

Socio-cultural factors influencing and maintaining yam and cowpea diversity in Benin

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Yam and cowpea are important elements in the food culture of local communities in the Transitional Guinea-Sudan Zone of Benin. Yam and cowpea serve to satisfy vital needs in households and in communities, but also play an essential role in the rituals and ceremonies of the agrarian civilizations of Benin. The diversity of rituals, food habits, technological traits and food security strategies for the two crops contributes to the maintenance of varietal diversity. It is not possible for one or even a few varieties to meet all needs. The more a variety is culturally and socially embedded, the greater the chance that it will meet acceptance on the local and regional market. Farmers' ambition to meet market demands in order to satisfy socio-economic needs also sustains and increases varietal diversity. Especially female farmers growing cowpea showed positive diversity maintenance behaviour. Overall, the study shows that the management of on-farm genetic resources is a socially and culturally constructed system. Any external strategy to improve management of on-farm diversity should take into account these social and cultural aims.

Keywords: Cowpea, diversity, gender, rituals, yam

Introduction

This paper describes and analyses some of the social-cultural factors in rural communities that influence the maintenance of crop variety diversity for two crops – yam and cowpea – in Benin, West Africa. Yam (*Dioscorea* spp.) was brought into cultivation in West Africa (*D. rotundata*, *D. cayenensis* and *D. dumetorum*), South East Asia (*D. alata* and *D. esculenta*), and tropical America (*D. trifida*). Yam is an important component of the agriculture and economy in Benin, contributing to the food security of large parts of its population, but is confined to the

savannah-forest ecotone, i.e. transitional lands between the eighth and tenth parallel in the Guinea-Sudan zone (Igué, 1974).

Cowpea (*Vigna unguiculata* (L.) Walp.) originated in tropical Africa (Padulosi & Ng, 1997). It is widespread in the tropics and sub-tropics, and is often an important component of local food supply, especially in sub-Saharan Africa, Asia and Central and South America (Coulibaly *et al.*, 2002; Mortimore *et al.*, 1997; Zannou *et al.*, 2004). In Benin, cowpea is grown for seeds and young leaves all over the country. The Guinea-Sudan zone is one of the major cowpea production areas in Benin (Zannou *et al.*, 2004).

In both crops, loss of genetic diversity has been reported. Eastwood and Steele (1978) and Okoli

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(1991) have shown loss of genetic diversity in yam. In Benin, farmers reported the disappearance of many yam cultivars, a reduction in the number of cultivated varieties and the abandonment of some others due to pest and disease problems (Dansi *et al.*, 1997). The genetic diversity of cowpea is gradually diminishing because humans change or destroy the natural habitats to which wild species are adapted and because farmers replace landraces by improved cultivars (Ng & Maréchal, 1985). *Ex situ* conservation in gene banks is not, by itself, an efficient tool for sustainable conservation of crop germplasm (Pardey *et al.*, 1999). On-farm conservation by farmers is needed to preserve crop diversity (Jarvis *et al.*, 2000). Convergence of farmers' needs for diversity and society's demand to maintain this diversity on farm must be realized.

Decisions regarding the use and management of plants are based on both biophysical and socio-cultural factors, and thereby at least partly on how a given community or individual perceives the natural world (Millar, 1999; Elias *et al.*, 2000). Social and cultural contexts shape the roles of different individuals or groups within a household or community (Arua, 1981; Bellon, 2001; Brydon, 1981; Chauveau *et al.*, 1981; Uzozie, 1981). These socially determined roles affect farmers' knowledge, actions and access to resources regarding the maintenance of crop diversity (Jarvis *et al.*, 2000). Thus, studying the relevance of socio-cultural factors to on-farm crop diversity is important to understand how the social maintenance mechanism of yam and cowpea diversity in Benin might be enhanced.

Socio-cultural framework

Scientists – mainly biologists – often see morphological and genetic diversity as natural patrimony resulting from a long period of crop species evolution. But when one wants to understand how and why a given farmer or community maintains (or fails to maintain) this diversity, one moves from the material world of morphological and genetic diversity into the world of social values. In this world, five different groups of factors can be distinguished: technological and culinary traits, food security in households, socio-cultural values,

market demand and agronomic traits. In the social world, some factors are interdependent. A single factor is rarely sufficient to explain diversity maintenance or why an improved crop variety is accepted by farmers. Any given crop variety goes through a process of social translation in which different values tend to align or exercise mutual influence. Taste, for example, may be as important as actual bulk in determining local notions of nutritional satisfaction, and thus helps explain why some varieties seemingly unproductive to the agronomist are carefully maintained. This process of translation depends on the community in which the farmer lives, socio-economic conditions and physical and economic environments. The diversity of uses and values is reflected by the crop varietal diversity as maintained by farmers.

Materials and methods

Data collection

One-hundred and ninety-four yam farmers (167 male; 27 female) and 136 cowpea farmers (109 male; 27 female) from four relatively large communities (ethnic groups: *Mahi*, *Idatcha*, *Tchabè* and *Bariba*) were interviewed with open-ended questions to assess the socio-cultural and economic importance of yam and cowpea cultivars. Simultaneously, planting material was collected for participatory characterization.

Two series of detailed studies were carried out in two villages for yam (*Yagbo* and *Kpakpaza*, district *Glazoué*) and two villages for cowpea (*Dani* and *Diho*, district *Savè*) in the Guinea-Sudan Zone of Benin, where communities mainly belong to the *Mahi*, *Idatcha* and *Tchabè* groups. During the first series of detailed studies, 40 farmers in each of the four villages were interviewed. Of these 40 farmers, 10 farmers were female in *Kpakpaza*, 11 in *Yagbo*, 10 in *Dani* and 14 in *Diho*. For each village, the cultural embedding of crop varieties was investigated by studying associations between yam and cowpea varieties and local divinities (*Vodoun* in *Mahi*). Respondents freely listed the varieties that (s)he considered important for cultural ceremonies and specific to given divinities. The role played by yam and cowpea varieties in local traditions, food habits, rituals and ceremonial and religious festivals was then analysed.

In order to take into account the variability in the environment of the farmers, the food security dimension, and the technological traits of the cultivated varieties, we interviewed in a second series of in-depth studies 100 yam farmers (87 men and 13 women), and 91 cowpea farmers (65 men and 26 women). The female farmers in the sampled populations have their own yam and cowpea farms. The objective of this second series of detailed studies was to link the socio-cultural and economic factors to agronomic, food security and food technological factors. The relatively high involvement of women in cowpea cultivation allowed a comparative gender analysis on cowpea diversity management. For the technological traits, only farmers who held technological knowledge on a given variety were requested to assess it. Yam varieties were evaluated for their culinary value in *Yagbo* and *Kpakpaza*, whereas cowpea varieties were evaluated in *Dibo* and *Dani*, by asking farmers to provide a score for each variety trait for the varieties that farmers knew well.

Data analysis

Frequencies, percentages and cross-tabulations were calculated, and mean comparisons were performed, using the Statistical Package for Social Sciences (SPSS 12.0.1) and the Statistical Analysis System (SAS 8e). The statistical tools to compare means included the *t*-test, *F*-test and Games-Howell test for multiple comparisons. Gender differences in behaviour regarding yam and cowpea varietal diversity management and the strategic choices of the yam and cowpea farmers were analysed using mean comparison in relation to relevant socio-cultural variables. On the basis of the relationships between the socio-cultural, economic, food security, agronomic and environmental factors, the cultivated varieties of yam and cowpea were classified into different categories.

Results and discussion

Socio-cultural rites involving yam and cowpea

In the research area, land, nature and supernatural forces are represented by gods (spirits), forming a unified pantheon and living as a family. Socio-

cultural rites involving crops are directed to several gods and family ancestral spirits. In this section, these socio-cultural rituals are briefly described.

Fâ

Fâ is a divinatory system of rites by which destinies are revealed. All religious and social activities involve consultation through *Fâ* to know the correct behaviour to follow and to protect against harmful forces.

Devotion to ancestral spirits

The ancestors are the spirits of historical or mythic persons; each ethnic community has a group of them. The ancestor cult can be conceived of as a ritual 'mapping' of features of the kinship system.

