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Cassava Production and Marketing Chains: the Forgotten Shock Absorber for the Vulnerable¹

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¹ The views expressed in this report are those of the authors and not necessarily those of INSTAT, Cornell University and USAID.

FOREWORD

Poverty alleviation is one of the major objectives identified in the General Economic Policy Framework Document (Document Cadre de Politique Economique, DCPE) of the Government of Madagascar. This objective will be achieved through multiple and concerted actions by economic and social development partners (public authorities, private sector, non-governmental organizations) at various levels - macro-economic, sectoral, regional, and even at the household and individual level.

Cassava is the second source of calories in the food system of Malagasy people, rice being the first. It provides a significant dietary supplement to vulnerable households and regions. Yet, the functioning of the cassava marketing chain as a caloric buffer is quite unappreciated and poorly understood in Madagascar. This study attempts to address this gap.

Based on a series of field missions and quantitative data from the Permanent Household Survey (Enquête Permanente auprès des Ménages, EPM) and the Ministry of Agriculture, the authors of this paper conducted a study of the cassava marketing chain. They followed the production and commercial circuits of green and dry cassava, as well as the seasonal behavior of consumers. This analytical and descriptive work is undertaken jointly by the National Institute of Statistics (INSTAT) and the staff of Cornell University, under financing of USAID.

I would like to thank the US Agency for International Development (USAID) for the financial support it provided in completing this analytical work of utmost importance.

I hope that the analytical results will contribute to informing and helping decision-makers in their discussions and development actions in Madagascar.

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LIST OF ABBREVIATIONS

AFOMA	Afokasoka malagasy
CAP	Commercial Agricultural Promotion
CIRAGRI	Circonscription de l'Agriculture
CIREL	Circonscription de l'Elevage
COTONA	Cotonnière d'Antsirabe
EPM	Enquête Permanente auprès des Ménages
FIMT	Association des artisans malagasy
FITIM	Filature et Tissage de Madagascar
FOB	Free on Board
FOFIFA	Centre National de la Recherche Appliquée au Développement Rural
IFPRI	International Food Policy Research Institute
INSTAT	Institut National de la Statistique
MINAGRI	Ministère de l'Agriculture
PAPAT	Projet d'Appui au Développement des Plantes à Tubercules
PAPMAD	Papeterie de Madagascar
PDMO	Projet de Développement du Moyen Ouest
PNSAN	Programme National de Sécurité Alimentaire et de Nutrition
PROBO	Produits du Boina
PSO	Projet Sud Ouest
SECALINE	Projet de Sécurité Alimentaire et de Nutrition Elargie
SOTEMA	Société Textile de Majunga
UNICEF	Fonds des Nations Unies pour l'Enfance

RESUME EN FRANCAIS

Le manioc fournit 14% des calories consommées à Madagascar, une contribution devancée uniquement par le riz. Son importance s'avère plus considérable auprès des ménages pauvres, particulièrement dans le Sud où il compte pour plus de 25% de la consommation calorique. Pendant la soudure, le manioc fournit un appui alimentaire, se substituant au riz au moment où les stocks ménagers et la hausse des prix rendent le riz hors du pouvoir d'achat de beaucoup de ménages pauvres.

Le marché du manioc et son fonctionnement restent imparfaitement connus, souvent oubliés et mal appréciés en dépit de son importance dans la sécurité alimentaire des ménages, des régions et des saisons vulnérables. Le présent rapport vise à combler cette lacune dans nos connaissances. Il résume les résultats d'une série d'investigations rapides sur terrain qui, ensemble avec les données quantitatives détaillées de consommation et de production, fournissent une image de la taille, la structure et le fonctionnement du marché du manioc à Madagascar.

L'étude a trouvé que le manioc sec transite sur de longues distances à Madagascar et que le manioc, frais ou sec, contribue à augmenter nettement la consommation des ménages vulnérables pendant la soudure. Pendant les années de sécheresse, les flux commerciaux se réorientent considérablement afin de diriger les flux vers le Sud et autres zones de détresse nutritionnelle. Donc, le marché privé actuel fournit un coussin clef pour les ménages, les saisons et les régions vulnérables, particulièrement pendant les années de sécheresse.

Néanmoins, la contribution du manioc à la sécurité alimentaire des ménages vulnérables peut être élargie à travers une expansion continue des technologies améliorées de culture, des méthodes de séchage améliorées pour le manioc et des investissements dans les infrastructures de transport dans certaines zones productrices. Vu le profil actuel de la consommation du manioc, de futures interventions en faveur du manioc cibleront sûrement les régions, les saisons et les ménages les plus vulnérables de Madagascar.

SUMMARY IN ENGLISH

Cassava provides 14% of all calories consumed in Madagascar, second only to rice. It is most important for poor households, particularly in the South where it accounts for over 25% of the caloric intake. During the lean season, cassava provides a significant dietary supplement as a substitute for rice at a time of the year when lower household stocks and higher prices move rice out of the reach of many poor households.

In spite of its importance in assuring food security for vulnerable households and regions, markets and their functioning remain poorly understood, often forgotten and frequently unappreciated in Madagascar. The present report aims to address this gap in our understanding. It reports the results of a series of rapid rural appraisal field missions which, together with detailed quantitative consumption and production data, combine to provide a portrait of the scale, structure and functioning of Madagascar's cassava market.

This study finds that dried cassava transits over long distances in Madagascar and that both fresh and dried cassavas provide a clear boost to household consumption during the lean season. During drought years, commercial flows are reoriented to a considerable extent toward the South and other areas experiencing greatest nutritional stress. Thus, existing private markets provide a key shock absorber for vulnerable households and regions, particularly in drought years.

Even so, cassava's contribution to the food security of vulnerable households could be enhanced through continued expansion of improved on-farm production technology, cassava drying facilities and improved transport in key production centers. Given current consumption patterns, future interventions focusing on cassava will clearly target Madagascar's most vulnerable regions and households.

1. OBJECTIVES

Cassava is an important factor determining the welfare of poor households in disadvantaged regions of Madagascar. Often forgotten in an economy where rice is the main staple, cassava still represents the second most important food source for the Malagasy population. It contributes to approximately 14% of the caloric ration, second only to rice. Moreover, among poor households and in the South, it represents up to 27% of the caloric ration. In urban areas, cassava consumption of poor households is double that of non-poor households. In rural areas, poor households consumption of cassava is triple that of non-poor households. When dried, cassava is both conservable and transportable over long distances. As such, it plays an important role as a substitute for rice during the lean season all over the country and as a cushion for alleviating the consequences of drought in the South.

The potential role of cassava as a food shock absorber for less advantaged households and regions is often neglected in Madagascar. In this report, we will describe the inner working of cassava markets and examine consumer behavior to better assess the potentially important role cassava plays for less advantages households and regions. This understanding will enable us, in later a study, to evaluate empirically how cassava helps to alleviate food pressure during the lean season.²

The report is divided into six sections. After summarizing out methods of investigation, we will look at the pattern of cassava consumption. In the two next sections, we construct a national map of cassava flows in Madagascar, focusing both on exporting (surplus) and importing (deficit) regions and the economic relations between economic agents. In the last two sections, we examine the dynamics of the cassava market and suggest some possible interventions in favor of vulnerable households.

