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Piaroa Manioc Varietals: Hyperdiversity or Social Currency?

Serena Heckler · Stanford Zent

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Abstract The maintenance of exceptionally high numbers of folk varieties by the Piaroa people of the Venezuelan Amazon is considered. We cataloged 113 manioc folk varieties, their nomenclature, use and relevant characters, revealing significant insights into the role of manioc in Piaroa social life. Through a qualitative investigation of the cultivation, processing and symbolic significance of manioc (*Manihot esculenta*) in two Piaroa regions over a period of 18 years, we have found that such agrobiodiversity can only be fully explained by a combination of multiple factors, including pragmatic and ecological considerations, the subtle and complex diversity of Piaroa manioc preparations and a variety of sociocultural factors, such as manioc's role as a mediator of social relationships and as a marker of cultural and social heritage.

Keywords *Manihot esculenta* diversity · Cassava · Piaroa · Agrobiodiversity · Indigenous agriculture

Introduction

Manioc has been widely cultivated and used by Amazonian populations since long before the arrival of Europeans (Piperno and Pearsall 1998). Today it is still the staple crop for the majority of native Amazonians. The nutritional importance, as well as the antiquity of the crop—it was probably domesticated some 5,000 years ago (Schwerin 1970:26)—suggest a great symbolic and cultural importance. Indeed, many Amazonian groups, including the Piaroa, classify manioc separately from other plant species and describe a unique mythical origin for the plant (Hugh-Jones 1979; Rival 2001; Descola 1994).[1] Intricate rituals involving entire villages ensure the success of manioc crops (Guss 1989). Manioc is the basis of almost all meals and manioc beer is often central to festivals and other social rituals (Rival 2001; Mowat 1989; Gow 1991; Descola 1994). Given its obvious cultural importance, it is perhaps not surprising to find dozens, even hundreds, of subspecific varieties being maintained by many indigenous and mestizo groups (Kensinger 1975; Frechione 1982; Carneiro 1983; Boster 1984a, b; Chernela 1986; Grenand 1993; Dufour 1993; Salick *et al.* 1997; Emperaire *et al.* 1998; Elias *et al.* 2000). However, this phenomenon of extremely high cultivar diversity, or "hyperdiversity" (Brush 1992:161), is still the subject of puzzled speculation by researchers (Elias *et al.* 2000:252, Salick *et al.* 1997). Hypotheses postulated to account for this "hyperdiversity" include suitability to micro-ecological niches (e.g. Hames 1983), pest resistance (McKey and Beckerman 1993:89; Wilson and Dufour 2002), farmer curiosity (Rival 2001), and organoleptic qualities (Carneiro 1983; Dufour 1993). While any or all of these hypotheses may be partially correct, they do not adequately explain the sheer number of manioc varieties maintained by many indigenous Amazonian communities. Those accounts that do recognize the exceptionally high diversity resort to a vague and generalized positive "valuation of agrobiodiver-

S. Heckler (✉)
Department of Anthropology, University of Durham,
43 Old Elvet,
Durham DH1 3HN, UK
e-mail: Serena.heckler@durham.ac.uk

S. Zent
Centro de Antropología,
Instituto Venezolano de Investigaciones Científicas,
Apartado 21827, Código Postal 1020-A,
Caracas, Venezuela
e-mail: szent@ivic.ve

[1] According to Piaroa folk botanical taxonomy, manioc is classified as a monotype life from category ($isaw^{h}\tilde{e}$), which is to say it is the only member of its class at the life form rank.

sity" (Elias *et al.* 2000: 252), in other words "maintaining diversity for its own sake..." (Boster 1984a: 344).

We believe that this lack of explanation as to *why* manioc diversity should be positively valued stems from a failure to sufficiently analyze the social role that such diversity plays in many Amazonian societies. As Brookfield observes "local or folk varieties...are best known to farmers themselves, often are known only by local names, and below the species level are not easily defined in taxonomic terms" (2001:22, note 7). Thus it is rather surprising that local perceptions, attitudes and values regarding agrodiversity, as opposed to scientific measurements of biotaxonomic, chemical or ecological properties, have been somewhat neglected in this line of research. Much previous research on manioc varieties has focused more on perceptual recognition of morphological characters, cyanogenic content, ecological factors and adaptive requirements, and largely ignored the sociocultural dimension. Those studies that do focus on sociocultural issues are concerned with symbolic or economic factors of manioc as a relatively undifferentiated whole and do not consider varieties or diversity in any detail (e.g. Hugh-Jones 1979: 169–192; Rivière 1987). Sociocultural factors may be highly complex, context dependent, and may only emerge in interviews in particular contexts or during the activities of daily life. We have, therefore, used ethnographic methods, such as participant observation and unstructured interviews over long periods of time to gain the perspectives of Piaroa farmers of what factors may be involved in manioc diversity maintenance. Our study has focused on ten different communities in which we have lived, worked and shared meals with Piaroa families. Given that much of the information is embedded within daily activities and discussed in unique contexts, our data, like all ethnographic data, cannot be meaningfully translated into quantified proportions and discrete data points. However, this approach has enabled a detailed and contextualized understanding of the role of manioc in these communities and suggests new directions for future research into the significance and value of agrobiodiversity in the lives of subsistence farmers the world over.

We have identified 113 manioc varieties, and documented nomenclature, folk classification, use, exchange and symbolic importance in two regions of Piaroa homeland. We have found that all the factors considered by other authors reflect part, but not the entire Piaroa situation; sociocultural factors, such as kinship, heritage, exchange, aesthetics, and sociality are also important determiners of varietal maintenance. We consider different contributing factors one by one, gradually building a picture of increasing diversity, from ecological determinants, that only explain the maintenance of a small proportion of the observed diversity, to sociocultural factors, which explain the maintenance of a high degree of diversity.

Ethnographic Background

The Piaroa are a tropical forest dwelling indigenous group mainly living in Amazonas and Bolívar States, Venezuela (OCEI 1995). They are shifting cultivators of manioc, with supplementary calories supplied by maize (*Zea mays*), sweet potatoes (*Ipomea batatas*), yams (*Dioscorea* spp.), plantains (*Musa* x *paradisiaca*), hunting, fishing, and gathering. Prior to the 1970s, most of their communities were small, dispersed, semi-nomadic, and composed of extended family groups headed by one or two patriarchs and matriarchs. The patriarchs were often shamans whose ability determined the size and stability of the communities (Overing-Kaplan 1975; Overing and Kaplan 1988; Monod 1970). In recent decades, they have increasingly settled in larger communities situated along navigable rivers.

Men clear and burn new fields while women perform most of the other agricultural work. Manioc is planted, maintained, harvested, and processed by women, which takes up most of their work time (Zent 1992:180–181, 245), and their identities, prestige and self-esteem are intricately interwoven with this crop (Heckler 2004). Manioc is present at nearly every meal, festival and social encounter: it is the centre of their economic lives. Like many other Amazonian groups, the Piaroa gain the majority of their calories from this crop (Zent 1992:307–309).