Egungun

Egungun is the cult of ghosts, and represents the spirits of dead persons who have joined the ancestors after a process of sanctification. The ritual masquerades associated with *Egungun* express the desire of communities to recall departed spirits.

Devotion to non-ancestral spirits [Vodoun]

The *Vodoun* are the spiritual forces regulating the natural order. They include *Sakpata*, *Hèviosso*, *Dan* and *Tohossou*. *Sakpata* is the spirit of the land, controlling e.g. contagious epidemic illnesses such as smallpox. *Hèviosso* is the spiritual force representing the thunder, which can intercede with God to obtain rain for the crop. *Dan* is the force regulating economic prosperity, through which farmers implore benediction for the success of their farm activities. *Tohossou* is in charge of the spiritual force of each clan, and so maintains peace and prosperity in the community.

Rituals of Kokotin within Idatcha

Kokotin is a deity protecting against the risk of being bitten by snakes and scorpions. These are common hazards for farmers.

The divinity Ikpé of Idatcha

Ikpé (for *Idatcha* people) means whistle. Whistling transfers a message that celebrates the clan's *Omon-Adjagou*, guardians of *Idatcha* customs.

Kouchaati ritual within the Otammari ethnic community

The *Otammari* are migrants in *Yagbo*; they celebrate the *Kouchaati* ritual for initiation and social integration of young people.

The role of yam in different socio-cultural rites

Fâ

Yam production is considered an activity requiring divinatory guidance through *Fâ*, because some varieties show large yield variation and are difficult to grow for some farmers. The ability to grow a given variety is considered a gift from God. The *Fâ* priest called *Bokonon* has to sacrifice the newly harvested yam to the *Fâ* before anybody can eat it.

Ancestors

The first roots of the new yam harvest are offered to ancestors so that they can intercede to obtain from God what each community needs or desires.

Egungun

Members of communities where these divinities are to be found, are required to give newly harvested yam to the divinities before humans can eat it. The yam ritual within the *Mahi* begins on 14 July each year. Yam festivities reach their climax on 15 August each year in Savalou, a district in the central part of Benin. The 15 August is the day when *Egungun* will be given the new yam; fellow masquerades come from other towns such as Porto-Novo, Cotonou and Abomey to participate in these festivities.

Kokotin

The newly harvested yam is the first important thing to be dedicated to *Kokotin* each year. The harvest must be done on the day of the ceremonies. Each male family member has to grow some early-maturing varieties each year, mainly the variety *Laboko*, in order to make this offering, and thus obtain protection for his family. As long as the rituals have not been performed, the officiating priest cannot eat the newly harvested yam. The offering of boiled yam comes before the offering of pounded yam.

Ikpe

Within the *Idatcha* community, *Laboko* is the ancestral sacred yam variety. It also characterizes the good yam grower. Farmers from this community stated: 'the best grower is the person who is the first person to eat the new yam, and not all farmers can produce it'. People think that it is by chance that they succeed to grow this variety. Their faith requires them to offer the variety to the divinity linking them to the High God.

Kouchaati

For the *Otammari*, the variety *Gangni* is a 'son' yam and the variety *Kokoro* a 'daughter' yam. These two varieties are very important for *Kouchaati* rituals. *Gangni* and *Kokoro* are considered an inheritance from the ancestors. A good harvest is a sign of benediction and peace from ancestors. The first harvest of these varieties is therefore given to the ancestors and divinities before any member of the community can eat new yam.

The role of cowpea in different socio-cultural rites

The *Fâ*, ancestor spirits and the *Vodoun*, are the supra-natural forces to which cultural rites involving different cowpea varieties are mainly devoted in Benin. In the area of study, cowpea is used during most rituals. Both in *Diho* and *Dani*, several cowpea varieties are used for funerals and offered to ancestor spirits and local divinities such as *Abikoun*, *Tohossou* and *Tchango*. It is after consulting the *Fâ* oracle that it is decided to give cowpea food to twins.

The ritual ceremonies of Kiy-Davi

This is a ceremony to uplift the souls of the deceased to the rank of ancestors within the *Mahi* community. Legend has it that these ceremonies originated in ancient times, deployed on behalf of an ancestor hunter who surprised the spirits (*azizas* = *zina*, i.e. genie) performing the *Kiy-Davi* ceremony for dead persons. When these ceremonies are enacted the white cowpea variety *Atchawékoun* is considered sacred. It is said that each year the community 'kills' that variety before any animal can be sacrificed. This cowpea variety is necessary to ensure the benediction of the ancestors, and to ensure a blessing of peace

on the family. It is necessary to enable the spirits of dead persons to return 'home' to be accepted by the ancestors. These ceremonies of deliverance are conducted by a woman called *Tassinon*. She is the chief of the altar of dead persons. The *Fâ* has to be consulted for any abnormality or irregularity during these ceremonies.

Ceremonies of twins

These ceremonies concern 'bringing back the twins from the bush'. Ancient beliefs in other regions sometimes saw twins as abomination to be abandoned in the bush. In the region of study, local communities saw twins as a blessing. Twins enjoy special spiritual powers, and thus often have to be ritually redeemed. The nutritionally valuable cowpea is an especially appropriate offering for twins. The variety *Atchawékoun* is mainly used. It is used to prepare seven different meals (*lèlè*, *yoyoè*, *dovolo*, *ata*, *ayiwolo-wolo*, *abla*, *abla-manbi-manbi*). The number of different dishes seems symbolically salient of the nutritional challenge posed by raising twins. *Atchawékoun* is also a variety that each member of the community has to cultivate in order to provide food for the divinities *Fâ*, *Hèviosso*, *Sakpata* and *Lègba*.

Ceremonies of Sakpata

Sakpata is considered to be a furious and hard divinity. The mark of the divinity is the manifestation of disease in humans, notably (in the past) smallpox. When an epidemic occurs, the cowpea variety *Atchawékoun* is prepared by the community to 'cool' the divinity. When *Sakpata* seems hard to appease the *Fâ* oracle is consulted to know the reason.

Determinants of diversity in yam

The socio-cultural determinants of crop diversity were analysed under three main headings: food culture, socio-cultural and income needs and socio-cultural rites. An attempt was then made to establish connections between socio-cultural requirements, market demand and agronomic performance. The specific needs of the availability of certain varieties of yam to carry out the common rituals are described.

Food culture and income needs

Table 1 presents the results of the interviews with 194 farmers from four ethnically different communities. Yam is a staple food for farmers in most rural communities in central Benin: 78% of farmers considered home consumption very important (Table 1). Every community needs a good supply of the varieties most suitable for pounding. Farmers' desire to eat pounded yam all year round enhances yam diversity as they then need to have early and late maturing varieties suited to pounding. Year round supply is assisted by selecting some types which can be processed into dried chips (*cossettes*) from which a paste can later be reconstituted. Farmers now cultivate such varieties intensively. Local religion stresses the importance of ancestors. As yam is considered an ancestral crop, it is highly preferred to other food crops. In local belief, 'If one has not eaten yam for dinner, it means that the person is hungry.' 'The farmer who has not grown yam has left his family to starve.' Having abundant yam is, conversely, an indicator of wealth and well-being.

Table 1 Number (%) of farmers indicating different uses for yam

Ethnic community	Number of farmers	Home consumption (%)	Income (%)	Cultural rites (%)	Gift (%)
Bariba	74	54 (73)	39 (53)	20 (27)	26 (35)
Mahi	47	41 (87)	35 (74)	36 (77)	10 (21)
Idatcha	44	39 (89)	38 (86)	34 (77)	25 (57)
Tchabè	29	18 (62)	18 (62)	10 (34)	0 (0)
Total	194	152 (78)	130 (67)	100 (52)	61 (31)

In the area, 67% of the surveyed farmers considered income from yam production very important (Table 1). For the *Bariba*, *Mahi* and *Idatcha* communities, yam is used to fulfil social obligations, for example during weddings and other ritual ceremonies. There was a specialization by farmers towards varieties having a high market price. Surplus production was sold on the market. Farmers of *Yagbo* and *Kpakpaza* were motivated to cultivate the variety *Laboko* for the market because it enabled them to be among the first farmers selling their yam on the market before the period of abundance in August to September (when prices drop).

