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PNA/E 960

FARMING SYSTEMS SURVEY  
OF MEME DIVISION

SOUTH WEST PROVINCE  
REPUBLIC OF CAMEROON

Testing & Liaison Unit  
Farming Systems Programme  
Cereals Programme

National Cereals Research and Extension Programme

IRA-Ekona  
PMB 25, Buea  
SWP Cameroon

IRA/IITA/USAID

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# 1987 Farming Systems Survey of Meme Division, South West Province

## Abstract

**Background:** In order to help IRA researchers on and off station direct their work more towards the potentials and needs of food-crop farmers in the South West and Littoral, the TLU at Ekona is undertaking a series of farming systems surveys. The series began in 1986.

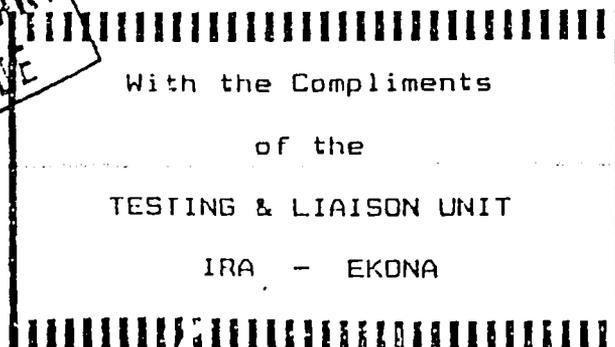
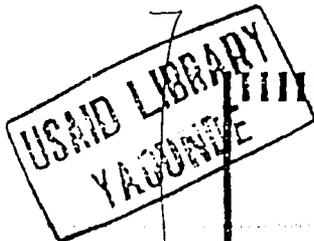
**Objectives:** To provide useful information to IRA breeders and agronomists, to MINAGRI extension workers and planners, and to the TLU for its on-farm trial program.

**Methods:** Preliminary analysis of Meme Division soils, climate and demographic data was followed by a formal survey of 120 farmers in 24 villages of all but one of the most populated ecozones, coupled with qualitative description of one to two fields per village. Statistical and qualitative results were combined to produce a descriptive report based on differences by ecozone and field type.

**Results and Discussion:** Meme farmers grow food crops both for commercial and subsistence purposes, and at least a third of the production of every major crop is sold. Despite this, the technological level is quite low. Major inputs are still land and labour; purchased inputs are limited almost entirely to labour. Chemicals and tools are scarce in quality as well as quantity. Improved planting materials are almost non-existent, although much desired. Crop protection chemicals and tools are in demand, but not fertilizers.

Meme crops in order of economic importance are plantains, yams, cassava, cocoyams, taro, maize, bananas, groundnuts, egusi melons, beans, and potatoes. Ordered by food energy, maize rises to third place and cassava to first. Cocoyams are low in importance only because the root rot is devastating yields. Plantain weevils and nematodes and maize stem borers and storage weevils are the other serious pest/disease problems meriting focussed research. Varietal improvement in maize will increase the already existing marketing problems unless storage improvements are concurrent. The best existing markets are for plantains, cocoyams and yams (local and export) and cassava (local only).

Priority zones for agricultural research are the area stretching east-west from Kumba Town and the area around the Supe Escarpment. The former zone is land-scarce and is developing problems stemming from over-utilization; its heavy soils and derivative planting methods cannot be replicated in IRA station trials. The latter zone is rapidly increasing production and moving onto more acid and fragile granitic soils that are virtually unstudied, at least in the Coastal Lowland Zone. Most of Tombel Sub-division is rich in agricultural potential but held back by poor roads. Most of Bangem Sub-division is highland, and suffering already from over-utilization. The sedimentary areas of Mbonge Council are highly productive for their size and can be benefitted by existing IRA technology in cassava and yams already tested at Ekona's Yoke fields. The accessible portion of Nguti Sub Division is not yet agriculturally important.



### Foreword

This report is written to be used by many types of people. Those with interest in a particular crop or crop should scan sections D.1 and D.2 and E.1 and E.2. (environment, cropping systems and field management) as well as the crop itself in section F. Administrators with little time may want to start with the recommendations in section G and with sections A, B, and D.1 and D.2. Social scientists will be more interested in Sections C and D.

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# 1987 FARMING SYSTEMS SURVEY OF MEME DIVISION, SOUTH WEST PROVINCE

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### A. Background information:

The Testing & Liaison Unit (TLU) at Ekona is charged with determining the utility of the technology developed by the Institute of Agronomic Research (IRA) for food-crop farmers in the South West and Littoral Provinces; and with bridging the gaps between IRA researchers on the one hand, and farmers and extension agents on the other. These two provinces are a root-crop and plantain region, in which cereals play a relatively minor role. Therefore the Ekona TLU has been charged with addressing the problems of the entire system, although with an emphasis on maize, the predominant cereal.

Until the TLU began work in this area, cereals breeders and agronomists operating from Nkolbisson had to extrapolate from conditions in the Centre-South to decide what to try in the coastal lowlands. Information on other food crops was somewhat more available, because Ekona plantains and root crops researchers have access to local farmers, but their principal contacts naturally tend to come from the Ekona subzone of Fako Division. Statistics on provincial and divisional production and sales will become available with the publication of the Ministry of Agriculture's Agricultural Census of 1984, but this will provide no diagnostic information and also cannot address the variety of ecological and socio-economic systems to be found inside the province. A description of food-crop farmers and farms was imperative for the TLU's work, and important for input to IRA work on-station.

Limited by resources, the Ekona TLU decided to start in Fako Division (South West Province) in 1986, and to take on one more division each year. The Meme Division survey was carried out in October-November 1987, and data col-

lection for the Manyu and Ndian surveys was conducted in April-May 1988. A full provincial report will follow the release of the divisional reports by the end of 1988.

### B. Objectives:

- 1) to provide information on cropping systems and cultivation practices of principal food crops to guide on-farm and on-station agronomy and variety trials for the Division;
- 2) to provide information to the breeders (maize, cocoyam, cassava) on existing varieties, cropping systems, treatment in production and post-harvest, field and storage problems and preferences;
- 3) to establish contact with the Ministry of Agriculture extension service and with interested farmers, in preparation for on-farm trials and training;
- 4) to collect information of interest to the Divisional and Provincial Delegations of the Ministry of Agriculture, to aid in their work.

### C. Research Methodology:

This section is written for those with a particular interest in survey methodology or in the validity of this survey. Others should skip to the next section.

Secondary data were collected to map soils, altitudes, rainfall, roads, villages and towns in Meme Division, and supplemented by a road tour in the company of staff from the Divisional Delegation of the Ministry of Agriculture, and by discussions with the Divisional Agricultural Sector Chief (CSA). These data were used to delineate nine potentially different agro-ecological zones, one of which (Upper Mbo) was inaccessible with the resources available.

This preliminary data collection also induced certain modifications in the original questionnaire applied in Fako Division, particularly a greater emphasis on the influence of cash crops on food cultivation. However, the final questionnaire is very close in form and method of administration to the one used in Fako.

The final instrument is eight pages long and takes an experienced enumerator an hour to an hour and a half to administer, depending on the farmer's understanding and the complexity of his/her crops. It covers all food and cash crops, their cropping system, land use and fallow, and for food crops, agronomic methods, field losses and harvests, type and source of inputs, input needs, storage, processing and marketing methods and difficulties, labour and cash bottlenecks and solutions, extension contacts, and demographic data. The enumerators were IRA and Ministry of Agriculture technicians.

Sampling was stratified by eco-zone and randomized within villages. In each of the eight accessible zones, two to four villages were selected according to population size. (In the end, reclassification of zones left none with less than three villages.) Villages were selected to cover the geographical range of the zone and the variety of village sizes. Local extension agents did the sampling, following instructions to start at one end of the village or town quarter and select every tenth house, or its neighbor if the tenth had no food-crop farmer working at least half-time. In all but one town (claimed to have so few farmers that this strategy would take a month to locate them), this procedure was followed. The number of non-farmers encountered in the process was factored into the population estimates per zone.

Although a Population Census was carried out in 1987, the results will not be released for several years. In Fako, we had spent a month with the local chiefs working out lists of food-crop farmers in each village sampled, but we could not afford to do this farther afield. We worked from the Agricultural Census estimates of number of farmers per Division, less 10% (since the Census includes very small part-time farmers in urban or formal employment). We used the Nominal Rolls to total the number of tax-payers in all the villages of each zone, factored in the percentage of non-farmers encountered in each zone during the sampling, and estimated the percentage of all Meme Division farmers in each zone. All results reported for Meme as a whole are weighted by the estimated size of farming population in each zone relative to the zonal sample. That is, the answers of a single Nguti farmer count less in the Meme total than those of a single Kumba farmer.

Attempts were made to interview the farming couple together, and, failing this, the woman, since she is the primary food-crop farmer. However, some women absented themselves because of sickness, death celebrations or simply a belief that their husbands should handle strangers coming about agriculture. 30% of the respondents were men alone, only 3% being unmarried. 31% were women alone. Individual respondents were continually reminded to answer for their spouses' concerns as well. "Families" or "households" were taken to be the group living together in one house and sharing fieldwork. In fact, in Meme very few families have polygamous arrangements within the same house, although several respondents had attached single adults who were farming separate fields in addition to helping with the family's.

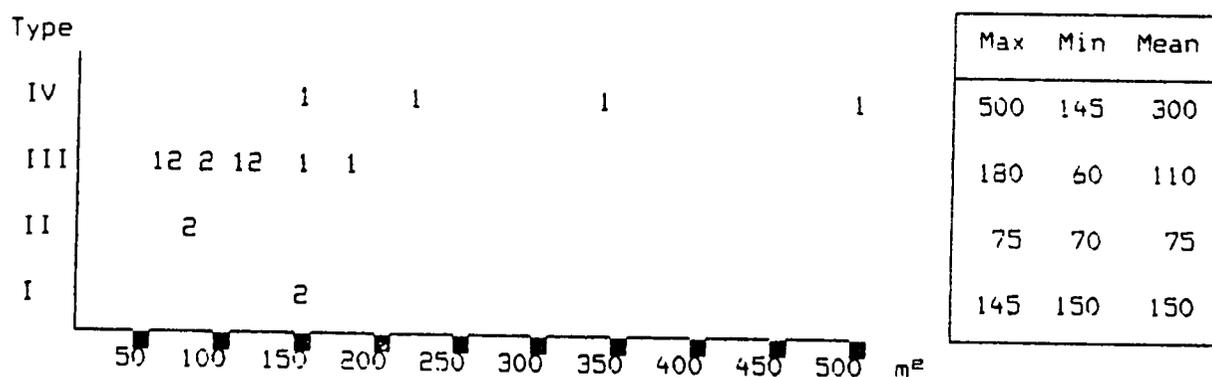
While the interviewers were administering the survey questionnaire in five farmers' homes, the team leader visited one to two fields picked as typical by the local extension agent, together with the latter and the farmer, or sometimes her husband. Crop association patterns were described, densities measured, soil taken for analysis, and the cropping and fallow history of the field, clearing, land preparation, planting, weeding and harvesting sequence described. Pests and diseases were described and often sampled, and healthy cocoyams taken for the breeders' collection at Ekona. Farmer and agent were also asked about local marketing, transport and access to inputs.

The TLU needed to approximate production and land area for purposes of weighing relative importance of different crops and cropping patterns. South West farmers have no conception of land area, and it was impossible to follow the Census procedures (visiting every farm to measure it). In the Fako sur-

vey, people were asked how long it took to clear the land, and, during the survey, one to two farms in each village were measured and compared to the answers. Because of the differing vegetation and relief, time to clear turned out to be totally unrelated to area. In Meme, the proxy chosen for land area was based on the number of man-days required to weed a field in the first weeding after planting. Again, the team leader measured sample fields and compared with weeding time, this time controlling for field type.

It was discovered that weeding time varied much less, except for the forest fields (Chart 1). Type I (cocoa/coffee farms) require less careful weeding than II and III (mixed, unshaded food/tree farms and food farms), while Type IV (heavily shaded food farms) grow few weeds and are seldom carefully weeded. The weeding time was converted to area estimates by multiplying Type I fields by 1.5 and Type IV by 3, and considering Types II and III to be roughly equivalent.

Chart 1: Area Weeded in One Person-day, by Field Type



Once field area was estimated, we also needed a way to assign area per crop under the normal intercropping situation. The 1984 Agricultural Census formula<sup>1</sup> was modified for this purpose. In it, each crop is given a standard weight, and the area of a given crop for a given field is set equal to the density of that crop times its weight, divided by the sum of the density-times-weights of all the crops in that field, and multiplied by field area. Because densities of secondary crops were not listed in the questionnaire, and because a few farmers insisted on impossibly low or high densities for some crops<sup>2</sup>, modal densities were substituted for individually reported ones, and measurements from the field visits were used for densities of secondary crops (usually 10% of normal densities, but 20% for cassava and maize). As crop

<sup>1</sup> Direction Nationale du Recensement Agricole, Ministère de l'Agriculture. 1983. 1984 Agricultural Census (methodology). Yaounde. Offset.

<sup>2</sup> The farmer was asked to scratch out on the ground how far apart she would put each seed group when planting, and was asked how many seeds or stems per group would be planted.

weights, the lowest recommended densities cited in Westphal et al.<sup>3</sup> were used.

Production was measured by self-report of the farmers of the previous year's harvests. Units were the volumes carried out of the field or filled at home: baskets, standard market basins and tins, hand-trucks, mokutas (jute bags used for cocoa bean sales) and 20-10-10 50kg fertilizer bags. Baskets and non-standard basins were equated to one of the other measures by the farmer. Experimentation with water, grain and tubers led us to make a rough equation of one fertilizer bag to 2.5 tins, 1.67 basins, and .36 of a mokuta or hand-truck. Finally, volumetric units appropriate to each crop were weighed in the market to arrive at approximate production figures. (The Agricultural Census of 1984 followed a similar procedure but weighed the units in the village and took reports of harvested quantities three times in the year.)

Although data on production and proxy data on land area has been collected and is being reported, they should be regarded as estimates only, of less accuracy than those provided by the Ministry of Agriculture censuses begun in 1984. The Census has concentrated large staff and technical resources on these two questions, whereas the survey reported here is focussed primarily on opportunities and constraints, both agronomic and socio-economic, rather than quantification of present production.

Zoning was refined after the survey. Villages originally assigned to a zone were compared with each other and with neighboring villages and their zonal totals on a series of indicators: main crops, number of crops, timing and nature of field operations, fallowing, densities, crop losses, ethnicity and household size. Those differing from each other more than from their neighbors were recombined, and neighboring zones were compared to determine if they should be merged (as were the areas east and west of Kumba Town). The only real anomaly was the village of Ebonji, which follows a predominantly Kumba agronomic pattern on Koupe soil, bordering the two; it was classified into Kumba but omitted from the soils summaries.

#### **D. Results: Environment and Resources:**

##### **1. Meme Division:**

Meme Division, with 6510 square kilometers and a population of over 196,000 in 1975, is the most populated and second largest division in South West Province. From the town of Kumba, a major commercial and industrial centre, and the dense cacao-culture surrounding it, to the sparsely inhabited forests of the northwest and the fantastically fertile and nearly inaccessible slopes in the east, it is a study in contrasts. Mostly low-lying, rolling hills under 400m altitude, it contains the northern slopes of Mt. Cameroon, the eastern sector of the rugged Rumpi Hills, most of Mt. Koupe (2050m) and the western half of Mt. Manengcuba (2396m). The only highland agriculture is on Mt. Mane-

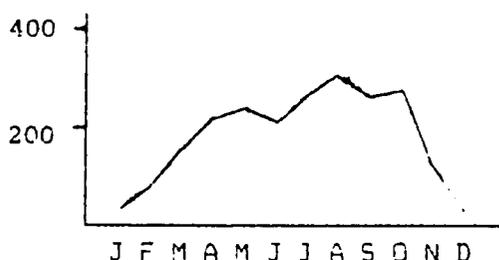
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<sup>3</sup> E. Westphal et al. 1985. Cultures vivrières tropicales avec référence spéciale au Cameroun. Wageningen, The Netherlands: Pudoc.

ngouba, since Meme farmers have not settled or planted above 700-800m elsewhere.

Large and small rivers flow throughout the division, providing space for dry-season farming and hindrances to travel and communication. The rainfall probably only drops below 2300mm per year (the Kumba Town average) along the Fako border, rising to about 3600mm on the eastern and western sides and perhaps 3000mm in the north. The rains start about mid-March and continue through October or later, with a peak in August and no mid-season break; there is a slackening in June around Kumba but it is not considered sufficient to dry a maize harvest.

Chart 2: Monthly Rainfall Variations in Kumba Town



(Source: National Meteorological Service data 1928-70)

Except for the Buea-Kumba road, there is no tarmac in Meme, although the continuation Kumba-Mamfe was prepared for tarmacking up to the Supe Escarpment in 1986-7. In dry season most of the division is accessible by most vehicles. Mt. Koupe, behind the entry town of Tombel, needs a high chassis and usually four-wheel drive. Upper Mbo, the eastern part of Nguti Sub-division, has no roads at all and the people usually trek to Western Province. The scattered small villages on Mt. Cameroon have roads which require lengthy detours through Ndian Division, and the little-populated border region between the Korup National Forest and Nguti-Supe has few and rough roads. In rainy season, the mud makes Koupe, Bangem and important cacao areas in the Kumba Corridor inaccessible for days or even weeks at a time, and similarly blocks the Mamfe road which passes through Supe and Nguti.

Large rubber estates, mostly owned by the Cameroon Development Corporation, only take up a small portion of the area, primarily in areas west of Tombel, west of Mbonge and south of Kumba. A much larger proportion of the agricultural land - two-fifths of the land in use - has been put into cacao (25%) and coffee (15%). This rises to 47% in the Kumba Corridor, creating shortages of land for food crops.

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" Rainfall data is only available for Kumba Town and environs, Tombel, and Ekondo Titi (Ndian, on the border). These estimates are partly based on observation and discussion of local conditions relative to the nearest sites with data outside the division.

Urbanization also creates land shortages, and varies around the division. 27% of Tombel Sub-division is packed into the town of Tombel. Although this includes a sizeable non-farming contingent, farms in the immediate environs are overutilized and plagued with pest build-ups. Kumba Town accounts for 16% of Kumba Central's population, and there are large urban clusters at the council seats of Konye and Mbonge. Nguti Sub-division has two large urban concentrations around major hospitals and schools, at Nguti and Manyemen, amounting to 15% of the population. Bangem Centre contains only 9% of its sub-division's population, with no other urban clusters.