² The present report is part of a research program done by Cornell University with the collaboration of l'Institut National de la Statistique (INSTAT) on the key political and economical structures influencing the lifestyle of the poor.

2. SURVEY METHODOLOGY

In this study, we follow the classic methodology for investigating agricultural circuits. (Shaffer, 1973; Goldberg, 1968; Holzman, 1985). After reviewing the literature, our team conducted a field survey of the “rapid” reconnaissance type (see Chambers, 1981), meeting with key participants to benefit from their understanding of the cassava market circuits, their functioning and their evolution.

A. Secondary sources

This study began in October 1998 in Antananarivo with an inventory of existing literature and data sources on the production, marketing and consumption of cassava in Madagascar and its impact on the nutritional status of the population. Meetings with key people in Antananarivo (from SECALINE, CARE, PNSAN, CAP, UNICEF, IFPRI-FOFIFA, MINAGRI, Laboratoire de Biochimie Appliquée) complemented the literature to help us plan our fieldwork.

B. Field work

The second part of the study consisted in fieldwork in November and December 1998 and January 1999. This work was done by a team of three people, a private consultant, an economist from INSTAT and a researcher from Cornell University. The team was led by an economic advisor from Cornell.

1. Choice of Regions Visited

The study focused on regions where cassava production and consumption are high relative to the national average, with a particular emphasis on exporting regions in order to quantify and trace the commercial circuits of cassava from beginning to end. We were able to find those regions by comparing production figures for cassava production from the agricultural ministry (MINAGRI) with consumption numbers from the Permanent Household Survey (EPM). Therefore, we chose to visit exporting regions like Mandoto, Tsiroanomandidy, Miarinarivo and Anjozorobe, in the Faritany of Antananarivo; Ankaramena, Ambatofinandrahana, Manakara and Farafangana in the Faritany of Fianarantsoa; Betroka and Bekily in the Faritany of Toliary. Some other regions such as Antsirabe, Toliary, Amboasary et Ambovombe were also visited because they consume more cassava than they produce.

2. Persons Contacted

We interviewed many cassava producers, participants in cassava markets and food processing factory managers in order to study links between the availability of cassava production, marketing flows and price seasonality. (see appendix 1). A survey of authorities and other knowledgeable people was also very helpful in shedding light on the patterns of cassava consumption, particularly its substitution for rice during the lean and harvesting seasons. That information was needed to evaluate the degree of seasonal nutritional stress experienced by poor households in less advantaged regions. Employees of the Circonscription de l'Élevage (CIREL)

supplied us with data on the number of hogs in the country so that we could evaluate the quantity of cassava used to feed them. Export data from INSTAT and interviews with exporters allowed us to explore the export potential of cassava.

Comparison of our interviews with consumption data made it possible to evaluate the size of the markets and to reconcile the consumption data with official figures when there were differences. Details of the reconciliation are given in Appendix 2.

3. THE STRUCTURE OF CASSAVA CONSUMPTION

At the national level, 14% of all calories consumed come from cassava. However, consumption levels vary greatly according to household income group, period, and region.

A. Importance for poor households

Roots and tubers constitute the main food group, both in terms of nutritional value and consumption by weight, after rice. Cassava is the most important element of this group. The attractiveness of cassava for poor households is mainly due to its price, 864 Fmg per kilo compared to 1926 Fmg per kilo for rice in 1997.

If we look at the price per calorie, then dry cassava cost only 0,3 Fmg per calorie against 0,6 Fmg for rice. Because of its low cost, cassava accounts for 17% of the calories consumed although it represents only 5% of household expenditures in the three first quintiles of expenditure according to the EPM. A look at the price-elasticity of demand for cassava for different socio-economic groups shows that cassava is really a good of first necessity for rural households.

Table 1 –Annual average consumption of cassava per capita per household group

Household Group	Green cassava		Dry cassava		Calories	
	Q.	Cal.	Q.	Cal.	Total Cal.	% Cal.
	Kg	Daily	Kg	Daily	Daily	Cassava
South	72	278	38	329	2277	27%
Urban, except South						
- poor	36	138	7	57	1963	10%
- non-poor	13	49	3	25	2279	4%
Rural, except South						
- poor	68	260	5	46	1920	16%
- non-poor	77	294	3	29	2611	12%
National	61	234	8	66	2157	14%

Source : EPM

Table 2 – Income elasticity for cassava and rice per household group

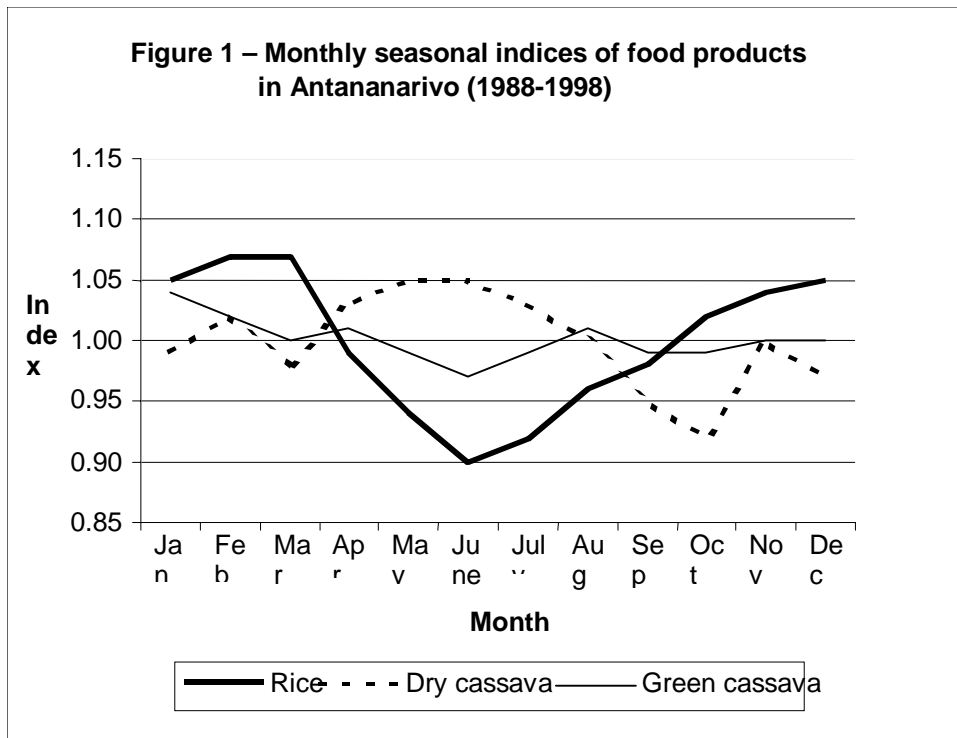
Household Group	Cassava	Rice
South		
- poor and non-poor	0,75	0,78
Urban, except South		
- poor	-0,08	0,48
- average	-0,76	0,18
- wealthy	-3,13	-0,04
Rural, except South		
- poor	0,28	0,75
- non-poor	0,50	0,41
National	-0,88	0,47

Source : Ravelosoa et al. 1999.