Also, yam was seen as conferring social prestige. Farmers stated: 'Being a big yam producer is a sign of social noblesse. The best producers are those farmers who are the first to have the newly harvested yam. Yam remains essentially the hope of the people who grow it.'

Yam diversity in response to changes in food needs

The number of varieties cultivated and the overlap of harvest periods together indicate the way in

which varietal diversity helps to fulfil farmers' various needs.

Yam diversity ensures four levels of food security over the year for farmers in Benin. These four levels correspond to four periods:

- (1) From late June to July, when the first harvest of the early maturing yams, e.g. *Laboko*, occurs. Farmers preferring pounded yam and unable to satisfy their needs during the period of shortage (February to June) are again able to eat their favourite food (Figure 1).
- (2) From August to September when food is relatively abundant, as the tubers of most yam varieties, and certainly early maturing ones, which are harvested twice, reach physiological maturity and become ready for consumption or sale. This period is marked by a drop in the price of yam on the market.
- (3) From October to January, when late maturing varieties are harvested, as soon as the plant senesces. Some early maturing varieties may be either harvested once or twice: e.g. *Gnidou* is harvested once in *Kpakpaza*, but twice in *Yagbo*. Towards the end of this third period, edible or marketable tubers of early maturing yam become scarce, and the price increases.

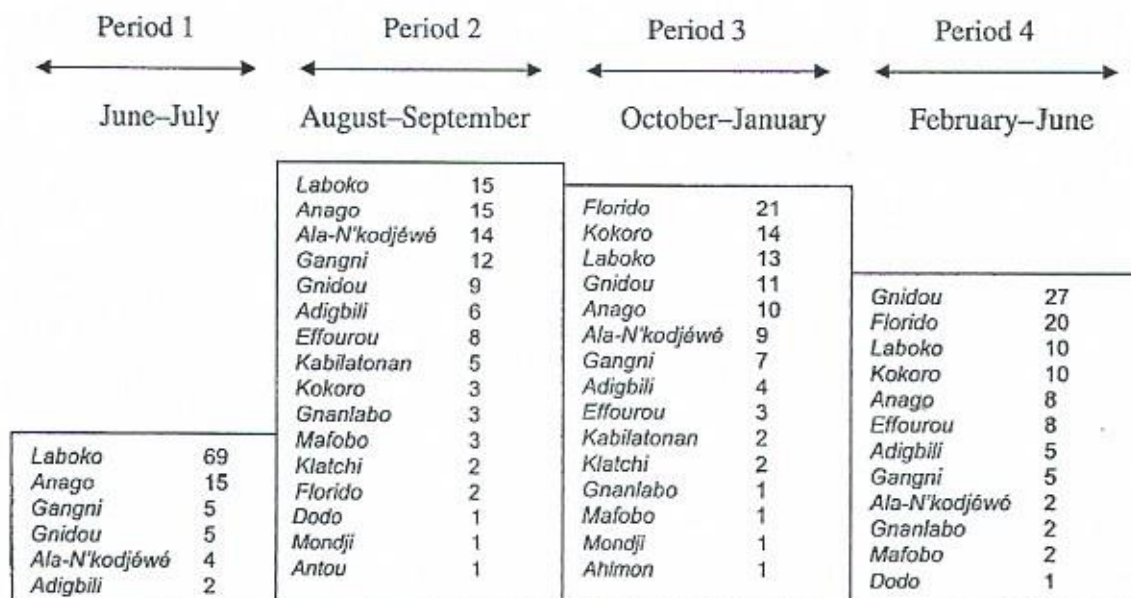


Figure 1 Yam harvesting and use periods, guaranteeing household food security. The figures represent the proportions of farmers (in %; $n = 100$) who harvest and use a specific variety in a specific period

- (4) From February to the beginning of June, there is a period of food shortage when yam and other crops are not available. Only *Gnidou* and *Florido* – considered to be of low socio-cultural and market values – remain with some farmers. Farmers usually consider these varieties as the ones that ‘support the households during the shortage period’.

Table 2 shows that about half of the harvest is designated for home consumption and the other half for sale. Some farmers consume the entire harvest of several varieties. Labour constraints do not allow growing more of these varieties, especially not the early maturing varieties of *D. cayenensis*/*D. rotundata*. Land clearing and heaping require a lot of labour and the appropriate period of heaping is highly restricted, coinciding with the period of the last rains in September to November when it is easier to make the heaps. Moreover, early planting of these varieties advances emergence. *D. alata* (e.g. *Florido*) includes varieties that ease labour constraints; they allow spreading of labour peaks because these varieties are mainly planted during the

beginning of the rainy season (March to early April). They also require less labour than the other varieties because they perform well on small heaps. Farmer management of these production constraints is determined by a land and labour availability schedule, but at the same time results in maintenance of high diversity of seasonally adapted yam varieties.

Technological and culinary traits

The main foods analysed were pounded yam, yam paste, fried yam and boiled yam. Their availability varies over the year. Table 3 reveals some specialization of varieties with regard to technological aptitudes.

Period of boiled and pounded yam

During this period, yam can be consumed after being boiled or after being pounded. When yam is eaten boiled, the values highlighted by producers/consumers relate to taste, flesh colour, friability and smell. Especially the characteristic smell of a variety is considered a determinant of quality in

Table 2 Allocation of yam harvest* to home-consumption and selling in *Kpakpaza* and *Yagbo*

	Variety	No. of farmers	Home consumption	Selling
<i>D. cayenensis</i> – <i>D. rotundata</i>	Early maturing			
	<i>Laboko</i>	77	4.9	5.1
	<i>Adigbili</i>	22	4.0	6.0
	<i>Ala-N'kodjèwé</i>	40	5.3	4.7
	<i>Anago</i>	22	6.0	4.0
	<i>Kabilatonan</i>	11	5.1	4.7
	<i>Mafobo</i>	8	5.3	4.7
	<i>Moroko</i>	26	4.8	5.1
	<i>Effourou</i>	21	5.2	4.8
	<i>Gangni</i>	33	5.2	4.7
	<i>Gnidou</i>	57	4.8	5.2
	Late maturing			
	<i>Gnanlabo</i>	9	6.2	3.8
	<i>Klatchi</i>	5	4.8	5.2
	<i>Kokoro</i>	48	5.3	4.6
<i>D. alata</i>	<i>Florido</i>	77	5.3	4.7
<i>D. dumetorum</i>	<i>Lété</i>	3	5.7	4.3

*The whole harvest is considered on a basis of 10 units.

Table 3 Assessment of varieties on culinary traits in Yagbo and Kpakpaaza

Varieties	No. of farmers	Bollied yam			Pounded yam			Fried yam		Cossettes/paste		
		Taste	Flesh colour	Friability	Smell	Plasticity	Swelling	Taste	Friability	Dried quality	Paste swelling	Paste taste
<i>D. cayenensis</i> - <i>D. rotundata</i>												
Early maturing	45	5	5	4	5	5	5	5	4	4	4	4
	31	3	4	5	3	3	4	3	4	4	4	4
	7	4	5	5	4	4	5	5	5	4	4	4
Ala- N'kodjéwé	25	5	4	4	4	4	4	4	4	4	4	4
	22	4	4	5	4	4	4	4	4	4	4	4
	17	4	4	5	5	4	5	4	4	4	4	4
<i>D. cayenensis</i> - <i>D. rotundata</i>												
Late maturing	32	5	4	4	4	4	4	4	4	5	5	5
	7	5	5	3	4	5	4	5	4	4	4	4
<i>D. alata</i>	43	3	4	5	3	2	2	2	3	4	3	3

1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high. The scoring represents farmers' evaluation of culinary traits for each variety. This scoring reveals the degree of satisfaction provided by each variety in considering each variety trait ($n = 100$). Only farmers who held technological knowledge on each given variety were requested to assess it.

boiled yam. Boiling is also an intermediate step in the conversion to pounded yam. The differential traits mentioned by producers/consumers when boiling and pounding are the elasticity or plasticity of the pounded product, the swelling (volume increase during pounding), and its taste (Table 3). Not all varieties are suitable for making pounded yam, nor are all appropriate to be transformed into dried yam (*cossettes*) for making yam paste. *Laboko* and *Gnanlabo* provide excellent pounded yam, but *Florido* and *Gnidou* produce a poor quality pounded yam. All types suitable for pounded yam (*Laboko*, *Gnanlabo*, *Effourou*, *Ala-N'kodjéwé*, *Gangni* and *Anago/Moroko*) are also appreciated for production of boiled and fried yam. *Florido* is commonly eaten boiled or fried. Fried yam is a snack food. The taste and friability are the main traits. Fried yam is made both during the period when yam is pounded and the period when yam paste is consumed.