Meme has many indigenous groups - Bafaw, Bakossi, Bassossi, Balong, Bakundu and Barondo - all of which, except the Bakossi and the Bassossi, are settled throughout the region. Each village and town has a primary ethnic identification, but 51% of settled farmers are from outside the Division, and 8% more from outside their own ethnic villages inside Meme. Households are usually based on a couple and their children, and the children's education is prized above any advance in agriculture.

## 2. Agro-ecological Zoning:

Agro-ecozones are sub-regions that are sufficiently distinct from one another in their farming goals and methods that they should be considered separately in deciding on appropriate technology and extension. In the Meme survey, six zones were delineated, with an estimated 85% of the farming population: the Kumba Corridor, a settled cocoa zone with 10,450 farming households; Mount Koupe, a fertile forest zone with 2,500 farming households; Bangem, a highland coffee zone with 2,100; Supe, a pioneer cocoa zone with 1,800; the Sands zone (a continuation of Fako's), a sandy sedimentary, primarily lower-rainfall zone with 1,100 farming households in Meme; and Nguti, a zone focused on hunting and urban concerns, with only 650. Areas omitted from the survey are Upper Mbo (1,250 households), the northern Rumpi Hills (800) and the variable north slopes of Mt. Cameroon (1,300), part of which should probably be classified with the Kumba Corridor.

**The Kumba Corridor:** The Corridor stretches from around Ebonji in Tombel Sub-division, through Kumba itself, west to Mbonge on the border with Ndian Division, both Ebonji and Mbonge being transitional areas. From Ekombe Three Corners, it stretches northwest almost to the Ndian border beyond Big Ngwandi, and south towards Mt. Cameroon as far as Barombi Koto. After Barombi Koto, the transport becomes sufficiently poor that fewer people have sought or stayed in the area for settlement. The soils are of volcanic lava origin, recent to old, dark brown to brown clay, not too acid, with half the nitrogen levels of Fako Division's volcanic zones but twice that of the Sands (see Table 1). They vary in permeability and ease of tillage, being worst in areas around, and to the south of, Ekombe. Kumba Town has farming areas of sandy sedimentary soil intruded from the Sands zone to its south. The annual rainfall at the Town averages 2300mm, but it becomes higher towards both the eastern and western borders, Lobe Estate (just beyond Mbonge) averaging 3600mm and Tombel Town 3700mm.



The most characteristic trait of the zone is the occupation of most of the arable land by long-established cocoa and coffee plantations owned by individual small farmers. Food crops are usually located within or on the borders of tree fields, fallows are short or non-existent, and farmers worry about future access to land for food. There is no unallocated land, and the villages almost touch one another along the roads.

Table 1: Average Soil Characteristics on Farmers' Food-crop Fields at Survey Sites in Meme Division, 1987<sup>a</sup>

Zone	No. Sites	pH (H <sub>2</sub> O)		% Organic Carbon		% Total N		Available P		K <sup>+</sup> meq/100g	
		r	m	r	m	r	m	r	m	r	m
Kumba Corridor	9	4.6-6.5	5.3	1.77-3.46	2.48	.13-.32	.21	1-40	11	.05-1.03	.23
*inside cocoa fields <sup>b</sup> :	4	5.3-6.5	5.8	1.83-3.46	2.50	.20-.32	.24	11-40	23	.05-1.03	.24
*other food fields:	3	5.0-5.1	5.1	2.33-3.36	2.71	.17-.24	.20	1-4	2	.05-.25	.13
Koupe	4	4.3-5.9	5.3	4.91-9.56	7.38	.41-.92	.73	9-18	12	.38-2.78	1.68
Bangee	4	4.7-5.3	5.1	2.61-5.12	3.72	.16-.35	.27	2-4	3	.23-.90	.54
Hgutl	3	4.4-5.0	4.6	2.00-3.93	2.35	.21-.30	.24	2-24	12	.06-.13	.10
Supe	5	4.3-5.6	4.9	1.76-3.25	2.53	.13-.29	.21	5-17	8	.09-.26	.19
Sands	3	5.2-5.8	5.5	1.10-2.12	1.68	.09-.13	.11	6-7	6	.02-.43	.18

The zone has attracted many immigrants throughout the century, due to its central location along the Ekondo Titi-Loum road and around Kumba Town, the crossroads with the Buea-Mamfe road. Most have come from the highlands to find land to grow cash crops; some still have wives farming food crops at home. So maize and groundnuts are more important than in any other Meme zone, and cassava, which is considered by many exhausting to the soil, is cropped less and at low densities. Cocoyams<sup>c</sup> and plantains suffer more from root rot and borers than in less heavily used zones, and are planted less than the farmers would like. Yams and fruit trees are grown by many for home consumption. Coffee is being gradually abandoned in favor of cocoa, which does not

<sup>a</sup> r=range, m=mean, P test is Bray-2 (ppm).

<sup>b</sup> Excluding coffee fields.

<sup>c</sup> Throughout this report, the word "cocoyam" refers only to Xanthosoma sagittifolium, while the word "taro" refers only to Colocasia esculenta.

require fertilizer to produce. Half combine farming with commerce, whether petty trading or dealing in cocoa or beer.

The typical food field is less than a thousand square meters, surrounded by the owner's cocoa trees, the latter interspersed with some plantains and fruit trees. All the other food crops are mixed together on beds about 20cm tall, built over weeded grass piles. There may be a principal crop, maize or groundnuts or cocoyam or taro; but it is almost always accompanied by substantial amounts of several of the others and cassava and/or yams, so that half or more of the cropping area is devoted to the other crops. Exceptions are often the smallest fields: dust-smothered patches between road and cocoa farm, or heavily shaded spots scattered throughout the cocoa farm. The food fields are more acid and lower in phosphorus and potassium than the cocoa fields.

**Koupe zone:** The Koupe zone stretches from the environs of Tombel Town, north around the lower slopes of Mt. Koupe, from about 400-800m altitude. The zone ends at the border with Bangem Sub-division, where the soil changes quickly from Koupe's deep loam to a harder, poorer clay loam. Both are volcanic, but Koupe's soil is pyroclastic (derived from eruptive material), and is extremely high in organic carbon, nitrogen and potassium, as well as extremely tillable and permeable enough to reduce the incidence of the cocoyam root rot. The upper reaches of the mountain go unused; according to an old soils survey<sup>a</sup> they are not covered with volcanic material and their soils are granitic. Rainfall is high (3700mm at Tombel) and continues most of the year.

Koupe would be one of the major farming areas of the province if its roads were better, but as it is many people have moved away to find jobs or even farms in less fertile, more accessible areas. Those who remain concentrate their efforts on the highest-value crops - not only cocoa and coffee, but cocoyams and plantains. Tombel Town itself is an anomaly; its special status as a Sub-divisional and military headquarters has given it a very dense population, a localized land shortage, relatively lower fertility, and major pest and disease problems. Elsewhere, fallows are long and land preparation methods leave tall shade trees on the principal farms, where cocoyams, taro and plantains are planted over several thousand square meters. Smaller plots inside cocoa/coffee farms or near the villages are cleared to cultivate a little maize and cassava, usually on the flat.

**Bangem zone:** The Bangem zone covers most of the inhabited part of Bangem Sub-division. It ranges from 300 to 1700m altitude, with farming villages located almost up to the crater lakes below the summit. The soil is of volcanic origin, mostly lava flow, weathered into a reddish-brown clay loam somewhat higher in nitrogen and organic carbon than Kumba's, high in potassium but very deficient in phosphorus. There is no rainfall data, but local reports indicate a pattern similar to Koupe's, with good rains from March to November. Because of the altitude, coffee is the principal cash crop, and is pruned and

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<sup>a</sup> Food and Agriculture Organization, The Soils and Ecology of West Cameroun, v. 1. Report to the Government of Cameroun. Rome: FAO. 1965.

weeded with great care, although seldom fertilized due to the difficulty of bringing fertilizer into the villages.

Bangem is cut off from the major markets by its roads, which lead only to Melong (Littoral Province) and usually degenerate into mud too slippery to pass during much of the rainy season. The adolescents and young adults have abandoned the region for urban employment, leaving behind families of young children and middle-aged to old farmers. Those who are left concentrate on their coffee, and enough food to feed themselves; sales of produce are lowest in the Division.

Food fields are usually over a thousand meters square and separate from coffee, and although farmers complain that they lack land, there is much land in fallow and fallows are long. However, disease and pest problems in cocoyams, cassava and maize have been increasing over the years, and the inhabitants are badly worried about land quality. Food fields are usually planted on a type of mound-bed that is characteristic of the area, about 40-60cm tall and about 2m across, with a wide variety of crops on the top and sides of each mound - usually maize and/or cassava, taro and cocoyams, often with some beans, yams or potatoes. Irish potatoes are a recent innovation and doing well so far, but sweet potatoes are still preferred. Plantains and bananas are planted bordering coffee fields or scattered through food fields.

**Supe zone:** The Supe zone stretches from around Ikiliwindi north to Babensi along the Kumba-Mamfe road. In many ways, it represents the past of the Kumba Corridor. It is a pioneer zone to which departed adults and newly educated youths are returning to join in family efforts to clear and plant as much of the forest as possible to cocoa. The soils presently being used are mostly pockets of recent volcanic lava origin, similar to Kumba's. However, the soils onto which people are beginning to extend seem to be largely of granitic origin, more acid, gravelly reddish sandy clay, and less fertile\*. Rainfall is probably around 2500mm annually.

Because of the concentration on cocoa, most food crops are grown either as the first year of a new cocoa field just cleared from forest, under partial shading left for the cocoa, or as small internal fields to cocoa, or on the silt of river banks during the December-February dry season. The latter lambda fields allow the woman to concentrate on food crops at a time when the cocoa labor requirements are least, but they can only be used for short-cycle crops like cowpeas, groundnuts and maize. The small internal fields are planted as in Kumba, on beds with mixtures of maize, cassava, cocoyams, taro and beans or groundnuts. The new fields, which may be several thousand meters square, are planted on the flat, mostly to young cocoa seedlings, cocoyams, taro, plantains and bananas. The plantains are die young and are replaced by bananas, which don't. The cocoa is planted late and only begins to establish itself after the cocoyams have been harvested. Bush animals damage crops as in Nguti, but not as severely, perhaps because there are many more fields rela-

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\* The region is unmapped except for tentative classification by aerial photography. Nguti does not even have the latter.

tive to forest cover.

**Sands zone:** The Sands zone in Meme is divided in two by the variable volcanic strip between the Kumba Corridor and Mt. Cameroon. One part, the continuation of Fako Division's Sands zone, goes from the Fako border to Ediki and over to the Littoral border. The other, continuous with the Ekondo Titi zone to be classified in the Ndian Division report, lies just south and east of Mbonga. Sands (II) is farmed similarly enough to Sands (I) to be classified with it for this report, although I (South Meme) gets much less rain, about 2000mm compared to Ekondo Titi's 3600mm. But the rains in Ekondo Titi come in April, later than in non-Sands zones in Meme. The two subzones also make up about half of the Mbonge Rural Council (and Cooperative) area. Both have sandy clay loam sedimentary soils, with about half the nitrogen and organic carbon of the other zones.

Sands farmers have cocoa farms, but most of their food fields are kept separate from these. Food fields are large (several thousand square meters), unshaded and planted on mounds or sometimes beds. Cassava and plantains are the most important crops, except among the few major commercial yam farmers that dot the zone. Plantains are usually associated with the cocoa, or cocoyams and taro. The cassava, at relatively low densities, is planted with first-season crops of maize, taro and egusi or groundnuts. Yams are planted before the other crops, and egusi and maize are added. Economically, because of the cassava and yams, Sands farmers make twice as much out of food crops as any other zone, making more even when the commercial yam farmers are excluded. The same was found to be true in the Fako Sands zone; yet Sands soil is poorer and extension services in these zones are usually delegated to untrained demonstrators.

**Nguti zone:** The principal distinction between Nguti and the Supe zone to the south is in the goals of its inhabitants. Most of the young and middle-aged men in Nguti zone are in the towns, either working in local government and hospital jobs or in urban jobs elsewhere. Most of those who are left are more interested in hunting than in farming. The urban people with farms tend to plant cocoa for old-age provision, and to depend on other income to buy food from outside the zone. Those who do try to grow food discover that bush animals eat or destroy the great majority of it, because their fields are so isolated. Perhaps because of this, they overplant their fields at incredibly high densities, intercropping cassava, cocoyams and taro, or maize and groundnuts, on beds or mounds. Food fields are usually under a thousand square meters, and may be associated with the cocoa fields or separate. Plantains are placed either in cocoa farms or with cocoyams and taro. The soils are unmapped; they seem to be transitional between older volcanic and granitic, as in Supe, with farming occurring on both. During the survey the volcanic soils were found around the villages along the Mamfe road, and the granitic soils in the eastern interior.

### 3. The Farming Households

Meme farm families are large, with an average of 6.9 residents per household<sup>10</sup>. A third are composed of couples with young and adolescent children, 45% of these couples providing homes also to nephews, nieces, younger siblings or grandchildren of absent parents. Almost a third are couples with extra adults to help out - 40% of these being their grown children, and the rest siblings, parents and others. A sixth are headed by single or widowed women, 40% of these with the help of an adult male child or relative, and only 3 households (2.8%) by single or widowed men, all with an adult female present. 8% are polygynous, most with several extra adult siblings or children as well as the husband and 2-3 wives. 7% are composed of adults only: 4 couples, 2 single women and one man living alone, a pair of women, and six orphaned brothers living together. In total, 70% of households are headed by a married couple, 18% by women alone, 4% by men alone, and 8% by a husband and several wives. 18% have an adult or adolescent member who cannot (or refuses to) work. 12% have released an adult or adolescent child for full-time study; that is, almost all children over the age of 10 contribute to family labour, if only during holidays and weekends.

Almost half of Meme farmers (49%) are natives of Meme Division, with 41% of all farmers being from the ethnic group to which their village belongs. The Bakossi are the largest group (24%). The rest are from North West (18%), West (13%), Manyu (7%), Ndian (6%) and Nigeria (6%). Male farmers have been in their villages an average of 29 years, women 19. 45% are Presbyterian and 42% Catholic; 7% go to no church at all.

Two in five households (40%) have some non-agricultural way of earning cash. 11% are in the formal sector, as labourers, cooperative storekeepers, teachers at primary and one at technical level. 28% have their own businesses or informal employment - from makers and vendors of puf-puf balls to artisans of all types to licensed buying agents of cocoa and coffee. The middle sector of artisans, school teachers and village off-licence owners (beer and liquor retailers) predominates, with 30% of all households involved. Low-income work such as labourer and street vendor (7%) is limited mostly to Kumba Town, and high-income traders and a professor (3%) to the Kumba Corridor and Nguti Town.

Present-day farmers are not well educated: the men have an average of 4.6 years of schooling, the women 3.3 years (almost always less than their husbands). But their children are going into secondary school and even university: for all households with a child of 10 or older, the child who has schooled longest averages 8.8 years, and many are still in school. In fact, 76% of all adolescents (aged 10-19) and 54% of all children under 10 were in school at the time of the survey.

At the same time, the adolescents contribute considerably to farm labour - particularly at peak seasons of weeding (usually May-July) and cocoa drying (September-November). At the family's busiest time of year, an average of 24 person-hours are put into farm work every day, 34% by adult men, 37% by women,

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<sup>10</sup>including dependent children who return weekends and holidays from school.

11% by male adolescents and 13% by female, 3% by male children and 2% by female ones. In households where they are present, men put in 9.0 hours and women 9.2; male adolescents 4.9 and female 5.7; boys 1.3 and girls 2.9. Children's work is often specified as limited to carrying food and produce between home and farm. Processing time varies greatly in the year; men and their sons (rarely women) sit up all night turning the drying cocoa seeds at the peak time, and responses to the questionnaire varied enormously according to whether the respondent recalled that time or the time when farm activity was at peak. Due to the cocoa drying, males claimed 44% of the processing burden, a percentage which is doubtless too low for cocoa season and much too high for the rest of the year.

Families average 2.8 adults (20 and over), 2.1 adolescents, and 2.0 child under 10. 50.6% of the household population is male, with male adolescents and children outnumbering females slightly and adult women outnumbering men 6 to 5. Some of the adolescents and newly adult sons and daughters are away at schools in Kumba and elsewhere, sustained by the family and working weekends and holidays. Schooling for the children is a primary goal, having the first claim on family income, and this is probably why so many older adolescents are still tied to the family. However, in the forest areas outside the crowded Kumba Corridor, educated young people are also returning home to take up farming, either with parents or on their own. Only in Bangem, with eroding land and severe isolation, is the rural exodus obvious.

The zones display certain significant differences (see also Table 2):

1. The Kumba Corridor attracts more dependent adolescents sent by outside relatives, possibly to look for work, and also has more families with an outside occupation and more mid-level ones. It has all the Western Province families in the sample (although Tombel area contains Westerners also), and very few natives<sup>11</sup>. Perhaps because of the Westerners, the Catholics outnumber the Presbyterians.

2. Koupe families have fewer adolescents, more incapacitated members, lower education levels, and fewer off-farm income opportunities; besides a sizeable group of Grasslanders<sup>12</sup> (35%), 25% are Upper Bakossi from Bangem. Koupe is a Lower Bakossi area.

3. Supe has larger families, because more adults stay or return to help with the clearing of new forest fields; educational levels are high, but most are in farming only, and from their individual villages' ethnic groups (Bakundu, Bafaw and Upper Balong).

4. Bangem is populated by older, smaller nuclear families from which adoles-

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<sup>11</sup> In South West, "natives" are those descended from the ethnic group that founded the village. Everyone else is a "stranger", whether a new immigrant or fourth-generation resident, from 5km away or another country.

<sup>12</sup> The Grasslands are the highland savanna region of North West and West Provinces.

cents and young adults have departed; all are natives, and there are very few outside income opportunities.

5. Nguti has smaller families with fewer non-adults and twice as many adult women as men; there is little outside income, and while the few men (mostly in Nguti Town) have high educational levels, the women tend to be older and illiterate and the children have less schooling as well. Two-thirds are natives (Bassossi and Upper Balong).

6. The Sands also has more adults, but added to larger families; parents' education levels are very low, but the children's are high; a third are Grasslanders and less than half native (Bafaw and Bakundu).

Nigerians are concentrated in the Kumba Corridor with a few in the Sands zone. Manyu natives are found in Kumba and Nguti, and Ndian natives in Kumba and Supe.