Usually, poor households fall back on cassava during period of nutritional stress. When their income goes down, poor urban households diminish their rice consumption and increase their cassava consumption, because cassava is an inferior good in the economic sense. Among the rural poor, a drop in purchasing power leads to decreasing consumption of both cassava (-3%) and rice (-8%) but the relative share of cassava in their consumption increases relative to rice. Thus, the relative importance of cassava increases during period of nutritional stress. This cushioning effect also affects consumption of other tubers and maize but to a lesser extent since they are consumed in much smaller quantities than cassava (see table 5). For poor households in the South, the retreat to cassava has been confirmed many times by cassava producers and dealers in Betroka, Fianarantsoa and even Tsiroanomandidy. They note that during periods of drought, there is a net increase in the quantity of cassava harvested as well as the proportion dried and shipped to the South. Therefore, cassava is important to both poor households and poor regions during periods of economic distress.

B. Importance during the lean season

The importance of cassava during the lean season (between sowing and harvesting) as the main substitute for rice matters for both urban and rural households. Seasonal fluctuations in the price of rice lead to the substitution of cassava for rice during the lean season. This substitution is more marked in urban areas. Cross price-elasticity of demand for cassava relative to rice among urban poor (0.5) and middle class (0.7) households confirm this observation (Ravelosoa, Haggblade and Rajemison, 1999).



Source: INSTAT.

A look at seasonal prices shows the rice price reaching its lowest level when the new harvest reaches the markets. During the harvesting of rice (i.e. between March and April for all regions except the Mahahanga plain where the main harvest takes place in September), rice consumption is very high because it is more affordable and available due to its low price. At the end of the summer, when fieldwork begins in anticipation of the next harvesting season, rice stocks come very close to exhaustion. Then, the rice price begins to creep up again and stays high until the next harvest.

As for cassava, it can be consumed fresh or dry. Since fresh cassava can be kept in the ground for as long as wanted, its price stays relatively constant all year long. We get a different price pattern for dry cassava. Its price is above average during the first part of the year, diminishes in winter and climbs up again at the beginning of the lean season. This is because harvesting and marketing of cassava take place essentially in winter when climatic conditions are best for drying. Collectors are then able to build up stocks to sell during the lean season.

Therefore, the price evolution of cassava seems on average to be out of step relative to that of rice. Because of the time lags and leads, the price of rice relative to the price of cassava increases during the lean season. This favors behavioral changes for the consumer who substitutes rice for cassava or other cereals in the household diet (table 3).

Table 3 – Relative caloric share per product per period and per region

Region	Calories Harvest	Calories Lean Season	Changes in relative caloric share (lean season - harvest)		
			Rice	Other Cereals	Tubers
Fianar. Haute terre	2738	2357	-14%	1%	20%
Ranomafana	2613	2353	-11%	1%	9%
Mahajanga Haute terre	3240	3172	-7%	4%	2%
Mahajanga plaine	2906	2782	-10%	10%	-6%

Source: Minten and Zeller (1998).

C. Importance in the South

Cassava consumption varies by household group and by region. Adverse agro-climatic conditions in the South explain why consumption of cassava is highest in that region, both for poor and non-poor households. In fact, cassava reaches 27% of caloric intake in the South (table 1).

Dried cassava is the main kind of cassava consumed in that region. In the South of Madagascar, the average annual consumption of cassava is five times that in other regions. Dried cassava accounts for over half of the calories consumed in the South, against only 20% in other regions.

4. REGIONAL FLOWS

A. Definition of the Regions

Dry cassava travels long distances depending on agro-ecological and climatic conditions as well as the availability of land suitable for cultivation. These differences result in a variation in technologies and the cultivation calendar (hence productivity) from one region to another. Consequently, food habits regional specialization, and price differences require trade between surplus and deficit regions. We will analyze in this section how a shortage in one region is filled or a surplus in another region is disposed of. This work will allow us to draw a national map of cassava spatial flows.

We distinguish between eight regions: the six Faritany, the south-east region which includes the Fivondronana of Manakara, Vohipeno, Farafangana, Vangaindrano, and an eighth region constituted of Bekily and Betroka. The seventh region has been split off from the remainder of the Faritany of Fianarantsoa because it produces almost triple the Faritany per-capita average according to MINAGRI . However, fieldwork in this region led us to believe that this production was more likely to be only about 60% of the Faritany average. The two Fivondronana, Betroka and Bekily, always produce a surplus of cassava even in the case of famine in the South and, as such, constitute a separate region for our analysis.

Since the Faritany of Toamasina, Mahajanga and Antsiranana do not show any important cassava flows, our study focuses on the five remaining regions (Antananarivo, Fianarantsoa Haut Plateau, Fianarantsoa Côte, Betroka and Bekily, Toliary).

B. Conditions of culture and production supply

Cassava is a hardy plant that grows on many different soil types as long as they are not prone to flooding. Cassava grows only in tropical or warm-temperate climate. It prefers light, and deep soils, rich in humus and mineral matter, in flat or almost flat terrain. Its vegetation requires 25 to 30°C. Cultivation of cassava can take place in almost every part of Madagascar. Total production in Madagascar was 2 million tons in 1995 with an average yield of 7t/ha. However, yields are very variable. The highest per-capita production can be found in the region of Fianarantsoa Haut- Plateau with 328kg, 35% of the national output, while Antsiranana shows the lowest (table 4). But looking at statistics for Faritany can hide big regional differences within Faritany of Toliary, the Fivondronana of Bekily and Betroka produce almost double the average per capita output of Fianarantsoa according to MINAGRI figures. That is why we classify them as a separate region.

Table 4 -- Per capita production per region

Per capita production per region (kg)	
Betroka and Bekily	780
Fianarantsoa HP	328
Fianarantsoa Côte	174
Toliary nc Betroka and Bekily	130
Toamasina	117
Antananariivo	96
Mahajanga	86
Antsiranana	70

Source: EPM, CIREL, INSTAT, own computations³.

Fianarantsoa Haut Plateau: Ikalamavony and Ikongo are two zones that grow a lot of cassava and more than meet demand for the zone. Annual output per capita is respectively 179 kg and 1118 kg in those two zones while demand is only 66% and 20% of production. However, farmers are not able to market all their output, except in time of drought in the South. The high output in those two zones accounts for the fact that Fianarantsoa ranks first in the national production of cassava, beginning in the sub-tropical zone of Ambalavao, a dry region with little rain and rocky soils that require very deep ploughing. Production there is just enough to meet auto-consumption demand.

Planting of cuttings is spread over eight months beginning in August and the production cycles last at least one year. Many cassava varieties are used including Beambony, Fitoravy, Kelimanatody, and Makamena. Yields vary between 7t/ha and 10t/ha. Drying begins in April and lasts until the rainy season begins. It takes three days to dry cassava in that region. The quantity of cassava dried depends on anticipated prices and orders.