The Study Areas

The two study areas represent two different lifestyles of contemporary Piaroa (Fig. 1). The Upper Cuao River is an interfluvial zone in the highlands to the east of the state capital of Puerto Ayacucho with only 250 residents at the time of fieldwork. Because of the mountainous terrain, there are no navigable rivers, few possibilities of building airstrips and very little access from land by non-indigenous peoples. In 1984–1987, when data were collected, they were entirely monolingual, were not involved in the market economy, and had no government-provided schools or health clinics. They moved home sites frequently and had relatively little access to western technology. They were renowned among other Piaroa for their forest skills, their craftmaking, their shamanism, etc. For these reasons, the Cuao Piaroa live in a way that can be loosely characterized as traditional.

All the Manapiare Valley communities, on the other hand, are accessible from the Manapiare River, a tributary of the Ventuari River, which is navigable by large boats. One of the study communities is the district capital, with schools, a Catholic mission, a Protestant church, a health clinic, an airport and shops. When data were collected between 1997 and 2002, approximately 20% of the Piaroa population spoke Spanish. All four study communities, as with nearly

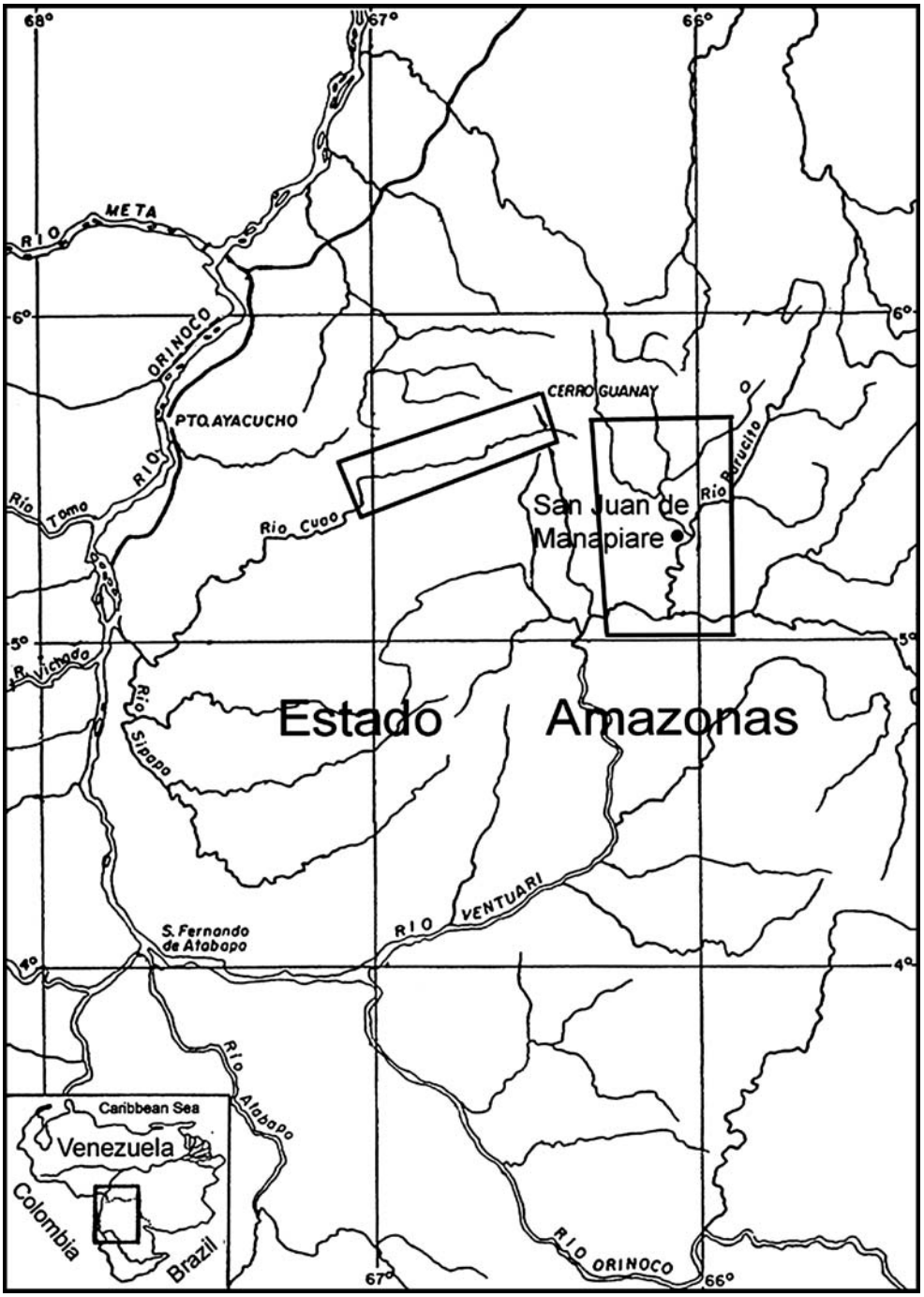

Fig. 1 A map of Piaroa territory. The *box on the left* indicates the Upper Cuao Valley and the *box on the right* indicates the Manapiare Valley. Although they appear to be adjacent, the Upper Cuao is 500–1000 m higher in elevation

all communities along this river system, were involved with an agricultural cooperative that sold produce in the state capital. Nevertheless, almost all Piaroa in the Manapiare Valley still depended upon agriculture for their subsistence.

Methods

The data presented in this paper were collected during extensive fieldwork in ten communities over a span of 18 years. From 1984 to 1987, Zent collected data in six communities in the Cuao region. Heckler collected data from 1997 to 1999 in four communities in the Manapiare region. Zent returned to the Manapiare Valley in 2001–2002 for follow-up interviews. The sampling within each community was largely self-selecting (Table 1). This fieldwork involved extensive participant observation of farming practices, food preparation and meals, and over 400 semi-structured and unstructured interviews, including questions about the ecological requirements, morphological

Table 1 Population and sample sizes for the different methods used in this study

Region	Community	Size[a]	Participant observation[a]	Interviewed[a]	Manioc inventory	Plots
Cuao	Ærõto	24 (9)	24 (9)	8 (6)	2	12
	Wæri ahe 1	5 (1)	5 (1)	3 (1)	–	6
	Wæri ahe 2	33 (8)	33 (8)	7 (5)	–	–
	Kwẽrãwẽ	14 (4)	14 (4)	3 (2)	1	–
	Kareka	10 (4)	10 (4)	3 (3)	1	–
	Sanaya	10 (2)	10 (2)	–	–	–
Manapiare	San Juan	110 (33)[b]	80 (27)	44 (24)	8	6
	Guara	50 (20)	40 (16)	24 (13)	–	3
	Caño Seje	30 (9)	30 (9)	17 (8)	2	3
	Guanay	80 (?)	15 (4)	8 (3)	–	–
Totals		366 (90+)	261 (84)	117 (65)	20	30

[a] The number of primary manioc farmers (i.e. adult women) included in this number is in parentheses.
[b] This only includes the Piaroa population of this multi-ethnic community.

characteristics, the preferred preparation and the role of exchange. For instance, while helping or observing a farmer harvest a particular variety, the researcher asked when it was planted, why it was cultivated, why harvested at this time and what the farmer was planning to do with it.