Table 2: Demographic Data Varying by Zone (% of households)

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Meme
Family type:							
couple and own children:	9%	25%	54%	20%	20%	20%	17%
c. & other dependent ch:	24%	5%	0%	13%	13%	7%	16%
Family size:	7.1	6.7	5.7	5.6	7.5	7.3	6.5
No. of adults:	2.8	2.7	2.4	2.0	3.9	3.3	2.2
Ratio child:							
adolescent:	.3	1.4	1.2	.9	1.2	1.1	1.1
W/ incspacita-member:	19%	30%	20%	20%	7%	7%	18%
Outside earnings:							
none:	47%	75%	93%	80%	73%	53%	60%
mid-level:	39%	20%	7%	7%	27%	27%	30%
Origin:							
NW/W Prov.:	45%	35%	0%	13%	0%	33%	31%
Meme Div.:	25%	65%	100%	80%	87%	47%	49%
Village grp:	12%	65%	100%	67%	80%	47%	41%
Schooling (years):							
husband's:	4.6	3.8	4.8	5.1	4.9	2.7	4.6
wife's:	3.6	3.1	3.3	2.3	3.5	1.9	3.3
best child:	8.8	8.1	8.9	7.7	10.0	9.7	8.8
adolescents in school:	72%	84%	78%	79%	80%	87%	76%

#### 4. Land:

Most land access in Meme Division is through ownership, whether by purchasing or indigenous right to village lands. 9% of farmers have no such permanent access to any farm: a seventh in the Kumba Corridor, a tenth in Koupe and 7% in the Sands zone. 3% of Meme natives and 14% of strangers have only temporary access to land; only 4% of natives but 34% of strangers combine permanent and temporary access. 19% of all farms are used on a temporary basis: a quarter in Kumba, where they are rented, given or pledged<sup>13</sup>, a fifth in the Sands, where they are usually rented, and an eighth in Koupe, where they are

Table 3: General Characteristics of Meme Fields by Zone

	Kumba	Koupe	Sangem	Nguti	Supé	Sands	Meme
% farmers w/:							
cocoa	85	55	0	73	100	87	73
coffee	45	65	100	57	50	33	56
neither	15	25	0	20	0	13	13
% growing food inside trees							
>5 yrs	52	40	13	30	64	8	44
Mean no. of farms:	3.1	3.2	3.7	2.7	3.1	3.1	3.2
Mean size <sup>14</sup> (m <sup>2</sup> )	3.300	2.500	2.900	2.700	3.300	3.200	3.100
Mean dis- tance <sup>15</sup>	49	49	32	40	41	54	45
% field type:							
I	21	20	24	31	41	32	26
II	25	25	7	10	17	4	18
III	53	28	69	58	37	64	50
IV	1	27	0	3	4	0	6

<sup>13</sup> Pledging is an arrangement in which a farmer loans money to the owner of an established tree farm, and gets to use the farm as if it was his own until the loan is paid back at an agreed time. The practice provides old-age security for people who developed their cocoa farms in earlier years and have no energy or resident children left to farm them themselves.

<sup>14</sup> Estimated by weeks required for first weeding, times an average 600m<sup>2</sup> per week weeding area, times 1.5 for Type I and III fields and times 3 for Type IV; see section C.

<sup>15</sup> Minutes from home (trekking).

usually given by natives in return for a freely offered, small portion of the harvest. A few farms in Nguti and Supe are also on loan or rent.

Most agree that land used to be easier to obtain when they started farming than it is now. But 22 farmers - including 14 from outside the province (38% of all non-SWP farmers) - claim that access is now easier, probably because of the difficulties created for immigrants during and after the Troubles of the 1970's in Koupe and Kumba.

Only an eighth of Meme farmers, mostly in Koupe and Nguti, have neither cocoa nor coffee farms, and over half plant food crops inside these after they have matured. (see Section E. 1 for details). Fields were classified into tree farms (Type I, 26%), tree farms with internal food fields (Type II, 16%), open food fields (Type III, 50%, possibly including some from Types II and IV) and forest food fields (Type IV, 6%). Average farm size is 5.8 weeding weeks in Type I (about 5,200m<sup>2</sup>), 5.6 in Type II (about 3,500m<sup>2</sup>), 2.8 in Type III (1,700m<sup>2</sup>), and 2.4 in Type IV (about 4,300m<sup>2</sup>) - an overall average of about 3,100 m<sup>2</sup>. A tenth of all farmers (15% in Koupe and none in Nguti or the Sands) have only Types I and II. There are an average of 3.2 farms (1.2 tree farms and 2.0 food farms) per household. The range is from 1 to 7 farms, with 78% between 2 and 4, and 0 to 5 food farms.

Only a few farmers, in Kumba and the Sands, believe that the land has maintained or improved its productivity. Farmers claim to fallow food fields as many years as they cultivate them, ranging from a ratio of .7 fallow to cultivation years in Kumba to 1.3 in the Sands, 1.5 in Nguti and 2 in Bangem. But in Kumba, where 19% claim not to fallow, 35% of Type III and IV fields over 4 years old have never been fallowed; in Koupe, where 7% claim not to fallow, 27% have never been fallowed; in Bangem (where none claim not to, but 10% do not fallow), the average fallow time of actual fields is 2.8 years whereas the claimed practice averages 4.7 years.

Overall, compensating for fewer and shorter fallows, the true average is probably about .7 fallow to cultivation years division-wide. Since only natives have free access to open lands, slightly more natives (79%) than strangers (76%) fallow, and their fallow-to-cultivation ratio is 30% higher than the strangers'. Fallow time does not directly relate to soil fertility or even pest and disease build-up; one Kumba field visited has been in continuous use for forty years, with incorporation of weeds and annual rotation between maize-groundnuts and cassava, and is still relatively pest- and disease-free and among the most fertile tested in its zone.

Most farms are quite distant from homes, an average 46-minute trek throughout Meme, from 54 minutes in the Sands zone to only 32 in Bangem. Forest food farms are the furthest - 60 minutes - and open food farms the closest, at 41 minutes. 34% are an hour or more away, an equal number between a half hour and an hour.

## 5. Labour:

All family members (except for the infirm, a few adolescents and most of the children) help in the farmwork, and most adults and adolescents help with processing - cooking, making garri, drying cocoa beans. According to reported hours of work in their busy season, the majority of work is done by the adults (59% of farmwork and 57% of processing) and by the women (51% and 54%). However, individual men work longer hours than individual women in farming, because the women have housework as well. During the cocoa harvest, men work much longer hours, staying up all night to turn the drying beans, but normally the situation resembles Bangem's, where women do almost three-quarters of the processing, as well as drawing of water, child care and cleaning. In Koupe and Supe, where there are fewer adolescents, two-thirds of the farm labour is adult, and in Nguti, where there are few men and many of the women are aged, less than a half is.

Adults work a six-day week, taking Sundays off, and adolescents help several days a week or on Saturdays, in the busy season. Children usually help with some weeding and by carrying food and harvested produce.

Table 4: Hours of Work per Person-day (Busy Season) by Age, Sex, and Zone

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Meme
<b>Farming:</b>							
Men 20+yrs	6.7	5.5	6.0	5.8	6.2	6.6	6.4
Women "	5.8	5.3	6.4	5.6	5.6	7.1	5.9
Boys 10-19	2.6	2.3	3.5	3.4	2.1	3.3	2.6
Girls "	3.1	2.4	3.3	4.2	2.9	4.7	3.1
Boys <10	0.7	0.4	1.3	0.4	1.2	0.4	0.8
Girls <10	0.5	0.3	1.3	0.5	0.4	1.0	0.6
<b>Processing:</b>							
Men 20+yrs	2.8	1.3	0.9	1.1	1.9	1.0	2.1
Women "	2.5	2.2	2.4	1.6	2.6	2.4	2.4
Boys 10-19	1.1	0.5	0.8	1.1	1.0	0.9	1.0
Girls "	1.3	1.5	1.6	2.1	1.2	1.7	1.4
Boys <10	0.0	0.3	0.4	0.1	1.9	0.1	0.3
Girls <10	0.1	0.3	0.5	0.4	0.1	0.1	0.2

Clearing is most commonly done by husband and wife together, with husbands helping least with open food fields (Type III) and wives least with pure tree fields (Type I). Husband and wife usually plant and weed together, but Type I fields are often planted and weeded without the wife and Types III and IV (forest food fields) without the husband. Wives almost always help harvest all fields, whereas husbands often do not help in food harvests. Customarily, men harvest plantains and oversee and participate in tree-crop harvests, while women act as labour in the tree-crop harvests and harvest all other crops. Because women usually participate in the highly labour-intensive cocoa harvest (peaking in September to November), both in the field and at home splitting

open the pods, they sometimes plant smaller food fields second season, or in Supe, concentrate on a December lamba (river bed or swamp) planting.

Adolescents help to harvest half the fields (primarily tree-crop), and help in weeding over a quarter (more in the food fields). Children help in over a quarter of fields in both weeding and harvesting.

Paid labour is used primarily in weeding (32% of fields) and clearing (29%) but also in tree-crop harvests (30% of Type I and II fields and 5% of others) and occasionally planting (3%). As many food as tree fields are cleared with paid labour, but it is used for weeding in 60% of tree fields and only 11% of pure food fields.

Meme farmers join in njanggi groups, in which they take turns working with each other on their farms, paid by the exchange labour and food and drink. Njanggi is used for weeding in 33% of fields and for all other operations in 14%, being most important in clearing forest fields (45%, primarily because these fields are concentrated in Koupe, where njanggi is more common than cash payment), general weeding, planting of food fields (18% of Type III) and harvest of tree crops (25% of Types I and II but only 4% of Types III and IV).

Overall, tree fields are the responsibility of the husband, helped by the wife, but the entire family as well as paid and exchange labour are recruited for weeding and harvesting. Food fields are the responsibility of the wife, helped by the husband and their children, with assistance from paid and exchange labour at clearing and principally exchange labour at weeding time.

Labour bottlenecks - months when the farmers claim there is too much work for them to handle adequately - occur in March (mentioned by 39% of farmers) and October (33%) with a quarter also mentioning July, August, September and November. March is the planting month, including bedding and mounding; only in Nguti do they emphasize also the clearing months of January and February. July and August are heavy weeding months for most crops - perennials, roots and tubers and plantains - made more difficult by the torrential rains. September combines the start of the major cocoa and coffee harvesting with the smaller second-season plantings; the harvesting only slacks off in December. Bangem harvests its coffee mostly in January to March, but only regards March and November (a weeding month) as difficult. The easiest months are May (13% complaining of it) and December (10%).

Faced with such bottlenecks, almost two-thirds of the farmers pay labour-three-quarters in Kumba, Supe and the Sands zone, under a half in Koupe and Nguti, and a quarter in Bangem. Over a third use njanggi - almost all in Bangem, half in Koupe, Supe and Nguti, and a fifth in the Sands and Kumba. Only 9% regard taking the children from school as an option, and 8% simply over-work. Labour payments are the major cash expenditure in agriculture, as will be seen in the next section.

## 6. Cash Flow and Input Use:

Meme farm families need cash at several key times of year - the opening of schools in September, the cocoa harvest (September to October), land clearing (December to February) and Christmas/New Year (December). Money comes in when the cooperative makes its cocoa and coffee payments, during harvests of plantains (generally March to October), cassava (March to August), cocoyams (year's end, or March to August for Koupe), and yams (October to December), and gradually throughout the year as other crops and an occasional animal are sold, or through salaries, off-licences, taxi-driving or street selling.

Table 5: Average Household Crop Sales and Other Income Sources, by Zone

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Meme
Food crop sales (FCFA) <sup>16</sup> :							
plantains	71.800	107.200	25.500	61.100	72.100	70.200	69.500
cassava	24.200	23.300	41.300	23.700	30.300	111.600	31.000
yams	54.100	0	7.900	-	5.000	289.900	51.100
cocoyams	20.400	100.900	3.900	2.400	60.100	7.900	28.300
taro	6.100	22.100	39.600	12.300	57.600	20.800	18.400
maize	15.500	15.300	18.800	5.700	6.900	13.300	14.300
groundnuts	6.300	5.500	0	1.700	7.600	4.200	5.500
bananas	(500)	-	-	(82.500)	(13.400)	0	6.900
egusi melon	2.700	0	0	-	0	20.100	2.700
Tree crops:							
% with cocoa	85	55	0	73	100	87	73
coffee	45	65	100	67	60	33	56
neither	15	25	0	20	0	13	13
Non-farm income:							
% mid/high level	43	20	7	20	27	27	33
% low level <sup>17</sup>	10	5	0	0	0	20	7

- few cases, all with missing data  
( ) insufficient cases for confidence

61% reported that in 1986-87 they needed what they regard as a large amount of cash for school fees - from 80% on Koupe and 63% in Kumba to only 40% in Bangem and Nguti (which have fewer children). 57% needed cash for agricul-

<sup>16</sup> See Section C for derivation of production totals. These were costed at the mean prices reported for sales in the survey: maize 1300fr/tin, cassava 4800fr/truck, cocoyam 2355fr/basin, taro 1300fr/basin, plantain 965fr/bunch, banana 570fr/bunch, yam 485fr/medium tuber, groundnut 2315fr/tin (shelled), and egusi melon 2120fr/tin.

<sup>17</sup> Labourers or petty sales.

tural labour, from 30% in Koupe (which depends on njanggi) and 47% in Nguti and Bangem to 63% in Kumba and 73% in Supe and the Sands zone. 12% more-only in Kumba, the Sands zone and Koupe - had other agricultural cash needs, 2% for inputs (chemicals, seedlings) and 3% for land rental or pledging. 28% needed extra money at Christmas, when gift-giving is often merged with once-a-year restoring of clothing and household equipment.

4% (in Kumba and Koupe) mentioned needing money in certain months to buy food. Two-thirds buy some of the foods they grow in some months; most buy rice year-round (77%), and garri (50%) when they don't want to make their own. The months of May to August are most often mentioned as food-scarce, but only by 11-13% each, and no month is mentioned by less than 4%.

Reports of the sources of this cash are confused between immediate and ultimate sources. 33% get cash directly from cocoa/coffee sales, 31% from food crop sales, and 8% from off-farm earnings. 14% can be traced directly to cocoa/coffee: 10% in loans from the Licensed Buying Agents (cocoa intermediaries) and 4% in Cooperative loans. 34% take money from "meetings," the village-based mutual aid societies. 8% borrow from a friend, and 3% from a bank or Credit Union<sup>19</sup>.

Average farm labour payments for all Meme are 100,000 francs CFA - 125,000 francs for the 78% of farmers who pay labour. Labour costs are under 30,000fr in Bangem, Koupe and Nguti, but reach 75,000fr in Supe (94,000fr for payers), 141,000fr in Kumba (160,000fr) and 143,000fr in the Sands zone (165,000fr).

Farmers were asked if they had saved/borrowed what they considered a large amount of money to use to improve their farms. Answers usually related to labour costs of annual operations, but included some land acquisition, chemical and equipment purchases. 51% responded, averaging 265,000fr: 55,000fr in Bangem, 330,000fr in Kumba, and between 145,000 and 170,000fr elsewhere. 85% borrowed some or all of the amount: 49% in local meetings, 23% from LBA's, 5% from cooperatives and 3% in Credit Union saving/borrowing schemes. 47% saved: 25% in meetings, 21% in banks and 3% in a Credit Union.

Few Meme farmers use purchased material inputs on their crops, other than insecticides and fungicides provided by the Ministry of Agriculture or cooperative for their tree crops. Two Koupe farmers once put Ammonium Sulfate and N-P-K 20-10-10 on cocoyams and plantains, and two Bangem farmers, one Koupe and one Kumba one used them on coffee within which food was planted. The Koupe farmers felt the fertilizer hurt the cocoyams and plantains, reducing yields and increasing vegetative growth (not surprising given the high N content of their soil). The questionnaire did not ask about fertilizer use on tree crops alone, although one farmer mentioned he put it once on some pure cocoa and one, on coffee. No field with tree crops visited had ever had fertilizer applied.

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<sup>19</sup> Figures add up to more than 100% because many have several sources. No-one relies only on a bank, 1 person on a Credit Union, 3 on the cooperative, and 6% on the LBA's.

Insecticides are used by one Koupe farmer (a powder, probably Gamaline, in planting plantains), by 19% of Kumba farmers (5 using Gamaline powder on maize against stem borer and one on groundnut against snails, and one professor using Nemacir on plantain), two Supe and one Sands zone farmer (all using Gamaline on plantain suckers). Gamaline was popularized by the Phytosanitary Brigade at Mambanda and is now brought in illegally by traders from Nigeria; the farmers do not realize that it is almost as toxic to them as to the insects, and handle it with bare hands, and without knowledge of proper amount, timing and location of dosage.

Farmers were asked what chemicals and tools they would want to buy if such were readily available in the nearest council seat. At present even simple tools are difficult to get - 54% want cutlasses, 38% hoes, 26% diggers, 10-15% the more specialized sprayers, files, axes and spades, 8% wheelbarrows, 5% engine saws (for clearing) and 4% hand-trucks. Cash crop chemicals are provided in only small amounts to a few farmers by the Ministry of Agriculture for trial, and little more is provided on payment basis through the cooperatives. Fertilizer supply is small, all through the cooperatives, but the demand is low. There are six farmers' cooperatives, all for cocoa-coffee, in Meme, one each in the Sub-divisions plus in the Mbonge and Konye Councils.

Most farmers wanted chemicals, of the most varied types, for everything from destroying tuber and root rots to borers, ants, capsids, snails and wild animals, trees and grass. The most popular, again, was Gamaline (25%). At this point chemical training seems to be more necessary than chemical provision to Meme farmers, as very few have an adequate idea of their uses and abuses. There is much more present concern with crop protection against destruction than with initial yield improvement. Farmers are willing to pay for the former but not the latter.

## 7. Extension:

The Ministry of Agriculture in Meme Division has 16 Agricultural Posts, including the four Sub-divisional offices: Kumba, Mbonge, Match, Konye, Kwakwa and Bai Grass; Tombel, Nyassosso, Ndom and Ebonji; Bangem, Nkack and Muambong; and Nguti, Ntale and Ediango. The survey visited villages under 14 of these posts, including 4 town quarters served by Sub-delegation offices, 2 villages with Agricultural Posts, 8 with posted VEW's (Village Extension Workers: demonstrators with no formal training beyond short courses), and 10 served by posts or VEW's elsewhere. Three of the villages to which VEW's had been posted had not seen the man for at least a year.

Three-fifths of the villages are served by technician-level staff. Some technicians and VEW's are active with the farmers, for both cash and food crops, and eager to learn more; others were interested only in the cash crops and/or seldom visit farmers. Urban farmers, those under Sub-delegations, are actually worst served; whether because of the difficulty of integration into the farmers' "community" in a town, or because the agents in Sub-delegations are more involved in administrative and supervisory affairs, 70% of urban farmers had never been visited, as vs. 45% of all farmers. Overall, about a

third of the staff met are highly involved in their villages and their work; a third carry out their work conscientiously but without special efforts; and a third rarely see farmers, or only a few of the cash crop farmers, or are embroiled in local disputes.