South Betroka : Soil types in Betroka and the climate in that area, which are similar to those prevailing in Ihosy make it possible to reach a per capita production level of about 741kg. Planting of cuttings takes place in October and cultivators dry and stock cassava during the dry season between July and October. Producers told us that almost 50% of total production is harvested only in case of drought in the South. Therefore, South Betroka may be considered as a big food reserve cushion for Madagascar.

Toliary except Betroka: Cultivation conditions in the South are very harsh because of the poverty of soil (sandy or rocky) dried out by the strong “tioka atimo” wind, and rain-fed cultivation without any irrigation possibilities, without use of manure, and without systematic rotation of crops or fields.

³ Data comparisons between MINAGRI and other sources can be found in the appendix.

The cultivation calendar varies depending on the region. Sowing takes place in June-July in Ambovombe and Toliary, in September in Fort-Dauphin and in November in Beraketa. Cassava needs 12 to 18 months to come to maturity depending on soil quality. Many varieties are used: Menalaingo, known for its high cyanhydric acid content, Bemandaly, very susceptible to the mosaic disease, Beambony, ... , Madarasy, which has only two stalks but is very good when eaten dry. The bitter variety, Mangononoka, cultivated along the Andranovory-Sakaraha axis, is intended for export and animal feed. Average per capita production in this region is 130Kg.

Antananarivo: The main representative regions for the Faritany of Antananarivo in terms of cassava production are Mandoto, Tsiroanomandidy and Miarinarivo, Anjozorobe.

Mandoto (and Ankazomiriotra) : Volcanic soils in that region are very favorable to cassava production. There is two production periods: almost two-thirds of the production is planted before the rainy season in November and the remaining third after the rainy season in March. Cassava can be harvested 12 months after plantation but this cycle can last up to 24 months. Usually, the first part of the production is harvested in June or July to be dried immediately and the second part is harvested in November to be consumed fresh. The decision as to the amount of cassava to be consumed fresh is taken by cultivators, depending on labor availability and the growth cycle of cassava. Actually, cassava does not taste good in October when its growth cycle starts again.

Tsiroanomandidy and Miarinarivo: Ferralitic in Sakay's plateaus and volcanic in Miarinarivo, soils are generally fertile. There are two planting dates: March and November in Tsiroanomandidy, March and September in Miarinarivo. The duration of maturation duration is 8 months to 2 years. Farmers from Tsiroanomandidy benefit from the supervision of CIRAGRI with the collaboration of the Projet de Développement du Moyen Ouest (PDMO) in a program of intensive farming, basin protection and hog feeding.

There exist two cultivation methods in that region: the traditional method (90%) and the 'improved' method with manuring, spacing, and annual land fallowing. The main varieties used are Rantsanakoho and Beadala (big tubers used only as animal feed). The average yield of fresh cassava is 13,5t/ha for the traditional method and 18,7t/ha for the 'improved' method. Drying takes place between July and October in two ways: in pods and "without norms". This last method of drying cassava is twice as expensive but it is easier to stock cassava when it is dried that way. According to the tax collector at the tollgate of Ankadinondry Sakay, fresh cassava is exported between November and March and dry cassava is exported between May and October.

Anjozorobe: Cassava is the second cash crop after rice on more than 6600 ha with an average yield of 6,5t/ha. Cassava production engages about 9000 farmers. Access to the rural communities of Ambohibary and Beronono where 80% of the production takes place is very difficult because a river must be crossed during flood seasons. Plantation takes place between November and December and harvest follows after 10 months. However, farmers can extend the harvesting season up to November. Many varieties are used including Rantsanakoho (big tubers) and Menalaingo. Farmers dry cassava from August to October.

East Coast: Cassava is generally cultivated on low or medium-size hills whose soils are sandy and ferralitic or on steep tanety with red lateritic soil. Soil types in that region are very

permeable with almost no water retention. Average yield in that region should be higher than on the peneplain. However, decreasing duration of fallow due to demographic pressure, intense leaching, chemical impoverishment of sloping terrain (due to stubble burning) and frequent cyclones are all factors contributing to a disappointing yield.

Plantation generally takes place in July and August. The production cycles last one year. Many varieties can be observed on a same field. Harvest can be done all year long or depending on needs. Peak harvest time is usually in April. The oriental zone is not very favorable for dry cassava production because of its high humidity level.

Table 5 – Structure of Basic Food Consumption (kg/per capita/per day)

	Rice	Fresh Cassava	Dry Cassava	Maize	Sweet Potatoes	Other Tubers
Betroka et Bekily	0,198	0,722	0,145	0,064	0,253	0,008
Fianarantsoa H.P	0,294	0,320	0,023	0,026	0,126	0,039
Fianarantsoa Cote	0,310	0,448	0,004	0,002	0,141	0,033
Toliary nc Betroka And Bekily	0,171	0,093	0,075	0,106	0,050	0,016
Toamasina	0,317	0,156	0,001	0,014	0,033	0,093
Antananarivo	0,306	0,157	0,018	0,055	0,077	0,102
Mahajanga	0,422	0,094	0,009	0,028	0,006	0,011
Antsiranana	0,392	0,048	0,002	0,013	0,009	0,054
NATIONAL	0,311	0,179	0,021	0,041	0,064	0,060

Source : EPM

C. Structure of the Regional Demand

1. Eating Habits and Human Consumption

Table 5 shows the importance of basic foods in Malagasy eating habits. Green (or fresh) cassava, which contributes approximately 179g to the daily food intake, comes right after rice. However, in the Faritany of Fianarantsoa (362g), more cassava is consumed than rice. That is also the case in Toliary if we put dry and fresh cassava in the same food category. The Antandroy are important cassava consumers in the South. They eat fresh cassava during harvest time (June and July) and dry cassava for the remainder of the year. In rural areas in the South, rice is generally stocked for family celebrations except where it is produced in sufficient quantity (Bekily, Betroka, Samangoky and Beroroha),

2. Animal Consumption

We were able to evaluate the quantity of cassava intended for hog feed on the basis of data on the number of hogs in 1995. Dairy cows make for a big part of bovine cassava consumption. It is worth noting that although most farmers usually give fresh cassava to their livestock, a majority of cattle breeders in the Faritany of Antananarivo use animal feed.