Period of yam paste

The late maturing variety *Kokoro* was considered by farmers in the study to be the best variety for the dried yams usually called *cossettes* and for paste (Table 3). In this dried form, the variety *Kokoro* can be kept by farmers without any attack by storage borers which greatly shorten the storage period of the dried yam of other varieties. Taste and swelling are also considered. Some poundable yam varieties are also used for processing as *cossettes* and paste. When poundable varieties are used for processing the main part of the tuber is taken for making pounded yam and processing is applied only to the heads of the second harvest, or those parts considered undesirable for making pounded yam. Despite its poor technological characteristics farmers still grow *Florido* because *Florido* is harvested in the dry season when it can be readily processed into *cossettes*.

Rites and yam diversity

Farmers have established relations between the varieties they cultivate and the various divinities. Table 4 presents results from 40 farmers in *Kpakpaza* and 40 in *Yagbo*. The table indicates the particular conditions under which rituals are performed for varieties such as *Laboko* and *Moroko*. About 88% of farmers in *Kpakpaza*

recognized that poundable yam varieties are important for the divinity *Kokotin*. Four farmers said they were also important for ceremonies devoted to twins (*Ibéji*), and two farmers mentioned *Tobossou* and funerals; one farmer mentioned the divinity *Dan*. In *Yagbo*, 23% stated that they venerate all fetishes (or *Vodoun*) with poundable varieties or varieties belonging to *D. cayenensis*/*D. rotundata* species (locally called *Tévi*), 20% mentioned the divinity *Dan*, 15% funerals, 13% *Fâ*, and 5% twins, *Tobossou*, ceremonies involving the King, and sacrifices (*Vossissa*). *Vossissa* is a kind of thanksgiving following the promises requested from a *Vodoun* have been made good.

Socio-cultural and market demands

Table 5 provides the links between the socio-cultural demand and market demand within the area of study. In *Yagbo* and *Kpakpaza*, other varieties in addition to *Laboko* were important for market, for a number of farmers. In both villages, *Laboko* was preferred for both social and economic needs. *D. alata* (water yam) varieties, such as *Florido*, locally called *Aga* or *Alougan*, were neither socio-culturally important nor considered economically relevant by farmers. This confirms farmers' statement that *Alougan* or *Aga* is preferred for its agronomic adaptation, mainly its adaptability to poor soils and its ability to be stored for long periods, ensuring the food security during the pre-harvest hungry season in the central part of Benin. The same argument holds for the *D. cayenensis*/*D. rotundata* variety *Gnidou*, considered to be well adapted to poor soils.

Varietal grouping

Based on the farmers' perception of these varieties in terms of socio-cultural values, technological traits, market values, food security, and adaptation to specific environmental niches, two major groups of yam varieties can be found with farmers in the central part of Benin. The first group (labelled Group 1) is composed of varieties with high socio-cultural values, high market values, lowland adaptation, high soil fertility and water requirements, mostly early maturing or used for double harvests (e.g. *Laboko*, *Ala-N'kodjéwé*, *Anago*/

Table 4 Yam varieties related to ritual practices as indicated by 40 farmers in *Kpakpaza* and in *Yagbo*

<i>Rituals</i>	<i>Kpakpaza</i>		<i>Yagbo</i>	
	<i>No. of farmers*</i>	<i>Varietal group or variety</i>	<i>No. of farmers*</i>	<i>Varietal group or variety</i>
<i>Kokotín</i>	35	Pounded, <i>Laboko</i> , <i>Moroko</i> , <i>Mondji</i> , <i>Effourou</i> , <i>Tévi-gan</i>		
Twins	4	Pounded, <i>Laboko</i>	2	<i>Laboko</i> , <i>Ala-N'kodjéwé</i>
<i>Tohossou</i>	2	Pounded, <i>Laboko</i>	2	<i>Laboko</i> , <i>Ala-N'kodjéwé</i>
Funerals	2	<i>Laboko</i> , <i>Effourou</i>	6	Pounded, <i>Tévi</i> , <i>Laboko</i> , <i>Ala-N'kodjéwé</i>
<i>Dan</i>	1	<i>Laboko</i>	8	Pounded, <i>Tévi</i> , <i>Laboko</i> , <i>Ala-N'kodjéwé</i>
<i>Vodoun</i>			9	Pounded, <i>Laboko</i> , <i>Ala-N'kodjéwé</i> , <i>Tévi</i> , <i>Gangni</i>
<i>Fâ</i>			5	Pounded, <i>Tévi</i> , <i>Laboko</i> , <i>Ala-N'kodjéwé</i>
<i>Assangni</i>			3	Pounded, <i>Laboko</i>
King's ceremony			2	<i>Laboko</i>
" <i>Vossissa</i> "			2	<i>Tévi</i>

*Some farmers mentioned more than one ritual and others mentioned no rituals at all.

Moroko) (Table 6). This group is mainly used for the production of pounded yam. The second group labelled Group 2 comprises varieties of relatively low socio-cultural values, low market price, and adapted to the erratic rainfall and poor soils of the plains or slopes; these are also characterized by adaptation to long storage.

Some socio-cultural factors appeared to influence the choice of varieties (Table 7). The female yam farmers grew on average 2.0 varieties of high socio-cultural and economic values and 2.1 varieties for food security during the period of food shortage, whereas male farmers cultivated on average 2.8 and 2.0 varieties for the two categories, respectively. The difference between these two groups of varieties grown was statistically highly significant for male growers but not for female growers, suggesting that the behaviour regarding the choice of the varieties in the two categories is different. As shown by the *t*-statistic for each of the other socio-cultural factors considered for

yam farmers (religion, ethnicity, age, household size), the mean number of varieties cultivated for high socio-cultural and economic values appeared higher than and significantly different from the ones grown for food security in the food shortage period (Table 7). Table 7 also clearly shows that differences in number of varieties between the categories of the different socio-cultural factors were only present for Group 1. Such differences were significant for sex and ethnicity as revealed by the *F*-statistic and the Games-Howell multiple comparison test.

Summary of findings on yam

This part of the study concerning yam has demonstrated that yam remains an important component of the culture and religious beliefs of sampled rural groups in the Guinea Sudan zone of Benin. The findings show a relationship between diversity of yam varieties and cultural diversity. The yam

Table 5 Frequency distribution of the socio-cultural and economic demands expressed by farmers concerning use of different yam varieties in Kpakpaza and Yagbo

Species	Kpakpaza (40)			Yagbo (40)	
	Yam varieties	Socio-cultural demand	Economic demand	Socio-cultural demand	Economic demand
<i>D. cayenensis/D. rotundata</i>					
Early maturing	Laboko	36	34	23	14
	Moroko/Anago	14	11	16	8
	Mondji	14	13	16	5
	Gangni	13	11	17	6
	Ala-N'kodjêwé	13	12	20	7
	Effourou	12	11	16	5
	Adigbili	12	10	16	6
	Gnidou	–	6	–	3
	Tevi-gan	2	–	–	–
	Gnanlabo	–	10	–	4
Late maturing	Kokoro	–	2	–	1
	Klatchi	–	9	–	6
	Florida	–	–	–	–
<i>D. alata</i>					

varieties preferred for cultural reasons also happen to be of high economic values as reflected in market preferences. However, the cultural and economic preferences cannot alone explain all of the diversity

Table 6 Diversity of yam varieties as indicated by the proportion of farmers (%) growing different numbers of two different types of varieties. Group 1 = yam varieties grown to fulfil socio-cultural and economic needs; Group 2 = yam varieties grown for food security, mainly in the dry season when food is short

Group 1: Yam varieties of high socio-cultural and economic values		Group 2: Yam varieties for food security in food shortage period	
Number of varieties	% of farmers	Number of varieties	% of farmers
0	7	0	1
1	16	1	24
2	23	2	53
3	25	3	20
4	16	4	2
5	10		
6	2		
7	1		

found in yam. The farmers' desire to guarantee food security all year round is the third important factor enhancing the diversity of cultivated varieties. This factor selects for varieties that perform well when others preferred for cultural and economic reasons become scarce. All these varieties offered to farmers and consumers various food technological and agronomic traits. Perceived values allow a categorization of yam varieties into two major groups: one group with varieties characterized by high socio-cultural and economic values and another characterized by low socio-cultural and market values, but high food security value. Between them, the two groups provide farmers and consumers with a range of technological and agronomic aptitudes and provide food at different periods of the year.