Over half the farmers have never been visited, and two-fifths refuse the idea of going to extension for farm advice. But almost a quarter are visited seasonally or more often, and fully two-fifths have asked help (59% of them obtaining it). Two-fifths have also been to a meeting about agriculture. As might be expected, since there is little food crop information for extension, 89% of farm visits concern cocoa and coffee only, 4% cash and food crops (usu-

Table 6: Extension Contacts, by Zone

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Meme
% visited by agent:							
never	37	65	33	79	60	40	55
yearly/less	15	15	53	7	27	33	21
more often	28	20	13	14	13	27	23
% who have asked help of extension:							
never, won't	41	30	40	53	20	33	37
" , but could	13	25	20	27	20	7	19
w ld ask other	1	10	0	0	0	7	3
have asked ext	40	35	40	20	60	53	42
% who have been to an agricultural meeting:							
	37	30	40	20	53	33	38
% who were helped:							
when asking	50	71	67	0	44	63	60
by meetings <sup>1*</sup>	33	33	54	100	50	100	52

ally the plantain intercrop), and 5% food (best farm competitions, certifications of loss for disaster aid, a woman's group, and plantains). When asking help, 73% asked for cocoa and coffee aid (both information and supplies), 14% for cash and food help (information and seeds), and 12% for food specifically (crop diseases, animal and other destruction). Failure to help was usually due to lack of supplies, sometimes (especially for food crops) due to lack of a remedy. Meetings were felt to be helpful by 52% of attendees. 71% of meetings were for cocoa and coffee (information about agronomy, pests, loans, and discussions of the cooperative), 13% for the Agricultural Show in Maroua or general exhortations to plant more, 13% for food (mostly the introduction of soybeans around Kumba), and 3% for mixed cash-food agronomy.

<sup>1\*</sup> Help with something applicable to improving the farm. Meetings also dealt with topics not directly applicable but potentially also helpful to the people attending.

Extension in Bangem and the Sands zone get the highest marks from farmers, and the farmers in Supe and the Sands zone are the most active in seeking help.

Gender is important to the farmer's relationship with extension. Both the local agent's name and work site are unknown to 8% of the households headed by a couple, none of those headed by a man alone, but to 25% of those headed by a woman alone. 60% of the single men, 59% of the couples and only 42% of the single women know both the name and work site of their agent. 50% of couples, 60% of single men, and 82% of the single women have never had a farm visit. Until extension agents have useful information on food crops to disseminate, however, it is impossible to attribute such discrimination to avoidance of women by male agents. Very few of the agents accompanied to food crop fields seemed ill at ease with the women farmers.

The transport problems of extension agents have been reduced in the last year or two, but supervisory difficulties have increased. Many of the agents now have their own motorcycles, provided under a Belgian cocoa/coffee program, but they have to supply petrol from their own salaries, and some still lack machines. More critical is the lack since late 1987 of functioning vehicular transport for Divisional and Sub-divisional staff to visit the isolated MZAs for supervisory control, training and distribution of inputs.

#### 8. Livestock:

Four-fifths of Meme farmers have livestock of some kind. Most (71%) have poultry, 36% have goats, 22% keep swine, and 10% have sheep. Although an average of 15 adult chickens are kept, adult goats and swine number only 4 among owners. The few sheep herders keep an average of 7 adults. All the Bangem farmers sampled have some animals, and more of them are owners of every kind of animal than in any other zone (except goats in the Sands); yet they keep below-average numbers of everything except goats. Bangem also contains two highland groups of pastoral Fulani, that raise and sell horses and some cattle to local butchers. Nguti has the least livestock. There were surprisingly few complaints about crop damage from domestic animals - only one in Bangem and five in Kumba. Most villages try to confine their goats on ropes, and fine owners of offending animals.

During the past year, over half of livestock owners (53%) sold no animal. The most sold animals were poultry (29% of owners), 18% of pig owners, 17% of goat owners and 4% of sheep owners sold an animal. About 60% of Kumba and Nguti owners sold animals, and only 30% of Bangem and Koupe ones. More animals were eaten - 50% of owners ate at least one pig, 52% a goat, 61% a sheep and 72% fowls. Goats were least eaten in Bangem (25% of owners) and Nguti (40%), as were sheep (20% and 0). Bangem owners also more rarely ate their pigs (13%) and fowl (57%).

The animals' manure is also little used, because of the lack of confinement in a closed space and the small number of animals. 14% of all farmers use manure on some crop - 5% using goat (Kumba and Sands zone) and 5% poultry,

Table 7: Livestock Ownership, by Zone

	Kumba	Koupe	Bangem	Nguti	Supé	Sands	Meme
% owning some animal:	79	75	100	53	80	87	80
goats:							
% owning	29	40	53	33	33	60	36
mean among owners	4.0	2.5	4.9	3.0	4.8	4.8	4.1
poultry:							
% owning	67	60	93	47	80	73	71
mean	21.5	6.3	7.9	9.1	9.2	8.3	15.8
swine:							
% owning	21	20	53	7	7	7	25
mean	3.8	9.8	2.0	(15)	(2)	(2)	4.0
sheep:							
% owning	3	10	33	13	20	0	10
mean	(35)	3.0	1.0	6.0	8.3	-	9.1

( ) one case only.

(Kumba) dung, one farmer in Kumba pig manure, and one in Supé sheep manure.

Most animals are not fed, but 71% of owners feed some of their animals, usually poultry. Maize is the favorite food, at 54% of owners, followed by rice (29%), cocoyams (18%), cassava (12%) and cassava leaves (2%), bananas (12%), plantains (9%) and taro (5%). Commercial feed is purchased by 4% around Kumba.

## 9. Food Markets:

Access to markets varies enormously, in Meme. About a third of crops are sold at village markets where the farmer resides (whether to trucker-traders or to other villagers), a fifth to truckers and other passers-by at roadside, two-fifths at central markets usually within an hour of home, and a few to Littoral Province (Douala, Manjoh and Mboassong). Maize, and especially yams, groundnuts and egusi are sold more often at central markets, cocoyams at local ones, cassava and taro equally at both, and plantain and bananas as much at roadside as at either.

The Kumba Corridor has large food markets scattered along its length, most notably at Kwakwa, Kumba, Ekombe and Ebonji, and Douala truckers come to these for the plantain surplus. Only 15% of the farmers travel a half hour or more. Almost half the crops are sold at village markets, a sixth by the road and the rest in larger markets in the zone.

Local Koupe markets get occasional trucker-traders who come for cocoyams and sometimes plantains, and interior farmers sometimes hire a Land Rover to

carry their produce to Tombel. But Tombel Market has poor prices in comparison with Manjoh, 3-4 hours' trek across Mt. Koupe in Littoral Province, and many women in the northern sector make a weekly trek there with cocoyams or other produce. Village markets account for most crop sales. Almost half travel at least half an hour, and a quarter over an hour.

Bangem farmers can sell in Bangem Market to the few non-farmers, or pay heavily for a taxi to Mboassing in Littoral, or trek the two to three hours to reach there; prices are the lowest in the Division. All sometimes trek to Mboassing.

Table 8: Market Distances, Transport and Prices, by Zone

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Mamfe
time to market (minutes):	14	61	125	50	18	37	3-
farmers not going to any mkt:	10%	20%	27%	53%	40%	0%	17%
transport:							
foot	80%	100%	100%	86%	56%	67%	82%
taxi	28%	19%	0	14%	67%	40%	27%
portion returned unsold:	.11	.09	.08	.03	.11	.06	.10
median price:							(mean)
cassava(truck)	5.000	2.500	2.900	4.450	7.000	4.750	4.800
maize (tin)	1.200	1.400	670	1.340	1.600	1.250	1.000
plantain(bunch)	1.000	500	400	1.500	1.000	750	968
cocoyam(basin)	2.300	1.800	1.000	2.500	2.400	2.000	2.355

Nguti farmers frequently do not harvest enough to sell at markets. Those that do, take their produce to Nguti Town or Babubok in the interior. Others sell at roadside to locals. Almost half travel at least half an hour, 30% for an hour or more. Many small traders from Nguti and Manyemen Towns travel south as far as Kumba and north to Mamfe Town to buy foodstuffs to sell at home, as local markets are very unreliable. Plantain prices are very high; bananas are more often grown but plantains are preferred by the urban immigrant population.

Supe farmers have markets at Wone, Baduma and Konye, and frequently use taxis to go to non-local markets, only a ninth needing over a half hour. They often sell instead to Nguti/Manyemen traders at roadside. Cassava and maize, which do not do well with their intercropping system, have high prices on local markets.

The Sands zone has the only two farmers that carry produce directly to Douala, and many go to Muyuka and Kumba with the crops they produce most, selling the rest in local markets or at roadside, often to Douala trucks.

that come to load up with plantains. The ones near Ekondo Titi trek to Mbonge Market, under an hour's distance. 60% travel a half hour or more, a third at least an hour.

Meme prices in general are lower than Fako's. Farmers' reports of prices at the time of year when they sell most average 37 F CFA per kilo for dried shelled maize (84% of Fako's), 145 F CFA per kilo for cocoyams (90%), 87 F CFA per kilo for taro (93%), 64 F CFA per kilo for plantains (74%), 192 F CFA per kilo for Calabar yams (77%) and 365 F CFA for shelled groundnuts (83%). Cassava, which is scarcer in Meme, has a better reported price: 32 F CFA (114% of Fako). These prices will have to be checked against the long-term provincial marketing survey now starting.

Most farmers make sure to sell all their produce before returning from market. An average 10% returns unsold.

### 10. Perceptions of Farming:

Only 2% of farmers interviewed, from Kumba Town, expect to leave farming, and 2% (in Nguti and Kumba) do not expect to increase their planting area. Only 53% felt agriculture will unqualifiedly improve, but 23% more felt it will improve if government continues to take more interest and help with extension and credit. 20% felt prospects are bad or mediocre. 6% in Kumba felt food farming will disappear. The Sands zone is most optimistic, but there are few real zonal differences.

Most farmers believe that in the past land was more fertile and easier to obtain. Over half the Bangem farmers and a fifth of the Kumba ones complain of bad soil and declining yields. Farmers in Kumba and southern Koupe worry about the lack of land, especially food crop land. But farmers in the Sands zone, Supe and Nguti welcome the recently increasing numbers of their children returning to farm.

Despite large cash-crop areas, most are more now interested in increasing food-crop area than tree crops: 63% mentioned only food crops, 30% both, and 3% only trees. 44% want to increase maize area (and 1% reduce), 39% cocoyam (6% reduce, in Bangem, the Sands and Kumba), 38% cassava, 37% plantain, 29% cocoa, 14% yam (in Kumba and the Sands zone), 9% coffee (but 7% from the Kumba Corridor, want to reduce it), 5% groundnut (1% wanting to reduce), 5% taro (2% to reduce), 4% oranges and Irish potatoes, and 3% bananas.

Monkeys, cutting grass, porcupines, rat moles, squirrels, bush fowl and deer are frequent complaints, the heaviest damage being perceived in Nguti, where the farmers' greatest desire is a legal way to kill the animals. Farmers in the Sands zone and parts of Koupe and Kumba have to cope with spear grass, requiring heavy weeding. Supe, Kumba and the Sands zone want financing to open more land, and for workers. Koupe and Kumba mention farm-to-market roads: Kumba farmers at least have home-to-market ones, but the Koupe roads are rough tracks negotiable only by Land Rover. A few Bangem, Nguti and Kumba farmers want access to fertilizer. The major food crops losses perceived are

due to animals, cocoyam root rot, plantain lodging and maize stem borer.

## E. Results: Meme Crops:

### 1. Cropping Systems:

This section discusses patterns of crop association in general and within four major types of field with food crops identified in the Division. Typical fields of each type are described.

There is no standard association of crops either throughout Meme or within zones, although paired associations of many crops occur in substantial numbers of fields: maize-cassava (22%), cassava-cocoyam (20%), cassava-plantain and cocoyam-plantain (19%), maize-cocoyam, maize-plantain, cassava-taro, cocoyam-taro and plantain-taro (18%), and maize-taro (17%). Lesser associations are maize-groundnut and yam-taro (13%) and maize-yam and cassava-yam (12%). Associations of three crops together are rarer: maize-cassava-cocoyam is found in 14% of fields and maize-cassava-taro in 11%, cocoyam-taro-plantain in 12% and cocoyam-taro-cassava in 10%, maize-yam-taro in 7%, maize-groundnut-taro in 5% and maize-groundnut-yam in 5%. Maize, cassava, cocoyam and taro are found all together in 5% of fields, and maize, cassava, cocoyam and groundnut in 4%.

Within-zone associations are shown in Table 9. There are also strong three-crop associations in Bangem between maize, cassava and taro, and cocoyams, cassava and taro (each 19% of fields), in Nguti between plantains, cocoyams and taro (15%), and in Supe between cocoyams, taro and plantains (28%), cocoyams, taro and cassava (17%) and maize, cassava and cocoyams (15%).

There are four distinct types of fields containing food crops in Meme Division: I, cocoa/coffee; II, cocoa/coffee plus internal food field; III, open food field; and IV, forested food field.

Type I is a cocoa or coffee field with interplanted plantains, cocoyams, and perhaps scattered patches of taro and even maize or cassava inside. The secondary crops occur wherever the major tree crop has been planted a little too far apart or a few trees have died and left a space. 26% of the 352 fields identified in the survey are of this type. The most frequent major intercrops for cocoa fields are cocoyam (.35), plantain (.35), banana (.31) and taro (.20); for coffee fields, banana (.26) and plantain (.22). Only 38% of Type I fields have only one major crop<sup>20</sup>, and 18% are monocropped<sup>21</sup>. They

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<sup>20</sup> A major crop is one identified when asked what is grown in the field; a secondary crop is one added when s/he is asked what other small things are grown there. In field visits, there was almost always a clear distinction in the fields between crops at near normal densities (or higher) and others scattered at about a fifth to a tenth of normal densities.

Table 9: Frequent Associations between Crops, by Zone<sup>##</sup> (% of fields, weighted by population)

Zone	Association	% all fields	% fields w/ crop 1	% fields w/ crop 2
Kumba	maize-cassava	27	66	66
	cocoyam-cassava	22	73	54
	taro-cassava	18	62	44
	groundnut-maize	18	95	44
Koupe	plantain-taro	17	52	50
Bangem	cassava-taro	28	76	72
	maize-cassava	22	71	59
	cocoyam-cassava	22	71	59
Nguti	plantain-taro	33	83	77
	cassava-taro	16	60	42
Supe	taro-plantain	30	36	65
	cassava-cocoyam	24	80	56
	maize-cassava	17	71	57
	cassava-taro	17	57	49
	groundnut-maize	15	88	63
Sands	cassava-maize	21	66	58
	taro-plantain	17	61	45
	taro-cassava	15	34	47

contain over two-thirds of the cocoa, coffee and fruit trees planted, and over half of the plantains and bananas. They are longer established than the pure food fields, averaging 19 years, and larger, averaging 5,200m<sup>2</sup> (with about 5-10% of the area in food, by field visit estimates), the largest being in Kumba (6,700), Bangem (6,200) and the Sands zone (5,700). They are weeded an average of 2.2 times in the year. In the field visits, 6 of the 34 fields inspected were of this type; the plantains were no less healthy than usual but the cocoyams and taro were more susceptible to rot and the little maize more spindly than normal. In areas where this type of field prevails especially

<sup>##</sup> This figure is somewhat underreported; the interviewers did not record pure cocoa/coffee fields and those with a few plantains/bananas only for about 10% of farmers; in these cases only one such field was attributed to the farmer.

<sup>##</sup> Major or secondary status of either crop was ignored in calculating these associations. The correlations (r) reported below give greater importance to associations of major than minor crops.

Table 10: Crop Composition of Fields, by Field Type (% of field area)

Field type:	I	II	III	IV
Crop:				
cocoa	44%	30%	2%	5%
coffee	25%	15%	1%	0%
maize	0%	18%	26%	0%
cassava	-	5%	19%	1%
cocoyam	3%	6%	11%	58%
taro	1%	4%	8%	19%
plantain	17%	10%	7%	13%
banana	5%	2%	2%	4%
yam	0%	4%	5%	0%
beans	0%	-	3%	-
groundnuts	0%	-	9%	0%
egusi	0%	-	2%	0%
sweet potatoes	0%	0%	2%	0%
Irish potatoes	0%	0%	1%	0%
fruit trees	3%	3%	0%	0%
total	100%	100%	100%	100%

- less than .5%

Table 11: Representation of Field Types in Total Area Planted to Each Crop (% of total crop area in Meme)

Field type:	I	II	III	IV	Meme
Crop:					
cocoa	71%	25%	2%	2%	100%
coffee	75%	22%	3%	0%	100%
maize	0%	34%	66%	0%	100%
cassava	2%	16%	80%	1%	100%
cocoyam	11%	12%	28%	47%	100%
taro	10%	15%	42%	33%	100%
plantain	57%	17%	16%	10%	100%
banana	60%	14%	14%	12%	100%
yam	-	34%	65%	0%	100%
beans	0%	4%	95%	1%	100%
groundnuts	0%	3%	97%	0%	100%
egusi	0%	5%	95%	0%	100%
sweet potatoes	0%	0%	100%	0%	100%
Irish potatoes	0%	0%	100%	0%	100%
fruit trees	69%	30%	1%	0%	100%

- less than .5%

the Kumba Corridor), the women concentrate maize-groundnut and maize-taro beds along the roadsides, where they can at least get sunlight from one side.

Typical Type I fields were visited in Bai Panya (Kumba Corridor). The villagers have cut cocoa farms deep into the surrounding forest, and serious food-crop farming is only done in the first few years of establishment. Dense, partially shaded beds of maize and groundnut or taro line the roadside wherever there is a small break in the cocoa. No fertilizer is used on any crop, food or cash. Inside the cocoa, wherever a tree has died, a small patch of cocoyams is planted; wherever several have died, plantains are intercropped with the cocoyams; and in larger spaces left by eight to ten trees, small beds of maize, taro, vegetables and plantains are put. One cocoyam-plantain plot had densities of 14,000 cocoyams per hectare, 1,250 regrowing wild tree stumps, 600 taro and 600 plantains; establishment at two months was retarded. In a small plot of one-month-old maize-cocoyam-plantain beds, the maize had been planted at about 40,000pph<sup>23</sup> and was already down to 15,000; these were being rapidly destroyed by borer, as were the plantains (1,250pph). The cocoyams (10,000pph) and few garden eggs were surviving.