Table 6 – Structure of basic food consumption (calories per capita per day)

	Rice	Fresh Cassava	Dry Cassava	Maize	Sweet Potatoes	Other Tubers
Betroka and Bekily	698	1010	460	230	389	23
Fianarantsoa H.P	1036	449	73	89	194	46
Fianarantsoa Côte	1092	628	13	8	217	43
Toliary nc Betroka And Bekily	603	130	236	379	76	18
Toamasina	1115	219	4	51	51	172
Antananarivo	1079	220	56	199	119	93
Mahajanga	1486	132	27	102	10	16
Antsiranana	1378	67	5	47	14	93
NATIONAL	1096	250	67	146	99	76

Source : EPM

Table 7 – Animal consumption in % of total consumption

Betroka and Bekily	0,0
Fianarantsoa HP	3,7
Fianarantsoa Cote	0,8
Toliary nc Betroka and Bekily	5,9
Toamasina	3,2
Antananarivo	9,9
Mahajanga	1,3
Antsiranana	1,9

Sources : CIREL, authors' computations

3. Animal Feed

Since the regions of Antsirabe and Tsiroanomandidy accounts for an important proportion of hog breeding, interviews conducted in those two cities regions enabled us to evaluate cassava demand for animal feed. We visited the four biggest industrial animal feed producers. However, cassava demand from those firms is certainly lower than 10,000 tons/year. We are unable to evaluate total cassava demand for producing animal feed due to the absence of data from small-scale production units. Instead we made an estimate based on the hog feeding formula provided by an agent of the CIREL.

Big factories obtain most of their cassava supplies during harvest time, in the midst of the dry season (May-September). However, medium to small-scale production units obtain dry cassava or cassava powder every week from wholesalers and do not maintain stocks in order to avoid losses.

4. Export

Most exporters are based in Toliary where there is a port with low hydrometry and no silting up, hence with all year long loading possibilities, and a capacity of 800t/day. Collection campaigns take place between August and October and shipping follows in November and December. Exported dry cassava comes from Sakaraha, Befandriana, Fotadrevo, i.e. nearby regions.

Many companies such as GAMA CASSAVA, SOPAGRI, PROGEM, and Société BALBINE were exporting more than 20,000t of cassava to Reunion and Britain before 1995 but now, with lower world cassava prices and higher shipping costs, the incentive to export is not very high. According to people interviewed, although prices to collectors are stable (225 Fmg/Kg), FOB prices were about 350 Fmg at the time of our meeting. To be profitable, exporters said that dry cassava prices from the collector should diminish to 100Fmg/Kg. Therefore total exports in 1995 were only 6,700t.

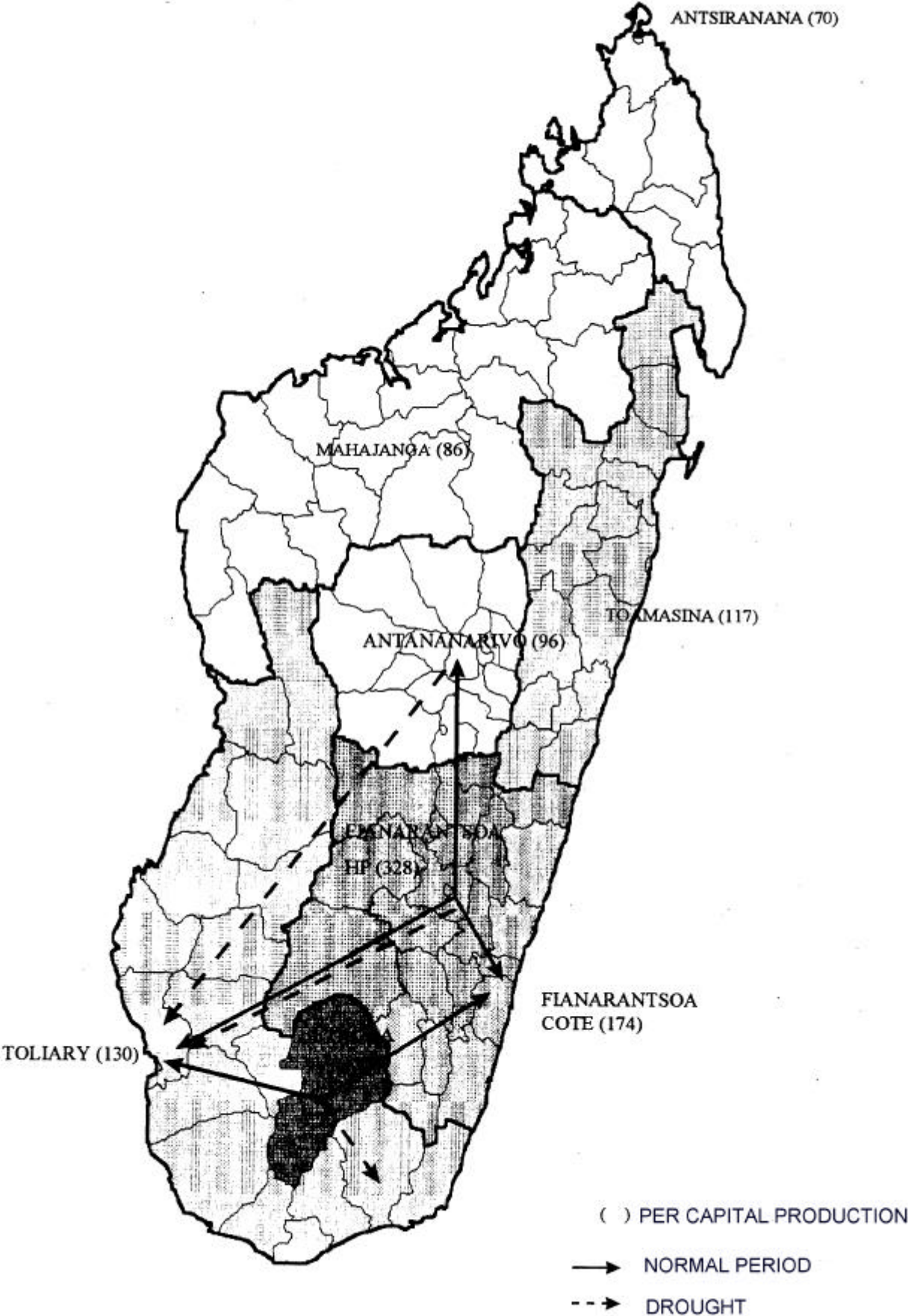
Although the potential demand from European markets could be as high as 100.000 t/year, only one company continues to export small quantities (20t) of cassava since 1996. Price competition from France's Over-Seas Departments and Over-Seas Territories is fierce and exporters from Madagascar are put at a disadvantage because they do not receive subsidies from France. That is why most of the exporters are instead now focusing on collecting cassava for resale on the domestic market.

5. Processing

Except for some small home based grinding units, the only two sizable processing plants in Madagascar are PROBO (Produits du Boina, Nouvelle Maïserie de Madagascar) in Mahajanga and the starch factory of Marovitsika (Moramanga). PROBO lost one third of its market following the closing of SOTEMA (cf. section 4). The starch factory of Marovitsika (Moramanga) is presently the only factory producing at full capacity. Founded in 1897, its principal activities are the production of cassava starch and complementary products, and the supply of pine and eucalyptus wood products. The size of its fields sown with cassava is 200ha/year. It does two sowing per year and uses mainly (98%) bitter varieties. It uses cattle manure and organic fertilizer extensively. It leaves fields fallow for three or four years after harvest activated by a Tephrosia-based green fertilizer and as "vala masaka " as pasture.