Determinants of diversity in cowpea

This section analyses the importance of cowpea as a crop culturally embedded in the tradition of the peoples of the central part of Benin. As with the analysis for yam, different components of culture are considered, relating the material world of

Table 7 Mean number of yam varieties grown from Group 1 (varieties of high socio-cultural and economic values) and from Group 2 (varieties grown for food security in the periods of food shortage) grown as affected by some socio-cultural characteristics of farmers ($n = 100$)

Farmers' socio-cultural characteristics	Levels	No. of farmers	Varieties of high socio-cultural and economic values		Varieties for food security in food shortage period		t-statistic ⁽¹⁾
			Mean	S.D.	Mean	S.D.	
Sex	Male	87	2.8	1.56	2.0	0.77	4.50***
	Female	13	2.0	1.08	2.1	0.64	0.22
	F-statistic ⁽²⁾		F = 3.21*		F = 0.25		
Religion	Traditional	13	3.3	1.42	2.0	0.76	2.92***
	Modern	87	2.6	1.53	2.0	0.75	3.45***
	F-statistic		F = 1.82		F = 0.09		
Ethnicity	Idatcha	69	2.4	1.49	2.0	0.70	2.27**
	Mahi	24	3.3	1.49	2.0	0.80	3.97***
	Otamari	7	3.6	1.13	2.4	0.97	2.02*
	F-statistic		F = 4.98***		F = 1.35		
Age (years)	Less than 31	31	2.5	1.43	1.8	0.67	2.61***
	31–50	45	2.8	1.50	2.0	0.74	3.03***
	More than 50	24	2.8	1.73	2.1	0.85	1.59
	F-statistic		F = 1.80		F = 0.33		
Household size	1 to 5	36	2.7	1.51	2.0	0.75	2.57**
	More than 5	64	2.7	1.55	2.0	0.76	3.34***
	F-statistic		F = 0.03		F = 0.12		
All categories together		100	2.7	1.53	2.0	0.75	4.23***
Games-Howell multiple comparisons with ethnicity ⁽²⁾							
Varietal groups	(I) Ethnicity	(J) Ethnicity	Mean difference (I-J)		S.E.		
Varieties of high socio-cultural and economic values	Idatcha	Mahi	-0.94**		0.354		
		Otamari	-1.18*		0.464		
	Mahi	Idatcha	0.94**		0.354		
		Otamari	-0.24		0.526		
	Otamari	Idatcha	1.18*		0.464		
		Mahi	0.24		0.526		
Varieties for food security in food shortage period	Idatcha	Mahi	-0.02		0.185		
		Otamari	-0.49		0.378		
	Mahi	Idatcha	0.02		0.185		
		Otamari	-0.47		0.404		
	Otamari	Idatcha	0.49		0.378		
		Mahi	0.47		0.404		

⁽¹⁾Results using SAS 8e; ⁽²⁾results from SPSS 12.0.1; level of significance: 1%:***; 5%:**; 10%:*

cowpea varieties to the spiritual world represented by divinities of the communities. The specific availability of certain cowpea varieties to carry out specific rituals is described.

Food culture and income needs

Food culture

Consumption of cowpea products begins with the vegetative phase, as leaves serve as vegetables. At harvest, cowpea is used in meals that often also include yam and cereal products. Cowpea products help farmers to bridge the period from one yam cropping season to the next. Cowpea is important as a buffer against hunger during pre-(yam)-harvest food shortages in central Benin.

Income needs

Some women grow cowpea in order to process it into derivative products before selling (Table 8). Cowpea plays an important role in commercial transactions. Cowpea does not have as high a financial profile as yam but its commercialization is easier, and turnover is faster than for yam. Income from cowpea supplements income from yam sales in most villages. The income is vital to the household economy – since it pays for kitchen seasonings, purchase of farm tools and repayment of agricultural credit negotiated with traders and friends. Income from cowpea is also used regularly as capital for buying a share in *tontines* (i.e. a rotational credit association). In the *Bariba* community, however, low scores were obtained in the categories income, social rites and gift. This may be due to the low level of involvement of *Bariba* women during the planting material collecting phase when the *Bariba* sample was interviewed.

Labour relations

Cowpea products are important elements in the meals often given to agricultural labourers during farm activities to ensure high quality of work. These meals are highly appreciated, and often a required condition of the labour contract to motivate external agricultural labourers, often migrants.

Social rites and gifts

Almost 50% of farmers recognized the uses of cowpea varieties in social rites as very important. Farmers interviewed from the *Tchabè/Nagot*, *Idatcha* and *Mahi* ethnic communities confirmed this socio-cultural importance (Table 8). In addition, 36% of farmers provided some parts of their harvest as gifts for relatives, neighbours or friends from other communities.

Cowpea diversity and food needs

Tawa is the most frequently cultivated variety, represented in both the first and second cropping season (Figure 2). Apart from its role in providing market income, *Tawa* plays an important role in food security in the dry season. *Tawa*, *Kplobè*, *Kaki*, *Malanville* and *Olikpokpo-doudou* are early maturing varieties mainly cultivated during the two cowpea cropping seasons. During the second cropping season, half of all farmers cultivated late maturing and half cultivated early maturing varieties.

Farmers use more for home consumption than they sell (Table 9). Yet most farmers sell cowpeas, and at least part of all varieties grown is offered for sale. In the case of *Tawa*, the proportion sold is greater than the part consumed. This is due to the fact that farmers usually consider *Tawa* to be

Table 8 Number of farmers indicating different uses of cowpea

Communities	Number of farmers	Home consumption (%)	Income (%)	Social rites (%)	Gift (%)
<i>Tchabè/Nagot</i>	54	43 (80)	47 (87)	33 (61)	33 (61)
<i>Bariba</i>	36	23 (64)	12 (33)	4 (11)	2 (6)
<i>Idatcha</i>	35	31 (89)	27 (77)	21 (60)	12 (34)
<i>Mahi/Fon</i>	11	8 (73)	10 (91)	8 (73)	2 (18)
Total	136	105 (77)	96 (71)	66 (49)	49 (36)

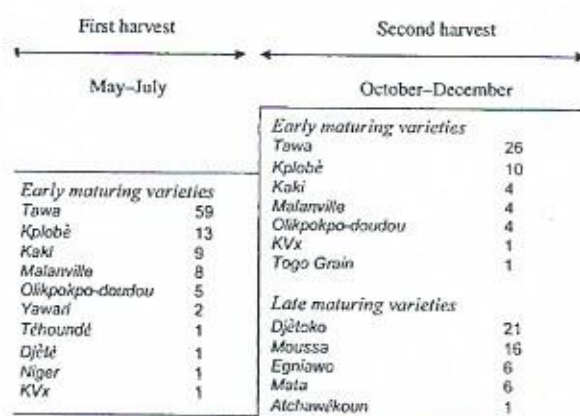


Figure 2 Cowpea harvest and use periods ensuring food security and income in households. The figures represent the proportion of farmers (in %; $n = 91$) who harvest a specific cowpea variety in a specific period

a commercial, early maturing variety and most farmers grow it. Late maturing varieties are used more for consumption than early maturing ones. The harvest of late maturing varieties occurs at the beginning of the dry season (November to December) when an important portion is reserved for home consumption during the dry season or period of food shortage. These late maturing varieties can also tolerate a relatively long period of storage. Moreover, they also have good technological and culinary traits, which make them preferred for home consumption by farmers.

Technological and culinary traits

The cowpea varieties *Mata*, *Atama*, *Djètoko* and *Egni-awo* are varieties with good taste and technological traits suited to the preparation of cowpea food derivatives (Table 10). The late maturing variety *Djètoko* got the highest score, suggesting that it met the desired food technological and culinary preferences of most consumers and food processors. *Kplobè* is the less favoured variety for processing.