We also carried out 30 structured *in situ* garden plot interviews in five communities (two in Cuao and three in Manapiare) that provide the foundation for a study on the effects of socioeconomic change on transmission and maintenance of manioc diversity. The results and detailed methodology of that study are presented elsewhere (Zent and Heckler 2004). Finally, we compiled complete inventories of the number of varieties cultivated by 20 farmers in four of the study communities (Table 1).

Given the broad geographical and time range of this study, there are many differences that could be analyzed, some of which are the focus of another paper (Zent and Heckler 2004). The majority of the factors discussed in this paper, however, have been expressed throughout the study by the majority of the farmers interviewed, thereby suggesting a wide distribution of such perspectives amongst the Piaroa. Where this is not true, it has been noted in the text.

We include an inventory of emically identified varieties (Appendix). We define a variety as a unique combination of character traits (Table 2) recognized and named by Piaroa cultivators.

Given the complexity of a dynamic nomenclatural system (see below) and informant disagreement, we erred on the side of caution in including a variety in our inventory. Several criteria were required for inclusion:

1. At least three farmers had to identify a variety by name and explain its particular diagnostic characters (in the event of several names, farmers had to acknowledge equivalency). Only in ten cases of specialist manioc cultivators with new varieties (see below) did we include a variety that was only confirmed by one or two cultivators.
2. At least one *in situ* plant and/or root tubers with corresponding name(s) were shown to the researchers,

Table 2 Characters and attribute variables used by the Piaroa to identify and classify manioc varieties

Character	Piaroa term	Key attributes
Leaf	*Iresohœ*	
Lamina	*Isohœ*	Color, size, shape, number, texture
Lobe	*Isohœ ido'si*	Shape, margin, number
Lobe base	*Kadak'ohœ*	Shape
Lobe apex	*Pœhurohœ*	Shape
Petiole	*Isœna*	Color, size
Stipule	*Isohœ kœrœ*	Presence or absence
Stem	*Iresaw^{h}ẽ*	
Vertical stem	*Isaw^{h}ẽ*	Size, shape, hardness, rate of growth
Bark	*Isaw^{h}ẽ ihœ̃ta*	Color, size, texture
Pubescence	*Isaw^{h}ẽ amiræ*	Presence or absence
Node	*Isaw^{h}ẽ iœriyœ̃*	Size, number
Vegetative bud	*Isaw^{h}ẽ iœre bawœre*	Size, number
Latex	*Isaw^{h}ẽ utœni*	Color, amount, presence
Lateral stem/ branch	*Isaw^{h}ẽ œnaw^{h}e*	Color, size, shape, number, texture
Underground stem	*Hak^{w}œ saw^{h}e*	Hardness
Root	*Iret'e*	
Enlarged root	*Isœt'e*	Size, shape, number
Enlarged root peel	*Wœmehœ̃ta*	Color, thickness, hardness, texture
Edible pulp	*Hak^{w}œt'e*	Color, hardness, dampness, fibrousness, taste, acidity
Secondary roots	*Iwewi*	Size, number
Enlarged root 'stem'	*Wek'a*	Size, hardness
Fruit	*Uwœhu*	Color, size
Seed	*Hak^{w}œhuwœ*	Taste
Flower	*Æũ*	Size, number

preferably in structured interviews (83% of the varieties were identified during the structured plot interviews).
3. In case of informant disagreement, further semistructured interviews were carried out. This may have occurred by asking groups of women to discuss particular varieties or traits or by going from house to house asking specifically about such disagreement.
4. Zent confirmed the inventory, including alternative names and corresponding traits, with seven farmers in the Manapiare Valley in 2001 and 2002.

Because of severe legal restrictions on access to genetic resources in Venezuela since the late 1990s, it was not possible to collect specimens of the manioc varieties much less carry out DNA or chemical analysis of any botanical material.[2] Given that manioc is generally asexually propagated, however, varietal differences can usually be determined by morphological traits. Moreover, farmers were able to identify spontaneous seedlings (i.e. genetic recombinants) in their gardens when they occurred. The possibility remains that genotype-environment interactions may cause unique expressions of the same genotype to be identified as new varieties (Emperaire *et al.* 1998:39). However, because we are concerned mostly with emic perception of manioc diversity, that being the locus of selection, this possibility is not central to our argument. A comparison of morphological characteristics minimizes the possibility that different genotypes have been identified with the same name.

All Piaroa names and words are written using the phoneme-based orthography developed by the linguist Laurence Krute (1989), which is very close to international phonetic alphabet conventions.

Piaroa Manioc Varieties

The number of folk specific taxa recognized by the entire Piaroa people is presently undetermined. However, in our study, which was limited to a portion of the communities in just two of the nine major fluvial basins inhabited by this ethnic group,[3] we recorded 113 folk varieties, which are listed with associated characteristics in Appendix. Of the catalogued varieties, 30 were recorded only in the Cuao region, 48 only in the Manapiare region and 35 recorded in both regions. Considering that the aggregate population we studied accounts for less than 10% of the total Piaroa population, it is conceivable that the overall count could reach several hundred or more varieties.[4] Like the Makushi case (Elias *et al.* 2000), Piaroa maintenance and transmission of manioc varieties is fluid, with new varieties constantly being adopted and old ones lost. Moreover, the nomenclature is dynamic with alternative names confirmed for 36% of the catalogued varieties. Given this dynamism and complexity, this catalogue represents a synchronic sample of an ongoing process. Nevertheless, considerable information about Piaroa management and perception of manioc diversity and the resulting dynamics can be drawn from this sample.

A few aspects of Piaroa manioc classification and management were expressed by all of our collaborators and largely match what has been described elsewhere in Amazonia. Certain attributes of the tuber pulp, namely color and bitterness, almost always figure in cultivar classification. Similar to other lowland South American manioc cultivators (Boster 1984b:37; Dufour 1988:256), the Piaroa classify root tubers into two basic colors: *tei/tea'a* "white", comprising 79% of our catalogue, and *tuwo/tuwa'a* "yellow", comprising only 8%. The color of six varieties (5%) was unknown, in some cases because they were recent introductions, while a further 8% evinced some informant disagreement. Between two to five varieties, depending on the collaborator, were considered intermediate in color, and were identified by their farmers as *hĩ'kĩčãwã tuwo*, "a little yellow", this being the source of some of the informant disagreement referred to above.