The starch factory also buys approximately 5% to 10% of the output of nearby farmers to complete its annual production of 10,000t. 80% of the input is lost as irretrievable scraps. 10% of the output is tapioca. Except for 50t to 200t of starch exported to Réunion, the main part of its production is directed to the local market. The factory supplies industrial input to Cafés Fotis, Salone, Cotona and Farmad.

Figure 2: REGIONAL CASSAVA FLOWS



D. Spatial Flows

1. Normal year

Comparisons of total supply and demand for each region allows us to classify them as exporting or importing regions. We can then distinguish spatial flows according to their size and direction. Those flows are described in table 8 and illustrated in the enclosed map.

It is mostly dry cassava that travels over long distances. Producers from Ikongo (Fianarantsoa) are however able to send fresh cassava directly to Manakara by train. Also, cassava flour from Fianarantsoa is plentiful in markets in Farafangana.

Table 8 – Origins and destinations of regional flows of cassava

Regions	Supply	Demand	Regional Import	Regional Export	Origin/ Destination
Fianarantsoa H.P.	685 622	523 976		161 646	Tana 121 857 Toliary 32 870 Fnr Côte 6 918
Betroka-Bekily	160 997	109 885		51 112	Tuliary 49 563 Fnr Côte 1 549
Antananarivo	367 211	489 068	121 857		Fnr HP 121 857
Toliary nc Betroka-Bekily	204 111	286 544	82 434		Fnr HP 32 870 Betroka 49 563
Fianarantsoa Côte	104 993	113 460	8 467		Fnr HP 6 918 Betroka 1 549
Toamasina	246 449	246 449			
Mahajanga	124 686	124 686			
Antsiranana	70 871	70 871			
TOTAL	1 964 940	1 964 940	212 758	212 758	

2. Drought

The flows described above take place especially during the lean season. However, different flows toward the South appear during droughts that often affect that region. Some people observe that the time period between two droughts, historically 6 years, is now tending to diminish. The non-harvested part (during a typical year) from Betroka has an outlet during drought years. The size of the flows coming from Betroka and Fianarantsoa also increases noticeably during such periods. In spite of the cassava deficit in Antananarivo, big trucks loaded with cassava leave from Tsiroanomandidy and Anjozorobe during periods of drought for delivery in the region of Toliary. Collectors and wholesalers take advantage of the price difference between the two regions.

5. MARKET ORGANIZATION

Cassava travels over long distances because of regional or seasonal deficits that are identified by dealers and signaled by big price differences. In this section, we describe how the production and distribution system is organized. Particularly, we identify the main functions of the marketing chain, its participants and its channels.⁴

A. Functions

The functions of marketing chain describe the different stages between production and final consumption. The cassava market in Madagascar consist of eight functions: production, drying, collect, stocking, wholesale, grinding and manufacturing, export and retail sale.

B. Participants

Key participants in the cassava market are the producers who dry part of the production themselves, the collectors who can also be stockers and wholesalers when dealing with dry cassava, the animal feed producers and processing factories, the exporters and finally the retailers.

C. Distribution Channels

We distinguish eight principal channels to show how cassava production transits among the participants who supply dry or fresh cassava through channels whose relative sizes are shown in table 9.

Note that fresh cassava is often sold directly to consumers while dry cassava sold to collectors and wholesalers represents one third of total transactions. Small animal feed producers carry out only a very small part of total collection.

Note also that we considered as irretrievably wasted the part of the production lost during processing or stocking and the part taken into account in production figures but not harvested, i.e. kept in the ground when there is no outlet or when the South does not experience drought. These amounts do not appear in the map of the marketing chain.

⁴ See Gamser et Haggblade (1991) for a description of the methodology for market analysis.

Table 9 – Relative size of the distribution channels for cassava and derived products

		Total	Auto-consumption		Marketing	
			(kg)	(%)	(kg)	(%)
Human Consumption	- fresh	778 898	656 000	33,4 (1)	122 898	6,3 (3)
	- dry	303 882	107 266	5,5 (5)	196 616	10,0 (6)
	- starch	11 000			11 000	0,6 (2)
	- powder	3 333			3 333	0,2
Exports	Dry	22 232			22 232	1,1 (7)
Animal Feed	Dry	194 238			194 238	9,9 (8)
Cattle Feed	Fresh	329 960	329 960	16,8		
Loss	Fresh/dry	321 396	321 396	16,4		
Total		1 964 940	1 414 622	72,0	550 317	28,0

Sources: EPM, CIREL, INSTAT, authors' calculations.

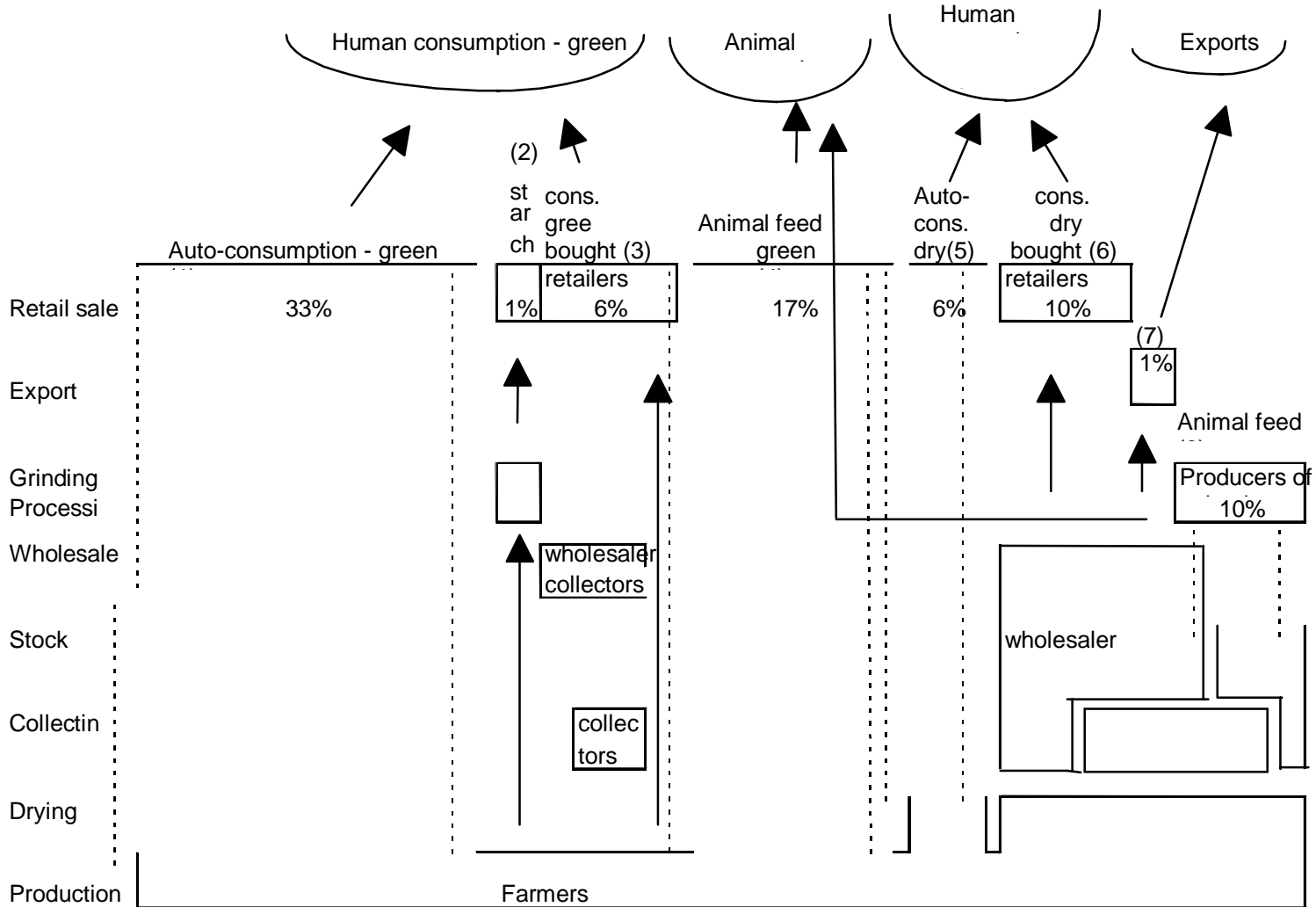
() : channel identification number (from the map)

