PN-AAU-186

POSTHARVEST FOOD SYSTEMS IN THE CENTRAL AFRICAN REPUBLIC

A Practitioner's Manual

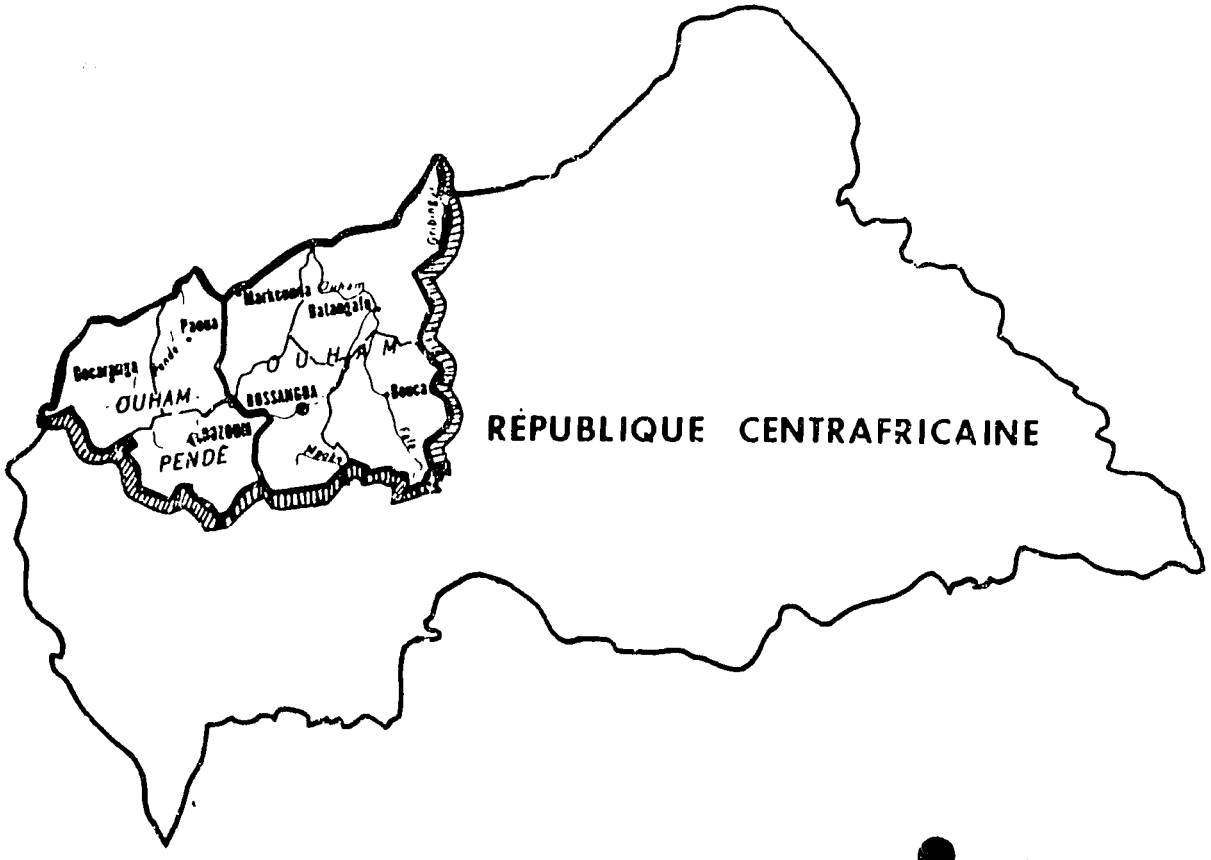
Prepared by:

Russell C. Barbour

Kenton L. Harris

Rosalind Eyben

Gregory N.T. Hung



a VITA publication

PN-AAW-186
47779

POSTHARVEST FOOD SYSTEMS

IN THE

CENTRAL AFRICAN REPUBLIC

A Practitioner's Manual

Prepared by:

Russell C. Barbour
Kenton L. Harris
Rosalind Eyben
Gregory N.T. Hung

Prepared for:

U.S. Agency for International Development/Cameroon

and

Volunteers in Technical Assistance (VITA)
1815 North Lynn Street
Suite 200
Arlington, Virginia 22209 USA

July 1984

TABLE OF CONTENTS

Section Title		Page
I.	The Agricultural Sector	1
II.	Description of the Target Area	11
III.	Village Food Systems	17
IV.	Reaching the Small Farmer	30
V.	Innovation Issues in the Postharvest System	45
VI.	Guidelines for the Baseline Socioeconomic Study	62
References		

POSTHARVEST FOOD SYSTEMS
IN THE
CENTRAL AFRICAN REPUBLIC
A Practitioner's Manual

I. THE AGRICULTURAL SECTOR

With a vast territory of 620,000 square kilometers, the population of 2.5 million has a density of only 3.9 persons per Km^2, grouped into some 8,000 villages and towns (see Basic Data in Table 1). Links between these centers depend on a network of "tertiary" and secondary roads which are very poor. Only about 400 kms of this network are paved. CAR depends greatly on river transport, which substantially raises both production costs and marketing costs. When the river becomes too low for navigation, economic activities become stagnate and basic consumer items are not available.

In addition to the physical bottlenecks, institutional deficiencies and poor economic policies, especially under the Bokassa regime, have led to mis-management of the country's meager resources and contribute to the poor economic and financial performance of recent years.

External factors have also contributed to the decline in the CAR's economic progress. World prices for cotton dropped at an average annual rate of 12 percent in real terms between 1976 and 1979, and in 1979 coffee prices fell to half their 1976-77 high level in constant terms. In the past, cotton and coffee exports provided the country with some 50 percent of export receipts. These earnings have now declined to about 35 percent because of falling prices. In addition to cotton and coffee, CAR also exports timber (20 percent of receipts) and diamonds (30 percent). The hike in oil prices in the late seventies and the worldwide recession in the early eighties have exacerbated economic problems in the CAR.

The sharp decline in both coffee and cotton prices was partly responsible for the poor performance of GDP (Gross Domestic Product) during 1979 and 1981. During these three years, GDP fell at an average rate of 3 percent a year from a positive growth rate during 1977-78 average at 3.5 percent per annum. There has been some improvement in recent years as GDP grew 0.4 percent in 1982 and 2 percent in 1983. However, domestic saving continued to be negative, averaging at -13 percent a year during 1979-1983 (Table 2).

From the GDP figures, one also finds the large size of the overall services component, accounting for over 50 percent. To a large extent, this is due to the government's oversized

TABLE 1

BASIC DATA

Area	620,000 square kilometers
1984 Population (estimated) (Rural) (Urban)	2.5 million (70 percent) (30 percent)
Current Population Growth Rate	2.5 percent per annum
GNP Per Capita (estimated)	$ 300
GNP Per Capita/Rural Population (estimated)	$ 200
Life Expectancy at Birth	44 years
Labor Force (thousands): Female Agriculture Industry	1,250 (49 percent) (88 percent) (4 percent)
External Public Debts (1982, estimated)	$ 169 million
Debt Service as Percent of Exports	13.5
Current Exchange Rate (5/1984)	US $ = CFAF 424

public sector including civil servants and public enterprises, which together employs about 50 percent of all salaried workers. The large service sector brings about three important consequences: first, it depletes the country's financial resources and limits its saving capacity; secondly, it drains human resources away from production by stimulating migration away from agriculture to urban centers; thirdly, it strengthens the bureaucratic bottlenecks standing in the way of the marketing system, and fourthly, it exacerbates the income disparities between the rural poor and urban dwellers.

The current government, intending to redress this economic imbalance, launched its 1982-1985 National Action Program, aimed at moving toward financial equilibrium, improving infrastructure, rehabilitating agriculture, and helping the small farmers.

Agriculture provides employment to some 80 percent of the population and accounted for about 38 percent of GDP in the seventies. In the early eighties, the agricultural share in the GDP declined to about 35 percent (Table 2). Agricultural activities include mainly the growing of food crops for consumption and of cotton and coffee for exports.

In recent years, however, there has been a growing trend of migration from rural to urban areas. During the period of 1975 to 1981, population in Bangui and in towns of 10,000 (and above) increased from 534,000 to 718,000 or by 34 percent, more than tripling the 9.5 percent annual growth in rural areas. Migration has continued at a fast rate and by 1985, rural population will be reduced to only 67 percent of the total as compared to 74 percent in 1975. By 1989, urban population is projected to triple its 1975 level (Table 3).

The farm population typically practices shifting cultivation. This system features a four-year rotation with cotton cropped on newly cleared land in the first year, followed by an interplanting of food crops (second year), cassava (third year), assorted regrowth crops (fourth year), terminated by a fallow period ranging from four to ten or twelve years.

Recent and revised data on food production are presented in Table 4. Cassava, the main staple food (about 56 percent of total production) decreased from 290,000 tons in 1973/74 to 251,000 tons in 1977/78. There was some increase in subsequent years, up to nearly 287,000 tons in 1982/83, but the level was still lower than the 1973/74. In recent years, there has been little change in groundnut and sesame production, which stood at around 120,000 tons and 10,000 tons respectively. Maize and sorghum crops registered a slight increase to reach 44,000 tons and 54,000 tons in 1982/83 respectively, up from 39,000 tons and 49,000 in 1973/74.

TABLE 2

NATIONAL INCOME ACCOUNTS AND STRUCTURES, 1977-1985

(In Billions of Current CFAF)

	1977	1978	1979	1980	1981	1982	1983
National Accounts							
GDP	123.5	136.7	150.9	168.4	188.6	216.2	251.4
Consumption	121.8	136.2	154.0	191.4	201.3	237.5	256.6
Gross Investment	14.4	15.0	14.6	11.8	17.3	18.5	30.5
Public Investment	9.2	3.4	11.5	8.5	12.3	13.3	24.7
Private Investment	5.2	5.6	3.1	3.3	5.0	5.2	5.8
Domestic Savings	1.7	0.5	-3.1	-23.0	-12.5	-21.3	-5.2
Exports	32.5	30.5	30.0	34.3	37.3	39.0	43.7
Imports	45.2	45.0	47.7	69.1	67.1	78.8	79.4
GDP (in mil. current $)	502.9	605.9	709.4	797.0	694.9	617.7	843.4
GDP Inflators Index	100.0	107.5	122.3	141.9	162.8	185.6	211.6
GDP at 1977 const. prices	123.5	127.7	123.4	118.7	116.0	116.5	118.8
GDP growth per year	4.0	3.0	-3.0	-3.9	-2.2	0.4	2.0
Sectoral Output in Percentages							
Agriculture	37.9	36.5	37.0	37.6	37.3	35.0	34.4
Mining	7.3	9.7	8.6	7.8	6.1	5.6	5.0
Manufacturing	6.2	7.9	7.8	6.8	7.0	7.8	7.9
Water and Electricity	0.7	0.6	0.7	0.7	1.0	1.1	1.2
Construction & Public Works	4.4	3.6	4.2	3.6	3.7	4.5	5.2
Commerce	15.1	14.7	14.0	14.6	14.5	14.9	15.1
Transport and Telecomm.	4.0	3.4	2.9	3.3	3.6	3.9	4.3
Public Services	13.7	13.2	14.6	15.1	16.4	16.3	15.0
Private Services	4.9	4.5	4.8	4.6	4.6	4.3	5.0
Indirect taxes (net of subsidies)	5.8	5.9	5.4	5.9	5.9	6.5	6.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: World Bank, and High Commission

TABLE 3

DISTRIBUTION OF POPULATION: URBAN AND RURAL AREA, 1975-1989

(1,000 persons)

URBAN SECTOR				RURAL SECTOR			
Date	Bangui	Towns of 10,000 and over	TOTAL	Adm. Ctrs. less than 10,000	Rural Zones	TOTAL	All RCA
31/12/75	279.8	254.4	534.2	142.5	1,411.3	1,553.8	2,088.0
31/12/81	360.9	357.3	718.2	150.9	1,552.3	1,703.2	2,421.4
31/12/85	422.2	457.0	879.2	139.5	1,654.1	1,793.6	2,672.9
31/12/89	439.9	567.2	1,007.1	126.7	1,762.5	1,889.2	2,896.3

Source: Ministry of Planning.

TABLE 4

FOOD CROPS PRODUCTION: QUANTITY, YIELD AND AREA UNDER CULTIVATION, 1972/73 - 1982/83

	1973/4	1975/6	1976/7	1977/8	1978/9	1979/0	1980/1	1981/2	1982/3
QUANTITY (tons)									
Groundnuts	121,980	111,680	119,970	108,550	109,300	119,380	119,730	119,870	120,400
Sesame	9,560	11,170	9,800	9,600	8,660	9,450	9,700	9,710	9,660
Maize	39,440	41,200	38,910	38,150	39,520	42,810	45,300	45,480	44,380
Sorghum	48,710	46,230	47,480	53,720	47,780	49,580	48,920	52,970	54,040
Rice	8,850	13,230	12,410	12,110	14,900	14,450	14,870	16,620	12,700
TOTAL	518,430	498,690	228,570	473,000	220,160	235,670	238,520	244,650	518,000
YIELD (kg per hectare)									
Manioc	950	950	950	950	980	970	970	980	980
Groundnuts	960	970	960	930	930	920	900	890	890
Sesame	260	250	260	260	270	260	250	250	250
Maize	390	400	400	400	400	400	400	400	400
Sorghum	630	640	640	640	650	650	650	650	650
Rice	880	940	930	950	970	960	970	940	900
TOTAL	4,070	4,150	4,140	4,130	4,200	4,160	4,140	4,110	4,070
AREA UNDER CULTIVATION (Hectares)									
Manioc	304,000	290,100	291,700	264,300	273,800	279,400	290,500	289,900	292,800
Groundnuts	127,200	115,100	125,200	116,100	117,100	129,100	132,500	134,600	135,700
Sesame	37,000	44,700	38,100	37,000	32,200	36,600	38,400	38,700	38,200
Maize	101,100	104,500	97,500	94,900	99,100	107,200	113,700	113,700	110,700
Sorghum	77,700	72,000	74,400	83,400	74,000	76,200	75,500	81,300	82,900
Rice	10,100	14,100	13,300	12,800	15,400	15,000	15,400	17,700	14,100
TOTAL	657,100	640,500	644,700	608,500	611,600	643,900	660,000	675,900	674,400

Source: High Commission of Planning.

On the average, according to a 1973 FAO study, a farm family cultivates 1.7 hectares of land to support 5.2 family members, of whom only 2.6 persons are considered active. Tools used total 3.5 hoes, 2 machetes, and 1.4 axes (Table 5). Food crops occupy two-thirds of the cultivated area, cotton or coffee occupy the rest. Food crops include cassava, groundnuts, maize, sesame, millet, and sorghum. It should be noted that all available statistical data use the concept of "farm family." However, the basic unit of production is the individual man or woman, as discussed in the Social Analysis.

In the rural area, millet and sorghum are grown mainly for family consumption, leaving only 25 percent for marketing. The portion left for sale accounts for over 39 percent of cassava, 35 percent of groundnuts, and 36 percent each of maize and sesame (Table 6).

The distribution of food for self-consumption and for marketing roughly corresponds to the distribution of population between rural (70 percent) and urban areas (30 percent). There is also an indication that there has been a shift from the cultivation of food crops to that of cash crops, especially of cotton.

According to an earlier FAO survey which used the 2.5 hectares as the average cultivated area per farm unit in the proposal project area (1973), the farm cropping pattern is as follows:

Cotton	:	0.80 ha.
Cassava	:	0.75 ha.
Groundnuts	:	0.35 ha.
Maize	:	0.12 ha.
Sorghum	:	0.10 ha.
Sesame	:	0.12 ha.
Rainfor Rice	:	
Cowpeas and Others	:	0.24 ha.
TOTAL	:	2.48 ha.

It was estimated that the average male cotton farmer had a total annual cash income of between 15,000-20,000 FCFA in 1981-82 (Castex p. 71). The increase in cotton production since that time has probably improved the situation. Joint average annual cash incomes of husband and wife in the project area can now be "guesstimated" at about 40,000 FCFA or approximately $100.