Rites and cowpea diversity

Table 11 establishes the relationships between divinities and farmer cowpea choices in *Diho* and *Dani*. Various varieties are offered to specific divinities. Most of these varieties have one characteristic in common – they are white, a colour often taken to symbolize purity. This culturally rooted colour preference seems greatly to affect cowpea diversity in the area. In *Diho*, the variety *Mata* is considered to be the variety of the ancestors. Just after harvest, it is used for food for offering to twins, the deity *Abikoun*, and to community ancestral spirits. *Moussa* and *Atama* are used for festivities associated with the birthdays of twins and in offerings to *Tohossou*. In *Dani*, several cowpea varieties – *Djètoko*, *Atama*, *Moussa* and *Tawa* – are used in funerals. White is an important colour in funerals, so white cowpea varieties are appreciated for such ceremonies. The same varieties are

Table 9 Allocation of cowpea harvest to home consumption and selling in *Dani* and *Diho*

	Variety	Number of farmers	Home consumption*	Selling*
			Mean	Mean
Early maturing	<i>Atacora</i>	6	5.2	4.8
	<i>Kaki</i>	10	5.6	4.4
	<i>Kplobè</i>	15	5.5	4.5
	<i>Malanville</i>	11	5.2	4.8
	<i>Tawa</i>	60	4.5	5.5
Late maturing	<i>Djètoko</i>	23	7.3	2.7
	<i>Egni-awo</i>	5	5.5	4.5
	<i>Mata</i>	6	5.8	4.2
	<i>Moussa</i>	18	5.7	4.3

*The whole harvest is considered on a basis of 10 units.

Table 10 Technological traits of cowpea varieties revealed by farmers of *Dani* and *Diho*

Varieties	No. of farmers	Technological traits					
		Taste	Smell	Abobo	Abla	Ata	Cooking duration
<i>Tawa</i>	75	4	4	4	4	4	52
<i>Mata</i>	30	4	5	5	5	5	47
<i>Djètoko</i>	23	5	5	5	5	5	39
<i>Malanville</i>	6	4	4	4	4	4	45
<i>Atacora</i>	7	4	4	4	5	5	47
<i>Kaki</i>	7	4	4	4	4	4	47
<i>Egni-awo</i>	6	5	5	4	5	5	37
<i>Kplobè</i>	16	3	4	3	3	4	58

Scale applied to all traits except for cooking duration: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high. The scoring represents farmers' evaluation of each variety trait with regard to each variety. *Abobo*, *Abla*, and *Ata* are local special foods made from cowpea. This scoring reveals the degree of satisfaction provided by each variety in considering each variety trait. Cooking duration is given in minutes. Only farmers who held technological knowledge on a given variety were requested to assess it ($n = 91$).

Table 11 Cowpea varieties related to ritual practices by 40 farmers in *Diho* and *Dani*

Ritual acts	Dani		Diho	
	No. of farmers*	Varietal group or varieties	No. of farmers*	Varietal group or varieties
Funerals	22	White varieties, <i>Djètoko</i> , <i>Moussa</i> , <i>Tawa</i> , <i>Atama</i>	5	White varieties, <i>Tawa</i>
Twins	5	<i>Atama</i>	10	White varieties, <i>Mata</i>
Baptism, naming	2	White varieties	5	White varieties, <i>Djètoko</i> , <i>Tawa</i>
<i>Fâ</i>	2	White varieties	—	
<i>Tohossou</i>	2	<i>Atama</i> , <i>Moussa</i>	—	
<i>Vodoun</i>	2	White varieties		
Wedding	1	White varieties	1	White varieties
<i>Ogoun</i>	1	<i>Moussa</i>	—	
Offertory to the King	1	White varieties	—	
<i>Tchango</i>	—		2	<i>Mata</i>
<i>Abikoun</i>	—		2	<i>Mata</i>
The Thunder	—		1	White varieties
Easter	—		1	White varieties
Reunion	—		1	<i>Djètoko</i>

*Some farmers mentioned more than one ritual and others mentioned no rituals at all.

also used in offerings to *Fâ*, *Tchango* (*Shango*) and *Tobossou*. The variety *Djètoko* is important in offerings, because it is highly appreciated and cultivated extensively due to its good taste.

Socio-cultural and market demands

Different cowpea varieties play important cultural and religious roles within each community. In *Diho*, most farmers considered white varieties important to meet socio-cultural needs; on the other hand, *Tawa* and *Djètoko* are cowpea varieties that most farmers chose to use for supplying commercial requirements (Table 12). In *Dani*, however, there was a significant link between social and market demands, meaning that the same varieties respond both to socio-cultural and economic needs.

Varietal grouping

As shown earlier in this paper, the dominant cultural colour preference of farmers in the Guinea Sudan zone of Benin is for white varieties. In addition to colour preference, the current strategic choice of farmers is based on two agro-physiological types: early maturing and late maturing varieties (Table 13). These varieties are the ones

satisfying consumption needs and local market preferences, guaranteeing both income and food security for farmers' households. In general, both men and women grow more early varieties than late ones. However, women tended to produce more late maturing varieties than men. From Table 13, it appeared that for farmers who produced two varieties of the two maturity types, the ratio (proportion of farmers producing early maturing to farmers producing late maturing varieties) was 23:7 for men and 8:4 for women; for farmers who grew three varieties, the ratio was 7:2 for men and 2:1 for women. For economic reasons, men are more and more oriented towards early maturing varieties, in order to have two cowpea harvests per year. These results suggest that women have a greater positive impact than men have on maintaining the current diversity of the two dominant agro-physiological types of cowpea varieties in the area of study.

Also, Table 14 shows that there were more early varieties grown than late maturing ones. This was true within each socially distinguishable group. In general, it appeared that on average less than one late maturing variety was grown by the different social categories of farmers, distinguished based on sex, religion, ethnicity, origin, age, and household size. Some socio-cultural factors appeared to

Table 12 Frequency distribution of the socio-cultural and economic demands expressed by farmers to use different cowpea varieties in *Diho* and in *Dani*

Cowpea varieties	Dani (40)		Diho (40)	
	Socio-cultural demand	Economic demand	Socio-cultural demand	Economic demand
Moussa	34	25	15	9
Mata	26	19	24	12
Atama	22	18	15	9
Tawa	24	18	18	13
Djètoko	29	10	15	10
Red varieties	6	4	—	—
Niger	—	16	—	10
Malanville	—	16	—	10
Ewa Nigeria	—	17	—	10
Kpodjigùguè	—	1	—	1
Atacora / Olikpokpodoudou	—	16	—	9
Egni-awo	—	2	—	—

Table 13 Number of varieties of cowpea grown by male or female farmers ($n = 91$) for two different categories of varieties: early maturing and late maturing ones

No of varieties grown	Early maturing group			Late maturing group			All varieties		
	Male ($n = 65$)	Female ($n = 26$)	Total ($n = 91$)	Male ($n = 65$)	Female ($n = 26$)	Total ($n = 91$)	Male ($n = 65$)	Female ($n = 26$)	Total ($n = 91$)
0	3	1	4	36	14	51			
1	37	18	55	26	9	35	21	9	30
2	23	8	31	7	4	11	30	12	42
3	7	2	9	2	1	3	14	4	19
4	1		1				4	2	7
5							1	1	2
6							1		1
Total (%)	71	29	100	71	29	100	71	29	100

influence the choice of cowpea varieties (Table 14). The mean number of late maturing varieties grown by female farmers (0.7) was slightly higher than the number grown by male farmers (0.6). *Indigenes* (who are mainly farmers of the *Tchabè* ethnic community) appeared to grow the fewest early maturing varieties of all the social groups considered. Conversely, they tended to grow more late maturing varieties than migrants. Farmers of a traditional (animist) belief tended to grow more early maturing varieties than farmers claiming modern religion beliefs. The *t*-statistic revealed significant differences between the choices made by farmers for the two categories of varieties. Table 14 also shows that the number of varieties between the categories of the different socio-cultural factors were present both for early maturing and late maturing varieties. Such differences were significant for religion, origin, household size and ethnicity as indicated by the *F*-statistic and the Games-Howell test for multiple comparisons.

