	77	62	
Other weeding	11	18	37	10	65	98	
Harvest	14	19	20	2	40	57	
Total	14	76	108	28	213	58	
All three villages							
Field prep. and plowing	32	8	1	0	9	120	
Manure spreading	6	2	2	0	4	60	
Planting and replanting	41	6	7	8	18	57	
1st weeding/cultivation	40	20	46	10	75	51	
Other weeding	35	13	33	6	52	88	
Harvest	41	14	18	1	33	73	
Total	41	63	108	20	191	49	

MEAN LABOR ALLOCATION

Cropping system: Millet-cowpea
Traction: Oxen
Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total c.v.	Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing	1	57	0	7	64	—	1 7
Manure spreading	0	—	—	—	—	—	0 —
Planting and replanting	1	5	17	0	22	—	0 —
1st weeding/cultivation	1	43	0	0	43	—	0 —
Other weedings	1	12	0	0	12	—	1 23
Harvest	1	21	0	0	21	—	0 —
Total	1	138	17	7	161	—	1 30
Maiguero							
Field prep. and plowing	10	26	4	6	37	51	9 22
Manure spreading	2	1	0	0	1	60	0 —
Planting and replanting	10	8	9	2	20	62	0 —
1st weeding/cultivation	8	16	43	6	65	34	1 1
Other weedings	10	23	32	9	68	83	0 —
Harvest	10	11	29	0	40	54	1 1
Total	10	85	121	24	230	38	10 24
Rigial Oubandawaki							
Field prep. and plowing	1	4	0	0	4	—	0 —
Manure spreading	1	17	0	26	44	—	1 41
Planting and replanting	1	5	7	6	17	—	0 —
1st weeding/cultivation	1	26	44	34	104	—	0 —
Other weedings	1	39	14	9	63	—	0 —
Harvest	1	29	0	0	29	—	1 3
Total	1	120	65	75	260	—	1 44
All three villages							
Field prep. and plowing	12	27	3	7	37	58	10 19
Manure spreading	3	2	0	2	4	135	1 3
Planting and replanting	12	7	10	2	20	56	0 —
1st weeding/cultivation	10	19	39	7	66	35	1 1
Other weedings	12	24	31	8	63	85	1 2
Harvest	12	13	24	0	38	55	2 1
Total	12	92	107	27	227	36	12 26

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum-cowpea
 Traction: Manual
 Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total	c.v. Fields	Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing	4	1	0	0	1	60	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	6	15	6	1	22	41	
1st weeding/cultivation	6	61	28	0	88	51	
Other weedings	6	45	16	0	62	70	
Harvest	6	74	24	0	98	76	
Total	6	197	73	1	271	43	
Maiguero							
Field prep. and plowing	7	9	0	0	9	43	
Manure spreading	2	6	0	0	6	73	
Planting and replanting	9	6	20	0	26	72	
1st weeding/cultivation	9	6	57	0	63	54	
Other weedings	8	6	39	0	46	69	
Harvest	9	9	32	3	45	54	
Total	9	43	148	4	195	35	
Rigial Oubandawaki							
Field prep. and plowing	10	4	0	1	5	50	
Manure spreading	5	6	4	2	11	81	
Planting and replanting	11	5	14	3	22	81	
1st weeding/cultivation	11	11	45	8	64	44	
Other weedings	10	9	32	4	44	41	
Harvest	11	11	17	3	31	59	
Total	11	46	113	21	179	34	
All three villages							
Field prep. and plowing	21	5	0	0	6	69	
Manure spreading	7	4	2	1	7	74	
Planting and replanting	26	8	14	2	24	70	
1st weeding/cultivation	26	20	45	4	69	49	
Other weedings	24	16	31	2	50	57	
Harvest	26	24	24	2	50	85	
Total	26	77	115	11	204	36	

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum-cowpea

Traction: Oxen

Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N		
		Men	Women	Youths	Total	c.v.	Fields	Hours
		- - - hours/hectare - - % -					hrs/ha	
Kandamao								
Field prep. and plowing	10	13	0	1	14	104	8	14
Manure spreading	0	—	—	—	—	—	0	—
Planting and replanting	10	8	4	1	13	60	0	—
1st weeding/cultivation	10	39	25	14	77	38	0	—
Other weedings	8	23	2	11	37	97	3	5
Harvest	10	50	12	6	68	74	0	—
Total	10	133	43	33	210	39	10	18
Maiguero								
Field prep. and plowing	6	21	3	3	27	68	5	10
Manure spreading	3	7	0	1	8	90	1	0
Planting and replanting	6	5	10	4	20	59	1	4
1st weeding/cultivation	6	29	39	9	78	77	2	13
Other weedings	5	30	25	4	57	81	1	0
Harvest	6	28	30	1	59	90	3	6
Total	6	118	107	23	249	76	6	33
Rigial Oubandawaki								
Field prep. and plowing	2	2	0	0	2	73	0	—
Manure spreading	2	21	0	0	21	106	1	5
Planting and replanting	3	9	7	5	21	33	0	—
1st weeding/cultivation	3	21	7	7	34	46	2	7
Other weedings	3	20	5	12	37	18	2	4
Harvest	3	41	19	6	65	48	0	—
Total	3	114	37	29	180	25	3	16
All three villages								
Field prep. and plowing	18	14	1	2	16	96	13	10
Manure spreading	5	6	0	0	6	105	2	1
Planting and replanting	19	7	7	3	16	56	1	1
1st weeding/cultivation	18	33	26	11	71	61	4	5
Other weedings	16	24	10	9	43	85	6	3
Harvest	19	42	19	5	65	73	3	2
Total	19	125	62	29	217	54	19	22