Main sources of cash income other than cotton are the sales of food produce, game and fish, honey and wax, wild plants and vegetables, and beer brewed from honey and sorghum. Men

TABLE 5

CHARACTERISTICS OF AVERAGE FARM BY REGION (for 1975)

	Area under Cultivation (ha)	Persons per Farm	ACTIVE Persons Per Farm	Cultivated area/PERSON (ha)	Cultivated area/ACTIVE (ha)	Number of HOES/ active	Number of MACHETE/ active	Number of HATCHET/ active	Travel from home-farm (minutes)
Country Average	1.73	5.24	2.62	0.33	0.66	1.33	0.77	0.54	41
Basse-Kotto	1.53	5.20	2.70	29	0.57	1.43	0.85	0.51	38
Kemo-Gribingui	2.56	6.5	3.1	40	0.83	1.39	0.64	0.42	49
Lobaye	0.89	4.2	2.3	21	0.39	1.10	1.15	0.62	29
Nana-Mambere	1.58	5.4	2.6	29	0.60	1.35	0.63	0.51	35
Ombella-M'Poko	0.84	4.2	2.1	20	0.40	1.31	0.88	0.53	52
Ouaham	2.10	5.2	2.7	41	0.76	1.35	0.76	0.53	52
Ouham-Pende	2.64	5.9	2.8	45	0.96	1.34	0.52	0.59	36
TOTAL	12.14	36.6	18.3	22.50	4.51	9.27	5.43	3.71	2.91

Source: UNDP-FAOm Recensement mondial de l'agriculture - RCA 1977.

TABLE 6

FOOD CROPS: SUBSISTENCE CONSUMPTION AND SURPLUS MARKETING PATTERN IN RURAL AND URBAN AREAS (In Percent)

	Subsistence	Marketing Surplus
MANIOC		
Urban	61.9	38.1
Rural	60.6	39.1
Bangui	63.4	36.6
Outer Bangui	57.1	42.9
GROUNDNUTS		
Urban	65.5	34.5
Rural	64.9	35.1
Bangui	52.9	47.1
Outer Bangui	44.4	55.6
MAIZE		
Urban	54.7	41.2
Rural	61.3	36.0
Bangui	47.2	52.8
Outer Bangui	50.5	49.5
SESAME		
Urban	58.8	41.2
Rural	64.0	36.0
Bangui	--	--
Outer Bangui	56.3	43.7
MILLET AND SORGHUM		
Urban	52.9	47.1
Rural	75.3	24.7

Source: UNDP 1975 Consumption Survey

and women always sell and buy as individuals not as a couple but men take part of the wives' proceeds. No statistical information is available about the relative importance of men and women's incomes.

II. DESCRIPTION OF THE TARGET AREA

Location

The targeted area comprises the prefectures of Ouham and Ouham-Pendé in the north-western part of the country, bordering Cameroon and Chad. These prefectures are situated within the production zone that is called the Savannah West, a part of the "Cotton Zone," the most agriculturally productive region of the CAR. This zone lies approximately between latitudes 4°-9° N. and stretches from the Bakore massif in the west to Alindao in the east. Topographically, the area is part of an extensive rolling plateau, divided by a central northeast/southwest ridge that constitutes a watershed between the tributaries of the Oubangui and Chari Rivers. Average altitude is 610 meters.

The Cotton Zone has an intertropical climate, with temperatures ranging between 18°C and 35°C (annual average 27°) and a well defined rainy season (April/May to October). Annual rainfall ranges from 1,300 mm to the north to 1,700 mm in the south. The shorter period of annual rainfall in the project area's more northerly regions (Bambari, 130 days) makes that area relatively more suitable for quality cotton production.

Cotton is the main cash crop in the area; its cultivation was mandatory until 1979. The principal food crop grown is sorghum, which accounts for 84 percent of total sorghum production in the country; other food crops include cassava, ground nuts, maize, and sesame, the production of which accounts for around 40 percent of the total annual food crops.

The average farm family in the target zone is made up of six persons, of which 2.8 persons are considered active. This is slightly higher than the 2.6 national average (Table 7). Each farmer cultivates 2.64 hectares which is 53 percent higher than 1.73 national average.

Principle Ethnic Groups

The target area is a mosaic of different ethnic and language groups. This mixture is to a large extent the result of upheaval and bloodshed in the 19th century.

While parts of the area were directly attacked by conquering groups from the west (The Fulani under Osman dan Fodio and

TABLE 7

THE TARGETED AREA: POPULATION BY PREFECTURE AND SUBPREFECTURE
(DECEMBER 1979)

Prefecture and Subprefecture	Population			Area (km^2)	Persons/ (Km^2)
	Rural	Urban	Total		
OUHAM-PENDÉ					
Bozoum	25,900	16,209	42,109		
Bocaranga	83,560	7,214	90,774		
Paoua	67,254	8,203	75,457		
TOTAL	176,714	31,626	208,340	32,100	6.5
OUHAM					
Batangafo (and Kabo)	41,318	14,891	56,209		
Markounda	24,143	1,310	25,453		
Bossangoa	80,038	31,686	111,724		
Bouca	29,846	10,334	40,180		
TOTAL	175,345	58,221	233,566	50,400	4.6

Source: Ministry of Agriculture

his successors) and from the east (the Arabized slave traders coming up the White Nile and its tributaries) other parts suffered from waves of successive migrant groups seeking refuge from the attacks of these and other slave-raiders. Today, in parts of Paoua, a traveller may enter a different language group after every three to four villages traversed along the road.

The main groups with which the project will be working include the Gbaya, the Kaba, and the Mboum. Others are the Banda, the Souma, and the Bororo.

The Gbaya are one of the largest groups, numbering between 300,000-500,000, depending on which sub-groups are included or not as Gbaya. In addition, there are another 80,000 to 100,000 in neighboring regions of Cameroon (Burnham: 72).

"The various peoples commonly classified as 'Gbaya' exhibit a considerable range of cultural variation and dialects, spoken at opposite extremes of the Gbaya region are, in some cases, mutually unintelligible. Confusion arises as well from the fact that certain groups who might seem to be 'Gbaya' both in terms of language and culture do not so identify themselves. On the eastern margins of the Gbaya area in the CAR, where Gbaya-speaking groups are interspersed with other populations such as the Banda and Manja...such confusion reaches its peak."

The project target zone most likely to be affected by the 'confusion' Burnham refers to is Zone Four, the road from Bassangoa to Badé, although in the two villages visited by the writer on this road, the inhabitants claimed to be Gbaya.

Cassava appears to have been the staple food of the Gbaya since the 1840s; according to Burnham, the Cameroonian Gbaya's culturally motivated taste for cassava allows them to remain relatively unaffected by food shortages while their neighbors, who prefer sorghum, are subject to radical seasonal and annual variations in grain productivity and prices.

For the Gbaya living in Zone Four, the writer does not know the extent which cassava or sorghum is regarded as the staple food. Respondents declared that they grew sorghum, which they kept in field granaries but, as the fields were not visited, the truth of these statements is still to be ascertained.

Gbaya are also the inhabitants of Zone Five, along the road from Nana-Bakassa to Leré. There they are a recognized sub-group referred to as the Gbaya and, according to Gosselin, the only Gbaya sub-group for which sorghum is the dominant food. Gosselin discusses the high cultural value placed on sorghum cultivation, to which were attached a

number of fertility and harvesting rites. He argues that with the ever-growing popularity of cassava, not only has the population suffered a decline in its nutritional status, but also in the authority of the extended family elders who used to control the distribution of sorghum among the group (25).

Hunting and gathering appear to be important to all Gabaya (Burnham: 37), and Prioul, writing with particular reference to Ouham, comments that the hunting and gathering economy must be considered as one of the fundamental and permanent factors of the economic organization of Central African People (105).

The Kaba live along the Chad border in eastern Ouham-Pendé and western Ouham. It is expected that they will be identified as the only ethnic group occupying Zone Two, the road north of Paoua. The Kaba are an off-shoot of the Sara group of Chad with whom they have maintained family and trading links. With a strong warrior tradition, they moved south into what is now Central Africa sometime during the 19th century and their southward advance was only stopped by the imposition of colonial government (Grosser and Pfeiffer: 40). This tradition led numbers of Kaba to enlist in the French army and, as 'anciens combattants' they used their pensions to invest in ox-plow farming. Indeed, it is largely among the Kaba that animal traction survived the years of Bokassa's agrarian reforms, entirely disappearing, for example, from the Nana-Bakassa area where it had also been introduced in the 1960s. Grosser and Pfeiffer suggest that this was because the Kaba benefitted from equipment and services available in on-going animal traction projects in southern Chad (196).

Comparing the Kaba with the other peoples of Paoua sub-prefecture (the Mboum group), Grosser and Pfeiffer comment that in many ways, not only through the maintenance of animal traction, do they seem to be more dynamic and 'progressive' and they wonder whether it is connected with the fact that sorghum remains the staple diet among the Kaba. The thesis is that cereal cultivation requires a more organized agricultural production system than does cassava (197).Interestingly, cotton yields were also higher than further south, thus contradicting the argument that cotton constrains sorghum production or vice-versa. Finally, for the Weberian sociologist, it is worth noting that Protestantism is more entrenched among the Kaba than among the other groups.

The Mboum groups live along both banks of the Logone River in Chad and Cameroon and they are also in north-western CAR. One sub-group, the Pana, occupy part of Zone One, the other part being Kaba. Members of the design team have not visited this

zone, nor was any documentary information available. However, according to several oral sources, the population is particularly dynamic and innovative. Crude rat-guards on granaries have been observed in this zone; here is the only road maintained as the result of voluntary communal labor; the cotton yield is the highest in the whole cotton belt and ox-plow cultivation has been well accepted. There is no information as to whether these phenomena are equally evident in both Pana and Kaba communities. It is very possible that the driving force behind the population's preparedness for innovation is the contiguity of the zone with Cameroon. It is well know that much food, and possibly some cotton, crosses into Cameroon where prices are higher; sorghum, for example, has been selling in Cameroon at about 75 francs per kg compared with 50 francs per kg in CAR and Cameroonian farmers in 1981 were receiving 85 francs per kg for their cotton compared with 60 francs in CAR. As mentioned, the Kaba are sorghum eaters and it is likely that the Pana are also, if they are like their relatives over the border into Cameroon.

Zone Three, south of Paoua, is also occupied by Mboum groups, notably the Talé, Karé and Pondo, all speaking different but mutually comprehensible dialects. Here cassava forms the staple diet and sorghum is generally used just for brewing and for selling to the Bororo (see below). The granaries here are smaller than among the Kaba north of Paoua. No information is available as to whether the people living south of Paoua have been cassava eaters for a long time. One village informant did comment, however, that in the year of the cotton strike, 1981, they all planted more sorghum than usual. In general, the people in this zone are regarded by development agencies as less dynamic and innovative than those living in the other two intensive zones of action in Ouham-Pendé. While staying in Goura, a village in the zone in November 1982, the writer was struck by the appearance of ill health among the adults and malnourishment among the children. Although this was the season of plenty, they appeared in worse condition than, for example, the Gbaya people observed in Ouham during the empty season the following May.

Other groups include the Banda and Souma. The Banda are the major ethnic group living in the eastern part of the cotton belt where they adopted cassava cultivation more readily than their neighbors (Prioul: 109). It is possible that the project team will encounter some Banda villages in Zone Four and possibly in Zone Three. The Souma are a small group speaking a quite separate language from any of the others already mentioned.

Scattered in the larger villages throughout the target area are Hausa and Arabic speaking traders.

The Bororo, pastoral cattle-owning nomads, move through the target region in their north-south transhumance. No information was available to the writer concerning the numbers of Bororo involved, the pattern of their movements, or what kind of impact they may be having on the lives and economy of the sedentary cultivators. However, some documentary information does exist for neighboring regions and there are indications that the role and impact of the Bororo should not be neglected in designing and implementing a postharvest food systems (PHFS) project.

In the Bossembelé area, a wooded savannah to the south of the project target area, an IFAD/FAO Mission has identified the Bororo as a major stimulus in increasing food crop production. Local authority statistics place the Bororo population at its peak as representing 40 percent of the total population in Bossembelè sub-prefecture and, as the Mission's report points out, this represents a very significant market for food crops (IFAD Annex I: 8-9).

According to Burnham, the Bororo population is at its peak between April and November, the herds moving further south during the dry months; it is in the wet season, therefore, that the demand for food (in this particular case, cassava) is at its greatest. Burnham also describes the bond-friendship relations that may exist between a Bororo man and wife and a Gbaya couple: the Gbaya men providing their services and food in exchange for meat or consumer items and the women providing vegetables in return for milk products (198-199).*

As witnessed in Paoua sub-prefecture in November 1982, there were considerable numbers of Bororo women trading milk for cassava, sorghum, and vegetables, such as okra.

Alloix, speaking of the eastern savannah region, raises the issue of the damage caused to standing crops by cattle. The Bororo headsmen no longer respect the pasture land boundaries. According to Alloix, the damage caused to the crops and the complaisance shown by the local authorities towards the Bororo, is having a severe effect on levels of agriculture production. In the Paoua area, it is said that Bororo herds occasionally devastate a complete field.

As a coda to the Bororo issue, it should be mentioned that a number of the aluminum rat guards placed on elevated granaries by the FAO pilot project were stolen by Bororo girls for use as hair ornaments.

---

* As Burnham points out (247), food bartering relations mean that both groups, Gbaya and Bororo, get a more balanced diet without cash expenditure.

III. VILLAGE FOOD SYSTEMS

Units of Production and Social Organization

Agricultural economists working in sub-Saharan Africa usually regard the nuclear family as the basic unit of production in rural society. This is also the case for the Central African Republic where the unit, or 'household,' or 'family farm,' is viewed as consisting of a man, one or more wives, and unmarried children. Thus the FAO agricultural census identified an average of 5.9 persons per 'farm' in Ouham-Pendé of which 2.8 are active workers. From this basis other calculations are made, such as the amount of equipment used on the farm or the number of 'man' days (Table 8 gives esimates of this sort) involved in producing each kind of crop. The male household head is viewed as a farm manager who makes decisions concerning the optimum utilization of the land, labor, and tools available to him.

In practice, the use of the 'household' model is probably not very useful for understanding what is actually happening in village society and for appreciating how decisions are made and who makes them. Patterns of food exchange and organization of labor for production can probably be more easily understood using another kind of model: that of a network of individual men and women grouped together for many purposes in residential hamlets, which coincide with extended family units. Fundamentally, it is that each adult individual controls his or her own production and husbands do not plan or make decisions concerning what their wives grow or how the food is used. Between husband and wife are contractual obligations by which each is obliged to render certain services to the other. Other kinds of obligations exist between men of the same group, women married into that group, and between women and their own relatives.

If Burnham's analysis for the Cameroonian Gbaya is valid for all the peoples in the target area, then it would appear that, above the individual, the basic social unit is the extended family (ndok fuu), averaging 24 persons including children (97). "The nature of this economic interaction is quite complex, involving, on the one hand, extensive sharing of production and income as well as communal eating arrangements within the 'ndok fuu' while on the other hand, retaining considerable potential for personal economic efforts based on highly individualistic property and land holding arrangements (93)."