Type II is a Type I field with a food field inside. The food field is hemmed in on three or four sides by trees, but at sufficient distance to allow almost full light. Usually the food-crop planting is on beds. Among the four Type II and three Type III fields for which samples were taken in the Kumba Corridor, the soils are better in the Type II, especially for pH, P and K. Because of the limited space left by the trees, however, most internal food fields are not fallowed, and intercropped densities are quite high (especially in Kumba and Koupe). Inside the cocoa farms, besides the intercropped plantains (.65), coffee (.49) and cocoyams (.42), are found cassava (.75), taro (.51), maize (.49), yams (.46) and groundnuts (.27). The cocoyams are often found both on the beds and under the cocoa. Coffee fields containing food fields are primarily found in Bangem: they contain cocoyams (.50), plantains (.38), cassava (.32), taro (.30), beans (.29) and maize (.23).

The Type II fields are also older, averaging 17 years, and measure an average 3,500m<sup>2</sup> (about 1,000m<sup>2</sup> being food field in fields visited), the largest in Nguti (4,600m<sup>2</sup>), Kumba (4,200) and Bangem (4,100). They average 2.3 weedings a year, plus clearing first season for the food. The fields average 3.0 major crops plus 3.0 secondary crops. By definition, no Type II field is monocropped, but 12% have only one major (tree) crop. They contain a quarter of the cocoa and coffee planted, a third of the maize, yams and fruit trees, and a sixth to an eighth of the plantains, bananas, cocoyams, taro and cassava. At least 18% of the fields reported in the survey were of this type; it is likely that a few of the fields classified as Type III are actually Type II, in cases where women begged or rented fields internal to someone else's trees and reported only the internal field. Six of the 34 fields inspected were Type II.

Type II fields from Ngussi and Bombe illustrate the effects of management.

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<sup>23</sup> Pph = plants per hectare. All densities for crops on beds include the empty alley space.

The Ngussi (Koupe) field is one of six inside a large, 40-year-old, unfertilized cocoa farm, in a zone of rich soil. The farmer plants one field each year, following the rest. All the food crops were on beds, and the primary crop was healthy groundnuts, at 130.000pph. The maize, also considered a major crop, was planted at about 10.000pph, with half surviving borers, streak virus and lodging to produce double cobs; there were also good stands of okro (11.000pph), cocoyam (5.000pph plus scatterings under the cocoa), a bed primarily of huckleberry and some few cassava, taro and Phaseolus beans. The beds covered two-thirds of the area, the alleys being narrow.

In contrast, half the Bombe (Sands) field, in an unfertilized cocoa-fruit grove, on poorer soils, is planted each year. Beds covered only 40% of the area, with large and irregular alleys. Groundnut densities varied widely, from 80-155.000pph on different beds, and the densest beds, at 6-7 weeks after planting, also contained the highest maize densities: 22.500pph, but only 10.000pph where the groundnut density was lowest). There were also a few plants of cassava, okro, taro and cowpea scattered inside, most dying of competition. The maize was almost all too stunted or spindly to produce.

Type III is an open field, sometimes with a few isolated trees but overall unshaded. This is the largest category (although some fields of type II and IV have doubtless been misclassified to it), with 51% of reported fields and 14 of the 34 fields visited. They average 1.700m<sup>2</sup> varying (from 2.250m<sup>2</sup> in the sedimentary zone and 2.000m<sup>2</sup> in Bangem to 1.350m<sup>2</sup> in Kumba and 1.150m<sup>2</sup> in Koupe). They average 1.7 weedings a year, plus an original clearing. They are newer, averaging eight years in age, and more often fallowed (48%, averaging 2.1 years; 76% of those fields over four years old). 13% are monocropped, and 5% more have only one major crop. Maize is most often associated with groundnuts (.43), beans (.22), and yams (.20); cocoyams with taro (.37), plantains (.28) and cassava (.24); plantains with bananas (.46), cocoa seedlings (.26) and cocoyams (.28); yams with egusi (.26 and maize (.20). Maize-groundnut-beans and cocoyams-plantain-taro form interrelated complexes. Cassava may be planted with anything. The type III fields - half the fields reported - contain four-fifths of the cassava, two-thirds of the maize and yams, two-fifths of the taro, over a quarter of the cocoyam, a seventh of the plantains and bananas, and almost all the beans, groundnut, egusi and potatoes.

Fields visited at Ekangte (Bangem) and Ebonji (Kumba Corridor) illustrate different levels of management. The Ekangte field is on a flat hilltop, long denuded of trees, and has been planted since the 1940s; yields declined so much that the farmer left it fallow five years before this planting. Tall mounds, 40-50cm high, typical in this zone, had root and tuber crops projecting out of the sides as well as the top. The mounds covered about 60% of the area. Because the coffee harvest occupies their labour in second season, the farmer did not plant until November, putting in maize, taro, cassava, cocoyams and yams (D. rotundata); she got a small maize harvest in February, and the tubers barely survived. When the rains returned in March, she planted sweet potatoes and more maize in between the tubers. Densities were very high; 15.000 Dasheen and 16.000 Edo taro per hectare, 16.000 white cocoyams, 3.700 yams, and (at planting) 25.000 maize. Speciality mounds carried about two-thirds the cocoyam/taro load plus 5.000 sweet potato, or a quarter of the

cocoyam/taro load plus 4,000 cassava. At one year, cocoyam and taro tubers were tiny, and all tuber leaves were small. She said that about half the maize lasted to be harvested.

The Ebonji field was effectively a maize monocrop, and surrounded by other farmers' maize and grass fallows. The farmer, who plants twice a year, used a similar field for ten years, when the yields started to drop somewhat. She already planted this one three years (six seasons). The maize was planted on the flat at regular intervals about two-thirds of a meter apart, in stands of three; she planted 4-5 per hole to defeat birds and chopped down the excess when it reached 1m tall. Densities at two months were 43,000pph, and 80% of plants were healthy and tall. She divided her field into quadrants, and each season planted an intercrop in one of them only, letting resprouts grow from previous seasons in the other quarters: thus this season there was a quadrant with 10,000 planted Phaseolus beans and 3,000 resprouted cocoyam per hectare in the maize, another with 5,000 cocoyams and some pumpkin, another with a few cocoyams and resprouting groundnuts and one with some resprouted sweet potatoes the goats destroyed last season. Nearby fields were similar, with cowpeas or beans the favoured intercrop.

Type IV fields are heavily shaded food fields. The exact number is uncertain because the distinction between types III and IV, among fields reported in the questionnaire part of the survey, was according to crop types<sup>24</sup>; but in the field visits eight type IV fields were visited, and four would have been assumed to be type III if reported on the questionnaire. By report, 27% of Koupe fields but only 5% of all Meme fields are forest fields. Those contain half of the cocoyams, a third of the taro, and a tenth of the plantains and bananas. These are created by cutting out the smaller trees and trash from virgin forest, sometimes heaping and firing the brush around the larger trees to partially kill them and reduce their canopy cover. 30% are monocropped, and 80% have only one major crop. Cocoyams, taro (especially Dasheen) and plantains are the primary crops, but in the field visits it was noted that half the farmers try to grow climbing beans and/or yams as well as some maize-cassava and various vegetables in slightly less shady spots.

Type IV fields are newest (5 years average) but large (4,300m<sup>2</sup>). They average only 1.3 weedings a year, plus the original clearing. 55% of the Type IV fields in the survey were fallowed, for an average of 4.4 years; 86% of those older than four years were fallowed. Ndum (Koupe) and Ebanga (Nguti) fields illustrate the range of variation. The Ndum field was on a 40% slope, heavily shaded and the floor covered with rotting leaves and branches. The farmer worked from start to end of the rains, cutting down the undergrowth and transplanting cocoyams from another field; she came back to earlier portions to weed at six and nine months, to replant the few rot-damaged sections to beds of vegetables, and to harvest. The cocoyams were at 19,500 pph and extremely large and vigorous.

In contrast, the Ebanga field was the first stage of a cocoa operation.

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<sup>24</sup> If there was more than one sun-loving crop (cassava, maize, beans, groundnuts) in a field it was considered Type III.

Virgin forest was cut, burning the heaped undergrowth to discourage the tallest trees. Food crops were planted the first year, with cocoa seedlings planted six weeks late (so they suffered badly from competition), and by the end of the year all crops except bananas and cocoa were removed from the field. The husband planted the plantains, bananas and cocoa; he prefers plantains but in the Supe-Nguti region most plantains immediately die (of borer, they say) and he replaces them with bananas. At six months there were 600 cocoa seedlings and 500 plantain/bananas per hectare. The wife planted Edo and Dasteen taro (11.000), sweet and water yams (1.200), climbing cowpeas (200) and a little cocoyam, dwarf beans, okro, bitterleaf, country egusi (ngon) and watermelon in the same field. She tried a small second-season field in a less shady section where she densely packed maize (34.000pph), cassava (7.000), dwarf beans (3.000), Edo taro (17.000), okro (10.000) and pepper (3.000) on small mounds between first-season cocoa seedlings; all these crops except the cassava, taro and okro were stunted and dying at 2 months, and the latter three were retarded.

## 2. Field Management:

Except for established pure tree fields, Meme field management starts with land clearing, in January and sometimes February. A few in Kumba start in December. Farmers in Bangem are as likely to open a new field in September, or perhaps August, and in Supe a minority open lamba farms in the river beds in October. Burning during land preparation varies little according to field type, but much by zone: all farmers surveyed in Nguti and the Sands zone burn, and most of the Kumba ones do, but only a fifth of Koupe farmers and no Bangem or Supe ones. Most of those who burn cut the grass, let it wither where it falls, and then do a light burn across the whole field, usually in February. A few make heaps, burn and then scatter the ashes as they make beds, and a few burn the cut materials to partially kill tall trees. Most of those who don't burn, incorporate the grass and plant residues into beds, or leave the grass where it lies and plant on the flat; they may remove large trunks and branches from the field. When they find ground-cover vines such as Pueraria, they usually remove them, but some leave them to rot inside if they clear long enough before the rains.

Beds are the dominant locus of planting most food crops other than plantains/bananas, but one-third of farmers plant on the flat, rising to three-fifths in the Sands zone and four-fifths on Mt Koupe. In general, on tillable soils people plant on the flat; the less tillable, the more beds. Even within the same farm both methods can be found if the soils vary. Mounds are rare, most being the semi-bed huge mounds of Bangem. Even cassava is only planted on mounds by a quarter of farmers, primarily in Bangem, Nguti and the Sands zone. Few farms are monocropped, and few have only one major crop plus secondary ones; 23% are in these two categories combined.

Farms are generally a good distance from home - from half an hour's walk average in Bangem to almost an hour average in the Sands zone - and farmers tend to do few weedings, an average of 1.8-2.2 per year per field in the different zones, plus the initial clearing. Usually if there is a short-cycle

crop like maize or groundnuts in the field, the weeding will come about half way through its cycle each season (most farmers planting these crops both seasons in the same place)<sup>25</sup>. If there is not, the weeding may occur 3-6 months or more after planting, or for tree farms, at four- to six-month intervals.

Table 12: Meme Clearing and Planting in Meme Fields, by Zone

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Meme
Clearing mo.s:							
1st pltg:	J-F-D	J-F	J-F	J	J-F	J-F	J-F
2nd pltg:	-	-	A-S	-	(0)	-	-
No. weeding							
per year:	2.2	1.8	2.2	1.9	2.0	1.8	2.1
% burning in							
land prep.:	70	22	0	100	0	100	61
% monocrop:	14	23	10	14	6	8	13
% effective							
monocrop <sup>26</sup> :	10	9	10	7	16	11	10
% 4/2 crops:	58	32	50	59	73	47	54
% maize farms							
pltg on flat:	34	78	13	17	23	60	37
pltg maize							
two seasons:	75	47	71	33	36	65	67

Harvesting occurs over long periods, and frequently during the first six months of a "fallow" period there are still cocoyams, cassava and plantains being harvested from the farm. Cassava harvests average four months, until the 16th month after planting; cocoyam ones the same, until the 13th month; and plantains seven months, until the 18th. When a farm is not fallowed, usually, the healthy plantains are left to continue to bear while the other crops are sown around them. The cassava and cocoyams are almost always harvested before new planting begins; there are few healthy cocoyams left in intercropped fields after a year, due to the root rot.

Farmers claim to fallow their food fields about as many years as they cultivate them, varying from two years of fallow to one of cultivation in Bangem down to 0.7 of fallow to one of cultivation in Kumba. However, they usually practice shorter fallows than they claim, especially in Bangem, Koupe and Kumba (Table 13). Correcting claimed fallows by percentage fallowing and

<sup>25</sup> See the sections on particular crops for average weeding times.

<sup>26</sup> Effective monocrop is one major crop and one or more secondary crops.

length of fallow, the average for the whole division is probably only 0.7, ranging from below 0.5 in Kumba and 0.6 in Koupe to 0.9 in Supe and the Sands, 1.1 in Bangem and 1.2 in Nguti. Fallowing is not directly related to soil fertility or pest and disease build-ups; this depends on soil type and management as well, as the 40-year-old Mambanda field illustrates. But in many of the smaller fields compressed inside cocoa, the negative effects are quite visible.

Table 13: Claimed and Actual Fallowing of Meme Fields (Types III and IV), by Zone<sup>27</sup>

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Meme
Claimed fallow: cultivation ratio:	0.72	0.95	1.95	1.46	1.09	1.27	1.00
Claimed % no fallow:	19	7	0	0	0	7	11
Actual % no fallow:	39	27	10	0	9	12	23
Claimed no. yrs. fallow:	2.4	3.4	4.7	2.5	2.5	2.1	2.8
Actual no. yrs fallow:	2.0	2.7	2.8	2.0	2.3	1.9	2.3

Only one farmer in a field visit and one in the survey (both near Kumba Town) rotate their crops, although many remove crops that do badly from a particular farm and try to substitute others. Relay planting is also relatively rare, with most people (70% of fields visited) planting all crops in the same field simultaneously. Yams are often planted before the start of the rains, and egusi with the first sprinkles. Cassava may be planted shortly before, after, or together with the other crops, and cocoa seedlings are often planted 2-12 weeks later than the food they are intercropped with. Reasons for planting a little before or after are to ensure establishment of a fragile crop (cassava because of stake rot, egusi because of low germination levels) before the others enter the field. Double-cropping (planting the same crop twice yearly in the same spot) is common for maize, groundnut and beans, but rare for other crops, although cocoyams and sometimes taro may be replanted to the same hole immediately after harvest in healthy fields (especially Type IV).

Meme farmers in general regard plantains, cocoyams, taro, egusi and maize as crops requiring new fields, and cassava, groundnuts and beans as crops that

<sup>27</sup> Farmers were asked in general how long they fallowed and cultivated food fields, and specifically for each field, how long they had fallowed it last. The first is "claimed" fallow, the second "actual". Number of years of fallow is taken as the claimed or actual years among those who fallow.

can be planted in old ones. But there is a lot of individual and zonal variation (Table 14). There is even more variation in identification of crops that grow well or badly with tree crops. Two-thirds of farmers in Kumba, Koupe and Supe continue to plant food crops in tree fields after five years (often indefinitely), but only a third in Nguti and a tenth in Bangem and the Sands zone.

Table 14: Crops Preferred by Meme Farmers in New, Old, and Tree Fields, by Zone<sup>ee</sup>

	Kumba	Koupe	Bangem	Nguti	Supe	Sands	Meme
in new fields:	cy, eg pl, ba	mz, tr pl	cy, tr pl, ym	pl, tr	mz, cy tr, pl	cy, tr pl	pl, cy, tr eg, mz
in old fields:	cs	cs	-	cs	cs	cs	cs, gn, be
inside trees:	tr, cs	cy, pl tr	pl, mz	ba	cy, tr ba	pl	ba, tr, pl cy, cs, be
away from trees:	mz, gn	mz, gn	cy	pl	cs, mz	-	mz

Chemical inputs are seldom applied. Fertilizer seems rarely used even on coffee, except in Bangem; three claimed the fertilizer applied to coffee helps the internal food crops, and one (on Koupe) that it hurts them, and one of the two Koupe farmers that once tried some directly on cocoyams and plantains said it hurt yields. Manure is also only used on a few crops, by only 14% of farmers, because there is little of it. Two farmers mentioned using coffee husks and one, dirty cocoa leaves, for yams and other food crops. Sprays and dusts have been applied to food crops only by 11 farmers, one plantain nematocide by a Kumba professor, and the rest Gamaline powder, by farmers near Kumba, Tombel and Supe. Three have abandoned it because they cannot get more.

#### F. Crop Agronomy and Utilization:

This section provides details on the incidence, cropping patterns and calendar, varieties, field problems, processing, storage and marketing of each food crop of any importance in the Division. Readers may prefer to skip to particular crops and then the section on recommendations. But first there are some specific cautions to note.

1987 was drier than usual. Almost two-fifths said they planted somewhat

<sup>ee</sup> ba banana; be bean; cs cassava cy cocoyam; eg egusi melon; gn groundnut; mz maize; pl plantain; tr taro; ym yam.

early first season, vs. one-fifth planting late, and over three times as many planted early second season as late, expecting shorter rains. Two-thirds said they planted less than usual first season, but to compensate, and because there was more sunshine in the usually overcast month of August, almost three-quarters planted more in the second season. These changes from usual habit must be recalled in considering area, production and the calendar. Calendar dates are early or late in a particular month, not specific days.

As described in Section C., production and area figures are tentative, and the calculation of relative crop importance depends on recommended and actual local densities. Farmers' estimates of field problems and losses are relative to their general expectations for a crop; they are not real "yield gaps", the difference between what should be obtainable in an area and what is obtained currently. Crop sales were discussed in two separate parts of the interview: at one point, the farmer was asked how much of the 1986-87 harvest was sold, and in another, in what forms the crop is eaten and sold. As a result, some farmers mentioned how they usually sell the crop but did not report selling the crop in 1986-87.

### 1. Maize:

**Importance:** Maize is planted on about 22 square kilometers of Meme land (monocrop equivalent). Approximately 3.050 tons were harvested in the 1986-87 crop year, equivalent to 265 million francs at local prices or 11.1 million kilocalories of food energy. This makes them sixth in economic importance and third in nutritional importance in the Division.

**Ecozones:** Bangem farms contain 70% more maize than Koupe and Supe ones, with the other zones falling between. By total area, Kumba ranks first with 39% of planting, and Bangem second with 14%. Bangem (215kg), Kumba (180kg), Koupe (175kg) and the Sands (155kg) lead in reported average household production, with Supe at 80kg and Nguti at only 65kg. In total divisional production, Kumba leads with 59%, followed by Bangem with 15% and Koupe with 14%.