MEAN LABOR ALLOCATION

Cropping system: Millet-sorghum-sesame/sorghum-sesame
 Traction: Manual and oxen
 Year: 1985

Means of traction, village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total	c.v.	Fields Hours
		- - - hours/hectare - - % -				hrs/ha	
Manual: Kandamao							
Field prep. and plowing	1	1	0	0	1	—	
Manure spreading	0	—	—	—	—	—	
Planting and replanting	2	7	7	2	16	6	
1st weeding/cultivation	2	17	23	23	63	63	
Other weedings	2	14	9	9	32	16	
Harvest	2	50	6	13	69	85	
Total	2	90	44	47	180	59	
Oxen: Kandamao							
Field prep. and plowing	8	30	0	3	33	130	8 45
Manure spreading	0	—	—	—	—	—	0 —
Planting and replanting	8	10	8	2	19	114	0 —
1st weeding/cultivation	8	86	12	12	110	97	0 —
Other weedings	4	8	0	0	9	42	2 1
Harvest	8	93	6	5	105	117	0 —
Total	8	226	27	22	275	104	8 46

MEAN LABOR ALLOCATION

Cropping system: Tobacco

Traction: Manual

Year: 1985

Village and task	Number of fields	P E R S O N S				O X E N	
		Men	Women	Youths	Total	c.v.	Fields Hours
		- - - hours/hectare - - % -				hrs/ha	
Kandamao							
Field prep. and plowing							
Manure spreading							
Planting and replanting							
1st weeding/cultivation							
Other weeding							
Harvest							
Total							
Maiguero							
Field prep. and plowing	0	---	---	---	---	---	---
Manure spreading	0	---	---	---	---	---	---
Planting and replanting	7	84	0	9	93	72	
1st weeding/cultivation	7	59	0	0	59	83	
Other weeding	1	9	0	0	9	---	
Harvest	7	210	0	0	210	84	
Total	7	362	0	9	371	69	
Rigial Oubandawaki							
Field prep. and plowing							
Manure spreading							
Planting and replanting							
1st weeding/cultivation							
Other weeding							
Harvest							
Total							
All three villages							
Field prep. and plowing	0	---	---	---	---	---	---
Manure spreading	0	---	---	---	---	---	---
Planting and replanting	7	84	0	9	93	72	
1st weeding/cultivation	7	59	0	0	59	83	
Other weeding	1	9	0	0	9	---	
Harvest	7	210	0	0	210	84	
Total	7	362	0	9	371	69	

APPENDIX C

Table C1: Weights in kilograms of local measurement units, three Madarounfa villages in 1984 and 1985.

<u>Item</u>	<u>Unit of measure</u>	<u>Kilograms</u>
Seed		
Millet	tiya	2.65
Sorghum	tiya	2.65
Cowpea	tiya	2.50
Peanut (hulled)	tiya	2.20
Maize	tiya	2.65
Sesame	tiya	2.50
Wardzu	tiya	2.50
Roselle	tiya	2.50
Mixed seeds	fistful	0.53
Farmyard manure		
Manure	calabash	11
Manure	basket	16
Manure (Maiguéro)	cartload	200
Manure (Rigial O.)	cartload	400
Manure	mudu	60
Manure (Maiguéro)	bowl	8
Manure (Rigial O.)	bowl	13
Manure	sack (50 kg)	30
Fungicide		
Thioral	packet	0.002

Source: DECOR surveys. Results rounded according to standard deviations.

Table C2: Weights in kilograms of farmyard manure measurement units surveyed at Maiguéro and Rigial Oubandawaki in 1985.

<u>Unit of Measure</u>	<u>Weight per measurement unit</u>					
	<u>Maiguéro</u>			<u>Rigial Oubandawaki</u>		
	<u>Number</u>	<u>Mean</u>	<u>S.D.</u>	<u>Number</u>	<u>Mean</u>	<u>S.D.</u>
Calabash	30	10.3	1.1	10	12.4	1.2
Bowl	30	8.1	1.5	10	13.0	1.4
Cartload	6	187.0	46.0	10	397.0	74.0
Basket	10	15.5	2.3	—	—	—
Sack (50 kg.)	—	—	—	10	29.5	1.5
Fistful	2	0.04	—	—	—	—

Table C3: Exchange rates assumed for the naira against the CFA franc, Madarounfa, 1984-85.

<u>Dates</u>	<u>Francs/naira</u>
1 June 1984 to 31 Octobre 1984	100
1 November 1985 to 14 November 1985	125
15 November 1985 to 1 March 1986	115

Table C4: Hourly wages paid to day laborers in three Madarounfa villages in 1984 and 1985.

<u>Village and year</u>	<u>Number of hours</u>	<u>Hourly wage</u>			
		<u>Mean</u>	<u>Median</u>	<u>Maximum</u>	<u>Minimum</u>
----- francs CFA -----					
Kandamao					
1984	72	94	98	98	51
1985	65	137	109	372	32
Maiguéro					
1984	825	144	148	300	76
1985	333	64	65	67	54
Rigial Oubandawaki					
1984	332	76	85	85	31
1985	739	57	55	200	53