TABLE 8 - ESTIMATED ANNUAL FARM FAMILY LABOR BUDGET, BY CROP ENTERPRISE (MAN-LABOR DAYS)

LABOR REQUIREMENTS	CROP								
Operation (area: ha)	All Crops	Cotton (.80)	Groundnut (.35)	Sorghum (.10)	Maize (.12)	Sesame (.12)	Cassava (.75)	Other (.24)	Total (2.48)
Land clearing	32	-	-	-	-	-	-	-	32
Cleaning/ plowing	-	30	7	2	2	2	-	4	47
Seeding/ plowing	-	8	6	1	1	1	7	2	26
Weeding	-	28	16	5	6	1	34	2	92
Fertilizer/ insecticide	-	10	-	-	-	-	-	-	10
Harvest	-	40	12	3	3	3	19	11	91
Marketing/ hauling	-	4	-	-	-	-	-	-	4
TOTAL	32	120	41	11	12	7	60	19	302

a) Assumes 2.48 ha. farm units

b) 2.8 actives x 260 days

Source: RRNA estimates from various sources

The principle of individual control over production also applies to the postharvest system and, in order to identify difficult spots in the system, it is vital to understand who owns what food and what is going to be done with it. The husband is not in a position to make economically rational decisions concerning optimum utilization of all the food produced by the 'nuclear family'; even his unmarried sons act individually in the production and distribution of food crops. It is indeed this individual approach, combined with the cultural belief that it is the woman's task to feed the children, that can lead to the current situation of children risking being underfed because of lack of consultation between husband and wife.

We may conclude this section by quoting an IRCT report concerned with the Banda Peoples in the eastern part of the cotton belt:

"From planting until storage, the stages of production are individual. It is only from the moment that meals are prepared that the system becomes communal (25)."

Historical Factors and the Present System

Settled agriculture is a relatively new activity for many groups within the CAR. To put this into historical perspective we should remember that in Central Africa, the upheaval of the 19th century, followed by the de-stabilizing activities of the colonial regime, mean that conditions have been unstable and it can be usefully postulated that in many instances the farmers are not fully exploiting locally available materials and techniques.

Many students of Central African history have stressed the point that unstable historical conditions have probably led to a decline in material culture and artisanal and economic specialization (Grosser and Pfeiffer, Vol. 1: 42-43). For example, less care may have been given to the construction of granaries because farmers had no guarantee that their stores would not be pillaged. There may have been a general decline in agricultural skills resulting from uncertainty concerning what would happen to themselves and their children before the next harvest; farmers may have returned to an increasing emphasis on hunting and gathering activities.

Cultural Attitudes Towards Food, and Men's and Women's Input Into Food Production

Variation in the extent to which men regard the cultivation of food crops as a major responsibility and whether this is

linked to their attitudes towards the postharvest conservation of food is a major question.

Available evidence indicates that such variations do exist and are primarily linked with whether or not cereals or tubercules are the staple food. In turn, this may be connected with the historical circumstances discussed in the previous section. Undoubtedly, the rapid spread of cassava northwards from the forest into the savannah is due partly to the fact that cassava was not easily vulnerable to pillage and after the invaders had left there was still something to eat. It has been observed that in western Africa generally, men's contribution to food crop production is much higher in the grain-growing belts than in the forest zones. In these latter areas men's participation in agriculture has been traditionally minimal and they devote much more time to hunting. In the context of the project target area this explanation may be postulated as to why in the zones where cassava is the predominant crop men's attitude towards agriculture is apparently casual. Burnham comments on the cassava-eating Gbaya where the men place a greater value on hunting. The writer observed the same attitude among the Talé south of Paoua, compared with the Kaba to the north, where sorghum remains the staple food.

In those zones where sorghum is the principal crop, it appears to be regarded as a "man's crop." Gosselin reported for the Nana-Bakassa area (project target zone five) that until recently only the men did the harvesting. Even today there is evidence that men are mostly interested in growing sorghum, and that most of the sorghum entering the market is from men's fields. This of course will be further explored in the proposed market investigations component of the baseline study. Interestingly, it is women who often buy the sorghum, converting it into beer, which is then sold back to men.

Most of the other food crops grown in the area are viewed as women's business, namely cassava, beans, cowpeas, okra, etc. Brief observation indicates that peanuts are grown equally by men and women.

It can be hypothesized that in the zone where sorghum forms the basis of the diet, such as around Bocaranga and north of Paoua, men assume a greater responsibility for not only contributing their labor to food crop production but also ensuring that the children have enough to eat. Among peoples of the same cultural group on the Cameroon side of the Logone river, it has been observed that senior males in an extended family group are expected to maintain a reserve stock of sorghum, which they will only release onto the market when it is clear that the women's granaries will in that year contain enough food through until the next harvest.

In those zones where cassava and other root crops play a much more important part in the diet, men's attitudes are different. The following quotation is about the cassava-producing zone to the south of Ouham:

"Here, the women have a much more responsible attitude than men do towards the utilization of their production and the revenues obtained--women are more concerned with the welfare and nutritional status of the family (IFAD Annex 3:12)."

The behavior and attitudes of men and women to the production of food crops may be reflected in the way that land is allocated, the women's fields are often far away from the home (Adrien-Rongier and Schoerry-Munzinger: 52). In some cases, women with their small children will camp in the fields for days at a time during the busy period of the agricultural calendar. The distance from the fields makes an additional burden to women and children bringing in the harvest. It is one of the reasons, advanced by informants, for why they build granaries in the fields in some areas. In some places this situation has arisen because the men cultivate cotton in a block of land placed alongside the road, to suit the convenience of visting extension agents. In the following year, men's food crops are grown in the block while the women continue to have to go to their own fields only after having carried out sowing, weeding, ridging, and harvesting tasks on their husband's fields. By and large therefore, the food crops destined for sale receive more timely attention than those destined for home consumption. To be discovered is whether this same pattern is repeated in postharvest practices.

Food Flow Networks

Apart from the exchange of food for cash, discussed in the following section on marketing, food is also exchanged within a complex web of family, friendship, and neighborhood ties. Food may change hands several times before reaching the cooking pot or market place. The principal kinds of food exchanges identified so far are summarized below. No information is available as to the significance of the quantities involved in this food flow system.

Within the extended family group it appears that the major movement of food is from senior men with several wives and fewer young children to junior men with only one wife and several small mouths to feed. The capacity for storing food and distributing it to other members of the group could be a sign of leadership and authority. From interviews it appears that a man may either give to another man or to that man's wife. Whoever receives the gift has control over its disposal, either contributing it to the communal cooking pot,

storing it for later use, or sending it on its way to other persons in or outside the family group. An example from the fieldwork was a young girl selling sorghum she had received from her grandmother, who had received it from her husband, who had received it from his older brother, who had taken it from his stock of last year's sorghum stored in a 200-litre drum inside his senior wife's house. The cash obtained from the sale belonged to the girl's grandmother.

A hypothesis worth examining is that men usually exchange unprocessed food and women processed food, such as cassava chips, or sorghum flour, or decorticated groundnuts.

Gifts to relatives are commonly made by women to their own family members belonging to another hamlet or village. A mother may send food to her married daughter in this way. However, men may also be involved with exchanges of food and game meat between brothers and sisters living in different villages.

The role of food in savings groups was observed during fieldwork: one member of the group had prepared a nutritious porridge of groundnut paste, rice, sugar, and water. The dish was regarded as a special luxury food. The other three women each brought 500 FCFA, which they gave to their hostess who was intending to buy clothes with the money. They also came with an extra 250 FCFA each in order to buy from the hostess ten platefuls of porridge to distribute to others as they wished, including members of marginal families dependent on this kind of charity for subsistence.

Food for labor often is used as part payment of a daily-hired laborer, and is also the basis of the organization of large work parties for clearing, planting, and weeding. In the southern part of the target area it appears that much of the sorghum is reserved for this purpose, the grain being converted into beer. It appears that most farmers, men and women, organize such parties two or three times a year at least; wealthy men, such as ox-plow farmers, are obliged to organize the parties on a larger scale because a) their labor requirements are greater, and b) they risk being accused of witchcraft if they are not sufficiently generous. Grosser and Pfeiffer mention the case of one village headman who spent in cash and equivalent in beer a total of 27,200 FCFA including fees for musicians and women "cheer-leaders" (236). In the hungry period of the year, which coincides with the planting and sowing season, the labor parties may have a secondary function of redistributing food from the richer to the poorer persons in the village. Wealthier farmers must therefore have the capacity to store food through until the next harvest.

Exchanges between cultivators and nomads were described on page 13 in the section concerning the Bororo cattle herders.

Food in the Cash Economy

It will be recollected that individuals not families sell food. But, who sells what to whom and in what amounts needs to be explored further. Each man or woman makes an individual decision concerning when to sell, and at what quantity, part of his or her harvest. It appears that men usually sell a much higher proportion of their crop than do women, although we have no solid data to confirm this. Most written sources and the writers' informants (officials and villagers) agree that when the man sells part of this harvest, he keeps all the money. When the woman sells, she must give part of the cash to her husband. In Goura village, a man showed the new granary he had just built for his wife and containing her peanut harvest: if she sells part of the crop for 5000 FCFA, he said, "Then she must give me 2000 FCFA."

There are two main ways in which a person may sell food: a) in bulk to mobile traders, and b) at retail in the market place.

Mobile traders are either market women from Bangui ("wali-gala") or Arabic- or Hausa-speaking men. For the Bossembelé region, the IFAD/FAO report previously mentioned describes how the "wali-gala" send out 'extension' agents to buy cassava. These agents spend one to three months in a group of villages, inciting and urging women to harvest and process a sufficient quantity of cassava. The aim is for about seven to eight villages to produce between 100 to 150 sacks, and when this target has been reached, the agents inform the trader in Bangui, who hires a ten-ton truck and comes up to fetch the food. The buyer, through her agents, may give the producers cash advances as well as, of course, the guarantee that their produce will be sold (9-10).

In the Bossembelé region, cassava processing and selling take place mostly in the rainy season as there is access to Bangui by an all-weather tarmac road. The report notes that in the dry season the "wali-gala" buy their cassava at a greater distance from Bangui where the price is cheaper (6). This may include parts of the project target area, in which case producers' concern and time spent on cassava processing is likely to be higher in the dry season months.

It appears that for other crops, such as sorghum, maize, sesame, and groundnuts, traders do not necessarily organize themselves in advance. An Arab or Hausa trader usually owning rather than hiring a truck, drives around the country, stopping in villages, haggling over the price, and gradually loading up his truck during a period lasting as long as two weeks. In some instances he may have filled his truck with

trade goods that he barters for the food in whole or part exchange. One village informant received his 200-liter oil drum in this way. The more isolated a village, the lower the price obtained by the producer, who in many cases is without any bargaining power when at last a trader appears on the scene.

Mobile traders buy by volume and not by weight--'marine sacks' and large enamel dishes known as 'cuvettes,' which resemble the old-fashioned wash pan. Various researchers have tried to identify standard weights for these volume measurements but their findings are rather contradictory, probably reflecting a somewhat chaotic real situation.* During the course of the year, the price per a certain volume may change in accordance with supply or demand or, alternatively, the volume may shrink. Producers feel that they are usually cheated by the traders but are no happier with those companies representing, for example, oil factories or breweries, who wish to buy by weight. As the company brings its scales on the lorry, the villagers have no control over their accuracy. SOCADA has been training the village cooperative groups, the GIRs, to cope with these problems.

Retail sales in the market place are always the responsibility of women who may be selling for themselves or on behalf of their husbands. Retail sales involve much smaller quantities of food and are likely to be the most common way in which a woman sells her own produce (although in Paoua subprefecture, women were observed selling several sacks of groundnuts). Selling at retail may be a deliberate decision because of the small amount to be sold, or may be due to a final desperate attempt to dispose of a crop when no trader has appeared to buy in bulk. Large markets are few and far between; in Bolio village in Target Zone Five, women had to sell their husbands' maize (after the brewery failed to buy it) by carrying it on their heads to Nana-Bakassa market, 25 km away.

In the larger villages, a piece of land is set aside for trading and on most days of the week one may observe two or three women selling a bowlful of sorghum or a handful of groundnuts. A Hausa trader with a bicycle may also be there, selling soap, matches, and torch batteries. In smaller villages a woman may simply sit outside her house offering her produce for sale, a calabash spoonful of sorghum at five francs or sesame at ten francs.

---

* As a rough guide, it appears that a cuvette of sorghum grain represents about 30 kg and one of cassava about 20 kg.

For observers familiar with the bustle and zest of African markets in neighboring countries, those in the cotton belts of CAR are rather gloomy and low-key affairs, in themselves a visual indicator of the constraints existing on commercial activities in the rural areas.

Proportions of food sold have already been examined for the country as a whole in an earlier part of this document. Gosselin in his study of a village in Target Zone Five analyses data collected in a survey between 1959-60. Unfortunately, lack of information about the survey design and conduct means that it is impossible to assess the validity of the findings. Some of the data presented appear confusing because they were collected on a household rather than individual basis. However, the results do confirm other sources that show that women and children often sell food not only on their own, but on behalf of the 'household' head (212-214). As discussed elsewhere, it may be that too large a proportion of the family's total crop is being sold by the men. For the same area where Gosselin worked, the writer recorded some additional information concerning proportions of crops sold.

In the village of Bolio, visited in May 1983, the farmers had sold part of their crops through a pre-cooperative structure known as a GIR. In the 1982-83 season, 800 registered cotton planters had farmed a single block of 700 ha of associated food crops (cotton the previous year). At an estimated yield in mixed cropping of an average of 250 kg of sorghum per hectare (estimate provided by Mr. Woimont), each planter produced an average of 220 kg of sorghum apart from any sorghum that he or she might have grown off the block.* Of these 800 planters, 98 sold part of their sorghum cooperatively (64 tons); another 30 tons were sold by an unkown number of planters to Arab traders. Regarding, therefore, simply the block sorghum production (an estimate of 175 tons), 94 tons were sold in bulk; i.e., 54 percent of the yield. This figure discounts that part of the block production sold 'retail.' In a second village, Bago, 243 planters (the total number in the village) sold cooperatively 30 tons of sorghum; i.e., based on the same estimates 57 percent of the total block production.

These proportions should in no way be regarded as typical for the whole target area, as the Nana-Bakassa to Leré Road (Zone Five) is probably one of the most developed and dynamic parts of the cotton belt, and in addition, farmers were aware that SOCADA was prepared to help in identifying purchasers for their sorghum.

---

* Average per farm production figures are 436 kg for Ouham.

Seasonal fluctuations in selling food at the local market appear to exist for most of the major crops. According to information provided by Bell, from her studies in Bossangoa market, the price of a cuvette of sorghum appears to be at its lowest in February, rising to a peak in November and then declining again. Interestingly, a sudden sharp price rise in April 1983, as compared with the previous April, confirms the general impression of those living in the region that there was a greater food shortage that year than the year before because of abnormally low rainfall. (In May 1984, however, it was observed that food supplies were more abundant in line with better weather conditions.) The price of sorghum in 1983 rose from 900 FCFA per cuvette in January to 1500 FCFA in May.

Bell reports a peak price for cassava chips in June-July (just before the maize and groundnut harvest), falling to a bottom price in January-February. As with the sorghum, there were indications of sharp inflation in price: in January 1982, the cassava was between 600-750 FCFA, and in January 1983, between 1300-1500 FCFA. By April 1983, it had already risen to 2000 FCFA, double the price for that month in the previous year!

In Paoua subprefecture in 1981, the in-shell price of groundnuts in August was 80 fr per kg, rising to 100 fr per kg and 150 fr per kg by February 1982 (personal communication from Mr. Grimmelman). At this time groundnut prices were apparently as high as 250 fr per kg. in the markets of northern Cameroon. These very high prices, which certainly acted as an incentive to produce more groundnuts and less cotton, are due to a sharp drop in production in Chad and, at least at that time, a continuing demand from Nigeria. The recent economic problems in Nigeria may possibly result in a drop in demand.

Are farmers prepared to wait until, for example, the prices of sorghum and groundnuts rise? The impression is that most farmers of moderate means do not sell early because of poor conservation techniques but because of their urgent cash needs. Burnham comments that most men among the Cameroonian Gbaya cannot aford to wait to sell their maize. This is not fundamentally due to poor storage techniques (difficulties due to rats, mold, etc., "are not considered insurmountable if the farmer is conscientious") but because of urgent cash needs (315). For these Gbaya, maize is the principal cash crop. In the target area in the cotton belt of CAR, cotton should help farmers to afford to wait for the prices of their food crops to rise--if it gave a high enough return. If the new SOCADA strategy and funding are successful, then farmers will earn much higher cash incomes from cotton and may therefore be in a position to be able to afford to wait for food

prices to rise before selling. In such circumstances they would of course be prepared to invest more time and labor (and possibly cash) in improving their postharvest conservation techniques.