**Associations:** Maize is planted in 35% of fields by 94% of farmers, as a major crop in 63% of the fields. Among fields with the crop, 1.6% is monocropped (with 0.5% of the total area of the crop). Almost all is intercropped with other major crops. 66% is found in open fields, and 34% in tree-food ones. It is associated most frequently with groundnuts (.48), cassava (.30), beans (.27), yams (.26) and cocoyams (.22). In Kumba, a closer association with cocoyams (.36) and egusi (.23) is added to these. In Bangem, the cassava association is dominant (.51), with taro, beans, cocoyams and sometimes yams. In Koupe, maize is grown most often with groundnuts and yams; in the Sands, with groundnuts, yams, and egusi, sometimes cassava, and separate from cocoa, coffee and plantains; in Supe, very closely with groundnuts, beans, yams, cassava, and also cocoyams and taro, and away from cocoa; and in Nguti, with taro, groundnuts, beans and sometimes plantains.

**Field size:** Converted to monocrop equivalent, the area planted to maize in a field averages 860m<sup>2</sup>, ranging from an average 600m<sup>2</sup> in Koupe and Supe to

1020m<sup>2</sup> in Bangem. Maize occupies 26% of the area in open fields and 18% in tree-food fields.

**Planting methods:** Maize is planted on beds (55%), flat (37%) and sometimes mounds (9%); on mounds, mostly in Bangem (where the distinction between a bed and a mound is sometimes difficult to make), and on the flat, in the Kumba Corridor, Koupe and the Sands zone (the latter two planting less on beds). Planting distances vary from 15 to 150cm, but cluster around 40-100cm, with a mean of 65cm. An average 2.7 seeds are planted per hole, ranging from one to five but with 81% planting 2 to 3. Densities vary around a mean of 58,000pph, from about 50,000 in Supe, the Sands and Koupe, to 60,000 in Kumba and 65,000 in Nguti, to 79,000 in Bangem. However, anywhere from a third to four-fifths of the seeds planted do not reach maturity, due to germination problems, competition and stem borer. Early competition within maize plants is quite severe; only one farmer was found to practice thinning, and she does this at one month.

**Calendar:** Maize is usually planted both seasons (94% first and 64% second), generally in March (72%) and August (74%). Planting is from February to April (69% March, with most early cases being in Ebonji) in Kumba, with two-thirds planting second season (80% August); March (100% of planters) in Koupe, with half planting also in late July to September (73% September); February to March in Supe (58% March), with 20% also planting in August and 15% in November in swamp; March (92%) in the Sands, with 27% planting in August and 13% in September; equally first and second season in Bangem, in February to March (58% March) and August to September and November (58% August); and 82% March in Nguti, with 20% planting in August. Maize is weeded a first time by 79% of growers first season and 74% second (the most weeding being done in Kumba), at an average of 1.7 and 1.4 months after planting respectively. First season, 31% weed by one month and 49% only at two to three months; second season, 50% weed by one month and 25% at two to three months. The second weeding in a season is only done by 4% and 5% of growers. Harvesting begins at an average 3.1 months first season and 3.0 months second season and lasts only two weeks on average. The latest average dates of harvest are in Supe first season (4.1 months) and the Sands second (3.9 months), and the earliest in Koupe first (3.1 months) and Supe second (3.0 months).

**Varieties:** In terms of general preference, most people (42%) prefer their maize hard and "red" (yellow), and 31% soft and white; 15% like it soft and red, and 6% hard and white. Meme and Ndian natives prefer it soft almost two to one; the Upper Bakossi of Bangem and the Bassossi of Nguti prefer it white, the Bafaw and Lower Bakossi red. Grasslanders and Manyu natives prefer it hard and red 2.5 to 1. 89% want it sweet. 15% mentioned "brightness", or shiny grains, as a desired characteristic.

At present, 45% grow both red and white maize, sometimes carefully separating the best pure white and pure red cobs for seed and planting them mixed in the same field, sometimes planting mixed ears. 41% plant only red maize, and 14%, only white. The soft white is a version of Calabar corn, small-cobbed, very floury, short-stature, early, and highly susceptible to weevils. The few white types are brought down from the North West and West by Grasslanders, as are the hard reds. There is a constant replenishing of the supply from the

highlands as people eat or lose all their seed to weevils and purchase again in the market; especially around Kumba Town, there is almost no local maize in the market during planting time. In 1987, 26% of farmers bought market seed, 77% took it from their own or a neighbor's store, and 1% used an improved variety (1 Kumba professor who had Ekona White and Yellow, and a Sands farmer who claimed to have received red seed from an extension agent). 77% of farmers also claimed to store maize for seed, indicating that their storage is more successful than in Fako. Highlands maize is said to do better the second time it is planted in the lowlands than the first, but also to change its taste. It is more resistant to weevils, but in some field visits, particularly in Supe and Bangem, seemed to lodge more.

**Field Problems:** Farmers reported losing an average 17% of their crop first season and 21% second season, or 19% of the total area planted and 17% of potential production. The worst losses per farm were reported to be in Nguti first season (30%) and second (42%), followed by Kumba (19%) first season and Supe and the Sands (25%) second season, with the least in the Sands first season (4%) and Koupe second (14%). Kumba and Koupe had approximately the same level of losses first and second season; the rest had worse losses second season.

Stem borers were the worst problem reported: only an average 2% loss first season (or 45% among the 4% of growers mentioning borers) but 15% second season (or 60% among the 26% of growers mentioning them). First season borer losses were in Bangem, the Sands zone and Supe; second season, everywhere except Nguti (where borers were found in the field visits). In field visits borers were tentatively identified<sup>ee</sup> as of two types: (1) *Sesamia*, a moth whose larvae eat from the crown into the interior of the stem until it rots and the plant dies, and (2) *Eldana*, a dark brown borer which lays its eggs late in the maize cycle on leaf surfaces, the larvae then boring directly into the stem after silking, seldom causing much damage to the plant but often migrating to the cobs to eat later. *Sesamia* was common throughout the Kumba Corridor, Sands, and Koupe, while *Eldana* was found in one Sands field and in Nguti and Supe; Bangem had some of both. The major chemical control used on food crops occurs against maize stem borer, and many more farmers would use chemicals if they could find them to buy.

First season, stunting (possibly caused by streak virus or malnutrition) was reported as the major problem in Kumba, Supe, and Koupe, by 9% of first-season growers, averaging 50% losses. All zones reported some animal damage (10% of growers) including both seasons. Birds, leaf-cutting insects, ear rot, lodging, drought and flood were also mentioned by one to two farmers. In field visits, borers caused the most damage in Kumba, Koupe, the Sands and Nguti fields; streak was second in Kumba and tied with other causes in Koupe, Bangem and Nguti. Lodging was a problem in Bangem, Supe and Koupe; stunting (probably due to malnutrition) in Bangem, the Sands and Koupe; and animals in Nguti. There was also some rust seen in Bangem, some ear blight in Supe, and some snails, leaf cutters and stalk rot in Kumba.

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<sup>ee</sup> on the basis of descriptions and discussion with Dr. Alan of IITA.

Farmers were asked if they would like to grow more maize (76% saying yes) and then why they do not do so: 45% gave answers that simply indicate a preference for other crops or contentment with present mixture (lack of land, labor or money to obtain these), but 14% mentioned forest shading or low soil fertility, 12% animal and bird damage, 9% insect damage in field or store, 9% lack of good seed or technical advice, 4% lack of a market, and 3% improductivity of their own variety. Most Kumba, Bangem and Sands farmers indicated mostly land/labor reasons. Two-thirds of Koupe reasons dealt with forest shading, animal and weevil damage. Two-thirds of Nguti reasons dealt with animal damage, and most of the rest with infertility and improductivity. Supe farmers complained of all these factors but especially of the need for new varieties and technical assistance.

**Processing and marketing:** Maize is eaten daily (four to seven days a week) throughout the year by only 7% of farming households, and several times a week all year by 13%. During the two maize harvests, 21% eat it daily and 12% less often. During only the principal maize harvest 11% eat it daily and 35% less often. None never eat it. 7% buy it all year and 15% out of season. There is little zonal difference. 74% eat it as green cobs (least in Kumba) and 94% in dried forms; but these latter include pap and koki foods that may be made from fresh or dried maize. As cobs, 39% of all farmers boil it and 55% roast it. Shelled, 75% make fufu (corn flour), 70% corn chaff (boiled grains, usually fresh, with beans), 57% koki (ground corn mixed with vegetable, tied in plantain leaf and boiled), and 33% pap (finely ground flour).

A third of the total maize harvest is sold (from a quarter in Bangem to three-sevenths in Supe) by 60% of farmers (50-60% except in Nguti (one quarter) and Supe (three quarters)). As many sell as fresh cobs as do dried (87% of sellers each). 74% sell to people to roast for themselves, and 69% to small traders who will keep them on braziers to sell to others<sup>20</sup>. 65% sell to people to make fufu, 27% for pap, 23% for koki and 7% for chaff. Fully 58% sell maize for seed.

**Storage:** Storage is a major problem for maize growing. The crop is stored for a month or more by 83% of maize growers, ranging from 40% in Nguti and 73% in Supe to 81% in Kumba and 93% in the Sands. It is reported to be stored for an average of 3.7 months in the rainy months after first season and 3.2 months in the dry months after second season - despite higher production second season and easier storage conditions. Storage is longer first season in Bangem, Supe, Nguti and the Sands zone; the last three of these have 50-100% more storers first season, and those not storing second season store longer in first (4.1 months as vs. 3.7 average). However, overall, equal numbers of those who store both seasons store longer first season, as store longer second season or store equal lengths of time.

45% store partly to sell later, and 87% for seed (only 55% in Supe and 64% in the Sands). 33% goes bad by end of storage (only a fifth in Nguti and Supe).

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<sup>20</sup> Present IRA varieties do not survive prolonged exposure on braziers as well as local ones.

Maize is stored either in a banda, or hung from the kitchen ceiling. Only 15% reported hanging from the ceiling, but it is often used as a supplementary method to preserve special cobs picked for seed. 6% shell their maize first and store it in jars or calabashes. 7% put cobs inside a container (bag, box, basket or plastic bag). Probably almost all the stored maize is exposed to smoke, although not all thought to report it.

Five percent, in the Kumba Corridor, use cocoa insecticides (including Gamaline and Lindalo 20) on the cobs, despite the fact that there are no insecticides locally available that are safe for storage. Maize is the only food crop besides plantains for which there is significant chemical use, demonstrating the farmers' need for help in this area, both in the provision of safer chemicals and their proper use.

## 2. Cassava:

**Importance:** Cassava is planted on about ten square kilometers of Meme land (monocrop equivalent). Approximately 18,300 tons were harvested in the 1986-87 crop year, equivalent to 580 million francs at local prices or 28.0 million kilocalories of food energy. This makes them third in economic importance and first in nutritional importance in the Division.

**Ecozones:** Sands zone farms contain three times the divisional average of cassava, with the least being planted in Supe, Kumba and Koupe. By total area, Kumba ranks first with 39% of planting, Bangem second with 25%, and the Sands third with 17%. The Sands zone (3500kg) and Bangem (1300kg) lead in reported average household production, followed by Supe (960kg). Kumba (42%), the Sands (20%), Bangem (15%) and Supe (11%) lead in total divisional production.

**Associations:** Cassava is planted in 36% of fields by 88% of farmers, as a major crop in 70% of the fields. Among fields with the crop, 11% is monocropped (with 39% of the total area of the crop because of the low densities in intercropped fields). In 4% it is the only major crop, with secondary crops added, and the rest is intercropped with other major crops. 80% is found in open fields, 16% in tree-food ones, 2% in tree fields, and 1% in forest fields. It can be associated with almost any crop, but most frequently with maize (.30), taro (.29) and cocoyams (.29). In Kumba, it is associated more often with cocoyams, maize and groundnuts; in the Sands with taro and maize, and away from cocoa; in Bangem, it is strongly associated with taro, maize and cocoyam, and often separate from coffee; and in Supe, it is planted with most other crops, all together.

**Field size:** Converted to monocrop equivalent, the area planted to cassava in a field averages 380m<sup>2</sup>, ranging from an average 240m<sup>2</sup> in Koupe to 1300m<sup>2</sup> in the Sands zone. Cassava occupies 19% of the area in open fields, 5% in tree-food fields and 1% in forest fields.

**Planting methods:** Cassava is planted on beds (53%), mounds (27%) and the flat (20%), the latter mostly in Koupe. It is planted on beds in all zones but

especially in Kumba, and on mounds mostly in Bangem, Nguti and the Sands zone. Planting distances vary from 20 to 600cm, but cluster around 100-200cm, with a mean of 155cm. 1.6 stakes are planted together, ranging from one to four but with 41% planting one alone and 58%, two. Average stand density is only 3.600pph, from 2.000 and 2.800pph in Koupe and Kumba to 7.000 in Supe and Bangem to 10.400 in the Sands and 14.500 in Nguti<sup>21</sup>. In forest fields, farmers leave the cuttings lying on the ground until they start to sprout, before covering them over with soil.

**Calendar:** Cassava is usually planted in first season (91%, with 14% planting second season), generally in March (55%). Planting occurs every month except December, but concentrates between February and April (83%). It goes from March to April in Kumba (54% March), in Koupe (65% March) and the Sands (85% March), February to March in Supe (69% March), February to November in Bangem (only 20% in March, the most popular month), and March (75%) in Nguti. It is weeded a first time by 98% of cassava farmers at an average of 2.3 months after planting, and a second time by 43% (only 27% in Bangem, and 50% in Nguti) at 5.9 months. Harvesting begins at an average twelve months (20% before ten months and 29% at thirteen or later) and lasts only until the sixteenth month (31% before thirteen months and 22% after eighteen). The longest harvests are in the Sands zone (to the nineteenth month on average), and the shortest in Nguti (to the fourteenth month).

**Varieties:** 69% of Meme cassava farmers grow both red and white varieties of cassava, 22% red only, and 9% white only (especially in Bangem). Although there is some variation, in general the red can be eaten boiled or even raw (as some do in Nguti) and the white requires more processing for safety. Cassava cuttings are taken from their own farms by 96% of farmers and from the market by 4% (mostly in Kumba); one Kumba and one Sands farmer had some IRA cassava as well.

**Field Problems:** Farmers reported losing an average 11% of their crop, or 11% of the total area planted and 12% of potential production. The worst losses per farm were reported to be in Bangem (33%) and Nguti (25%), with the least in the Sands zone (2%). In Nguti, Supe and the Sands zone, almost all reported losses are due to animals; 12% of all Meme growers reported animal damage. Tuber rot was next most prominent, common in Bangem (33%) and occurring to one farmer each in Nguti, Supe and Koupe, with average losses of 35%; two Bangem farmers also had 90-100% losses when tubers were too hard to boil, and one Bangem, one Koupe and two Kumba farmers had good vegetative growth with tiny tubers. There were also one report each of probable anthracnose (Bangem), cassava bacterial blight (Kumba) and root rot (Kumba). In field visits, only three tuber rot cases (one in Kumba and two in Bangem) were seen, with the Bangem cases accompanied by rot of the cuttings before germination. Mosaic was common but not severe.

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<sup>21</sup> Reported densities are somewhat lower on the flat (averaging 2.400pph) and higher on mounds and beds (3.800 and 4.000pph), reflecting the failure of our measuring system to take into account the empty space between mounds and beds. Relative densities between zones change little by planting location.

**Processing and marketing:** Cassava is eaten primarily as water fufu (soaked three days, pulped, and stored in a sack in water, 74%), pounded fufu (boiled, pounded and eaten immediately, 67%), and garri (grated and pan-roasted, 53%). It is also consumed in koki (pounded fufu mixed usually with pounded cowpeas and fried in balls, 38%), as a boiled tuber (31%)<sup>22</sup>, as myondo (pounded, rolled in thin lengths and wrapped in plantain leaves, 25%), as mosoma (water fufu made into thick wafers and eaten with coconut as snacks, 7%), and, by one to two farmers, as ekwan (mixed with pounded cocoyam and wrapped and boiled) and roasted. Only one farmer never eats it, while 50% buy it all year (usually as garri, when they don't want to make their own) and 20% buy it during some months when they have none in the farm. 37% of the total cassava harvest is sold, by 56% of farmers (87% in the Sands zone, 40% in Koupe and 50-60% elsewhere). 51% sell it as raw tubers, 17% as garri, 7% boiled, three farmers as kumkum (flour made by drying pounded fufu), two farmers as water fufu and one farmer as myondo.

**Storage:** Cassava is stored for a month or more by only two farmers, in the form of kumkum, without loss.

### 3. Cocoyams:

**Importance:** Cocoyams are planted on about 19 square kilometers of Meme land (monocrop equivalent). Approximately 3,650 tons were harvested in the 1986-87 crop year, equivalent to 530 million francs at local prices or 4.8 million kilocalories of food energy. This makes them fourth in economic importance and fifth in nutritional importance in the Division, despite the severe crop losses of recent decades due to the cocoyam root rot.

**Ecozones:** Koupe farms contain three times the divisional average of cocoyams, with the least being planted in the Sands, Kumba Corridor and lastly Nguti. By total area, Koupe still ranks first with 40% of planting, and Kumba second with 33%. Koupe (695kg) and Supe (415kg) lead in reported average household production (Kumba producing only 140kg), and Koupe (40%), Kumba (35%) and Supe (21%) in total divisional production.

**Associations:** Cocoyams are planted in 31% of fields by 83% of farmers, as a major crop in 24% of the fields. Among fields with the crop, 1.7% are monocropped (with 7.7% of the total area of the crop). In 1% they are the only major crop, with secondary crops added, and the rest are intercropped with other major crops. 49% are found in forest fields, 23% in open ones, 12% in tree-food fields, and 11% in tree fields. They are associated most frequently with taro (r=.42), cassava (.29), plantains (.25), and maize (.22). In Kumba, they are found most often with cassava and maize; in Nguti, with taro, yams and egusi; and in the Sands, with taro, beans and plantains, and separated from egusi.

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<sup>22</sup> It is boiled most frequently in Nguti (over half); IRA cassava is good in most recipes but does not boil well in some places.

**Field size:** Converted to monocrop equivalent, the area planted to cocoyams in a field averages 720m<sup>2</sup>, ranging from an average 400m<sup>2</sup> in Kumba to 2,100 m<sup>2</sup> in Koupe. Cocoyams occupy 58% of the area in forest fields, 11% in open ones, 6% in tree-food fields and 3% in tree fields.

**Planting methods:** Cocoyams are planted on beds (43%) and mounds (40%), with 19% of farmers planting on the flat, mostly in Koupe. Planting distances vary from 15 to 300cm, but cluster around 50-100cm, with a mean of 84cm. The exception is Nguti, which plants at an average 30cm. Only one farmer was found to put two plants in a hole, thus densities vary around a mean of 14,500pph, from about 12,000 in Bangem and Kumba and 13,500 in the Sands to 18,000 in Koupe and Supe and 111,000 in Nguti.