Bitterness is one of the most important features used to differentiate manioc varieties for both scientists and farmers, having immediate economic and health consequences. Our collaborators initially verbalized a major classification of bitter vs. sweet, but upon closer questioning they demonstrated a more graduated comprehension of bitterness. The degree to which the Piaroa trait of "bitterness" correlates with cyanogenic compound concentration was not determined, however many of the traits described by our collaborators (see below) suggest that there is significant overlap between the two. The Koch scale identifies three qualitatively distinct classes of total cyanogenic compound concentration: innocuous (<50 ppm), moderately poisonous (50–100 ppm), and very poisonous (>100 ppm) (cited *in* Dufour 1988:259). By comparison,

[2] In the midst of this period of uncertainty, both authors applied separately for research permits to collect plant samples in the late 1990s but were unable to obtain them.

[3] The major fluvial regions occupied by the Piaroa in Venezuela include: Suapure, Parguaza, Cataniapo, Cuao, Autana, Sipapo, midddle-upper Orinoco, lower-middle Ventuari, and Manapiare.

[4] We are aware that the total inventory of culturally recognized varieties cannot be extrapolated on the basis of population numbers alone, especially given the lack of representative sampling design. But the magnitude of hypothetical increase should take into account the size and variability of the population (>12,000 in 190 communities), the diversity of the environment inhabited (savanna, lowland forest, upland forest; blackwater, clearwater, whitewater basins; seasonal and a seasonal pluvial conditions), and the considerable degree of interethnic contact and interaction.

our collaborators utilized a four-fold classification of tuber bitterness: (1) *t'oroɬ̃* "very bitter", (2) *amonœtee t'oroɬ̃* "slightly bitter", (3) *t'oro'okɨ* "not bitter", and (4) *sa'nɨ* "sweet". Moreover, the parameter of bitterness was perceived as a continuous variable. In rating the bitterness of specific varieties, our collaborators frequently resorted to comparative statements framed by the adjectives "more" or "less" and "a lot" or "a little". Thus some "very bitter" varieties were considered to be more "very bitter" than others and were sometimes qualified by the term *niñu* (lit. "toxic to the point of lethal"), in which case the appropriate use was limited to flat bread or toasted flour. At the other extreme of the spectrum, at least one of the "sweet" varieties (*wœčœ ire*) was considered to be so sweet that it could be eaten raw with no apparent ill effects. Varieties classified as "slightly bitter" were suitable for beer brewing but those which are closer to being "very bitter" must be brewed for a longer period of time than those judged to be closer to "not bitter". A continuous conceptualization of bitterness was also suggested by informant disagreement or inconsistent statements about acidity designation and use allocation for 19 varieties (17%). In the confirmation interviews, we found that in 12 of those cases our collaborators agreed that the bitterness actually ranges between two of the aforementioned named categories (see Appendix).

The number of varieties cultivated by individual women varied from seven to 39 (n=20, average=20.3, standard deviation=7.9). When asked why they chose to cultivate certain varieties, farmers responded with a wide range of considerations, including: ecological or economic determinants such as productivity, maturation time, and *in situ* storage potential; organoleptic features including culinary needs, desires, and ease of preparation; and sociocultural determinants, such as social significance of the propagule, largely related to exchange, and its significance as a marker of cultural and ethnic heritage. Each farmer had a unique decision-making process, which was highly situational, so that farmers chose different varieties for different reasons at different times. To fully understand the diversity and dynamism of manioc cultivation, it is necessary to consider all of these factors as interconnected contributors to an overall diversity that goes well beyond that explainable by any one of them.

Ecological Determinants

To date, most considerations of manioc diversity have focused on ecological explanations. For instance, several important studies have considered the impact of bitterness on productivity, the suitability of individual varieties to particular soil, topographic, or climatic conditions, and/or the selective advantage of cultivar intercropping for withstanding pest or disease attack. (Kensinger 1975; Hames 1983; Salick *et al.* 1997; McKey and Beckerman 1993; Wilson and Dufour 2002; Wilson 2002, 2003). Given such evidence, the role of ecological determinants cannot be dismissed.

Indeed, Piaroa farmers' intimate and detailed knowledge of the ecology and morphology of individual varieties is indicated by the rich nomenclature: 46% of the catalogued varieties were named for diagnostic morphological or ecological characters (e.g., *iwã ire* named after the sloth because of its slow growth or *kubœwœ ire* named after an iguana because it is prone to insect galls that resemble iguana eggs). All our collaborators were aware of the pest and rot resistance of each variety, as well as the amount of time it required to mature. They explained that rot resistance is mainly determined by bitterness: tubers of the less bitter varieties will rot in the water-logged soil of the rainy season, so that they must be harvested approximately 6–12 months after being planted. Bitter varieties, on the other hand, may remain in the soil for up to 2 years, although they may mature much sooner. Despite detailed questioning, there was no suggestion that bitterness changed with the amount of time left *in situ*. This explanation supports Dufour's argument that the bitterness of a variety is correlated to its *in situ* storability (Dufour 1993:584). This consideration was combined with the known maturation times of the varieties—some mature in 6 months while others require 24 months or more—to plan and schedule the planting of certain varieties at particular times of the year, thereby ensuring that different types of manioc are available throughout the year.

It has been argued that polyvarietal manioc cultivation is an adaptation to micro-variation in soil fertility characteristics (Hames 1983; Wilson 2003). However, the Piaroa collaborators of this study judged soil fertility by how many successive manioc crops could be grown in one plot before the soil is exhausted (two successive crops in each plot was the norm), rather than by any particular variety being more successful than another. Indeed, given that different bitter varieties are planted immediately adjacent to each other, sometimes with stems of different varieties planted together in the same mound (Zent 1992: 194), and with up to 22 varieties within 100 m^2 (Zent and Heckler 2004), specific genotype-microcondition interactions were demonstrably not a significant factor in determining planting patterns. This may lead to post-hoc selection, for instance the propagule that is most suited to the particular conditions may outcompete the other varieties planted with it. However, this possibility was never mentioned by our collaborators. It may be that this extreme intercropping of different varieties protects against pathogens (McKey and Beckerman 1993), but this consideration was never mentioned either.

Number and size of root tubers were often mentioned as desirable features of particular varieties, but these were

considered to be inherent traits of the variety combined with the moral rectitude of the person who planted the variety (Heckler 2004) or the magico-spiritual efficacy of the village shaman (Freire and Zent 2007), rather than an interaction with local soil conditions. Thus, ecological considerations are responsible for encouraging a low level of crop diversity, primarily by encouraging an intercalation of bitter and sweet varieties that can be stored *in situ* for different lengths of time with varieties that are known to mature at different speeds. Given that more than 90 bitter varieties were catalogued, however, ecological considerations, as expressed by our Piaroa collaborators, cannot account for all the diversity.

Practical and Culinary Determinants

When asked about desirable varietal characters, farmers often responded with practical considerations related to productivity, processing, or suitability for particular preparations. A sufficient number of varieties must be maintained to meet a combination of these requirements. Harvesting, peeling, and grating of manioc are particularly onerous tasks that are made easier by specific traits. Weary women peeling tubers after a long day harvesting told us that they preferred larger tubers requiring less peeling per volume and those that peel easily, as well as those varieties that have a higher water content and so grate more easily. We were told, however, that hard-grating varieties were more rot resistant after harvest and so more suitable in those instances where the processor expected a delay between harvest and processing. Although these characters were not the primary factors in deciding which variety to plant, they were weighed, along with other many factors, by cultivators when discussing their planting decisions.