The significance of food sales in the total cash income varies between men and women farmers, with men earning the major part of their income from cotton in most places. However, most sorghum is sold by men. Women's biggest sources of cash are from the sale of processed cassava and sorghum beer. Available data provide conflicting evidence as to whether or not women give part of the profits of cassava sales to their husbands. A woman may either use part of her husband's sorghum stock for brewing, and split the profits of the beer sales, or she may buy sorghum with her own cash. It appears quite common for a group of women to band together, each in turn being chosen as the one to take the profits with all the members each time contributing to buy the sorghum, carry it to the woman's house, pound it, cook it and help in selling it. In the village of Goura (Target Zone Three), the writer encountered a woman informant reaching the last stages of her work. She had purchased the sorghum at Paoua market with the proceeds of her groundnut sales--11,000 francs for five cuvettes (about 150 kg.). Four persons had helped her bring it back to the house and for the actual pounding and brewing she received the more or less full-time assistance of her husband's brothers' wives. The amount of labor and time involved can be illustrated as follows:

Day 1	Day 2	Day 3	Night 3	Day 4	Day 6
Travelling to/from market (5 persons)		Pounding sorghum	Brewing (3 persons)	Brewing	Selling (1 person)

The informant expected a gross profit of about 25,000 francs, or a 125 percent return on her investment. In this case, the beer was brewed in order to be sold on Sunday and on that day the writer counted five different women selling beer in the villa, which has a total of 79 women. Assuming that all the women brew (probably not the case with the old widows), then at any time about 20 percent of the women are involved brewing in any given week. November is, of course, a fairly prosperous month and demand probably drops off considerably from about March onward.

Other sources of income are from groundnut and shea oil; peanut butter is sold separately. A range of dried vegetables is also sold; sesame may be made into little cakes; and in one village in Target Zone Three, the writer observed two women selling rice water as a refreshing drink.

Finally, Gosselin comments that whereas younger women may gather wild food for income generation, older women will tend to invest in goats, pigs, and chickens (222).

The Impact of Current Changes in Agricultural Production

While the great majority of farmers are still using only the hoe for land preparation, animal traction is beginning to become well established in parts of Ouham-Pendé (target zone one to three). SOCADA plans to revive animal traction in its intensive zone of action in Ouham. By 1983, there were about 1300 pairs of oxen in Ouham-Pendé. In the areas where they are most common they are bringing about a number of changes in the division of labor that are likely to affect food crop production and, eventually, farmers' storage requirements. Ox-plowing means that more land can be cultivated (an average of 4 hectares rather than the hoe-cultivated average of 2.6 ha). However, the effectiveness of animal traction is considerably reduced because of the shifting nature of cultivation.

The oxen are used only for plowing and cannot also be used for ridging and weeding because the land has not had the stumps removed. Farmers resist stump removal because of the temporary nature of the fields. As a result, women continue to ridge and weed with a hoe. Some observers suggest that this creates a production bottleneck with the potential for increased yields being severely reduced (Alloix 1983), and others have raised the possibility that women may be working longer hours on their husbands' fields and neglecting their own, with a resulting decline in the amount of food produced for family consumption (Schoerry-Munzinger and Adrien-Rongier: 72).

From field observations, however, a third alternative may be hypothesized: the increasing frequency in the hire of cash-paid daily laborers. Farmers, who have already made a considerable cash investment in oxen and equipment, decide to use cash further in order to protect the initial investment. Through the use of hired labor they can reap the full benefits of increasing the area of land under cultivation. Laborers, usually women, receive about 200 FCFA per day and a farmer may hire up to ten at any time for major operations, such as cotton harvesting. If the trend of rising cotton prices continues, this tendency to employ laborers within the cash economy is likely to increase. The eventual outcome may be that many of today's marginal farmers (widows, neglected or abandoned wives) switch to wage-earning as a full-time occupation. This will, in turn, contribute to a greater number of food sales within the village, as the laborers change from growing food for themselves to buying it from the more prosperous farmers. The speed of such an evolution

hinges very much on the extent to which farmers decide that investment in animal traction is a worthwhile proposition: it also depends on the extent to which these farmers' wives insist that they hire laborers rather than demand longer hours of labor from the marriage partners.

IV. REACHING THE SMALL FARMER

Previous Agricultural Development Programs: Cotton Programs

The production of cotton by all farm families and the associated infrastructure developments, particularly roads, was for many years almost the only development intervention in the target area. These programs emphasized supervision and regulation of production, which was compulsory during the colonial period. The extension and marketing services for cotton were provided by a number of private companies that in 1964 grouped together into the Union Cotonière Centrafricaine (UCCA) with a majority shareholding by the State and minority participation by the cotton companies as well as CFDT. CFDT became the executive and marketing agency for UCCA while Bureau Pour la Développement de la Production Agricole (BDPA), a French parastatal agency for agricultural development, was invited to work alongside CFDT in the prefecture of Ouham. BDPA was to concentrate on three activities:

- improvement of the agricultural extension program,
- introduction of ox-plow cultivation, and
- creation of village proto-cooperatives, GIRs.

UCCA's overall aim, with a series of technical assistance projects funded by France and the European Development Funds (EDF), was to "fundamentally change the cotton growing industry in the Central African Republic by bringing it forward from the stage of compulsory extensive cultivation to the stage of modern intensive farming, spontaneously accepted by the rural population" (MINACRI 1980: 2). All that had been achieved by the late 1960's was destroyed in the following decade. Following the downfall of Bokassa, the government restructured UCCA in 1980 to become SOCADA, with a new mandate as the umbrella rural development organization for the cotton belt. At the end of 1983, following an interim rehabilitation period, SOCADA launched a large-scale integrated rural development program with funding and technical assistance from the World Bank, the European Economic Community, and other donors. Apart from agricultural research and extension (food crops as well as cotton), funds and personnel are available for road improvements, wells, and support of village proto-cooperatives and development committees, known as GIRs.

An organization chart of SOCADA is on the following page: the village-level agent is still usually referred to as an STA (Surveillant des Travaux Agricoles) although officially the name has changed to "Vulgarisateur" to reflect the new approach of SOCADA to working with the farmers. An intensive retraining program has been established for extension agents and their supervisors and the emphasis on farmers' participation has been stressed with the help of the Community Development Department. It is possible that some of the older SOCADA agents may find it difficult to switch from a supervisory to a participatory approach in working with farmers. Despite their being given a broader rural development mandate they are also likely to put the greater part of their efforts into cotton production: each agent receives an annual cash bonus on the basis of his work in ensuring that the cotton planters carry out scheduled activities correctly and on time. So far there are no women village-level agents working for SOCADA and this may handicap effective dialogue with women food crop farmers. The UNDP/FAO Programmation report comments: "The agricultural extension system is based on the fiction that only the household head is concerned with farming(97)."

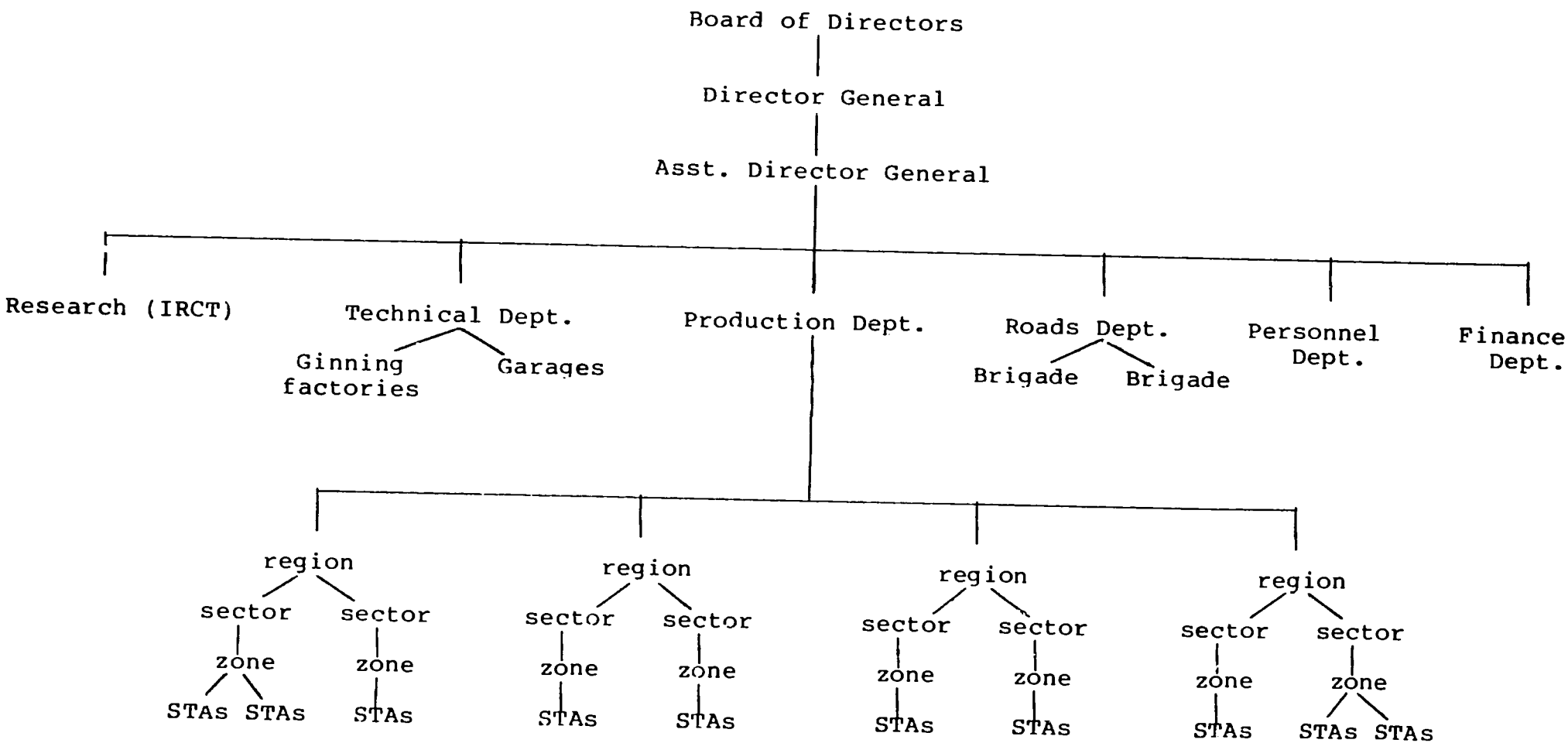
About 450 village-level agents (STAs) are hierarchically organized in 90 zones, 16 sectors, and 4 regions. The PHFS project will be working in parts of four of the 16 sectors, two in Ouham and two in Ouham-Pendé.

SOCADA has divided up the cotton belt for organizational purposes into 'intensive' and 'extensive' zones of action, the former having a higher ratio of extension agents to planters. During the first phase of the new project (1983-85) action will concentrate in the intensive zones, which have been selected on the basis of the following criteria:

- highest quality soils and climate;
- most receptive target population;
- proximity to SOCADA ginning, research and seed multiplication facilities; and
- areas where present SOCADA/ACADOP organization, service, and extension programs have been judged most effective (Nathan: 94).

These intensive zones are defined in relation to specific stretches of road and thus all villages along these roads will be automatically part of an intensive zone. SOCADA estimates that each STA will work with about 400 cotton planters.

SOCADA ORGANIZATION CHART



SOCADA's wider mandate and its new approach to working with farmers will inevitably require a period of readjustment for the organization: the PHFS project, by concentrating initially on working with ACADOP and CD agents in Ouham-Pendé, will not become closely involved with training and follow up of SOCADA agents until this period of readjustment has been achieved.

Other Rural Development Efforts

ACADOP, with financial and technical assistance from the GTZ (West German Ministry of Cooperation), is a GOCAR agency created in 1977 for developing the prefecture of Ouham-Pendé, initially in the sub-prefectures of Borcaranga and Paoua. ACADOP's mandate included cotton as well as food crop production, with SOCADA's role being limited to the provision of fertilizers, insecticides, and seeds (through the agency of ACADOP) and the buying of cotton. Initially, problems were experienced in identifying the most appropriate and feasible areas of intervention and much time was inevitably devoted to cotton production. The first marked success was in strengthening the expanding ox-plow cultivation; secondly, after some trial and error, a number of villages were assisted in setting up development committees, known as "groupements villageois." The first activity, in collaboration with the FAO postharvest project, was the establishment of village-level food stores. ACADOP is now concentrating on other activities that have a greater priority from the villagers' point of view, such as wells and pharmacies. In 1979, it started a subproject known as AFROP (Action Feminine Rurale de l'Ouham-Pendé) that had the goal of developing specific women-oriented activities inside the villages. Managerial and technical problems caused the program to be shut down in 1981, but there are still six women village agents working for ACADOP; the agency is very anxious to revive this part of its activities.

In March 1983, a protocol between ACADOP and SOCADA established that SOCADA would assume responsibility in Ouham-Pendé as in the other cotton belt prefectures for all agricultural production activities. Accordingly, the STAs were transferred to SOCADA, leaving ACADOP with a small number of village-level agents who from henceforth are intended to concentrate primarily on non-production activities, particularly wells, roads, village pharmacies, etc., using a community participation approach through the 'groupement villageois' strategy. Because of its proven experience and efficiency in this field, ACADOP will also continue to help the development of animal traction. In 1983, following this agreement, ACADOP was left with 21 village-level agents but a high concentra-

tion of German technical assistance, based both in Paoua and Bocaranga.

The Community Development Department, attached to the Ministry of Social Affairs, is the other GOCAR rural development agency in the area. Village agents are working in target zones two, three, and five. Apparently all these agents are male because few educated CAR women are willing to work in the rural areas. The Department's approach is to encourage villagers to solve their own problems and in villages where there are residential agents, development committees are formed. Main activities so far have been wells, village pharmacies, and nutrition education. Funding from UNDP and France is allowing the CD Department to start in appropriate technology and training of rural craftspeople. The Department is small, but has considerable influence and prestige in the CAR.

The Catholic Church maintains a nationwide "non-religious" community development organization known as 'Animation Rurale.' Strongly entrenched in Ouham, its activities became minimal in Ouham-Pendé in recent years, although there are indications it is planning to return. Animation Rurale, through the placement of trained village-level agents, works in a very similar fashion to the CD department; in Ouham the two organizations work in close collaboration to ensure as wide as possible a population is reached. The service is directed and funded by the Catholic mission, sometimes assisted by young French volunteers. Maternal/child health and nutrition education activities are present at Bossangoa and Paoua, and at Paoua the sisters also run a three-year training program in home economics and literacy for village girls. Finally, in Bocaranga subprefecture there are three training centers of interest to the PHFS project:

- A 12-month young farmer's training course in collaboration with INADES at Ngoundaye with an annual enrollment of about 15 young men.

- A two year course for catechists in rural skills for income-generation at Bocaranga town.

- A three year fully fledged vocational training program at Ndim with an annual enrollment of about 17 young men.

The 'Eglise Evangelique des Frères' is a United States-based fundamentalist mission particularly strongly established in Paoua subprefecture and in the north of Ouham. Its approach and activities are fully described in Grosser and Pfeiffer (268-269). Organized activities concentrate on purely religious themes and the church does not perceive itself as having a major role in the economic development of the area.

Grosser and Pfeiffer comment that through thier own industriousness, the church pastors set an example to their congregation (268). The church also operates a highly efficient medical service in the area, based from its hospital in Boguila.

Other Protestant sects assume a community development approach, similar to that of the Catholics, and are grouped together in an organization known as PAEDA to undertake various rural training and development activities. However, PAEDA does not appear to be very active in the project target area.