Cf. appendix : comparisons of MINAGRI data and other sources.

As shown in Figure 3, eight channels constitute the cassava market. In channels 1 to 4, fresh cassava is used directly by the producer for human or animal consumption. In channels 2 and 3, fresh cassava goes through some supplementary stages before consumption. In channel 2, fresh cassava is transformed into starch. The factory obtains cassava directly from the farmers. In channel 3, fresh cassava is distributed either by retailers or through collectors or wholesalers who supply retailers.

Channels 5 to 8 include drying. Channel 5 represents auto-consumption of dry cassava. In channel 6, dry cassava goes through collectors then wholesalers or through collector/wholesalers before reaching the retail market. Dry cassava going through channel 7 is intended for export. Finally, channel 8 takes dry cassava into animal feed.

Figure 3 – Diagram of the cassava sector



6. MARKET DYNAMICS

We want to find through an analysis of its dynamics what are the driving forces and constraints responsible for the evolution of supply and demand in cassava the marketing chain. We would like to identify channels that are most likely to grow in the future and single out interventions that could benefit poor households.

A. Evolution of Supply

National production of cassava tripled between 1955 and 1995. Per capita production went from 444g to 500g. Increase in cultivated areas and yields are the two main factors behind this result. In contrast with rice whose cultivated area grew only by 35% and yield by 5%, area devoted to cassava doubled and yield went from 4t/ha to 7t/ha.

With a production increase four times larger than the national average, the Faritany of Fianarantsoa keeps its first position. Its yield is also higher than the national average. Production in Ihosy also quadrupled because it was possible to increase the area devoted to cassava cultivation. However, in general, the East Coast is characterized by a falling level of agricultural production. In that region, decreases in yield are due to impoverishment of the soil (deforestation, stubble-burning, bush fires) and successive cyclones.

Table 10 -- Increases in production, area cultivated and yield (1995 relative to 1955 in %)

	Production	Area Cultivated	Yield
Fianarantsoa	371	123	111
- Côte Est	0	37	-26
-Ihosy - Ambalavao	354	489	-23
Toliary	188	89	52
- Ambovombe	0	-19	8
- Betroka	185	6	170
Antananarivo	186	42	102
-Tsi/didy	243	72	99
-Vakinankaratra	67	-50	236
- Anjozorobe	1272	154	441
Mahajanga	7	-9	18
Toamasina	165	124	18
- Alaotra			
Total	226	87	75

Source: MINAGRI

Production in the Faritany of Toliary tripled between 1955 and 1995. The area cultivated and yields were improved. New varieties and new crop rotation and association techniques could

be spread in intervention regions by development projects⁵, thus increasing yields even more. The situation in Ambovombe and Betroka, two special regions of the Faritany of Toliary, deserve separate study.

During the 1950s, Ambovombe was the region that produced the most cassava in the Faritany of Toliary (20% of the Faritany output), but this region now experiences difficulties and needs to be supplied in cassava from other regions (it still accounts for 9% of the Faritany's production but a large share of consumption). Despite a big potential in terms of cultivable lands and an important livestock population of cattle, pigs and sheep that could supply manure for cultivation, this region suffers from infrequent rain, lack of water, and manpower shortages resulting from the exodus of young people, which constitute major constraints for the development of production in the region. Moreover, the cultivation of sweet potatoes tends to compete with that of cassava in view of its yield, its production cycle and the required climate.

The region of Betroka did not experience a significant increase in area devoted to cassava cultivation although the use of a new variety (Bemirepa) with a yield of 10t/ha allowed it to increase its production by 185%. A lack of storage infrastructure remains the big problem of the region.

Production tripled in Antananarivo. Two reasons explain this evolution: the increase in area under cultivation in the region of Tsiroanomandidy and Anjozorobe; and an increase in yields in the whole Faritany. In fact, those regions benefit from good external support and follow-up (see section 3.1). Note that the decrease in the area sown with cassava is due to competition from other products such as potatoes.

In Mahajanga, stagnation in production is explained by the low level of demand in the region. Sweet varieties sown in November have a cycle of 4 months and are not suitable for drying. It is not possible to wait until November (the beginning of the lean season) to harvest them. Moreover, varieties used in Mahajanga are not appropriate for processing into flour. . PROBO, the main user of cassava in Mahajanga, used to obtain its raw material from the regions of Betafo and Miarinarivo but is no longer involved in the cassava market.

⁵ The Projet sud-ouest (PSO) and the Projet d'Appui au Développement des Plantes à Tubercules (PAPAT) launched new initiatives for promoting the cultivation of tuber plants. Those projects now stress increases in productivity.

B. Evolution of Demand

1. Human Consumption

The 14% increase in per capita production has made possible an increase of 11% of rural household consumption. Moreover, the share of cassava in household food expenditures follows the same trend as other starch and tubers, which increased from 28,4% to 46,4% between 1961 and 1995 (Rachel Ravelosoa, 1996).

It is also worth noting that calories generated by roots and tubers in the daily ration also registered marginal increase (19% in 1962 versus 21% in 1993).

Thus, the substitution effect between basic food groups explains part of cassava demand dynamic. Difficulties in getting supplies of rice or other cereals, loss of production due to cyclones or locust epidemic can cause a food deficit, while a long lean period favors cassava consumption.

Also, factors that can have an impact on other cassava utilization such as animal feed or demand by exporters and processing factories can also influence cassava demand.

2. Animal feed

Over the last few years, animal feed production has expanded rapidly with the promotion of hog breeding. Development projects such as DELSO (Projet de développement de l'élevage dans le Sud-Ouest) were responsible for bringing technical and financial support to small scale breeders. However, a recent outbreak of hog plague reduced the number of hogs in the country by a third and thus reduced the demand for animal feed. Since the animal feed industry represents half the total demand for animal consumption, the consequences of a reduction in livestock for cassava demand are important.