Most studies only describe between two and four preparations of manioc, while Elias *et al.* identify six different preparations (2000:244). We catalogued five major types of preparation: bread (*casabe* in lengua geral); flour (*mañoco*); beverages (*yucuta*, *yarake* and other beverages); whole tuber boiled, baked or eaten raw; and juice (*catarra*). Sub-types in each category add up to 30 different manioc-based food types, providing a rich diversity of tastes and textures (Table 3). This menu was created through different cooking techniques, selective preparation of different edible parts, blending with other food items, and manipulation of fermentation processes.

In discussing preferred varietal characteristics for these preparations, it became clear that each farmer had her own preferred varieties for each preparation. Indeed, five of the catalogued varieties were named after their preferred preparation. Thus, one of the factors encouraging genetic diversity is organoleptic, with high value placed on gastronomic variety. Due to limited space, we cannot enter into a detailed description of each of these preparation techniques, but a few examples illustrate how this culinary diversity encouraged the maintenance of varietal diversity.

Table 3 Taxonomy of manioc preparation and consumption forms

Manioc prepration and consumption forms
Bread/casabe/ *ĩrisi*
Fresh baked (soft) bread (*kwœi ĩrisi*)
Crisp-toasted bread (*hoekwœsi/ sarĩœsi/ sarĩdœkwœwœsi*)
Sun-dried bread (*kiyi ĩrisi/kiñœsi*)
Stale dried bread (*purukœ ĩrisi*)
Pungent bread (*temire ĩrisi*)
Starch bread (*itœbi ĩrisi*)
Dog and animal bread (*marap^{h}ak^{w}a ĩrisi*)
Maize-manioc bread (*yãmɨ̃ ĩrĩsĩ*)
Sweet manioc bread (*ẽt^{h}ẽwẽ ire ĩrisi*)
Toasted flour/mañoco/*iresap^{h}œ/mayukusap^{h}œ*
White flour (*tei iresap^{h}œ)*
Yellow flour (*tuwo iresap^{h}œ*)
Starch flour (*itœbi mayukusap^{h}œ)*
Fermented root flour (*muruw^{h}i wiwati iresap^{h}œ)*
Beverage/ *irisawa/sãrĩ*
Sweet potato beer (*wiriyœ sãrĩ/dawœwœ sãrĩ*)
Sweet (*sa'ni sãrĩ*)
Fermented (*at'ɨ̃ sãrĩ*)
Traditional red manioc beer (*tuwo ire sãrĩ*)
Traditional white manioc beer (*amuwœri sãrĩ*)
Yekuana white beer (*kusiwa sãrĩ*)
Nontraditional beer(s) (*yœrœke*)
Shamanic (strongly fermented) beer (*at^{h}isoya)*
Anime tree beer (*Dacryodes* spp.) (*hičũte sãrĩ*)
Maize beer (*yãmɨ̃ sãrĩ*)
Pungent casabe beer (*temire ire sãrĩ*)
Masticated beer (*k^{w}œwœ sãrĩ*)
Yucuta (*irisawa*)
Starch drink (*itœbi irisawa)*
Root/*isẽte*
Boiled (*dawœwœ*)
Roasted (*ẽt^{h}ẽwẽ*)
Fried (*pœrœwœ*)
Juice/*atoya*
Boiled (*atoya*)
Soup (*akoya*)
Clarisia ilicifolia fruit sauce (*ause nikoya)*
Chili pepper sauce/*catarra* (*rœte atoya/huœti atoya)*

Although any variety may be used for *casabe*, the preferred varieties were bitter and white. All of our collaborators had their own preferred varieties stating that they impart distinctive tastes to *casabe*: in the Cuao region, *webiya ire*, *ow^{h}otɨ̃ i.*, *hičũtẽ i.*, *hũrũk'ũ(tũ) i.*, *(i)sœp^{h}a(tɨ̃)*, *p^{h}ãnɨ̃ i.*, *w^{h}ei i.*, *and yũœsĩ i.* were considered to be especially good varieties; while in Manapiare the distinct variety *te'œma ire* was a standard *casabe* variety cultivated and used by 36% of the farmers interviewed, while in one Manapiare community, six farmers cultivated a variety that

they described as 'propio *te'ɨ ire*' (lit. 'proper white variety') for *casabe*. Non-bitter varieties were generally preferred for beer (e.g., *ærəɛ̃ɨ̃ ire*, *mærotɨ̃ i.*, *kærəsa i.*, *marawaka i.*, and *mɨ̃tʰãkɨ̃ i.*), because although some bitterness imparts a desired taste to the beer, the more bitter the variety, the longer it must be cooked before being consumed. Sweet varieties, such as *kɛ̃ræba ire* and *kɛ̃ræsa i.*, were considered edible as whole tubers, either roasted or boiled, although they were more commonly used for making beer, *casabe* and *mañoco*.

In the Manapiare region, we recorded higher numbers of yellow and sweet varieties than in the Cuao region. When asked about this, our collaborators explained that a variety of cooking techniques were introduced in recent decades from neighboring ethnic groups, including *mañoco*, that encouraged the adoption of yellow varieties, as they are preferred for *mañoco* production, perhaps because bright yellow mañoco (*tuwo iresapʰœ*) has a higher market value. The external origin of just under half of these yellow varieties was encoded in their names: *kurœsikœ ire, yœwœrœnœ tukwœ ire*, *wɛ̃ɛ̃ĩnɨ̃ tukwœ ire* and *wiru tukwœ ire*, which mean 'Curachicano', 'Yabarana food', 'Yekwana food' and 'Maco food manioc' respectively.

Introductions of new food preparation techniques also encouraged the adoption of more sweet varieties. Most of the introduced sweet varieties are generically labelled *ɛ̃tʰɛ̃wɛ̃ ire*, which translates literally as "roasting manioc", although their cultivators were clear that they were different varieties and would point to different morphological traits to explain the difference. Several of the Manapiare farmers reported that they cultivated more sweet manioc after adopting frying (*pœrœwœ*) from mestizo neighbors, which is becoming increasingly popular as Piaroa acquire the necessary frying pan, stove and vegetable oil. Bitter varieties were not fried because they "did not taste right". As with yellow varieties, the exogenous origin of non-bitter varieties was encoded in the names of six of the twenty recorded varieties, for instance *Panare tukwœ ire*, *waruwaru tukwœ ire*, and *pare ire* meaning 'Panare food', 'Hoti food' and 'priest manioc' respectively.