Many of the effective health, welfare, and non-formal education activities in the target area are implemented by church organizations. Nearly the whole population is nominally Christian (apart from the Moslem traders). The secret initiation societies that formed the bases of traditional religion have long since disappeared, although various rituals and beliefs still exist. Membership in a church group is probably the only significant way in which an individual villager can establish strong and mutually rewarding ties beyond his or her immediate residential and kinship group. In some villages only one sect appears to be represented but in others two or more may be present in varying strengths.

Peace Corps Volunteers have been working with the Community Development Department, the Nutrition Centre at Bossangoa and the women's program of ACADOP. Through their current activities with farmers (bee-keeping and fish ponds) they have become fairly well known in the villages. French volunteers are also active in the area.

Postharvest Interventions

Experience with postharvest interventions has been fairly limited, except for the FAO pilot project at Paoua. Some CD agents have demonstrated the need for granary sanitation and this point is covered in the CD booklet on peanut cultivation. At the time of the UCCA/BDPA program, 20 years ago, SOCADA agents received basic training in storage and warehouse management and they are continuing to transmit this information to interested farmers.

The major postharvest activity to date has been the FAO project. This pilot project was concerned with identifying methods in use elsewhere that could be appropriate in the CAR cotton zone. The project worked directly with farmers, helping them build improved silos, place rat guards, and so forth. Most of the actual construction was in fact done by laborers paid from project funds; imported materials (cement,

aluminium) were provided free of charge to selected farmers who contributed only materials available in the bush. The selection of target villages was not based initially on any particular criteria although afterwards the project concentrated its interventions in villages where ACADOP was active. While farmers in these villages became sensitive to postharvest issues, the project's lifetime was too short to develop any comprehensive training and extension program.

Doing the work on behalf of the farmers, rather than training them, means that while they may appreciate the intervention, such as rat guards, they do not learn how to continue to benefit from the innovations after the project has ended. Providing non-locally available materials free of charge severely limited any possibility of spontaneous diffusion of improved techniques.

Social Units and Individuals in the Postharvest System

As described in the main text of the project paper, direct extension efforts of the project should be limited to five villages in each target zone. All men and women farmers and their children will be given the chance to participate in on-farm trials, demonstrations and evaluation workshops. Three main categories of target farmers exist: (1) ordinary men farmers, (2) ordinary women farmers, (3) wealthy and innovative men farmers, such as the ox-plow farmers. During the course of the baseline study it is expected that these categories will be further refined.

Reaching Individual Men and Women

In identifying whom to work with in various parts of the postharvest food system it is important to remember that the principle of individual control of food applies to all stages of production, including postharvest processing and marketing, irrespective of a sexual division of labor. The division of labor in postharvest processes may be summarized as follows: men are responsible for making the granary baskets and platforms and caring for the food stored in them. They are also responsible for any other storage containers kept outdoors, such as oil drums, and may make special baskets for keeping cowpeas or beans in trees. A man must build a granary for each of his wives and will also have one of his own. A woman is responsible for all food stored inside her house, including that belonging to her husband. Here are some examples encountered during the project design process:

- A woman purchased an oil drum and was using it for storing cowpeas inside the house. She was planning to sell this

crop in January and the drum, still inside the house, would be used for storing her husband's sorghum.

- A man has built three granaries, one for himself and one for each of his wives. When they want food from their granaries, the wives inform their husband who orders a child to climb up and fetch the required quantity.

- Three grass-woven baskets of beans are hanging from a mango tree. A young unmarried man has made the baskets and is responsible for caring for the beans inside: one basket is his, one is his elder brother's and the third belongs to his brother's wife.

Women are responsible for all postharvest processing and food marketing. A man with a cassava field may ask his wife to harvest a certain portion, process it, and sell it on his behalf.

Food only becomes communal or shared property at the moment of consumption. Often, however, meals are not a matter of food prepared by the wife for her husband and children, but food prepared in turn by a number of women belonging to a residential group. This group appears to be a three- or four-generation patrilineal extended family residing together in what can be called "hamlets" or village "quarters." Because the women in the group take turns to cook, on any one day in a village only a few may be observed at this work, while the others are occupied with different tasks. The food a woman uses for preparing the group's meal may be from her store, given to her by her husband or in-laws, or received from someone else in the wider community.

It is proposed that the postulated hamlet/extended family group is probably the most effective way of reaching both men and women. For introducing improved storage techniques, the project team will need to find out how and why decisions are made concerning what is kept inside the house and what is stored outside. Target audiences of either men or women will be designated accordingly. Evidence from field interviews suggests that men within the same group frequently help each other in the contribution and repair of granaries, just as they do in building houses. A really prosperous farmer will rarely do his own work but will request a more junior male in the group to undertake the task. Such arrangements are based on mutual help, not on cash payment. It remains to be tested what would happen if some men learned more complex techniques from the project and then offered to sell their services to other men in the village. Would farmers be prepared to pay for a service that until then had formed part of a complex chain of mutual obligations?

While the extended family group is probably the best basis for demonstrations of improved granaries, the whole village can also benefit where there is a tradition of keeping the granaries inside the village. There is nothing to prevent any villager stopping to look at the outside of someone's granary.

What goes on inside the house would normally only be known to the woman herself and her intimate friends. In other words, it could be possible to demonstrate an improved granary to all the men in the village whereas improvements in in-house storage could only be restricted to that group of women sharing cooking duties described earlier. Most food processing, however, such as pounding sorghum, take place in public view of the whole village.

The project staff will look closely at how groups of cooperating women organize themselves and consider whether such groups are the most suitable units for the introduction of expensive capital items to be shared communally among an already functioning group. Items such as drying floors and mechanical mills have a greater chance of a long life if those using them are not a specially created group for that purpose but rather have a long tradition of mutual help and cooperation. In this respect it is also worth noting that most women belong to informal savings groups. That women as a group can raise fairly large sums of money has been shown by the 11 women in a village near Paoua who came to ACADOP with 3,500 FCFA asking that a concrete drying floor be built for them.

These women's groups are also probably the most appropriate unit for introducing improved techniques of food conservation and associated nutrition education. The women already form a mutual help cooking unit and their children rotate from one cooking pot to another on a nightly basis. Demonstrations of better management of food stocks for improved nutrition should be aimed at all husbands and wives in the group, assembled together.

In determing the roles of different kinds of individuals in the village's postharvest system, the significance of children should not be forgotten. Girls help their mothers in all the work of postharvest processing and boys are the ones usually sent up into the granaries. In those villages where many children attend primary school, the project could consider close cooperation with the teachers in transmitting simple and lively messages to the children. In time the children will also act as agents of diffusion, particularly girls who will marry into other villages where the project may not have been working.

Social Stratification

The distinction has been made between ordinary and wealthier farmers. Before looking at the significance of these more prosperous men, attention should be drawn to a category of villagers whom the project may not reach: the marginal persons. In any village it is postulated that there is a certain number of people who barely manage to stay alive, cultivating small patches of land, earning some food and money as day laborers, and also depending on village charity. Such persons are likely to be widows without grown sons, neglected co-wives, and childless elderly couples. It may become evident that the struggle for existence is so harsh for these people that they have neither the time nor the capability to benefit much from the project's activities, particularly if the amount of food they grow is minimal and immediately consumed or sold, rather than stored.

Above this poorest stratum may be identified the great majority of men and women living in the village and then, at the top, perhaps 10 percent of richer persons. In the Paoua and Bocaranga sub-prefectures these men (often retired soldiers) are frequently those who have had sufficient cash or enterprise to benefit from ACADOP's animal traction program. It appears as if these men (and it can be hypothesized that one such person is in each of the hamlet-groups) have certain obligations towards the others in the group to ensure that all receive enough food to eat. Such a man will normally be polygamous, cultivate more land than the others, and need more storage space. At the same time, he and his wives must distribute food for the communal meals more often than the poorer or more junior people in the groups would be obliged to do. Considerable granary space may also be required in order to keep grain for brewing and feasting, in association with the organization of work parties for clearing and preparing the land. In the hungry, preharvest season, these parties may also function as a means of redistributing food among the poorer members of the community. Certainly, as was clear from the FAO pilot project, it is the ox-plow farmers who were the most interested in improving their storage capacity and it is arguable that this is not just because the have produced more food (which they could have sold), but because they have more people to feed.

It is estimated that by the third year of the project there will probably be about a total of 2,000 ox-plow farmers in the sub-prefectures of Bocaranga and Paoua. Because they make up the most innovative and dynamic section of the farming community, it is proposed that the project attempt to reach all of them, not just those living in the 15 target villages in Ouham-Pendé. This task should not be too difficult as

ACADOP agents concentrate much of their time on working with these farmers.

Leadership

Villages probably vary in the extent to which they are socially integrated and the extent to which village leaders can be identified as key persons with whom the project can work.

None of the ethnic groups living in the target area have a tradition of centralized political authority. The explorers and representatives of the early colonial authorities identified various leaders as 'chiefs' but these men did not hold hereditary positions and it would be easier, even today, to understand the present situation if leaders are thought of as 'big men' rather than as chiefs. Describing the pre-colonial situation, Burnham writes "successful men did not 'fill' pre-existent offices so much as to 'create' leadership roles." (36)

The following description of leadership in today's villages in the target area should be read as what the writer hopes is a workable hypothesis, based on observations and hints gleaned from documentary sources. It must not be read as a statement of fact but rather one to be tested and modified as a result of the proposed baseline study.

In every village, each hamlet is led by a senior 'big man.' As the hamlet grows bigger so it is likely that the 'big man's' leadership role will be challenged by another and eventually the hamlet will split with one big man moving away, taking with him his core of followers. That a hamlet can be in the process of splitting is recognizable to the whole village. In Bolio village the writer was told that there were currently nine quarters but soon there would be 10.

A successful big man may come to assume informal authority over a number of hamlets and may even become the recognized village leader, playing a vital role in village decision making, such as the selection of the new block of land to be planted for cotton, and the settlement of inter-hamlet disputes. Development agents in the region are frequently puzzled that, in some villages, things move easily and in others nothing works, but it is probably due to the presence or absence of a charismatic big man in the village, whose position is more or less unchallenged by other hamlet leaders. It will obviously be harder to achieve communal decision making at the village level if there are a number of big men competing for power and status.

Big men must maintain and win support, first inside their own hamlet by ensuring that all are well fed and clothed and have access to medical treatment. Afterwards, if they are ambitious, they must offer generous beer and work feasts to the whole village. The development of a large permanent labor force through polygamy is obviously essential in order to produce sufficient food crops both for sale and storage for feasts and parties.

A big man may be chosen by the village as its official, government-recognized village headman but, more often, the hamlet leaders choose from among themselves someone elderly and respected who will satisfy the government but not try to impose himself. In any village, it will still be necessary not only to work with the official headman but to identify where other power and authority may lie. It is very likely that in numerous villages there is no one with sufficient wealth and personality to impose himself and in this case the village will be nothing more than a disparate collection of separate hamlets (cf. also Burnham: 102).

Is it possible to identify leaders among the women members of a hamlet or village? One possibility always to be considered is the presence in the village of a traditional midwife. One may speculate that in any hamlet one is likely to find a woman who has a more dominant or energetic personality than the others. She may not necessarily be the wife of the hamlet big man.

Finally, in this very individualistic and 'democratic' system, the number of permanently loyal followers is obviously important. Men without children or with few brothers would seem to be unlikely candidates for leadership roles.

Recommended Approach of the PHFS Project

The project will be working in two ways: (1) through the training and follow up of CAR field agents working for such agencies as SOCADA, ACADOP, DC, and Animation Rurale, and (2) through direct communication between project extension staff and farmers in selected target villages.

Training and follow up of field agents by the PHFS projects involves adding an extra component to the agent's existing workload. Agents are not likely to perceive their work in the postharvest sector as being the major part of their responsibilities, and training and follow up programs must be designed to take into account the agents' part-time involvement. The project will need to adapt its own VITA approach so as not to conflict too strongly with the training and extension strategies of the agents' employers. This will be achieved by

working closely with those responsible for staff training in each of the concerned agencies. Long-term planning will be needed in order to ensure that agents are reached on specific postharvest topics at the appropriate time in the agricultural calendar. SOCADA is already attempting this timely message system with its zone chiefs and the PHFS project could probably fit neatly into the program. While the project can provide information, demonstrations, and educational material to the agents, it will not have the mandate to influence the agents' methods of disseminating information, except with the full support and understanding of the parent agencies. Training without follow up visits usually proves to be worthless: it is proposed that the total quantity of agents receiving regular timely training be limited but that each of them be ensured a follow up visit at two to eight weeks after every workshop. The purpose of such a visit would be to ensure that the techniques and improvements being introduced are fully understood and correctly demonstrated. The agents' supervisors should be invited to attend at least some of the workshop training and to accompany project staff on the follow up field visits.

Although exact figures are not currently available, information developed during the initial visit of the AID specialist in 1983 gives the approximate number of agents from other organizations in the project area.

Target Zone One:	20	SOCADA Agents + 4 zone chiefs
	5	ACADOP Agents
	3	Animation Rurale
Target Zone Two:	8	SOCADA Agents + 1 or 2 zone chiefs
	8	ACADOP Agents
	2	Community Development
Target Zone Three:	8	SOCADA Agents + 1 or 2 zone chiefs
	8	ACADOP Agents
	2	Community Development
Target Zone Four:	8	SOCADA Agents
Target Zone Five:	10	SOCADA Agents + 5 zone chiefs
	1	Community Development
	2	Animation Rurale
TOTAL	86	

By the end of VITA's involvement, it is hoped that a functioning extension program in the project area can be the basis for a national PHFS program to be started elsewhere in the CAR.

Direct extension activities will be carried out by seven persons in the project: four extension specialists (two VITA and two GOCAR) plus three PCVs. The VITA approach to innovation can be fully implemented and it is hoped that the expected success of this approach will serve as a model.

The underlying principle of the project's approach to working with the farmers will be to assist them in identifying for themselves useful improvements and new techniques. It will, through the baseline study, explore the best ways of communicating with the farmers and be, above all, receptive to ideas coming from farmers themselves. The project is aiming at spontaneous diffusion of innovation (really good ideas do not need extension agents) and this kind of spread of a new or improved technique has the greatest chance of success if the farmers feel that they have contributed to the change.

Stages in the development of communication and the two-way transfer of ideas between the target farmers and the project are itemized below:

- The first step is an explanation of what the project hopes to do and an identification of the priorities of the farmers with regard to postharvest issues. Findings from the baseline study will be reported back to those who participated in the research.

- The introduction of improvements and modifications to the postharvest system should start by reflecting farmers' priorities, although these may not be the parts needing the greatest improvement. Subsequently, the project can begin introducing other modifications linked to the findings of the loss assessment study. It is proposed that the farmers participate fully in the design and testing of the modifications. The choice of volunteers for testing/demonstrating improvements should as far as possible be made by the farmers themselves, although any specific technology should be appropriate for the volunteer (for example, the more costly innovations being tested by the richer farmers and those dependent on materials available in the bush, tested by poorer persons). The World Bank concept of the key or contact farmer is not recommended, as this may lead to the project only working with the more prosperous and clearly innovative people who probably represent 10 percent or less of the population.

- Farmers will fully participate in the evaluation of any new technology: village or hamlet group workshops will be organized.

The holding of village meetings is a routine procedure for SOCADA, ACADOP, and CD extension agents--and one the project can initially follow as a way of introducing team members to target farmers. Care should be taken, however, that the whole village is actually present and that some hamlets have not been left out. All the women in the village may have to be invited to a separate meeting where the introductions would be made in the local language rather than Sango.

Appropriate audio-visual and educational methods will be developed and tested. Nearly all of the target population is not only illiterate but is unfamiliar with visual images. How to design posters and flipcharts for such an audience may require the services of a specialist consultant. The Community Development Department has produced much interesting material. One of the great pioneers in this field is Andreas Fuglesang, some of whose works are available in the USAID library in Yaounde.