**Calendar:** Cocoyams are usually planted in first season (89%), generally in March (50%). Planting is from January to May in Kumba (50% March), March to November in Koupe (53% March), January to March, June and August in Supe (50% March), March and a few in June in the Sands, February to March (31%) and June to November (46% August-September) in Bangem, and March (100%) in Nguti. They are weeded a first time by 94% of cocoyam farmers (the least in Koupe) at an average of 2.2 months after planting, and a second time by 42% (only 8% in Bangem) at 5.9 months. Harvesting begins at an early average 9.7 months (45% before eight months and 17% at twelve or later) and lasts only until the thirteenth month (59% before twelve months and 13% after fifteen), due to the root rot. The longest harvests are in Koupe (to the sixteenth month on average), and the shortest in Nguti (to the ninth month).

**Varieties:** Half the farmers plant both white and red cocoyams, and 49% plant white only. Despite the greater susceptibility of white to root rot, only one farmer planted red alone. The most red was found in the Sands zone (100% of growers), Supe (67%) and Koupe (69%), and the least in Bangem (10%). 95% of growers took their seed tubers from their own farms, and 6% bought from markets. Thirteen of the twenty-three farmers storing for more than a month did so at least partly for seed, averaging 3.5 months storage. Fields visited with both cocoyam and taro had more taro in eight out of fifteen cases, with cocoyam outnumbering taro in four of the five heavily shaded fields. Overall, cocoyam outnumbered taro by four to three in unshaded fields and fourteen to one in shaded ones.

**Field problems:** Farmers reported losing an average 39% of their crop, or 40% of the total area planted and 35% of potential production. The worst losses per farm were reported in Nguti (61%), Bangem (55%) and Koupe (48%); Kumba reported 38%, the Sands 31% and Supe only 20%. In Nguti, a third attributed their losses to animal destruction and a third to root rot. Little cocoyam was seen there in field visits, all apparently free of rot<sup>23</sup>, but attacked by soil borer beetles and by a red ant that lays its eggs on the tuber and causes the tuber itself to rot. Cocoyams and taro are also a favorite food of cutting grass, deer and other animals. In Bangem, the root rot was blamed by 93% of farmers and seen in all three fields visited. It was somewhat worse by

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<sup>23</sup> Root rot was counted by number of plants with yellowing, dying leaves and verified by uprooting some of the dying plants.

report at 1300m altitude than at 900m, and in the fields visited, 85% of plants were dying in the highest field (a flat hilltop), 10% on a shaded, steep hillside at about 1100m, and none among the few planted on a flat, unshaded field at 900m. In Koupe, 60% complained of the root rot and 20% of maggots (possibly ants, borer beetles or even the rot). The areas furthest from Tombel had the least rot. Field visits showed about 5% rot in two of the four fields (the steepest), plus reports of a borer beetle rampant in dry season in the Nyassosso area. In Kumba, 53% complained of the rot, and 13% of a problem that leaves roots healthy and leaves green but no tuber formation. This latter was also mentioned by one farmer in Supe, and described by extension agents as common to some areas around Mbakwa Supe, but never seen in the field. In the Kumba fields, four of the five with cocoyam had rot (10%, 15%, 25% and 40% dying). In the Sands zone, 47% complained of the rot, but no field visited had cocoyams. In Supe, 20% complained of the rot, but it was found in only one of the three fields with cocoyam and the extension agents had not realized it existed locally.

**Processing and marketing:** Cocoyams are eaten pounded (90%), as ekwan (grated and tied in vegetable leaves to boil, 77%), boiled (51%), as porrage (chunks in stew, 46%), kwa coco (grated and tied in plantain leaves to boil, 16%) and roasted (5%). Only 2% don't eat them. Cocoyams are sold as raw tubers (44% of farmers) or sometimes boiled (10%) - although only 41% reported selling last year. An average of 32% of the harvest was reported sold, from a low of 4% in Bangem and 22% in Nguti to 36% in Kumba and 46% in the Sands zone.

**Storage:** Only twenty-three farmers stored their cocoyams a month or more. Seventeen stored them in the house in a cool, dry place on the floor; four in a hole in the farm, covered with plantain leaves or grass and then soil; and two in the farm on top of the soil, covered with plantain leaves. Eleven mentioned putting wood ash on them. They were kept for an average of 4.9 months (4.6 with ash, 3.8 on the farm and 5.2 in the house), for sale, seed and/or food. An average 21% rotted by the end of storage, being higher with ash (25%) and in the house (24%, vs. 15% on farm). Cocoyams were stored everywhere except in Koupe, where long planting and harvesting periods make it unnecessary.

#### 4. Taro:<sup>34</sup>

**Importance:** Taro is planted on about eight square kilometers of Meme land (monocrop equivalent). Approximately 3.950 tons were harvested in the 1986-87 crop year, equivalent to 345 million francs at local prices or 3.9 million kilocalories of food energy. This makes them fifth in economic importance and sixth in nutritional importance in the Division.

**Ecozones:** Koupe farms contain two times the divisional average of taro, with Bangem planting the mean and the other zones below. By total area, Kumba ranks first with 35% of planting, Koupe second with 30%, and Bangem third with

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<sup>34</sup> See also Section F.3. Cocoyams.

16%. Supe (665kg) and Bangem (460kg) lead in reported average household production, with the Sands and Koupe at 250kg and Kumba at only 70kg. Supe (35%), Bangem (24%), Kumba (18%) and Koupe (15%) account for most of the divisional production.

**Associations:** Taro is planted in 32% of fields by 77% of farmers, as a major crop in 62% of the fields. Among fields with the crop, 2.4% is monocropped (with 4.6% of the total area of the crop). In 1.6% it is the only major crop, with secondary crops added, and the rest is intercropped with other major crops. 42% is found in open fields, 33% in forest ones, 15% in tree-food fields, and 10% in tree fields. It is associated most closely with cocoyams ( $r=.42$ ), and often with cassava (.29) and plantains (.28). In Supe, it is grown with most other crops, all together; in Bangem, usually with cocoyam and cassava, and often with maize; in Kumba, more often with yams, plantains and maize; and in Koupe, more with cassava, cocoyams and plantains, and away from coffee.

**Field size:** Converted to monocrop equivalent, the area planted to taro in a field averages 365m<sup>2</sup>, ranging from an average 240m<sup>2</sup> in Nguti and Supe to 780m<sup>2</sup> in Koupe. Taro occupies 19% of the area in forest fields, 8% in open ones, 4% in tree-food fields and 1% in tree fields.

**Planting methods:** Taro is planted the same way as cocoyam in almost every case where they are both grown. Planting distances vary from 10 to 200cm, but cluster around 35-100cm, with a mean of 70cm, Nguti being the major exception with 35cm spacing. Densities vary around a mean of 22,000pph, from about 17,000 in Koupe, 21,000 in Kumba and 24,000 in Bangem 77,000 in Nguti.

**Calendar:** Taro is usually planted in first season (82%), generally in March (59%), with planting occurring at every month except July and December but concentrating in February to April (83%). Planting is from February to April in Kumba (54% March), March in Koupe (75%) and the Sands (78%), February to March in Supe (50% March) and Nguti (67% March), and February to March and August to November (43% March) in Bangem. It is weeded a first time by 87% of farmers (the least in Supe), and a second time by 21% (only 7% in Bangem and Supe and 44% in the Sands). Harvesting begins at an average six months and lasts only until the eighth month. The longest harvests are in the Sands zone (to the ninth month on average), and the shortest in Supe (to seven and a half months).

**Varieties:** 99% of taro farmers have "Ibo coco" (*C. esculenta* var. Edo) and 40% "country coco" (var. Dasheen). Dasheen taro is most prevalent in the Northern half of Meme: Bangem, Nguti, and Supe. The Dasheen is taller and "slimier" in cooking; according to some farmers, it is a heavy feeder that crowds out some companion crops; according to Dr. Wuton of Ekona it is less resistant than Edo to the cocoyam root rot. 17% of farmers use seed tubers from their farms, and 7% buy in the market. Fourteen out of the twenty-four farmers that reported storing taro for a month or more store for seed, an average of 2.2 months in storage.

**Field problems:** Farmers reported losing an average 8% of their crop, or 6% of the total area planted and 9% of potential production. The worst losses per

farm were reported to be in Nguti (36%). Four farmers (two in Koupe and one each in Kumba and Supe) claimed that they lost 25-50% of their taro to root rot, not differentiating the varieties. One in Bangem claimed that ants had eaten 50% of her Edo and 20% of her Dasheen; ants often are attracted to cocoyams with root rot and are mistaken for the cause by many farmers. Two in Nguti and one in the Sands said maggots had eaten the tubers, and one in Kumba blamed snails. One in Bangem and one in Kumba reported small/no tubers, despite healthy roots. In field visits, the only problem discovered was taro leaf blight, heavy around Tombel in Koupe.

**Processing and marketing:** 10% of farmers do not eat taro at all. 63% boil it, 83% pound it to make achu, 8% make ekwan (pounded, tied in leaves and boiled in soup), 15% porrage (chunks cooked in stew), and one used it in kwa coco. 29% of the total harvest is sold. 33% of farmers said they sold it last year (60% in Nguti and under 30% in Koupe and Kumba), although 42% claimed to sell it raw; 4% sell it boiled.

**Storage:** Twenty-four farmers, some in each zone, stored taro for a month or more, six in the farm (five in covered holes and one covered on the surface), two in sheds (one also covered with plantain leaves), fourteen on the floor in the house (at least nine with wood ash), and one on a banda (raised shelf). Fourteen of them save planting material. The taro is saved an average of five months and about a quarter is spoiled by the end of this period, most to rot (one mentioned losses to sprouting). Only one had no loss.

## 5. Plantains and Bananas:

**Importance:** Plantains and bananas are planted on about 17 and 4 square kilometers of Meme land respectively (monocrop equivalent). Approximately 20,200 tons of plantains and 3,400 tons of bananas were harvested in the 1986-87 crop year, equivalent to 1,300 and 130 million francs at local prices, or 18.9 and 2.7 million kilocalories of food energy. This makes plantains first in economic importance and second in nutritional importance in the Division; bananas rank seventh in both categories.

**Ecozones:** Sands zone farms contain two times the divisional average of plantains, with the least being planted in Kumba and Nguti. Banana area planted per field is 75% above divisional average in Supe and Bangem, low in Kumba, and not even mentioned in the Sands. By total area, Kumba ranks first for plantains, with 45% of planting, and second for bananas, with 28%. Supe ranks first for bananas (45%) and second for plantains (13%), followed by Koupe (14% for plantains and 5% bananas) and Bangem (10% plantains and 16% bananas). Nguti (145 banana and 63 plantain bunches) and Koupe (111 plantain bunches) lead in reported average household production, Bangem reporting the least (26 plantain bunches) and few growers outside Nguti reporting banana totals at all. For plantains, Kumba (56%), Koupe (19%) and Supe (12%) lead in total production; for bananas, among reporters, Nguti (46%) and Supe (45%) lead.

**Associations:** Plantains are planted in 35% of fields by 74% of farmers, as a major crop in 54% of the fields. Among fields with the crop, 0.7% are mono-

cropped (with 2.5% of the total area of the crop); the rest are intercropped with other major crops. Bananas are planted in 12% of fields by 20% of farmers, as a major crop in 54% of the fields. Among fields with the crop, none is monocropped, and 2.3% contain bananas as the only major crop, with secondary crops added; the rest are intercropped with other major crops. 57% of plantains and 50% of bananas are found in tree fields, 17% of plantains and 14% of bananas in tree-wood ones, 15% of plantains and 14% of bananas in open fields, and 10% of plantains and 12% of bananas in forest fields. Plantains are associated most frequently with bananas ( $r=.44$ ), and vice versa; but also with cocoa (.37), taro (.29), coffee (.26) and cocoyams (.25). In Kumba, they are found with bananas, cocoa and sometimes coffee and maize; in Koupe, with coffee, cocoa, and sometimes bananas, cassava, cocoyams and taro; in Supe, with most crops, all together; and in Bangem, with bananas and coffee, and sometimes cocoyams. Bananas in Kumba are found mostly with plantains and agusi; in Nguti, with plantains, cocoa, coffee, yams and beans, and away from cassava; and in Supe, again, with every other crop except maize and coffee.

**Field size:** Converted to monocrop equivalent, the area planted to plantains and bananas in a field averages 665 and 505m<sup>2</sup> respectively, ranging from an average 480m<sup>2</sup> of plantains in Nguti to 1380m<sup>2</sup> in the Sands, from no bananas in the Sands to 840m<sup>2</sup> in Supe, and, added together, from 635m<sup>2</sup> in Kumba to 1620m<sup>2</sup> in Supe. Plantains and bananas occupy 13% and 4% of the area in forest fields, 7% and 2% in open ones, 10% and 2% in tree-wood fields and 17% and 5% in tree fields.

**Planting methods:** Plantain spacing varies from 100 to 800cm, but clusters around 300-450cm, with a mean of 360cm. Densities vary around a mean of 2000ph, from about 500 in Bangem and Koupe and 800 in Kumba, Nguti and Supe to 1,000 in the Sands zone. Bananas are planted exactly as plantains wherever they coincide.

**Calendar:** Plantains are usually planted in first season (81%), generally in March (52%). Planting is done in every month except May and December, with 75% between February and April. It goes from February to April in Kumba (48% March) and Nguti (54% March), March (63%) and October-November in Koupe, March to the Sands (93%), February to March in Supe (54% March), and all year (20% March) in Bangem. Bananas are planted first season by 70% of growers, with only 34% in March, in all months except January, May, August and December; in Nguti, 67% are planted in March, and in Supe, 43%. Plantains are weeded a first time by 90% of farmers (the least in Koupe) at an average of 2.7 months after planting, and a second time by 37% (over 50% in Bangem and Nguti) at 5.2 months. Bananas are weeded a first time by 93% of growers (the least in Supe) and a second time by 46% (67% in Kumba and Nguti). Harvesting of plantains begins at an average 11.5 months (22% before ten months and 9% at fourteen or later) and lasts until the eighteenth month (42% before fifteen months and 25% to two years or more). The longest plantain harvests are in the Sands and Koupe (to the twenty-first month on average), and the shortest in Bangem (to the thirteenth month). Bananas are harvested from 10.4 months to 18.7 on average.

**Varieties:** 93% of plantain farmers grow horn types (Ebanga) and 41% French types (Sombre, Clair, Dwarf Njinikorn, giant Brococa, and Small Finger), with

the French being most common (beside the horn) in Koupe (100%) and Kumba (86%). 90% transplanted suckers within their own farms, 3% buy on the market, and 2% (in Kumba Town and one in Supe) have bought from IRA Ekona or IRA Njombe. 49% of bananas for which information was given are unnamed locals; four farmers had No. 1, five Poyo, and two Gros Michel; 75% came from their farms, 20% from the market, and 5% are improved species.

**Field problems:** Farmers reported losing an average 20% of their plantain crop, or 20% of the total area planted and 19% of potential production. The worst losses per farm were reported to be in Kumba (25%), the least in Bangem (9%). Banana losses were reported at 13% of the crop, the most being again in Kumba.

Stem borers (plantain weevils) and root nematodes were the principal reported causes of the losses in almost all cases. The larva of the plantain weevil bores into the stem of the plantain, creating black rotten paths that ants are attracted to, and eventually causing the plant to lodge before bearing. Because of the ants, yellowing leaves and rot at base, it is equated by many farmers with cocoyam root rot, and both with "Panama", a banana disease brought in to the CDC plantations. Farmers do not often recognize the cause (and never the adult insects - in one village the predator beetle was identified by farmers as the adult borer), but 14% of growers described the rotten stems as causing an average of 60% loss, in all zones. A further 14% described general lodging before bearing, with 50% loss in all zones. 10% described lodging due to dead root systems, with 40% loss in all zones except Nguti and Bangem. In Kumba, there were also three "disease" mentions, two cases of prematurely dying leaves, and one each of flood, monkey damage and leaf-cutters; in Bangem, one case of monkey damage; and in the Sands one of small bunches.

In field visits, borer was found more frequently than nematodes in Supe and Kumba, and the opposite in Koupe; in Bangem, cigar end and nematodes were identified. Cases of prematurely dying leaves were inspected in Kumba, and identified in photographs later by Mr. Kofi of Plantains as severe early borer attack (not, as suspected, black sigatoka). No plantains were seen in the Sands and Nguti, and in the latter zone and Supe many farmers claim to have given up plantains in favor of bananas because the plantains would not do well on most of their soils.

**Processing and marketing:** Plantains are eaten by all but one farmer. They are boiled by 82%, eaten in porrage (cnunks in stew) by 63%, roasted by 42%, fried (dodo) by 10%, eaten in koki balls by 7%, in ekwan packets by 4%, and pounded by 4%. 47% of all farmers said they sold plantains last year (two-thirds in Koupe and the Sands, and a quarter in Bangem), selling almost one half of the total harvest. Plantains are the highest-value crop for effort expended (yam production and cassava processing being much more work), and the closest food crop to commercial status. Plantains are sold raw by 56% and boiled by 10% of farmers.

## 6. Yams:

**Importance:** Yams are planted on about five square kilometers of Meme land (monocrop equivalent). Approximately 5,250 tons were harvested in the 1986-87 crop year, equivalent to 955 million francs at local prices or 5.5 million kilocalories of food energy. This makes them second in economic importance and fourth in nutritional importance in the Division. However, their economic importance is restricted to few people outside Kumba Corridor.

**Ecozones:** Bangem farms contain 60% more than the divisional average of yams, with the least being planted in Nguti, Supe and Koupe. By total area, Kumba ranks first with 73% of planting, and Bangem second with 14%; the Sands has only 7%. The Sands, however, leads in reported average household production, with 1600kg, followed by Kumba with 300kg and only 45kg in Bangem. The Sands total is swelled by one major yam grower, without whom the average would be 240kg, below Kumba's; but it was observed that a few such extraordinary growers could be found in most of the Sands villages. Kumba (63%) and the Sands (33%) lead in total divisional production.

**Associations:** Yams are planted in 20% of fields by 51% of farmers, as a major crop in 52% of the fields. Among fields with the crop, 1.5% are monocropped (with 4.0% of the total area of the crop). The rest are intercropped with other major crops. 65% are found in open ones, and 34% in tree-food fields. They are associated most frequently with egusi ( $r=.26$ ) and maize ( $.26$ ); in Kumba, with taro and sometimes maize; in the Sands zone, with egusi and maize; and in Bangem, with beans and maize.

**Field size:** Converted to monocrop equivalent, the area planted to yams in a field averages 385m<sup>2</sup>, ranging from an average 60m<sup>2</sup> in Koupe to 600m<sup>2</sup> in Bangem. Yams occupy 6% of the area in open fields and 4% in tree-food fields.