Hence, the diversity of manioc preparation and the techniques used in preparation require different combinations of hardness and moisture, peel characteristics, bitterness, and color and also favors some varieties for particular preparations. As suggested by Wilson and Dufour (2006), the desire to cultivate sufficient numbers of varieties to prepare the desired foods is more significant in determining diversity than that of ecological limitations. Nevertheless, it would be possible for the Piaroa to meet all their culinary needs with far fewer varieties than they actually cultivate. For example, one Manapiare farmer was considered by her husband to be a good cook and a hard worker while only cultivating seven varieties (three bitter white, two non-bitter white, one sweet white and one bitter yellow,), while several others were able to prepare all their desired foods and flavors with between ten and 15 varieties. Nevertheless, half of the 20 farmers for which we compiled a complete inventory cultivated more than 20 varieties and four of those cultivated 30 or more. A similar observation by Elias *et al.* led them to identify considerable 'functional redundancy' in the number of varieties cultivated for each preparation (2000:244). To understand the cultivation of a much higher number of varieties than is necessary to meet culinary requirements, the sociocultural dimensions of manioc cultivation must be taken into account.

Sociocultural Determinants

Manioc cultivation is embedded within a wider agricultural system which, like agricultural systems throughout Amazonia, is imbued with symbolism and social significance (Descola 1994, Hugh-Jones 1979). By far the most detailed analyses of the social and symbolic role of manioc varieties are those carried out by Elias *et al.* (2000) and Rival (2001) amongst the Makushi of Guyana and in most respects, our data correlate very closely to theirs. However, Rival states that "The Makushi...cannot explain why they have so many varieties. Like collectors, they just have them. It is also clear that they are driven to cultivate as many varieties as possible by a deep-seated curiosity that pushes them to continuously 'try out' new types" (Rival 2001: 62). While we agree that farmers are curious and that they are "collectors", the relegation of the reasons for this to some unexplainable mystery does not satisfy us. We argue that to understand this push to collect, one must consider not just the practical, economic or even symbolic significance of manioc varieties, but also its affective value. To begin to understand this value, we turn to the role of manioc varieties in exchange.

Exchange of Varieties

Manioc varieties, in the form of vegetative propagules, are regularly exchanged between farmers. We observed manioc propagule transfer from one gardener to another occurring in five contexts: (1) from kin or neighbor as a means of starting a first garden; (2) generalized exchange of work, food and materials between kin or neighbors; (3) direct exchange of work or food for propagules between kin or neighbors, often women; (4) informal gift exchange between women or men; and (5) formally as gifts or sales, often from or via men.

When a new garden was planted, anywhere from 60–150 propagules per 100 m^2 were used. In the vast majority of cases, these were taken from mature gardens belonging to

the same gardener, but one to three times during a farmer's lifetime, such as when young women plant their first gardens or when environmental disaster or unexpected relocation forces someone to start afresh, propagules were obtained from other people's gardens, usually the gardens of kin. As a result, we observed that varieties often followed kinship lines, particularly in the Cuao. In this type of exchange up to 20–25 varieties may be passed on at one time, so that it is important in terms of sheer number of varieties, although it occurs less regularly than other types of exchange.

Once established, 97% (57 of 59) of the farmers that we interviewed became involved in generalized, direct, or gift exchange with their kin and neighbors. In the small Cuao communities, where everyone usually lived under the same roof, a norm of generalized exchange prevailed in which food, labor and material resources were freely and openly shared among coresidents. Even though individual families tended to plant and harvest their own garden plots or particular sections within communal plots, the varietal seed stock was treated as a common pool resource and a farmer may collect stem cuttings from someone else's section without anything ever being said about it.

In Manapiare, this model prevailed with close, coresidential kin, but other modes of exchange were observed as well. For instance, a neighbor or distant relative would accompany another for at least half a day's work in the garden. In exchange for their labor, they were given 6–50 propagules. This labor sharing was initiated either as a request for assistance in the garden by the donor, or as a request for propagules by the receiver, who often requested the propagules of specific varieties. This type of exchange happened one to four times per planting season for each Manapiare farmer. A less common context in which informal exchange occurred was when kin from another community visited for an extended period of time. These visits are common practice for the Piaroa and many Manapiare households, particularly, visit kin in other communities for periods ranging from a few days to several months per year. Visiting women worked alongside their hosts in the gardens. As a result, they were sometimes given up to a dozen propagules to plant in their gardens back home.

In a very few cases, particularly when distant kin visited from other communities, or with neighboring women who were not closely consanguineous, women brought propagules from their garden and presented them as freely-given gifts. The gift variety was more appreciated if it was new to the recipient and had some desirable quality.

Formal manioc exchange accompanied visitation from one community to another. We recorded no examples of this in the Cuao region, although six Cuao varieties were explicitly sourced from another ethnic group, leaving open the possibility that formal exchange had occurred. In the Manapiare region, however, 19 varieties were introduced from other regions or ethnicities, one case of formal exchange was witnessed and the formal introduction of three other varieties was related to us. This was related to an increase in travel to political events and political alliances with other indigenous groups regionally, nationally, and internationally (Oldham 1996). In such cases, one or several propagules were carried from one community to another, or presented as a gift from one gardener to another, for example *pare ire*, which was given to a Manapiare farmer by a Catholic priest and was then disseminated to at least two other women through informal exchange routes. Another example is the variety that was presented to a (male) delegate at a national conference by one of his Wayuu hosts as a gift for his wife (unnamed variety). Once home, the delegate gave the propagule to his wife in the midst of a circle of curious and delighted farmers who speculated about the organoleptic, ecological and morphological characteristics of the variety.

The social significance of varietal exchange has been largely overlooked (but see Boster 1986; Chernela 1986; Rival 2001:63 for exceptions). This is surprising given that the importance of gift exchange as a means of creating and maintaining relationships has been a major aspect of social analyses since Mauss' *The Gift* (1990[1925]). Ethnographic accounts from all regions of Amazonia stress the importance of exchange in incorporating affines into the community, managing potentially dangerous relationships with outsiders and solidifying relationships amongst close kin (Overing 1992: 194–6; Siskind 1973, McCallum 2001:95–98, 117–119). Just as men may exchange meat, fish, ritual items or services related to their primary roles (Chernela 1993: 110–122; Gow 1991: 122–129), women exchange labor and goods related to their primary roles, including childcare and manioc production (Chernela 1986; Rival 2001: 63; McCallum 2001: 82–83). By exchanging manioc varieties as gifts and for labor, Piaroa women create and generate safe productive relationships. This exchange is made more meaningful by being able to offer new and unique varieties to others (Heckler 2004). The importance of such exchange was not only demonstrated by the way in which women responded to exchange events as they were witnessed by the authors, but also in the way in which they talked about the exchange years later, when the variety in question was established and producing in their garden.

Personal and Collective Memory

Each variety bore the memory of the event, person, or place of its origin. We found that, when new propagules were planted, the stories of their origin were remembered in 100% of cases, sometimes encoded in their names (19% of

our inventoried varieties were named for the place, person, or ethnic group of origin), and became a significant part of their appeal. Even for those varieties whose names did not change upon being exchanged, we were told about the social contact that had accompanied the exchange, often with considerable emotion. For example, a farmer who had left the community of her childhood and her parents behind years before when she, her husband and children moved to a Manapiare community to seek hospital treatment. During an unstructured interview, she spontaneously related the origins of 16 of the 30 manioc varieties that she was cultivating and used this as an opportunity to relate stories about her late husband, her parents and the communities where she had lived during her lifetime (Table 4). The origins of her other 14 varieties were related later upon explicit questioning.