V. INNOVATION ISSUES IN THE POSTHARVEST SYSTEM

One of the functions of the baseline study will be to identify those issues of crucial importance for implementing an effective project that meet both the needs of the target population and GOCAR development goals. Some issues are already apparent and are discussed below.

Reducing Time and Energy in Postharvest Food Processing

Women work longer hours than men. A study made 20 years ago and summarized in the IFAD/FAO report gave the following information: (IFAD: Annexe 3)

Average Time in Any Day Devoted to Different Work Activities

Type of Activity	Number of Hours	
	Men	Women
Agricultural work	2.7	4.1
Other work (including building houses, hunting, etc.)	2.5	0.5
Domestic work	0.3	3.6
TOTAL	5.5	8.2

The half hour spent by women in other activities seems rather low. Gathering of wild food in particular appears to be a fairly time-consuming activity in some seasons. During a stay in a village in Paoua sub-prefecture it was observed that women were rarely not working during daylight hours; even when sitting down they were engaged in some manual activity such as shelling groundnuts.

The two major areas of activity in postharvest processing that consume the greatest amounts of time and energy--and which women themselves feel to be a heavy burden--are the pounding of dry grains (sorghum, maize, peanuts, paddy, beans) and the processing of cassava.

There is no accurate information concerning daily hours spent pounding of dry grains with a pestle and mortar.

Some observers estimate that a woman spends 15 percent of daylight hours in this activity; Schoerry-Munzinger and Adrien-Rongier suggest that in areas where sorghum is the staple food a woman can spend two to three hours daily pounding the grain (56).

Will women be prepared to pay for mechanically milling of grain to be consumed at home if mills are introduced into the villages?

It was observed, for example, that when making peanut oil for sale, women pay to use a hand-mill but that when making it for home use they revert to the customary process. Even so, most available evidence from all over Africa indicates that manual pounding or grinding of cereals is considered so exhausting that the introduction of mechanical mills is always a success. It is possible that the presence of the mill will act as an incentive to women to find the cash resources to use it. In an area in neighboring Cameroon, for example, women organized a salt trade as a means of earning money to use the mill. The introduction of a mechanical mill may actually not only reduce women's time and labor but may serve as an incentive to economic development.

It is probable that mechanical mills will have a longer lifetime, and be run more efficiently, in the hands of private entrepreneurs rather than by parastatal enterprises. Previous experience of SOCADA with the provision of mills to proto-cooperative groups indicates that such an approach is likely to end in failure. In any case, the project would ensure that interested traders with capital resources had the opportunity to learn about the new technology.

Cassava processing consumes much less energy than pounding grain. Indeed, some women have indicated that they have switched from grain to cassava as the staple food because of this factor. On the other hand, in some localities, cassava processing is very time consuming because of the lack of nearby streams and drying rocks. Women may have to walk miles from field to water--then again from water to drying rock and back the long distance to the village. The whole process, from harvesting to cassava chips ("cossettes") in Ouham or crumbs in Ouham-Pendé, may take up to five or six days. In villages where drying rocks are not easily available one of the strongest felt needs is for a concrete drying floor.

Village-level Group Storage

Village stores were constructed in Ouham by BDPA 20 years ago. In addition to functioning as retail outlets they provided facilities for farmers to store their food free from

insect and rodent attack. Villagers refused to use these central storage facilities and the stores were subsequently used for the cotton harvest. Each village store was managed by a development committee or proto-cooperative known as a GIR (Groupement d'Interet Rural).

By 1980-81 the concept of GIRs was revived, both for cotton and food crop marketing. In Ouham, a cooperative union was established (UCGIR) with the function of buying food from the village stores and sending it down for sale in Bangui. In Ouham-Pendé, ACADOP assumed similar managerial functions, creating 'groupements villageois' for village-level storage. Because the food could only be bought from the farmers at the official price, villagers were reluctant to use these cooperative storage and marketing facilities (MINAGRI 1982:16). High overhead costs meant that despite funding support from the European Development Funds, each kilogram of food was sold in Bangui at an average of 50 FCFA loss. This effort to develop a centralized system for buying and selling food crops was abandoned in 1981 and now both SOCADA and ACADOP are concentrating on helping each village-level committee store and market its food independently.

In Project Target Zone Five (North Bossangoa) there are now a number of flourishing GIRs, each with a management committee elected from among village leaders and receiving technical advice and help from the village agent. The central storing and marketing of cotton is the principal function of the GIR but several have also started cooperative marketing of sorghum and maize. SOCADA's only role is to act as a channel of information between the farmers and the big buyers in Bangui. Seven GIRs have stores built 20 years ago where farmers bring their food for weighing, bagging, and communal storage. In the other villages, the GIR committee weighs and bags the crop, which the farmers then stores at home until the buyer's truck arrives.

The advantage for the buyer is that he is informed in advance of a truck-load of food ready and waiting for him. In return, he is expected to pay slightly more than the usual market rate--for example, 53 francs per kg of sorghum, rather than 50 francs. The additional 3 francs is kept by the GIR committee and used for community projects such as pharmacies, wells, and schools. SOCADA tries to ensure that the GIR is not cheated by obliging the buyer to weigh his empty truck at Bossangoa before proceeding to the village and then to weigh it again, loaded up with the food.

The biggest problem appears to be the identification of interested buyers in Bangui who are prepared to pay cash down--essential if the villagers are to keep their confidence in a cooperative storage and marketing process. But another

problem, where the PHFS project could intervene, is ensuring that the food is stored under proper conditions. One issue has been inadequate drying of the grain prior to storage, with subsequent weight loss in the following months. As each farmer's crop is weighed and recorded at the moment of storage he expects to receive cash for that weight at the moment of sale. At one village GIR the original total weight of 25 tons of maize had dropped to 24 tons after two months in store. This 4 percent loss wiped out the profit to be used for village community projects. Inadequate drying was also observed to lead to mold and increased insect attack and has occasionally resulted in the buyer refusing to purchase.

In Ouham-Pendé ACADOP is also encouraging farmers to store and market their food crops cooperatively through the groupement villageois system. While farmers see the technical advantages of safe storage, there is some reluctance to let their crop out of their control and suspicion about the price they will be offered. The stores are also not being fully used because of the many farmers who sell that part of their crop destined for the market immediately after the harvest because of urgent cash needs. One possibility would be to buy the crop from the farmer at the current market price after the harvest and then distribute further profits after the crop has been sold. However, such a system would imply managerial skills and qualifications not available in most villages. For the time being ACADOP's and SOCADA's strategies appear to be the most appropriate. Their insistence on village self-management is essential if the farmers are to learn to organize their own lives and development projects.

Regarding the GIRs and GVs, it would appear that the project's main role will be to provide technical advice and training for proper storage. In each village where such a group food store is operational, extension staff must remain aware of the people's feelings about the store. Over-identification that a group storage committee which does not have the full trust or confidence of the farmers could result in the project failing to reach its target population at the level of the individual farmer.

Better Management of Family Food Stocks

There are indications that men often sell so great a part of their crop that the women are obliged to feed the family with only the food they grow in their usually smaller fields. One reason for this is that items such as salt, soap, and clothes that the family needs, have increased in price more rapidly than has the seller's price for the food grown. On the other hand, there does appear to be a tendency among men to believe that their crops are mainly a source of cash while women

perceive the cultivation of food as part of their responsibility as mothers. If food prices were to rise and marketing constraints eliminated, men might concentrate on growing more food and demand additional labor from their wives who would then be forced to neglect their own fields. Thus the nutritional situation of the family could deteriorate even though its cash income increased. If better storage techniques act as one incentive to grow more food, then the project must ensure that family food consumption does not decline. By helping reduce the amount of time and energy women spend on food processing, it is possible that additional labor can go into the cultivation of women's fields. However, the project must also include as one component of its program a way of teaching better utilization of the crops grown and preserved. Communication is necessary with both men and women, and perhaps most important is that husbands acquire a greater sense of responsibility for feeding their children.

A Role for Credit?

There are no banks or rural credit institutions in the project target area and farmers are largely dependent on their own informal savings organizations. Wealthier farmers have access to considerable sums of money through membership of small savings pools: once a year each member takes it in turn to take the pool and sums quoted are as high as 60,000 FCFA.

Because the project's strategy is spontaneous diffusion of improved technologies, assistance with credit, let alone subsidies, is not appropriate. The experience of the FAO pilot project shows that the introduced technologies were not replicated once the financial support was no longer available. However, ox-plow farmers are familiar with credit arrangements and, because of their larger storage requirements, may be prepared to make a capital investment. If ACADOP (and eventually SOCADA) should wish to assist these farmers with credit for postharvest improvements, the project will provide appropriate technical advice and assistance. The project will not, however, be involved financially in any such credit arrangements.

Training of Craftspeople

There appear to be two main income-earning craft activities in the villages: pottery (women) and black smithing (men). But pottery is becoming a disappearing craft as older women no longer teach their skills to their daughters. Other skills, such as building houses, are common to all men and they are not regarded as an income-generating activity.

It is proposed that in each target village the baseline study identify both paid craftspeople and those known to be particularly skillful at non-income earning tasks. Such persons would be given the opportunity to attend special workshops connected with improved postharvest technology and they would be taught how to sell their skills to interested wealthier farmers.

The project should also contact the artisanal training programs in the area, such as the skills centers in Bocaranga, and discuss whether improved postharvest technology could form part of the curriculum.

Current Postharvest Practices and Proposed Interventions

The CAR is an example of the universal rule that the humid tropics are prime targets for high postharvest losses. Insects, rodents, and molds thrive in the warmth and moisture. High moisture makes mechnical drying technically desirable but difficult to attain by conventional means. The lack of material resources results in the potential for high losses. The low density rural population makes it difficult to afford or support mechanical threshing, drying, and milling. All of these problems exist in the target area.

Postharvest losses will vary from farmer to farmer, village to village, and area to area. Information is needed on specific problem situations, not on national averages. Nonetheless, some generalizations may be useful. It is expected that postharvest losses will seldom exceed 20 percent. Five to 15 percent losses will probably be common, and some situations will have dramatically low losses of less than seven percent. The World Bank Report No. 4187-CA reports that storage losses of cereals may reach 15 percent.

While problems will differ from village to village and area to area, there are many technical and culturally-related problems, including poverty and the absence of an orderly and dependable marketing system. The exhausting tasks endured by the women in cultivation, grinding, and household duties leave little time and energy for attending to granary or household stored grain. It is believed that this is a major factor in the present scene.

The woven basket, thatched roof, and outdoor granaries are built by the men but the grain is withdrawn by women, who thus have an opportunity to observe its condition. While the woven stores are probably necessary to storing and providing some aeration for high moisture grain, they are easily accessible to rodents and insects. Grain drying needs to be studied and improved. This requirement is best approached from the beginning with improved on-stalk and field drying.

This would include protection against birds and rodents and possibly the use of drying platforms that could also be used for cassava.

The critical and as yet unquantified factor is grain moisture and its intimate dependence on more than simply rainfall. Air humidity is equally if not more important. There are no data on diurnal, daily, and monthly fluctuations in the relative humidity of the air.

Grain absorbs or releases water depending on the relative humidity of the surrounding air. The rapidity of this exchange depends on the moisture exchange differential and air movement; the higher the temperature the faster the exchange. Grain absorbs water faster than it is released. Finally, and what is critical here, is the fact that insect pests of stored grain do more damage in moist grain than in dry grain. Most of the common insect pests that destroy grain in the CAR do the most damage in grain of over 12 percent moisture and do less damage below this point.

While it is improbable that grain can be economically brought to less than 12 percent moisture, and indeed there will be problems reaching that level, most grain insects do not multiply below 10 percent moisture and populations actually begin to die off.

All of this is part of an interrelated whole of which the occurrence of granaries with apparently minimal losses (less than five percent) needs to be studied and the lessons learned brought into the loss-reduction plans.

A complete discussion of each of the many factors is not warranted here. They are presented below in outline form.

Physical-biological factors in postharvest losses are as follows:

1. Small fields in a high rainfall area with access to rodents;

2. Some small fields near villages so that the field rodents enter villages and village rodents have access to fields;

3. Village and field granaries as reservoirs of insects that contaminate successive crops;

4. High humidity that prolongs field drying and access to birds, rodents, and insects;

5. Woven-walled village granaries of mixed benefits/liabilities:

- Permit moisture exchange and shrinking/swelling
- Open to insects and rodents
- Roofs difficult to clean
- Inexpensive and entirely of local materials
- Long support poles give some but only minor protection against rodents;

6. The numerous hunting dogs that be good rat catchers;

7. Labor intensive farming with little time to devote to the stored grain;

8. Lack of an orderly, dependable, and economically beneficial marketing flow, including prices and transport;

9. Lack of high quality extension information in the target area.

The program of simultaneous loss assessment and intervention initiates a redressing of the problems and a demonstration of costs and benefits of improved handling, drying, and storage practices. Execution of the plan, including cooperation with farmers and extension agents, is designed to establish a setting for culturally and economically viable postharvest food loss reduction efforts.

From the above we come to the need for interventions based on drying, control of insects and rodents, and reduction of laborious and debilitating labor requirements so as to make peoplepower available for loss reductions. Subject, then, to cultural feasibility, the proposed interventions would be selected from among the following; those underlined will be instituted by constructing and/or applying the improvements on a small scale, demonstrating their benefits, upgrading skills through extension techniques, and integrating into village cultures.

- Improved corn and sorghum drying practices. Interrelations and trade-offs between length of holding on the plant and improved drying, and increasing risk to exposure to rodents, insects, and birds.

- Improved windrow and field stacking practices for combined rodent, bird, and insect protection and improved drying.

- <u>Use of multiple-purpose drying platforms/areas</u> for improved drying and pest protection.

- Improved groundnut cultivation (location and size of fields and cropping practices) for loss reduction.

- Other groundnut and grain drying practices such as cribs, and storage-drying over household fires.

- Improved understanding of moisture assessment by non-instrument techniques.

- Rodent exclusion:
  - Granary location and area rodent controls
  - Rat guards
  - Improved in-dwelling practices

- Insect control:
  - Storage over household fires, as above
  - Improving woven mat granaries
  - Improved granary cleaning to reduce insect carry over
    a. Cleaning
    b. Dusting
    c. Sun-heating of thatch
  - Use of wood-fire ashes
  - Insect detection and stragetic interventions

- Village sanitation for insect, rodent, and bird control

- Relief from energy-sapping village practices
  - Mechanical (including hand-powered) grinders
  - Multiple-use drying areas
  - Shallow mills for cassava soaking

Operations Guide to the Local Setting and Baseline Study

As an operations mode, the baseline study will move without a break into the continuing loss reduction operation, there being no distinction between the measurement-reduction baseline work and the loss-reduction emphasis during the remainder of the project.

During the baseline postharvest loss assessment, interventions will be begun as outlined and comparisons will be made of parallel situations with and without the interventions. The most successful interventions, or those most likely to be improved upon and helpfully incorporated into the local scene, will be continued and enlarged into the several project areas.

Introduction to Postharvest Concepts

The essential ingredient of postharvest food loss control is the existence of a predictable and orderly flow from harvest to consumer. Culturally and economically viable interventions need to fit into the existing patterns. Locating loss points (and potentially useful intervention points) in the flow must

begin by determining existing patterns and obtaining an understanding of the leaks in the flow and their approximate importance. A determination is then made of where losses can be measured and are amenable to loss-reduction interventions.

The techniques for measuring and reducing postharvest losses exist in relation to their human and socioeconomic setting. Assessment and reduction will be carried out in this setting. The design team points to the following critical points subject to review during the baseline study:

- Field losses to birds and rodents during crop maturation and drying of the standing grain.
- Field losses to birds and rodents during drying of the cut grain.
- Losses to insects and rodents during village granary storage.
- Losses to insects and rodents in house stores.
- Moisture measurements:
  - Grain
    At harvest
    End of drying before threshing
    At threshing/drying/cleaning
    At entering storage
    Periodically during storage
  - Air humidity
    In four parts of the target area, e.g., Paoua, Bossangoa and two field-agent positions
    Rainfall at Paoua and Bossangoa daily
- Comparisons of field and village granaries.