Summary of findings on cowpea

This study of cowpea has revealed that cowpea is a central element in religious rituals and ceremonies associated with social relations in the Guinea Sudan zone of Benin. Female farmers showed high predilection for cultivation activities with ritual significance. White types are preferred in the area of study. The diversity of cowpea varieties was related to socio-cultural and market preferences. Cultivated varieties comprised two

agro-physiological types: early maturing and late maturing varieties. Men showed more tendency towards the early maturing varieties, allowing them to grow two cowpea crops per year; women farmers revealed a positive preference for maintenance of both agro-physiological types of cowpea. These varieties offered farmers food security all year round and responded to various consumer food and technological preferences. Results suggest that female cowpea farmers have a positive impact on the maintenance of cowpea varieties.

Discussion

The priority farmers give to food security in households is an important factor in diversity maintenance. Food security provides the frame within which yam and cowpea varieties with low socio-cultural and market values survive. Indeed, it is so important to cope with hunger in this way that these kinds of varieties have come to dominate in terms of area planted and percentage of farmers cultivating them. Data on areas cropped and proportion of farmers cultivating each yam and cowpea variety have been reported elsewhere (Zannou *et al.*, 2004).

This study also revealed that the larger ethnic communities in the study area – *Tchabè*, *Idatcha* and *Mahi* – share some socio-cultural rituals, including funeral rites, ceremonies for twins, and offerings to *Tohossou*. Yam and cowpea feature in all these rituals (Table 15). The yams are

Table 14 Mean number of early or late maturing cowpea varieties grown as affected by some socio-cultural characteristics of farmers ($n = 91$)

Farmers' socio-cultural characteristics	Levels	No of farmers	Early maturing		Late maturing		t-statistic ⁽¹⁾
			Mean	S.D.	Mean	S.D.	
Sex	Male	65	1.5	0.79	0.6	0.77	6.24***
	Female	26	1.4	0.70	0.7	0.87	2.98***
	F-statistic ⁽²⁾		F = 0.48		F = 0.20		
Religion	Traditional	16	1.8	0.77	0.3	0.44	6.70***
	Modern	75	1.4	0.76	0.8	0.84	5.02***
	F-statistic		F = 2.60*		F = 5.58**		
Origin	Native	33	1.2	0.61	0.8	0.88	1.78*
	Migrant	58	1.7	0.78	0.6	0.75	7.50***
	F-statistic		F = 10.03***		F = 1.77		
Ethnicity	Idatcha	32	1.7	0.81	0.8	0.82	4.44***
	Tchabè	33	1.2	0.61	0.8	0.88	1.78*
	Others	26	1.6	0.76	0.3	0.54	6.91***
	F-statistic		F = 5.26***		F = 3.95**		
Age (years)	Less than 31	20	1.4	0.88	0.6	0.75	3.08***
	31–50	57	1.5	0.76	0.8	0.80	4.80***
	More than 50	14	1.8	0.65	0.4	0.84	4.28***
	F-statistic		F = 0.20		F = 1.61		
Household size	1 to 5	44	1.5	0.70	0.5	0.66	7.04***
	More than 5	47	1.4	0.82	0.8	0.90	3.35***
	F-statistic		F = 0.77		F = 2.94*		
All categories together	–	91	1.5	0.77	0.7	0.80	6.90***
Games-Howell multiple comparisons with ethnicity ⁽²⁾							
Varietal group	(I) Ethnicity	(J) Ethnicity	Mean difference (I-J)		S.E.		
Early maturing group	Idatcha	Tchabè	0.57***		0.180		
		Others	0.14		0.207		
	Tchabè	Idatcha	–0.57***		0.180		
		Others	–0.43**		0.183		
	Others	Idatcha	–0.14		0.207		
		Tchabè	0.43**		0.183		
Late maturing group	Idatcha	Tchabè	–0.01		0.211		
		Others	0.50**		0.181		
	Tchabè	Idatcha	0.01		0.211		
		Others	0.51**		0.188		
	Others	Idatcha	–0.50**		0.181		
		Tchabè	–0.51**		0.188		

⁽¹⁾Results using SAS 8e; ⁽²⁾results from SPSS 12.0.1; level of significance: 1%:***; 5%:**; 10%:*

Table 15 Some rituals involving both yam and cowpea varieties in local communities ($n = 40$ from each village)

Rituals	Cowpea (Dani and Diho)		Yam (Yagbo and Kpakpaza)	
	Farmers	Varieties	Farmers	Varieties
Funerals	27	White varieties, Tawa Atama, Moussa	41	Pounded, Laboko, Ala-N'kodjéwé, Effourou
Twins	15	White varieties, Atama	6	Pounded, Laboko, Ala-N'kodjéwé
Vodouns	2	White and red varieties	9	Pounded, Laboko, Ala-N'kodjéwé, Tévi, Gangni
Fâ	2	White varieties	5	Pounded, Laboko, Ala-N'kodjéwé, Tévi
Tohossou	2	White varieties, Atama	4	Pounded, Laboko

mainly the poundable varieties, such as *Laboko* and *Ala-N'kodjéwé*. The featured cowpea varieties, such as *Atama*, *Moussa*, and *Tawa*, are white. The food provided during these rituals can either be a specific preparation based on one or other specific crop variety, or a combination of the two. These varieties, which have high technological requirements, are also highly demanded by the market, and are also noted as food security crops. They can thus be considered multi-purpose varieties, even if they are harder to grow than some other varieties.

This study goes beyond the general assumption that crop varietal diversity management is mainly a matter of introducing new varieties, and specifically analyses factors that contribute to or affect the maintenance and use of crop varieties by farmers. The use farmers make of yam and cowpea varietal diversity is not solely an expression of an individual preference set, but the outcome of a community-specific intersection of economic and cultural factors. Collective factors are as important as rational choices expressed through market forces. Here, we state that the maintenance of a specific crop variety in the farming system depends (at least in part) on the socio-cultural values assigned to that variety by local communities. The strength of this factor derives from the 'social fact' that farmers believe they belong to a specific ethnic community (or religious congregation) and recognize and express social membership through ritual activities that draw the members of the community together. It is in this framework of collective values that a diversity of yam and

cowpea varieties is drawn upon farmers to communicate with and thank various divinities in each community.

Agbo (1995) and Millar (1999) make similar points about the importance of divinities for local communities. It is through these rituals that ancestors continue to play a role in the life of the living; their souls remain associated with the terrain and they are thus available as intermediaries between the divinities and the living (Millar, 1999); the spiritual, cultural and the natural worlds are inter-linked in local agricultural thinking (Agbo, 1995). People believe that their planting materials were given to them by their ancestors, who also taught them how to survive. Continued survival depends on continuing to pay close attention to the ancestors. For most farmers in central Benin, crop variety choice cannot, therefore, be solely a matter of technical efficiency. In the communities of the southeast of Guanajuato in Mexico, the cultural significance of food and culinary practices explained how farmers allocated their maize area, and as a consequence, the number of maize land-races that they grew on their farms (Smale *et al.*, 2001). Taking the case of cassava diversity among Makushi Amerindians of Guyana in South America, Elias *et al.* (2000) showed that various socio-cultural factors exercised selective pressure and that food preparation, cultural knowledge and social processes all played a role in bringing cassava varietal and genetic diversity into existence. In the Southern Peruvian Sierra, Zimmerer (1991) argued that off-farm labour is negatively correlated with the maintenance of crop diversity

because cultivating diverse types of maize and potatoes is highly labour intensive and entails high opportunity costs.

But maintenance of varieties is not solely a matter of widely-accepted socio-cultural values. Besides the socio-cultural context, the market demand strengthens the use and maintenance of crop varieties in local farming systems. But even here cultural aspects may be surprisingly important. This is an important observation, since it suggests (for this area at least) that there will be a positive link between levels of ethnic diversity and levels of crop varietal diversity. Thrupp (2000) argued that the numerous practices used for enhancing agricultural biodiversity are tied to the rich cultural diversity and local knowledge supporting the livelihood of agricultural communities. Along the same lines, Pretty and Smith (2004) suggested that social learning creates positive biodiversity outcomes and social capital for biodiversity improvements.