Some varieties were considered to be the original or traditional varieties of the Piaroa people and our collaborators identified them as '*tæbot^{h}ihœ*(*minœ*) *t^{h}uk^{w}œ ire*' (lit. 'ancestor's dietary manioc'; 64 varieties in our catalogue). We recorded some inter-informant differences in the identification of a variety as *tæbot^{h}ihœ*(*minœ*) *t^{h}uk^{w}œ ire*, especially between junior and senior cultivators of the same community. Hence, the notion of ancestrality is dynamic and relative to a person's education, experience, and motivation. In the Cuao region, newly discovered varieties which were grown from uncultivated stems recovered from ancient garden sites (*tæbo resabœ*), i.e. genetic recombinants, were also called *tæbot^{h}ihœ*(*minœ*) *t^{h}uk^{w}œ ire*. On three occasions farmers told us that these sites had been cultivated by ancestral Piaroa groups, therefore the propagules found there are considered to be the heritage left by their ancestors and, as such, farmers were motivated to plant them experimentally. Thus the Piaroa put a different, but equally meaningful interpretation on genetic recombinants than the Makushi (Rival 2001).

Although no genetic recombinants were identified in the Manapiare region, so-called "ancestral varieties" were traced back to Piaroa regions, such as the Cuao, where Manapiare residents said that people "lived like the ancestors". Over half of the catalogued varieties, then, were valued as markers of identity and heritage.

Social Status and Aesthetics of Diversity

Farmers varied in the extent to which they were the donors and recipients of varietal exchange. In Manapiare, two to four women in each community were renowned for their interest in and cultivation of many varieties of manioc (Heckler 2004). When asking questions about manioc varieties, other farmers would recommend that we talk to these farmers, saying that they were the experts. These experts experimentally cultivated new varieties, discussing them with other women during their regular visits to the kitchens, where they talked about the ease of peeling and grating, the productivity of each plant, organoleptic qualities, rot resistance, etc. On the basis of these visits, women requested propagules directly or indirectly, through offers of assistance or food. These experts were also central in the social life of the community, with important kin, such

Table 4 The manioc varieties cultivated by a Manapiare farmer with the type of exchange that was involved

Variety	Origin as related by farmer	Exchange type
K'uræma ire	Was brought by her father from her community of birth	2
K̃æræsa ire	Not bitter, good for making sari, brought from Guanay by her sister	4
Kareba ire/ pare ire	Sweet manioc from Caracas, introduced by priest (padre).	4
K'uræme ire	Brought from Guanay after a visit to her sister.	4
Guahibo tuk^{w}æ iresaw^{h}e	Yellow manioc that was given by a neighbor of the ethnic group Guahibo who taught her to make mañoco.	3
Wãyãmɨ ire	Sweet manioc that was brought back by her brother from a trip to Brazil.	4
Wæčæ ire	Brought back from a visit to Saupure.	4
M̃æhîyæ ire	Brought from Guanay by her sister	4
Name unknown	White, bitter variety from Platanál	2
Name unknown	Brought by her mother during a visit	4
Norikæ ire	Brought from Caño Seje, bitter	3
Pærewa ire	Brought by her from the community of Guayabalito when she moved here.	1
Tæmɨ ire	Brought from Saupure	3
Tuwæræ ire	Gift from her mother before she left for new community	4
Tuwo iresaw^{h}e	Her brother brought it as a gift from a woman named Betania in Puerto Ayacucho	5
Waruwaru tuk^{w}æ ire	A man from the neighboring ethnic group Hoti brought it for her during a visit	5

1 Establishing new garden, *2* as the outcome of generalized exchange between kin, *3* direct exchange of work for propagules, *4* informal or freely given gifts between women or men, *5* formal gifts, often from a distant community and often via men.

as the community shaman, captain, or many children, in-laws and grandchildren. Their houses were often the location of rituals and informal gatherings. In this sense, these experts resembled the "source" families described by Rival, i.e. those families who "manage manioc production efficiently...(and are)...proud and respected community members with a high status" (2001:65). In the Cuao region, most women cultivated a high number of varieties and, in other ways, such as the wide variety of foods prepared, resembled the "expert" roles in Manapiare. Space does not allow a full consideration of this possible decline in the sociocultural valuation of agrobiodiversity, however it has been discussed elsewhere (see Heckler 2002, 2004).

Certainly manioc diversity had aesthetic value for our collaborators and as such it was a marker of the gardener's expertise. The expert farmers reported that they preferred to cultivate an abundant number of different varieties because "a garden rich in varieties is more beautiful and pleasing to the eye". A group of Manapiare farmers responded to questions about another woman's garden with appreciative comments about the many varieties she cultivated, hence its beauty and by extension, her skill as a gardener. One Cuao resident explained that just like it is good to have a house that is full of people of different faces, sizes, ages and personalities, it is good to have a garden populated by manioc of varying appearances and habits. The notion of community or house as a place of amiable and productive sociality characterized by the positive emphasis placed on a full and diverse family membership is the basis of social morality throughout Amazonia (see Overing and Passes 2000:2; Overing 2003:309; McCallum 2001; Johnson 2003; Belaunde 2001).

Conclusions

Undoubtedly, a complete survey of all the regions inhabited by Piaroa would greatly enhance and enrich the data presented here. Equally, a systematic genetic and morphological analysis of the varieties described would clarify many uncertainties. Nevertheless, through the combination of quantitative and qualitative data collection, we have found evidence that many of the factors suggested by other authors are indeed significant in encouraging manioc diversity. However, when a Piaroa farmer decides which varieties to plant, she does not consider any one of these factors in isolation, but brings them all to bear on her planting patterns. She may say that she plants one variety because she expects it to be harvestable at a particular time of the year, and she may plant another variety so that she can make a particular type of beer. By using participant observation and unstructured interviews, we have found that all of these decisions occur within the context of manioc agriculture as symbol and marker of social relationships. Thus, for the Piaroa, the rather vague "positive valuation of agrobiodiversity" postulated elsewhere (Elias *et al.* 2000: 252) can be understood to stem from the importance of varietal exchange in the development and maintenance of female relationships and status, the association of a diverse manioc plot with the aesthetic and moral ideal of "living well", and the association of particular varieties, including genetic recombinants with personal and collective memory.