At the outset, measuring losses/benefits related to the following interventions seems appropriate and feasible:

- Drying on concrete platforms instead of in the field
- Granary rat guards
- Mechanical threshing, cleaning, and recleaning during storage
- Clay jar storage of very dry grain
- Raising the granaries and building cooking/night fires underneath

- Granary basket cleaning and new roof thatch
- Protection against birds during on-stalk drying
- Village sanitation against rodents

Proposed Approach

The PHFS project will be working (a) in direct contact with the farmers, and (b) through training and follow up of GOCAR field agents.

The second phase of the approach involves adding an extra component to the field agents' existing workload. The agents are not likely to see work in the postharvest sector as the major part of their tasks. Thus, training and follow up assistance have to take into account that agents have, from the project's point of view, only a part-time involvement. Secondly, the project team will need to adapt the VITA approach so it will not conflict strongly with the way the field workers are trained by their parent agencies. SOCADA works primarily with those growing cotton, regularly contacting all concerned farmers. ACADOP's main interest is in the more progressive and prosperous ox-plow farmers--although its agents also work, on a group basis, for storage, village pharmacies, etc. In the Nana Bakassa area (target zone 5), SOCADA also works with village committees--the GIRs. The project can provide information, demonstrations, and educational material to the agents but usually it will not have the mandate to influence the agents' methods of disseminating information. Follow up visits will be made, however, to ensure that the techniques and improvements being introduced are fully understood and correctly demonstrated.

As mentioned earlier, the project will work also directly with farmers in selected villages. In this case, the VITA approach to innovation can be fully used. It is hoped that the expected success of the participating approach will serve as a model. At the same time, project staff will have to remain sensitive to the extension methods and approach of other agencies working in the region.

The underlying principle of the project's own approach to working with the farmers will be to assist them in identifying for themselves useful improvements and new techniques. It will, through the baseline study, explore the best ways of communicating with the farmers and be receptive to ideas coming from farmers themselves. The project is aiming at spontaneous diffusion of innovation; this kind of spread of a new or improved technique has the greatest chance of success if the farmers feel that they have contributed to the change.

Various stages can be identified in the development of communication and the two-way transfer of ideas between the project and the target farmers:

- The first step is an explanation of what the project hopes to do and an identification of the priorities of the farmers with regard to postharvest issues. Findings from the baseline study will be reported back to those who participated in the research.

- The introduction of improvements and modifications to the postharvest system should start by reflecting farmers' priorities, although these may not be the areas needing the greatest improvement. Subsequently, the project can begin introducing other modifications linked to the findings of the loss assessment study. It is proposed that the farmers participate fully in the design and testing of the modifications. The choice of volunteers for testing/demonstrating improvements should as far as possible be made by the farmers themselves, although any specific technology should be appropriate for the volunteer (for example, the more costly innovations tested by the richer farmers and those dependent on materials available in the bush tested by poorer ones). The World Bank concept of the key or contact farmer is not recommended as this may lead to the project working only with the more prosperous and clearly innovative persons that probably represent 10 percent or less of the population.

- As discussed elsewhere, farmers will fully participate in the evaluation of any new technology: village or hamlet group workshop will be organized. In all the communication with the farmers, appropriate audio-visual and educational materials will be developed and tested. Considerable thought must be given to the fact that most of the target population are not only illiterate but are not even familiar with posters, pictures, or other images. Traditionally, communication is almost entirely through the spoken word and actual demonstration and it is advisable that priority be given to techniques involving these elements such as instructive drama.

A Determination of the Postharvest System

Losses in the CAR are currently reported at 10 to 20 percent. They do not occur as independent phenomena. What occurs before and after each individual aspect influences the nature and degree of the loss. For example, the length of holding maize and millet in the field as practiced in the CAR can decrease subsequent losses by improving drying, or increase losses because insects invade the grain and carry over into storage. Improving grain quality for roadside or Bangui mar-

keting by sifting and winnowing can remove insects and the debris that stimulates their growth. Storage after cleaning can result in lower losses than storage before or without cleaning.

Thus, loss assessment and loss reduction interventions will proceed on a step-by-step basis from understanding the grain flow, locating losses in the flow; and evaluating which losses are important, can be assessed, and are amenable to loss reduction interventions.

No two CAR sites or seasons, as they depend on rain and harvesting periods, are identical and the measurement of losses and improvements--thus the relationship between costs and benefits--will proceed concurrently. For example, losses due to inadequate drying will be accompanied by the use of improved drying at the same site. Holding in mud-walled granaries will parallel in all other details holding in existing granaries.

- Preliminary Examination of Specific Problem and Rapid On-site Appraisals--This is described in part above. In addition, rapid appraisals will be made as the baseline study gets underway. The purpose of this is both to determine where more careful assessments are to be made and to provide rapid assessment techniques to be used by project and GOCAR Peace Corps personnel throughout the project. Rapid on-site appraisal techniques are described. During the background study they will be perfected for CAR as a whole and for individual regions.

- Sampling--Every scientific measurement is based upon assumptions regarding the situation about which the measurement is to supply information. Conducting a survey to measure average grain losses would be such a measurement. It would entail an understanding of all of the cultural and economic conditions; levels of knowledge of farmers; farming storage, etc., practices; size of farms; roles of men and women; storage inside and outside of houses, etc.; and sampling so as to be representative of all of the CAR variables. Such a survey is beyond the scope or needs of the baseline study and the project. We will select individual systems or parts of the system and measure examples of what is happening.

- The Fact-Gathering Scene--Planners and field workers in grain recovery programs should be familiar with the social and cultural background of the places where they are working. But far too often this knowledge is insufficient at the start of an operation. In the CAR there are more than prefecture differences. The baseline study will include obtaining such information and incorporating it in the project. This is covered elsewhere in this manual.

- Loss Measurement Techniques--The actual techniques will be rapid field procedures, as internationally accepted and described. They are described in detail in Annex.

  They will cover losses due to birds, insects, rodents, mold and general deterioration, and handling. The latter includes such steps as harvesting, transport, milling, and drying.

  Note that losses due to these factors can occur in fields, household granaries, markets, etc. Measurements will be made at sites judged to be significant.

- Application and Interpretation of Results--In assessing losses it is necessary to plan and follow a system that will produce the information required and be related to existing patterns, proposed interventions, biological parameters, and loss/benefit values.

  Losses will be assessed as they are related to the use patterns and as to how they affect the amount of grain available over an entire growing-use season, not as end-of-season dramatic examples.

- Moisture--The single essential factor that universally runs through all aspects and causes of losses is grain moisture. FAO reports an average of 71 percent relative humidity in CAR north of 7° latitude. It affects harvesting losses, how long the grain must remain in the fields (and thus exposed to rodents and birds); how and how long it must be dried prior to storage or use; what kinds of insects and rodents can and do eat it and how rapidly; whether or not molds and respiration continue in storage and to what extent. All of this is related to atmospheric temperatures, air moisture, and rainfall. These will be measured chronologically throughout the project areas. The significance of moisture as a loss factor will be assessed.

  Grain moisture will be determined using portable moisture meters. Atmospheric moisture will be determined by wet-dry bulb readings with percent moisture calculated by standard tables. Dry bulb readings will give the air temperature. Rainfall will be determined using standard rain gauges.

- Operations Standardization and Control--Operations techniques and actual procedures will be centrally controlled by the project officer with all daily logs, readings, observations, etc., centrally maintained with periodic summaries to VITA/USA. These will be worked out in detail with the project officer. Several requirements are listed below:

- All technical workers will keep a log in ballpoint pen.
- All measurements and observations will be kept in this log or in data sheets supplied by the project officer.
- Moisture meters will be calibrated periodically.
- Samplings, measurements, etc., will be practical procedures tested in the target area and established prior to June 1985.

Loss Reduction

As noted earlier, reduction interventions will be accompanied by parallel existing systems so as to establish and demonstrate the amount of improvement realized by the intervention. Which intervention is used in which village or area will be subject to the cultural assessment as described elsewhere in this manual. Examples and explanations are given below:

o Rat Guards--Rodents (rats and mice) are important causes of losses in food grain. Protection is best accomplished by keeping rodents out of granaries.

  Elevated granaries will be equipped with metal and plastic rat guards (sleeves). These sleeves will be 25 cm long and, if possible, at least 1 meter from the ground. Consideration will be given to using rat entanglement paste in some situations.

o Improved Granary Sanitation--In the target area a large factor in insect-caused losses may be the carry over of insects from the preceding stocks. Insects can hide in the granary baskets, in the thatched roofs, on the ground, in nearby stores of grain in the houses or outside. While it appears that many farmers in the target area clean out the basket itself, the thatch is not cleaned and is changed only every two to five years. Cleaning on the spot would also leave insects ready to "re-seed" the next stored grain. Present techniques will be evaluated and sanitation procedures introduced. These will include new vs. old baskets; new vs. old thatch; storing among the houses vs. storing away from houses; present vs. improved cleaning; moving the storage sites each season.

o Improved Granary Containers--The present containers are excellent if further drying is required during harvest. However, grain at 12 percent moisture or less may often be stored safely, and be better protected, if kept in closed containers. In combination with moisture testing, maize, sorghum, and possibly other grains will be stored in mud,

clay, or perhaps concrete containers and compared with present techniques.

- Grain Drying--Drying is the prime ingredient for the control of insects in food grains. Insects can live at above 10 percent relative humidity. From 40 to 70 percent they will readily develop and some will flourish. Below 40 percent development is retarded and with accompanying control measures grain may be safely stored. The depth and need for "accompanying" measures depends upon the types of insects present, type of grain, and moisture level. It is anticipated that moisture is a serious problem in CAR food grains. Groundnuts in the target area have been reported as being seriously moldy. This is also a health hazard due to mold toxins.

  Drying methods will be introduced and measured. These will include field drying, storage over household cooking fires, and changes in basket design. Storage over cooking fires should be cost free. If culturally acceptable and helpful in reducing losses it could be of major importance.
- Other procedures are listed below without explanation but they are not necessarily of lesser importance:

  - Use of hermetically sealed clay jars;

  - Raising the height of the granaries, replacing on-floor, in-house containers with suspended sacks, jars, etc;

  - Field protection against birds and rodents while drying;

  - Introduction of mechanical cleaners (blowers, sifters) and/or cleaning during storage;

  - Introducing mechanical grinders and using the time saved for grain sanitation, etc;

  - Assessing concrete drying platform for their feasibility and building them if culturally/economically acceptable.

- Energy Transformation--Women look after food stored in the house and are entirely responsible for all the other postharvest practices including transport, threshing, winnowing, grinding, and its accompanying sifting/winnowing. All of these--especially grinding--are extremely laborious jobs. Women need relief from these tasks. VITA proposes to improve labor efficiency of selected postharvest processes, thereby freeing laborers, especially women, to per-

form other more productive, less tedious, or less strenuous functions. Especially targeted are a few of the estimated 27,000 women farmers who may be willing to make small capital investments in labor reducing transformation technologies.

- The introduction of grain grinders is a key element in relieving the burden imposed on women by present procedures. Indigenous mortar and pestle hulling and grinding is unduly energy and time consuming. Alternative procedures will be introduced. These can include small family-sized hand grinders, larger village- or area-sized foot-powered grinders, and larger gasoline-driven and portable grinders owned and managed by local progressive farmers.

  Successfuly operated grinders can be major interventions to improve the lot of the women and rural conditions in general. They can improve nutrition by increasing the use of millet and/or sorghum over cassava, and can be an attraction in other extension training including insect and rodent control and grain drying.

  Recommendations on the use of grinders (location, size, mechanical requirements) will be a part of the early baseline study work. These will be reviewed by VITA and specific interventions will be made.

- Water for cassava processing is often of poor quality and located at some distance from its point of use. The soaking, pounding, and drying are also energy consuming. While it is not nutritionally desirable to stimulate the use of cassava over millet and/or sorghum, attention will be given to individual villages where water quality, quantity, and proximity are serious problems.

  As time permits, the baseline study will investigate the feasibility of introducing new wells (possibly tube wells to the Lake Chad Aquifer) into selected villages, especially where such wells would benefit other program objectives.

VI. GUIDELINES FOR THE BASELINE SOCIOECONOMIC STUDY

Study of the Village Postharvest System

A study will be made in one village in each of the five selected zones for a duration of at least two weeks. The information collected in the village will be supplemented by consulting any available documentation concerning that specific target zone.

Personnel

The same study team will work successively in all five villages in order to be able to note and try to understand observable differences between one village and another. The team will be composed of the principal project specialists who will thus gain right at the start of the project a firm grasp of the lives and problems of the project's target population. The team will be composed of the VITA grain storage and food processing specialists working in collaboration with the relevant national experts from the Ministry of Rural Development. The team will recruit within the zone two local language interpreters, preferably one man and one woman. The study team will live in the village for the duration of the research, thus gaining the villagers' confidence more rapidly and observing evening as well as daytime activities.

Duration

A total period of about four months will be assigned to this part of the study with a one-week write up period at Paoua between each field trip and a final two-week period for the preparation of a comprehensive report. The team will be assisted in the preparation of the report by two senior consultants, a postharvest technology specialist and a social scientist, who will work with the team in using the findings for finalizing the design of the loss assessment study that will commence immediately afterwards.

Methodology

It is recommended that the methodological approach to be used in the village study be based on the principle of participant observation with loosely scheduled interviewing, home and field visits, and general adaptability to permit follow through and further investigation of what may emerge as crucial aspects of the postharvest system. Care will be taken

to find out how and why there are differences between one zone and another. For example, it is already known that in some places people cook beneath the granaries and in other villages they do not, that granaries vary in height from the ground and in construction techniques, and that in some places most of the granaries are in the fields and in other areas are in the villages. It is not recommended that statistical survey techniques be used for this study as there is insufficient information to design an adequate sampling frame; more valuable information will be gained through a qualitative case study approach rather than through the use of a household survey questionnaire or a similar tool.

Investigators should start off with a series of topics they wish to cover (as itemized below) and conduct interviews and observations accordingly. In this kind of loosely structured research the keeping of a daily field journal is the most important tool. Typed up every evening from the investigator's notebooks, it summarizes the main findings of the day and highlights issues and inter-relations to be explored further the following day. In addition, notes may be written up on specific topics such as observations of material technology.

Topics

Some of the important topics that the team will explore are listed below. It is evident that fully comprehensive answers to many of these questions cannot be obtained in such a short period of time but clearly the project team will continue to deepen its knowledge during the remaining part of the project's first phase and that further contribution will be made by those carrying out the loss assessment study.

- What kinds of food crops are grown and in what quantity and circumstances?

- Where are the fields located and are there any time/labor problems involved in harvesting and transportation?

- What is the unit of food production? Does the nuclear family serve as a useful model or should one perceive food as produced by individual men and women? Who actually does what, where, how, and when with regard to food production?

- What are the various stages in the postharvest process and which kinds of persons are involved at each stage? How much time is devoted to each activity? (A team member should observe, for example, each process such as sorghum grinding.)

- Who controls what quantities and kinds of food for what purposes during the various stages of the postharvest process?

- How and why does food move between individuals and/or groups prior to reaching either the cooking pot or the marketplace?

- Are there differences in handling food for consumption, food for sale and seed?

- Does there appear to be an adequate amount of food available to the community and is there any marked variation between one family and another? Do some producers sell too much of their crop in order to satisfy cash needs?

- What proportion of different crops is sold on the market? Are people buying or selling food at certain periods?

- Who sells which kind of food (e.g., men selling sorghum and women cassava)? What is the money used for?

- Do food traders visit the village and what and when do they buy?

- What is the material technology used in the village and to what extent are specific items multi-purpose in use, particularly in the postharvest system? What is the cost of specific items such as a pestle and mortar or a corrugated iron sheet for drying?