This study adds the finding that socio-cultural factors and market demand are interlinked, not independent, dimensions. Put simply, where tradition lives (as in central Benin) tradition sells. But it also contributes to stability of local production systems. Di Falco and Perrings (2003) found that crop genetic diversity is positively related to mean income and negatively related to the variance of income. The result on the variance of income confirms that greater genetic diversity makes a system more resilient, e.g. to rainfall and temperature fluctuations.

This paper also adds an important finding on gender. Female farmers had a greater positive effect on the maintenance of diversity of both yam and cowpea than male farmers, as the former valued food security, long storage and technological and culinary traits more than the latter. As shown by Pionetti (2005), women in semi-arid India have the most stakes in increasing crop diversity as they see a direct relationship between diversity and food security, and have the responsibility for preparing meals. They cultivated varieties of different duration to minimize the risk of harvest failure, to meet multiple needs, and to ensure household food security.

The implication of this study for sustainable use and conservation of genetic resources is that farmers bring a variety of motivations to variety

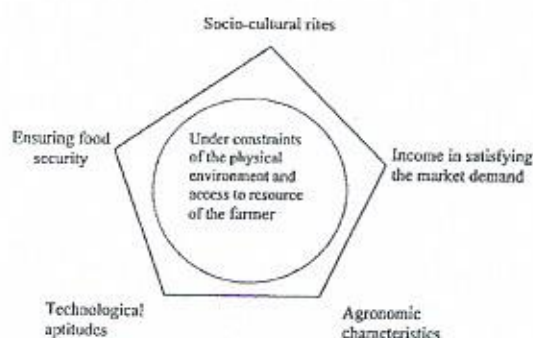


Figure 3 Functions of yam and cowpea varieties in local communities

choice and management, and that this helps maintain a wider range of material than utilitarian selection alone. The maintenance of crop varieties in farming systems or the adoption of crop varieties by farmers should take into account all the relevant components (Figure 3): viz. technological characteristics, socio-cultural values, market demand, agronomic characteristics, capacity to cope with the climatic risks and the capacity to contribute to food security. The study suggests that on-farm management of genetic resources is an important respects driven by social factors. Any strategy for on-farm diversity management should develop an integrated framework for evaluating social factors alongside biological factors.

References

- Agbo, V.A. (1995) Rôle des représentations du sur-naturel dans la connaissance endogène et leur influence sur les résultats de la production agricole. Abomey-Calavi (Bénin): Faculté des Sciences Agronomiques de l'Université Nationale du Bénin. *Série d'Économie et de Sociologie Rurales* 4, 1–24.
- Arua, E.O. (1981) Yam ceremonies and the values of Ohafia culture. *Africa* 51 (2), 694–705.
- Bellon, M.R. (2001) Demand and supply of crop infra-specific diversity on farms: Towards a policy framework for on-farm conservation. *CIMMYT Economics Working Paper 01-01*, Mexico, D.F.: CIMMYT.
- Brydon, L. (1981) Rice, yams and chiefs in Avatime: speculations on the development of a social order. *Africa* 51 (2), 659–677.
- Chauveau, J.P., Dozon, J.P. and Richard, J. (1981). Histoires de riz, histoires d'igname: Le cas de la Moyenne Côte d'Ivoire. *Africa* 51 (2), 621–657.

- Coulibaly, S., Pasquet, R.S., Papa, R. and Gepts, P. (2002) AFLP analysis of the phenetic organization and genetic diversity of *Vigna unguiculata* L. Walp. reveals extensive gene flow between wild and domesticated types. *Theoretical and Applied Genetics* 104, 358–366.
- Dansi, A., Zoundjihékon, J., Mignouna, H.D. and Quin, M. (1997) Collecte des ignames cultivées du complexe *Dioscorea cayenensis-rotundata* au Bénin. *Plant Genetic Resources Newsletter* 112, 81–85.
- Di Falco, S. and Perrings, C. (2003) Crop genetic diversity, productivity and stability of agroecosystems. An theoretical and empirical investigation. *Scottish Journal of Political Economy* 50 (2), 207–216.
- Eastwood, R.B. and Steele, W.M. (1978) The conservation of yam germplasm in West Africa. *Plants Foods for Man* 2, 153–158.
- Elias, M., Rival, L., McKey, D. (2000) Perception and management of cassava (*Manihot esculenta* Crantz) diversity among Makushi Amerindians of Guyana (South America). *Journal of Ethnobiology* 20 (2), 235–265.
- Igué, O.J. (1974) *Le rôle de l'igname dans la civilisation agraire des populations Yoruba*. Abomey-Calavi, Dahomey: Université du Dahomey.
- Jarvis, D.I., Myer, L., Klemick, H., Guarino, L., Smale, M., Brown, A.H.D., Sadiki, M., Sthapit, B. and Hodgkin, T. (2000) *A Training Guide for In Situ Conservation On-Farm. Version 1*. Rome: International Plant Genetic Resources Institute.
- Millar, D. (1999) From T & V to learning about cosmo-vision. *COMPAS Newsletter* 1, 7–9.
- Mortimore, M.J., Singh, B.B., Harris, F. and Blade, S.F. (1997) Cowpea in traditional cropping systems. In B.B. Singh, D.R. Mohan Raj, K.E. Dashiell and L.E.N. Jackai (eds) *Advances in Cowpea Research* (pp. 99–113). Co-publication of International Institute of Tropical Agriculture (IITA) and Japan International Research Center for Agricultural Sciences (JIRCAS). Ibadan: IITA.
- Ng, N.Q. and Maréchal, R. (1985) Cowpea taxonomy, origin and germplasm. In S.R. Singh and R.O. Rachie (eds) *Cowpea Research, Production and Utilization* (pp. 11–21). Chichester, New York: John Wiley & Sons.
- Okoli, O.O. (1991) Yam germplasm diversity, uses and prospects for crop improvement in Africa. In N.Q. Ng, P. Perrino, F. Attere and H. Zedan (eds) *Crop Genetic Resources of Africa* (Vol. II) (pp. 109–117). Co-publication Rome: IITA/IBPGR/UNEP/CNR and Ibadan: IITA.
- Padulosi, S. and Ng, N.Q. (1997) Origin, taxonomy, and morphology of *Vigna unguiculata* (L.) Walp. In B.B. Singh, D.R. Mohan Raj, K.E. Dashiell and L.E.N. Jackai (eds) *Advances in Cowpea Research* (pp. 1–12). Co-publication of International Institute of Tropical Agriculture (IITA) and Japan International Research Center for Agricultural Sciences (JIRCAS). Ibadan: IITA.
- Pardey, P.G., Koo, B., Wright, B.D., van Dusen, M.E., Skovmand, B. and Taba, S. (1999) Costing the *ex situ* conservation of genetic resources: maize and wheat at CIMMYT. EPTD Discussion Paper N°52. Washington DC: International Food Policy Research Institute (IFPRI) and Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT).
- Pionetti, C. (2005) *Sowing Autonomy: Gender and Seed Politics in Semi-Arid India*. London: International Institute of Environment and Development (IIED).
- Pretty, J. and Smith, D. (2004) Social capital in biodiversity conservation and management. *Conservation Biology* 18 (3), 631–638.
- Smale, S., Bellon, M.R. and Aguirre Gómez, J.A. (2001) Maize diversity, variety attributes, and farmers choices in the Southeastern Guanajuato, Mexico. *Economic Development and Cultural Change* 50, 201–205.
- Thrupp, L.A. (2000) Linking agricultural biodiversity and food security: The valuable role of agrobiodiversity for sustainable agriculture. *International Affairs* 76 (2), 265–281.
- Uzozie, L.C. (1981) The changing context of land use decisions: Three family farms in the yam cultivation zone of Eastern Nigeria, 1964–1977. *Africa* 51 (2), 678–693.
- Zannou, A., Ahanchédé, A., Struik, P.C., Richards, P., Zoundjihékon, J., Tossou, R. and Vodouhé, S. (2004) Yam and cowpea diversity management by farmers in the Guinea-Sudan transition zone of Benin, *NJAS – Wageningen Journal of Life Sciences* 52 (3–4), 393–420.
- Zimmerer, K.S. (1991) Labor shortages and crop diversity in the Southern Peruvian Sierra. *Geographical Review* 81, 414–432.