Table 11—Evolution of cassava consumption per capita

<u>Grams/Day</u>	<u>1962</u>	<u>1993</u>
National	244	249
Urban	182	111
Rural	254	285

Sources: National survey on budget and food, 1962; EPM 1994.

3. Exports

Cassava exports from Madagascar keep falling (6.737 t in 1995, 29t in 1996). High transportation and freight costs due to poor road quality, out of date port infrastructures and insufficient storage capacity near the harbor of Tuléar are the main reasons why ship immobilization and shipment cost are so high even though FOB prices stay low. In 1998, the main import price for the European Union continued to fall to 107\$US per ton, a much lower price than the average price in 1994-1996 (158\$US) and the lowest price in ten years (FAO,1999).

4. Processing Factories

Aside from the starch factory of Marovitsika whose output seems to have been pretty stable over the 100 years of its existence, PROBO was producing 500t to 600t of cassava flour according to a report by CARE for the PAPAT project. Production quality problems and difficulties in finding sales outlets caused an important decrease in output. Red bark varieties cultivated in Mahajanga are not suitable for processing since they change the color of the flour. The main customers are the textile industry, which uses the flour for gluing thread (COTONA et SOTEMA) and other factories using or producing glue (AFOMA, FITIM, FIMT, PAPMAD...). Note that with the closing of SOTEMA, PROBO lost a market of 200t/year.

7. IMPLICATIONS

The present cassava marketing system responds to two distress situations of vulnerable households: the lean season and regional deficits, notably by the reorientation of flows toward the South during periods of drought. In order to facilitate this role in support of vulnerable households and regions, we propose several potentially useful interventions:

- **Production technology** :

Diffusion of the research on new cassava varieties is in large measure responsible for the big increases in cassava productivity and total production seen in the last few years. However, some intensification possibilities remain unexploited. Farmers, as well as consumers and exporters are likely to reap many benefits from them.

- **Infrastructure** :

Basic infrastructure improvements such as road construction or road repairs in the isolated production region of Betroka, Ikongo and for cassava importing regions such as the South and South-East zones of Madagascar will benefit all products. Once cassava demand is met throughout the country, cassava processing to diversify eating habits⁶ may be envisaged.

- **Drying** :

Improvements in drying techniques could allow better conservation of cassava by avoiding mould.

In conclusion, cassava plays an important role as a safety cushion for vulnerable zones and households during difficult seasons. Better knowledge of its role can help in improving the functioning of this significant cushioning mechanism.

⁶ The project “appui à la filière manioc” launched by “le Centre National de la Recherche Appliquée au Développement Rural” (FOFIFA) propose the inclusion of the agro-business industries to the cassava market.

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Appendix 1

List of informants who participated in the interviews

Date	Region	Interlocutor
16-11-98	Antsirabe	5 wholesalers – retailers of dry cassava 2 retailers, fresh cassava 6 animal feed producers
17-11-98	Mandoto	Farmer-stocker Manager CECAM/FIFATA Agricultural popularizer Fresh cassava collector for COTONA Collector, Mandoto tollgate
18-11-98	Betroka	Mayor Zone supervisor –CIRAGRI Fort-Dauphin Agricultural popularizer 2 farmers Collector-wholesaler
20-11-98	Ankaramena	Mayor Supervisor CIRAGRI
20-11-98	Fianarantsoa I	Sub-prefect Zone supervisor CIRAGRI Fianarantsoa 3 wholesaler-retailers, dry cassava
24-11-98	Toliary	Exporter-wholesalers : SOPAGRI-PROGEM- Etablissement Balbine PSO CFSIGE Custom Tax Collector Toliary 2 wholesaler-retailers Animal feed producer
26-11-98	Bekily	Mayor 2 collector-wholesalers
27-11-98	Ampanihy	Sub-prefect Collector-retailer
27-11-98	Ambvombe	Mayor SAP officer Head of Administrative service CGDIS

Date	Region	Interlocutor
		Former employee SECALINE PAM Agent (based in Ambovombe) Farmer 2 collector-retailers Restaurant owner
27-11-98	Amboasary	Deputy Mayor 4 retailers of dry and fresh cassava
28-11-98	Fort-Dauphin	Custom Tax Officer Stocker-retailer 2 fresh cassava retailer
7-12-98	Tsiroanomandidy	Head of Organization Department CIRAGRI-PDMO Head of Monitoring Department CIRAGRI-PDMO Team of statisticians - PDMO Ankadinondry Engineers, in charge of cultivation test PMMO Engineers, breeding CIREL Tax collector Ankadinondry
08-12-98	Miarinarivo	Head of CIRAGRI Miarinarivo Technician-Instructor for food producing CIRAGRI Ministry of Commerce Officer Animal feed producer
11-12-98	Starch factory Marovitsika	Agricultural Technician, Head of Cultivation Division Foreman and Assistant Director Laboratory assistant Laboratory technician
11-12-99 12-12-99	Ambatomanoina Fiv. Anjozorobe	Sub-prefect Deputy mayor President of the municipal council Chief, CIRAGRI Chief, Western area Chief of the Ambatomanoina unit
22-12-98	Ambatofinandra- Hana	Mayor Head of Agricultural Services Restaurant owner
12-01-99	Manakara	Mayor 2nd Deputy mayor Railway station monitor, Manakara Surveyor CIRAGRI-PNVA Veterinarian Collector
13-01-99 14-01-99	Farafangana	Deputy Prefect Prefecture Representative Chief, Southern area, CIRAGRI Technical collaborator, Breeding division 2 wholesalers for dry cassava and cassava powder 2 retailers, dry cassava, 2 retailers, fresh cassava

Appendix 2

Data comparison between MINAGRI and other sources

	Population	Actual survey		MINAGRI		Reconciliation
		prod/capita	Prod.	prod/capita	Prod.	
Antananarivo	3 805 613	96	367 211	96	367 211	367 211
Fianarantsoa HP	2 093 232	328	685 911	382	800 646	800 646
Fianarantsoa Côte	601 768	174	104 993	631	379 434	104 993
Toamasina	2 108 771	117	246 253	132	277 680	277 680
Mahajanga	1 442 291	86	124 622	85	122 374	122 374
Toliary nc Betroka And Bekily	1 566 268	130	204 111	174	272 059	272 059
Betroka and Bekily	206 344	780	160 997	602	124 181	160 997
Antsiranana	1 008 946	70	70 842	56	56 400	56 400
			1 964 940		2 399 985	2 162 360

*regional production = human consumption (EPM)
+ animal consumption (estimated with hog census data from CIREL)
+ exports (trade data INSTAT)
+ regional exports (interviews –fieldwork)
+ regional import (interviews –fieldwork)
+ raw materials (processing factories, animal feed and starch prod.)
+ production loss (20%)

Our fieldwork allowed us to reconcile our production figures with those of MINAGRI for the South-East region and the region of Betroka-Bekily. MINAGRI adjusted figures are very close to our own.