- Are there specialized artisans in the village?

- What relationship exists between food production and other economic activities in the village?

- What observed economic differences exist between villagers who are likely to be innovators and those who are not?

- What kind of socio-political organization is present in the village? Does the village break up into smaller, tighter units? Who are the leaders, men and women?

- What are the villagers' perceptions of their problems? How do they rank postharvest issues among their problems? What are the most crucial issues for them with regard to the postharvest system, e.g., rats in the granaries, drying of grain, cassava processing, etc.?

Methods of Cost and Benefit Analysis

Nature of Analysis

Though the major effort of the specialists is to be directed to the main task of assessment of the postharvest food loss, there is the need t pay attention to an important aspect of the problem, the cost and benefit measurement. Ultimately it will be the magnitude of the benefits as compared to the cost involved that will determine the level of success or failure of the project.

Cost and benefit assessment is a very complicated and time consuming concept, involving the works of economists, financial analysts, and accountants. There are at least three types of measurement involved in the PHFS:

- Cost and benefits to the farmers;
- Cost and benefits to the government (and society), and
- Cost and benefits to the donors, e.g., USAID.

Given the fact that the government has already considered the reduction of food loses as national priority and that cost to the government in this project is marginal, the need to measure cost to government and society is not pressing. It can be safely assumed that with the successful use of storage and processing techniques, substantial saving of foods can be made even if the percentage losses are relatively low.

From the viewpoint of the donor (USAID), overall benefit to the recipient country is the most important economic criteria for aid consideration, overriding the profit maximization criteria. Furthermore, donors tend to look at the long-term and secondary impacts of a project, such as the impact on income redistribution, employment (including employment of women), health, education, and social stability. As such, measuring cost and benefit to the donor in this project does not appear to be an important task.

The specialists' effort then, could focus instead on estimating (a) the benefits to the farmers, and (b) the various costs involved.

Methodology

For the sake of simplicity, only a straightforward method of measuring cost and benefit is proposed. In case the specialists can devote more time to the task and could employ more sophisticated methods, it is suggested that concepts and methodology described in J. Price Gittinger, Economic Analysis of Agricultural Projects (EDI Series in Economic Development, John Hopkins University Press, 1982) be considered.

The Cost--The concept of marginal cost should be employed, that is the measure "how much does incremental cost incurred to the farmer" by employing each of the techniques experimented in saving food lost (rat guards, insect elimination, grain washing devices, etc.) between harvest and sale time.

In order to assert how much is the incremental cost, we must know the existing cost structure. Unfortunately, there are no reliable data on cost food production in the CAR at this stage. However, data in Table 9 offer some guidance. Evidently, the cost of land in the rural area is insignificant so that only labor and seeds are calculated in production cost.

Estimates in Table 9 are by SOCADA for the cotton zone, which encompasses the PHFS' target area. According to this information, for example, a groundnut farmer is using 50 kg of seed per hectare at the 1981 cost of CFAF 1,750; total labor used to cultivate a hectare was 117 days. Cassava production involves no cost of seeds. On this basis, return to the farmer was estimated at CFAF 284 per working day.

The expert may verify that the amount of seed cited here is accurate; if not, adjustment must be made to arrive at a more accurate picture of input used in all major crops: cassava, sorghum, sesame, maize, groundnuts, and rice. The amount of inputs used are then multiplied with the price existing in the local market at the time to find the total cost.

Having arrived at existing production cost, incremental cost in conserving the food can be quantified by measuring the cost of the amounts of materials and labor required to install, say, a storage granary or a rat guard device. The problem here is not to identify the materials needed but to find out how much of each is required. By observation and simple counting and measuring of sample granaries, this question can be answered.

The Benefits--The question of measuring benefit is directly related to the question of food loss and saving assessment which is the main task envisaged in the baseline study. Attention is therefore called to the Methodology section of the Food Loss Assessment in this project.

The increase in food availability assessed for each intervention technique benefits the farmers in three ways: (1) raising their family food consumption, (2) increasing their local sale, and (3) very possibly increasing sales across the border to Cameroon and/or Chad.

Increasing family food consumption. Table 10 provides some indicators of food consumption by products and by region. The

TABLE 9

FOOD CROPS: CURRENT RETURNS TO FARMERS (1981)

CROP	Yield (kg/ha)*	Price (FCFA/kg)	Gross return (FCFA/ha)	Labor use (days/ha)	Seeds (kg/ha)	Seeds (FCFA/ha)	Total cost (FCFA/ha)	Net return (FCFA/ha)	Return per labor day (FCFA/ha)
Groundnuts	1,000	35	35,000	117	50	1,750	1,750	33,250	284
Maize	1,000	40	40,000	100	30	1,200	1,200	38,800	388
Sorghum	1,000	35	35,000	110	10	350	350	34,650	315
Sesame	300	70	21,000	58	6	420	420	20,580	355
Manioc	1,000	30	30,000	80	-	-	-	30,000	375
Other	950	50	47,500	80	20	1,000	1,000	46,500	581
TOTAL	5,250	260	208,500	545	116	4,720	4,720	203,780	2,298

* Based on estimates by SOCADA and by C. de Caso, Note sur la Situation Actuelle et sur les Perspectives de Developpement de la SOCADA, October 1981.

Source: Adopted from R. Nathan Associates, Inc., Feasibility Study/Cotton Zone, 1982.

TABLE 10

FOOD CONSUMPTION : BY PRODUCTS AND BY REGION
(Tons / Year)

	Central Savannah	Savannah West	Forest Zone	Mining Zone	Outer Bangui	Bangui
			(TONS)			
	127,737.0	92,721.9	93,547.1	28,065.8	17,709.6	57,501.6
Vegetables	18,354.0	6,208.3	11,788.9	2,098.9	1,851.8	4,149.6
Tuber Foods and plantain	62,415.0	60,813.9	51,867.2	17,805.9	8,041.7	25,119.9
Grains	11,229.0	5,282.2	3,452.2	1,028.6	1,823.6	12,275.9
Oil Seeds	8,208.0	4,081.7	5,725.6	1,195.4	940.0	3,556.8
Fruits	5,700.0	1,200.5	6,230.8	1,542.9	1,903.5	741.0
Fish	4,332.0	1,509.2	2,820.7	222.4	930.6	1,160.9
Meat, Eggs	12,996.0	11,808.2	8,672.6	3,226.5	1,809.5	6,471.4
Beverage	3,192.0	205.8	1,768.2	347.5	141.0	2,420.6
Others	1,311.0	1,612.1	1,220.9	597.7	267.9	1,605.5
			PERCENTAGE			
	100	100	100	100	100	100
Vegetables	14	7	13	7	11	7
Tuber Foods and plantain	49	66	55	63	45	44
Grains	9	6	4	4	10	22
Oil Seeds	6	4	6	4	5	6
Fruits	5	1	7	6	11	1
Fish	3	1	3	1	5	2
Meat, Eggs	10	13	9	12	10	11
Beverage	3	-	2	1	1	4
Others	1	2	1	2	2	3

Source : Bui Quang Minh (Project CAF/72/011), Enquête budget et consommation des ménages,1977.

targeted area falls in the Savannah West and Central Savannah regions. Table11 shows the per capita food diet. On the average, a person in the targeted area consumes about 619 grams of food per day (226 kg per year), of which 335 grams is from tuber foods and plantain. How much of the food saved is consumed by the farmer is the question to be addressed. The answer is to be found by observations and simple "interviews" method such as visiting selected farmers (by random sampling) and obtaining information by conversation.

In doing so, it must be remembered that one of the farmers' taboos is not giving out information for superstitious reasons. The conversation then must be carried on in a skillful, casual manner.

Increasing sale on the local market. Part of the food saved will evidently be sold on the local market. To measure the increase accurately is not an easy task since there are no records of daily sale. By frequently visiting a number of the local markets during a marketing season prior to the implementation of the PHFS's techniques, the experts can estimate the volume of sale; the result will then be compared to estimate obtained during visits to te same markets in the marketing season immediately following the implementation of the PHFS's techniques. One of the key issues here is whether or not the farmers can dispose of the food saved; that is whether or not there is sufficient demand to absorb the surplus. In this regard it is to be noted that there are severe "economic barriers" that increase the cost of transportation from rural to urban areas and tend to deter a number of potential traders from reaching the village markets.

Increasing border trade. There is an active trade along the CAR's area bordering Chad and Cameroon where the PHFS's project is to be implemented. There are at least three factors that contribute to these activities: (a) proximity,which does not increase marketing cost the way it does in moving the produce to, say, Bangui; (b) convertibility of the CFA franc, which facilitates exchange; and (c) difference in producer prices for food crops especially for groundnuts and sesame; these prices are frequently higher in Cameroon and Chad than in the CAR.

Because of these factors, it is very probable that an important part of the food saved from loss will eventually find its way to the border. Leaving the legal aspect aside and to the extent that the trade brings in additional cash income, it does benefit the farmers.

To estimate the increase in food crop movement across the border, the experts cannot pose any questions to the traders but can only observe the flow and make a rough estimation.

TABLE 11

DAILY FOOD DIET BY REGION

	Central Savannah	Savannah West	Forest Zone	Mining Zone	Outer Bangui	Bangui
			(GRAMS)			
Total	608.4	629.8	609.0	553.9	996.2	542.8
Vegetables	88.3	48.5	76.6	40.9	62.6	46.2
Tuber foods and plantain	299.5	370.8	337.6	351.2	469.0	275.5
Grain Foods	53.6	47.6	22.5	20.5	106.3	52.5
Oil seeds	34.8	32.8	37.3	23.5	63.1	31.4
Fruits	28.7	9.7	40.6	30.4	111.2	7.7
Fish	20.7	7.2	18.5	4.5	54.2	12.9
Meat, Eggs	62.2	94.6	56.4	64.3	105.7	71.7
Beverage	14.3	5.5	11.4	6.9	8.1	26.9
Others	6.3	13.1	8.1	11.7	16.0	18.0
			PERCENTAGE			
Total	100	100	100	100	100	100
Vegetables	15	8	13	7	6	9
Tuber Foods and plantain	49	59	55	63	47	51
Grain Foods	9	8	4	4	11	10
Oil Seeds	6	5	6	4	6	6
Fruits	5	1	7	6	11	1
Fish	3	1	3	1	5	2
Meat, Eggs	10	15	9	12	11	13
Beverage	2	1	2	1	1	5
Others	1	2	1	2	2	3

Source : Bui Quang Minh (Projet CAF/72/011) Enquête budget et consommation des ménages, 1977

Farmers in the Market

The Project team will need to know more about how, when, and why farmers sell their food crops in the marketplace and also the ways in which they use the money they earn. Some of this information will become available from the village studies described earlier. The subject is of sufficient importance, in terms of assessing the extent to which producers are prepared to invest in innovation, that it is recommended that a parallel study be undertaken in some of the principle markets in the target area such as Paoua, Bocaranga, Nana Bakassa and Bossangoa. These investigations can be made at, for example, three or four month intervals in the year following the completion of the village study. Simple questionnaires can be designed along the lines suggested below and the data can be rapidly processed back at the Project's headquarters. The questionnaire should of course be tested and modified as required before starting the study. It is proposed that all team members participate at one time or another in the study but that as far as possible interviewing should take place (as in the village study) in the principle local language of the area where the market is located. This is particularly important as the majority of those selling food in the markets are women, many of whom do not easily speak Sango.

The following activities are proposed:

o A census of those bringing food for sale in the market. The interviewer and interpreter should station themselves on one of the principal roads leading into town in the evening and again early the following morning. (It should be noted that because of the long distances people have to travel they often journey the day before and sleep over night in the marketplace.)

  As many as possible of the people carrying food produce should be interviewed. Questions should cover the following topics:

  - Kind and approximate volume/quantity of the food (i.e. number and size of the basins usually used).

  - Origin of the food: in whose field was it grown? (a) the respondent, (b) a relative of respondent, or (c) a stranger? In cases (b) or (c) did the respondent buy the food? Has the respondent been concerned with the processing of the food, e.g, cassava chips, threshed and cleaned sorghum, etc.?

  - Sex, approximate age, and village of residence of respondent.

- Distance in kilometers or time it took from home to market? Means of travel? Cost to respondent if she comes by pick-up truck?

- Price respondent expects to receive and intentions concerning use of money.

- Date of previous time she came to sell food at the market.

An in-the-marketplace census is an alternative or additional approach and actual price data can also be collected and contrasted with the expectations of those coming into the market. Finally, a census may also be taken of those leaving the marketplace with an observation of the extent to which people are taking home consumer items and/or returning to the village with cash.

Food Price Fluctuations

An often used argument for improving a postharvest system is that farmers sell their crops at a low price after harvest because they cannot protect the food from storage losses. If storage were improved, then farmers would be in a position to keep their crops until prices rose later in the season. As discussed elsewhere, in many cases farmers sell immediately after harvest not because of inadequate storage facilities but because of urgent cash needs. The issue remains to be explored further and it is necessary to know the extent to which prices do fluctuate and what kind of profit farmers make when they release their food onto the market at a later date. It is proposed that a price survey be conducted in Paoua market for the principal food crops throughout the duration of the Project. Any long-term changes can thus be noted with the consideration that a reduction in seasonal fluctuations could be attributed (although not necessarily) to many farmers keeping food crops in store for a longer period. The survey should be conducted by a Central African Project member buying approximately the same volume of food each time and then weighing it in the project's laboratory.

Exploration of Other Relevant Factors

During the first phase (two-year period) of the Project, team members will investigate a number of key issues that will have to be decided upon when preparing the main implementation phase. In investigating these issues some data will be generated while undertaking the three other components of the baseline study, but other information will need to be collected by making specific inquiries and visits to other development projects, factories in Bangui (availability of

materials), a survey of merchants in a position to stock materials equipment, etc. The Project will be working very closely with ACADOP and will be able to profit from its lessons learned in terms of credit, supply of materials, messages to farmers, marketing of food crops, etc. The Project should also investigate the experience of the IFAD-financed Ombello-Mpoko Project and the Appropriate Technology Project of the Community Development Department, as well as the activities of the GIRs (Groupements d'Intéret Ruraux) of SOCADA. Undoubtedly some decisions concerning appropriate interventions will only be made following the experience of trial and error. Some of the issues to be explored are summarized below.

- Evaluating the region's absorptive capacity for sorghum grinding mills of varying sizes in terms of profitability, maintenance needs, number of villages to be served, and a viable means of shared, competitive, and individual mill ownership;

- Assessing the possible energy sources for sorghum mills in the project area;

- Assessing import needs of any project-recommended postharvest innovations for merchant willingness/ability to undertake complete responsibilities for assuring supply;

- Assessing the potential for nutritionally-improved uses of locally available foods, food budgeting, and the means of popularizing any viable improvements;

- Assessing the farm to market flow, with emphasis on the limitations of farm to market transport, road access and maintenance, and the role of these factors in local storage and sales decisions.

- Exploring the possible means of alleviating harvest time cash flow pressures in order that food produce sales might be delayed or reduced until market prices have increased and the increased quantities stored can alleviate the nutritional hardships of the hungry season.

REFERENCES

Burnham, P. Opportunity and Constraint in a Savanna Society: The Gbaya of Meiganga. London: Academic Press, 1982.

FAO/UNDP. Mission Conjointe de Programmation. Vol. 1. Rome: Food and Agriculture Organization, 1982.

Fuglesang, A. Applied Communication in Developing Countries. Uppsala: Dag Hammarskold Foundation, 1973.

IFAD/FAO. Rapport de la RCA Projet de Développement Agricole dans la Préfecture de l'Ombello Mpoko. Rome: Food and Agriculture Organization, 1983.

MINAGRI/GOCAR. Revue des Projets Secteur Agriculture Elévage. Bangui, Central African Republic: Ministry of Agriculture, 1982.

Schoerry Munzinger, M. and Adrien-Rongier, H. Femmes Rurales de l'Ouham-Pendé. Paoua, Central African Republic: ACADOP, 1980.