**Planting methods:** Yams are planted on mounds (64%), on the flat (21%) and end beds (14%), with little zonal specialization except in the Sands, where all but one farmer used mounds. Planting distances vary from 20 to 400cm, but cluster around 80-120cm, with a mean of 115cm. Densities vary around a mean of 2,000pph, from about 4,000 in Supe and Nguti and 7,000 in Kumba to 10,000 in the Sands and 15,000 in Bangem.

**Calendar:** Yams are usually planted in first season (99%), generally, in March (59%), with 12% in January, 19% in February, and a few in April and May. Planting is from January to April in Kumba (73% March), February to March in Supe (57% March), Nguti (60% March) and the Sands (71% March), and December to March (40% March and 30% January) in Bangem. They are weeded a first time by 91% of yam farmers (the least in Supe and Koupe) at an average of 3.1 months after planting, and a second time by 34% (only 20% in Bangem but 50% in Nguti) at 4.9 months. Harvesting begins at an average 7.5 months (22% before seven months and 11% at ten or later) and lasts only until the tenth month (12% before nine months and only 2% after eleven). The longest harvests are in Bangem (to the eleventh month on average), and the shortest in Supe (to the ninth month).

**Varieties:** 63% of yam growers have Dioscorea rotundata (Caiapar or white

yams), 12% each D. Alata (water) and D. Dumentorum (sweet yams), and 3% other types (all in the Kumba Corridor: two with D. cayensis (yellow), and one with D. Shipiana (red)). Calabar yams are mostly in Kumba and the Sands, water yams in the Sands, and sweet yams in Bangem, Supe, Kumba and the Sands. 58% of the yams farmers keep their own setts or get them from a neighbor, 42% buy them in markets, and one farmer in the Sands zone had some from Extension. Eleven farmers store yams for seed.

**Field problems:** Farmers reported losing an average 7% of their crop, or 9% of the total area planted and 7% of potential production. The worst losses per farm were reported to be in Kumba (11%). The reported losses were to maggots (one case each in Kumba and Nguti), animal damage to one Sands farm, a case of tuber rot in Kumba and three cases there of small tubers. No yam problems were seen in the field, through one farmer in Nguti showed beetles (about two-thirds the size of a yam beetle, with longer antennae) that eat through yam roots and tubers as well as bean and egusi vines, taro and cocoyam tubers, and eggs of a red ant laid on cocoyam tubers (and yam and taro ones) that cause the tuber to rot.

**Processing and marketing:** 22% of farmers do not eat yams, the largest proportion for any crop. 65% eat boiled yams, 48% chop them up for porrage, 22% make pounded yam fufu, and 3% roast. 18% said they sold yams in 1986-7, averaging a third of the total crop. 25% sell yams as raw tubers, 7% boiled and one each as porrage and planting material. Yams are a high-value crop but are constrained by the labour required for large-scale digging of holes and staking, and by the availability of planting material.

**Storage:** Yams are stored a month or more by fifteen farmers, twelve for planting material, four only to eat, and two to sell. Three farmers tie them on sticks in a barn and one each, to eaves of a house, on a fence, hang them on ropes in the house or pin them to leaves of a palm tree. Seven leave them on the floor in a cool, dry part of the house, three applying wood ash, and one puts them in bags in the kitchen. Storage in or outside gives equal losses, about one-fifth, to rot. Two farmers keeping them in the house reported no loss, and one who ties them on sticks reported dessication. Storage is in all producing zones except Bangem, but proportionally fewer of the Kumba yam farmers store.

## 7. Groundnuts:

**Importance:** Groundnuts are planted on about six square kilometers of Meme land (monocrop equivalent). Approximately 350 tons were harvested in the 1986-87 crop year, equivalent to 105 million francs at local prices or 1.5 million kilocalories of food energy. This makes them eighth in economic and nutritional importance in the Division.

**Ecozones:** Sands farms contain twice the divisional average of groundnuts, and they were not grown by any of the Bangem sample. By total area, Kumba ranks first with 70% of planting, Supe second with 15%, followed by the Sands and Koupe with 7%. Production is low. Supe and Kumba (25kg), Koupe (20kg) and

the Sands (15kg) lead in reported average household production, and Kumba (65%), Supe (16%) and Koupe (13%) in total divisional production.

**Associations:** Groundnuts are planted in 14% of fields by 42% of farmers, as a major crop in 53% of the fields. They are never monocropped or the only major crop in a field. 97% is found in open fields, and 3% in tree-food fields. They are associated most frequently with maize ( $r=.48$ ) and beans (.28); in Kumba, with maize, egusi, sweet potatoes and cassava; in Supe, with most other crops except cocoa and coffee; in Koupe, with beans and maize; and in the Sands, with maize and away from cocoa and plantains.

**Field size:** Converted to monocrop equivalent, the area planted to groundnuts in a field averages 560m<sup>2</sup>, ranging from none in Bangem to an average 1020m<sup>2</sup> in the Sands zone. Groundnuts occupy 9% of the area in open fields.

**Planting methods:** Groundnuts are planted on beds (100%) and sometimes also on the flat (13%). Planting distances vary from 10 to 50cm, but cluster around 15-30cm, with a mean of 27cm. Only one farmer planted more than one seed to a hole. Densities vary around a mean of 150,000pph, from 130,000 in Kumba and 140,000 in Nguti to 190,000 in Supe and 210,000 in Koupe.

**Calendar:** Groundnuts are usually planted in both seasons, 86% first season and 64% second, generally in March (64%) and August (44%). Planting is from February to April and July to September in Kumba (65% March, and most second-season in August), March (71%) and July to September (most August) in Koupe, February (25%) to March (50%), August (40%) and November (25%) in Supe, March (60%), April (20%) and August (80%) in the Sands, and March (71%) and August (57%) in Nguti. They are weeded a first time by 77% of farmers (the least in Nguti and Koupe) at an average of 1.5 months after planting, and a second time by only 4%. Harvesting begins at an average 2.2 months and lasts only a week on average.

**Varieties:** Most groundnuts named are Yaounde (fourteen farmers), and most are a red and white mix. 56% buy seed from the market, 40% keeping their own. Seventeen growers said they saved seed.

**Field problems:** Farmers reported losing an average 12% of their crop. The worst losses per farm were reported to be in Nguti (25%), with none in Koupe and the Sands. Losses were reported due to few/no seeds in a pod (calcium deficiency) in three cases in Kumba, Nguti, and Supe, animal damage in six cases (also in the three zones), and two cases of stunting (rosette virus?) and one of snails in Kumba. In field visits, groundnuts were seen in only two Sands, one Kumba and one Koupe field: rosette was about 5% in two of the fields and absent in the others. Five to seven pods per plant averaging two grains are a normal yield.

**Storage:** Twenty-four farmers stored groundnuts a month or more, seventeen for seed, ten for later sale, and four only to eat. They were reported bagged in seven cases, put in airtight containers (calabashes, tins) in six and in baskets in two. Generally they were reported as left in the kitchen banda, or ceiling (usually the same thing). They were kept two to eighteen months, averaging six; and were damaged by rats (sixteen cases) and weevils (seven),

with seven having no losses and the average loss being a fifth.

## 8. Egusi Melon:

**Importance:** Egusi is planted on about 1.2 square kilometers of Meme land (monocrop equivalent). Approximately 3,500 jute (cocoa) bags were harvested in the 1986-87 crop year, equivalent to 50 million francs at local prices. This makes them ninth in economic importance in the Division.

**Ecozones:** Sands farms have 60% more planting of egusi than Kumba ones, and no other zone plants more than an insignificant amount. By total area, Kumba ranks first with 70% of planting, and the Sands second with 30%. Reported average household production is 1.4 jute bags in the Sands and 0.2 in Kumba.

**Associations:** Egusi is planted in 6% of fields by 21% of farmers, as a major crop in 53% of the fields, always in association with other major crops. 75% is found in open fields, 5% in tree-food fields. It is associated most frequently with yams ( $r=.26$ ); in Kumba with bananas, groundnuts and maize; in the Sands with yams and maize and separate from cocoyams and plantains.

**Field size:** Converted to monocrop equivalent, the area planted to egusi melon in a field averages 320m<sup>2</sup>, ranging from none in Bangem and Koupe to an average 480m<sup>2</sup> in the Sands. Egusi occupies 2% of the area in open fields.

**Planting methods:** Egusi is planted on the flat (80%), and sometimes on mounds (31%) and beds (15%), mostly in the Sands zone. Planting distances vary from 20 to 300cm, with a mean of 190cm. 2.8 seeds are planted to a hole, ranging from one to six but with 75% (in roughly equal distribution) planting between two and four. Densities vary around a mean of 3,000pph, from about 7,000 in Kumba to 20,000 in the Sands.

**Calendar:** Egusi is usually planted in first season (75%), generally in March (67%), with 22% in February. Planting is from January to March in Kumba (67% March), and February to March in the Sands (39% March) and Ngubi (67% March). They are weeded a first time by 76% of farmers at an average of 1.8 months after planting, and not a second time. Harvesting begins at an average 4.6 months and lasts a half month.

**Varieties:** Eight farmers have "Ibo" egusi (a slender ground vine, probably Citrullus lanatus) and four farmers, "country" egusi (a climbing vine, probably Cucumeropsis mannii, known in the east as ngôn). 63% took the seed from their farms (six claiming to store seed) and 40% from a market.

**Field problems:** Farmers reported losing an average 7% of their crop. The worst losses per farm were reported to be in the Sands zone (14%).

**Storage:** Egusi was stored by seven farmers, by six for seed, four to sell and one only to eat. Most put it in bags, one in tins. It was kept one to nine

months, averaging seven. Three had no losses, and the average loss including these was one-fifth, to rats (three farmers) and maggots (two).

## 9. Beans:

**Importance:** Beans are planted on about 1.3 square kilometers of Meme land (monocrop equivalent). Approximately 1.350 jute (cocoa) bags of all types of beans were harvested in the 1986-87 crop year, making them a minor crop in the Division.

**Ecozones:** Supe and Koupe farms contain two times the divisional average, with the least being planted in Kumba. By total area, Bangem ranks first with 40% of planting, Supe second with 28%, and Koupe third with 14%. Average household production is low: 0.2 jute bags in Supe and less in Bangem and Koupe; Supe has 41%, Bangem 28% and Koupe 27% of total divisional production.

**Associations:** Beans are planted in 8% of fields by 24% of farmers, as a major crop in 42% of the fields, always in association with other major crops. 95% are found in open fields, 4% in tree-food fields, and 1% in forest fields. They are associated most frequently with groundnuts ( $r=.28$ ) and maize (.27); in Bangem, with maize, Irish potatoes and yams; in Koupe, with groundnuts; and in Supe, with maize, groundnuts, cassava and taro, and separate from cocoa.

**Field size:** Converted to monocrop equivalent, the area planted to beans in a field averages 220m<sup>2</sup>, ranging from an average 55m<sup>2</sup> in Kumba to 480m<sup>2</sup> in Supe. Beans occupy 3% of the area in open fields.

**Planting methods:** Beans are planted on beds (64%), the flat (19%) and mounds (17%). Planting distances vary from 10 to 100cm, with a mean of 50cm. 1.9 are planted to a hole, ranging from one to four, with 73% planting two and only 5% more than two. Densities vary around a mean of 90,000pph, from about 60,000 in most zones to 230,000 in Supe and 380,000 in Koupe.

**Calendar:** Beans are usually planted in both seasons, 71% of growers first season and 52% second, in all months except April and May, but most often in February (24%), March (44%) and August (32%). Planting is from in March (75%) and late July-August in Koupe, in almost every month in Supe and Bangem, and March (86%) and August in Nguti. They are weeded a first time by 76% of farmers (the least in Supe) at an average of 1.3 months after planting, and a second time by none. Harvesting begins at an average 3.4 months and lasts about half a month.

**Varieties:** 36% of bean growers have dwarf (bush) haricot beans, 36% climbing haricot beans, 33% cowpeas, and 14% (in Kumba and Supe) the soybeans recently introduced from Dschang by the Ministry of Agriculture. Bangem has most of the dwarf and climbing beans, and Bangem, Supe and Nguti the cowpeas. 97% of growers save their seed and 18% buy it at the market. Ten farmers stored bean seed for an average of 5.3 months.

**Field problems:** Farmers reported losing an average 4% of their crop. The worst losses per farm were reported to be in Nguti (24%) and Supe (15%).

**Storage:** Beans were stored by ten farmers, by all for seed and by two also to sell. They were kept in bags in the kitchen banda (six farmers) or in sealed containers (bottles or plastic bags, four), once with wood ash. Storage was for one to fourteen months, averaging 5.3. Six had losses, which averaged a fifth overall, to weevils (all) and rot from moisture (one).

## 10. Potatoes:

**Importance:** Potatoes are planted on about 1.2 square kilometers of Meme land (monocrop equivalent), two-thirds being sweet potatoes. Approximately 1.400 jute (cocoa) bags of both sweet and Irish potatoes were harvested in the 1986-87 crop year, making them a minor crop in the Division.

**Ecozones:** Sweet potatoes were found among only a few farmers, with the largest area per farm in Bangem and small areas in Supe and Kumba. Irish potatoes were found only in Bangem. By total area, Bangem ranks first with 95% of sweet potato planting and all Irish potato. Reported average household production was only 0.5 jute bags in Bangem (both types) and 0.2 in the Sands zone., giving Bangem 83% of total divisional production.

**Associations:** Potatoes are planted in 2% of fields (2% sweet and 1% Irish) by 9% of farmers (7% and 5%). Sweet potatoes are a major crop in 53% and Irish, in 83%, of the fields. Sweet potatoes are always planted in association with other major crops, but Irish potatoes are monocropped in 33% of fields (43% of the area). Both are found only in open fields. They are associated frequently only with each other (r=.22).

**Field size:** Converted to monocrop equivalent, the area planted to sweet and Irish potatoes in a field averages 730 and 400m<sup>2</sup>, ranging for sweet potatoes from none in Koupe, Nguti and the Sands to an average 1440m<sup>2</sup> in Bangem. Sweet potatoes occupy 2% and Irish, 1%, of the area in open fields.

**Planting methods:** Potatoes are planted on beds (60%) and on the flat (40%), with only Bangem using the latter method. Planting distances vary from 15 to 100cm, with a mean of 55cm (60cm in Bangem). Densities vary around a mean of 32.000pph, 29.000 in Bangem.

**Calendar:** Potatoes are usually planted in first season (83%), generally in February in Supe and February to June, October and November in Bangem. They are weeded a first time by 83% of farmers and a second time by 9%. Harvesting begins at an average 5.5 months and lasts until the seventh month.

**Varieties and field problems:** 40% of Bangem farmers grow Irish potatoes. Sweet potatoes are grown by 7% of Meme farmers - 27% in Bangem, 13% in Supe, and a few in Kumba and the Sands. All seed comes from the farm. There were no reported losses of sweet potatoes. One Bangem farmer reported losing all of her Irish potato crop to blight.

## **G. Conclusions and Recommendations:**

### **1. Zones:**

In terms of farming population, present production and agronomic problems, the priority zone for agricultural research (both breeding and agronomy) and extension is the Kumba Corridor.

In terms of agricultural potential and future social needs, the Supe region should be considered second priority for research, with particular emphasis on the adaptation to, and handling of, its granitic soils. This work will eventually also benefit the development of the Nguti zone as the farming population expands there.

The Koupe zone would be capable of substantial expansion of production both in the short- and long-term if the road system were to be improved.

The Sands zone already enjoys substantial production for its size but can benefit from the IRA varietal improvement in cassava and future technologies to reduce labour input to yams; it may face a marketing problem shortly if new urban cassava and yam markets are not developed.

The Bangem zone should be included in testing of IRA technology for soil and pest management, maize and root crops in the highlands stations of Bambui and Dschang.

### **2. Management and investment:**

Despite short and shortening fallows, sustained cultivation does not yet threaten soil fertility, as the fallows are shortest on the more durable soils. But poor field management (high densities, shading, lack of rotation) is creating pest, disease and soil texture problems in these same areas, especially on the food farms planted inside cocoa and coffee farms. Pest and disease incidence is also high in Bangem, despite longer present-day fallows. There is very little monocropping in Meme, and intercropped densities are often quite high, reducing individual yields. Both extension and research (social and agronomic) should be focussed on improved management techniques and the reasons for present ones.

Labour bottlenecks occur in March (making of beds and planting), July to August (weeding of long-cycle fields), and September to November (cocoa harvesting). Technology recommendations should be tailored to reduce, or at least not increase, labour inputs in these months.

Women bear the primary responsibility for food-crop fields. It is the women who most determine what is planted in the fields and how it is planted, managed and harvested, although their husbands have supervisory authority and are likely to act as intermediary to extension and research visitors. Constant effort must be maintained to interact directly with the women as well as the men, to improve research understanding and extension education.

Substantial sums of money are spent on labour for land clearing, weeding and cocoa harvesting, but other cash investments for agriculture are rare. Local village meetings are the main credit source. Crop protection chemicals (against animals as well as crops and diseases) are much more desired and used than fertilizers; but food-crop chemical education is badly needed, even more so than chemical supply. There is little experience with new food-crop varieties, but great interest. Simple tools are difficult to obtain in most areas.

### 3. Crops:

Maize, despite low prices, is of considerable importance, especially in the Kumba Corridor. Preferences are for hard yellow or soft white maize, sweet and bright, to make fufu, chaff and boiled or roasted green cobs. It is grown both in open and cocoa/coffee fields, on beds and on the flat. Constraints are over-planting without thinning, stem borer (both seasons), streak virus and storage weevils.

Cassava is scarce relative to demand but still first in provision of food energy, and most important in the Sands zone and Bangem. It is grown in open fields or beds. Harvest is usually completed by the eighteenth month, posing no problems for IRA varieties. Processing is to water fufu, pounded fufu and gari. Constraints are the local varieties' yield potential, animal damage and some tuber rot. Local markets are not yet satisfied, but further production increases would require external marketing outlets.

Cocoyams are still widely planted despite severe production losses to the root rot, with Koupe being the most important zone. Forest fields contain almost half the planting, but the crop is found in all types of field. Almost half harvest before eight months due to the rot, which does not seem to vary with altitude or slope. Taro is usually planted with cocoyams but considered of lesser importance; it is rarely damaged by the root rot. Seed storage is a problem for those who cannot maintain crops in the field until next planting.

Plantains are the most important economic food crop in Meme, and are widely commercialized and exported from the Division. Almost half plant a French type as well as the traditional horn. Planting is usually between February and April, and they are often a secondary crop to cocoa, coffee or other food. Bananas are most important in Supe and Nguti, where plantains do not do well. Losses, due to borer weevils and nematodes, are almost as heavy as for cocoyams.

Yams (especially D. rotundata) are a very important economic crop in the Kumba Corridor and among a minority of large-scale Sands growers. Planting is in January to March. Yields appear to be very low in Bangem, but notable field problems are few, land preparation and planting material being more important constraints to production.