To manage such a diversity of factors requires skill and forethought, which men and women acknowledge when discussing the varieties cultivated by other women. In the Cuao, this devotion to manioc cultivation as a highly developed skill is the norm, so that the Cuao farmers that were interviewed maintained a uniformly high number of varieties in their gardens (an average of 18.5 varieties per 100 m^2 plot, SD 3.1, n=18). In the Manapiare Valley, on the other hand, many younger women had to divide their time between wage labor, childcare,[5] and farming. For these women, there was no longer a possibility of devoting the time and skill to farming that their mothers and some of their contemporaries had done (Heckler 2004). This was reflected in the low number of varieties cultivated in their gardens (an average of nine varieties per 100 m^2 plot, SD 5.1, n=12).[6] Despite this trend, an overall erosion of agrobiodiversity has been staved off by the continued practice of skillful and socially meaningful agriculture by at least a quarter of the farmers in this region.

The importance of social significance in encouraging agrobiodiversity has been largely overlooked in discussions of manioc diversity. We believe that this is at least partly related to the methods and analytical approaches that are often used, which privilege quantitative survey approaches over qualitative ethnographic methods. While standardized questionnaires and statistical analyses are useful for capturing consensus, variation and trends, participant observation, informal conversations and intimate familiarity with the daily lives of one's collaborators are more appropriate for capturing the lived experience, symbolic and social significance that humans place on their landscape, in this case on the crops that they grow. Here we have used for our analysis of agrobiodiversity a variety of methods and analytical perspectives that recognize a wide range of contributing factors. This is the most accurate way to describe a complex and dynamic agricultural system in which Piaroa farmers raise their management of manioc varieties to an art, with all the associations and meanings that such a term suggests.

[5] The nucleation of families and the removal from the home of men for wage labor and older children for education is placing a considerably higher childcare burden on adult women (Heckler 2002).

[6] For methods and more on this study see Zent and Heckler 2004.

Appendix

Table 5 Manioc varieties identified in Upper Cuao and Manapiare Valley Piaroa communities

Primary name	Translation	Alternative name(s)	Comments	Acid[a]	Use[b]	Col[c]	Loc[d]	Anc[e]
æi(tɨ̃) ire	Bocon fish (*Brycon* spp.) manioc			1[f]	c, ts	w	M,C	Y
ækæræ (iæyæ) ire	Chicken (egg) manioc			2	c, m, ws[f]	w	M, C	Y
(h)ærɑ̃tɨ̃ ire	Small fish manioc	*ærɑ̃'sa ire* 'small fish manioc', *t^{h}ɨ̃'ɑ̃tɨ̃ ire* 'small fish (*Creatochanes* sp.) manioc', *yæwærænæ tuk^{w}æ ire* '*Yabarana* dietary manioc'	Named for small fish that has red head and tail; the tuber skin is reddish but white inside, like the fish; borrowed from Yabarana ethnic group	2	c, ws	y[f]	M,C	N
æwe(tɨ̃) ire	Catfish (*Leiarius marmoratus*) manioc	*bæreu ire* 'large manioc'		1	c, m, ws	w	C	Y
(ahe) ihure ire	Currasow *(Crax alector* or *Mitu tomentosa*) manioc		Characterized by red-purple leaves	3	ws	w[f]	C,M	?
ahæ ire	Bottle gourd manioc		Name comes from cultivated bottle gourd used for beer storage			w	M	?
ækuwæ ire	Termite (*Syntermes* sp.) manioc	*tamari ire* 'Dagmari's manioc'	Alternative name refers to local woman who cultivates it	1			M	N
ak^{w}ĩtɨ̃ ire	Nine-banded armadillo (*Dasypus novemcinctus*) manioc	*nirĩyũ ire* 'armadillo shell manioc', *cachicamo ire* 'armadillo manioc'		2–3	c, m, ws	w	M	Y
æukæ ire	tarantula (*Avicularia* sp.) manioc			3	c,ws	w	M	Y
bei ire	Short tuber manioc	*marakanati tuk^{w}æ ire* 'Salto Maraca dietary manioc'	Characterized by short or small stem and branches, but large tuber; imported to Cuao from Salto Maraca community	1–2[f]	c, m[f], ws[f]	w	M,C	N
buok'ayu ire	Mythical deer manioc	*buo ba ire* 'large container manioc', *ow^{h}otɨ̃ ire* 'tapir manioc'	Characterized by large fat tuber, like mythical deer's or tapir's body	1	c	w	M,C	Y
č'aredukæ ire	Bulging eyes manioc	*webiya ire* 'swollen lips manioc'	Names refer to vegetative buds which bulge out like eyes popped out of their sockets or grossly swollen lips; very damp tuber; tall plant habit	1	c	w	C	Y
čurĩ ire	Sanema manioc		Borrowed from Sanema ethnic group	1–2		w	M	N
ciæwahu ire	Skinny woman manioc		Takes name from scrawny plant habit and sparse foliation	1	c	w	C	Y
ɛ̃t^{h}ɑ̃wɑ̃ire	Roasting manioc	*bære ɛ̃t^{h}ɑ̃wɑ̃ire* 'large roasting manioc		4	r, b, ws	w	M,C	N[f]
ɛ̃t^{h}ɑ̃wɑ̃ ire, p^{h}otɨ̃	Roasting manioc, small variety	*panari tuk^{w}æ ire* 'Panare dietary manioc'	Borrowed from the Panare ethnic group	4	r, b	w	M	N
æũ(kæ) ire	Small flower manioc		Characterized by small but abundant florescence	1	c, m	w	M	N[f]

Table 5 (continued)

Primary name	Translation	Alternative name(s)	Comments	Acid[a]	Use[b]	Col[c]	Loc[d]	Anc[e]
hæde ire	*Matisia ochrocalyx* manioc	*marawaka awarua/ubuo/ihæwa ire* 'marawaka relative/brother manioc'	Considered to be close relative of the *marawaka* variety	3	c, ws	w	C	Y
hærækʷæ ire	Guachalaca (*Ortalis motmot*) manioc			1			M	
hæyu ire	Albarico palm (*Astrocaryum munbaca*) manioc		The leaf resembles the leaf of *Astrocaryum munbaca*	2	c, ws	w	M,C	Y
hakʷæti wasi ire	Pinta on the inside manioc		Name refers to spotty discoloration of the tuber pulp	1	c, m	y	M	?
hat'i(re) ire	Green manioc	*hat'isækæ ire* 'greenish slender manioc', *hat'ɨpā ire* 'green tall manioc'	Described as very tall plant with green leaves and stem	1	c	w	C	Y
hat'iwæræ ire	Deep green manioc		Described as short plant with green leaves and stem	1?	c	w	C	Y
hawitu ire	?		Characterized by very damp tuber	3	c, m, ws	y	M	N
hičũt ire	Anime tree (*Dacryodes* spp.) manioc		Takes name from forest tree (*Dacryodes* spp.), with which it shares purplish color	3	c, ws	w	M,C	Y
huriakʷæ ire	Julia's dietary manioc		Named for woman who cultivates it			w	M	?
hũrũk'ũ(tũ) ire	Striped manakin (*Machaeropterus regulus*) manioc	*orok'o(tɨ̃) ire* 'striped manakin (M. regulus) manioc' (dialectical variant)	named for green bird whose coloration resembles that of this plant	1	c, ws	w	M,C	Y
hut'u ire	?			3	c, ws	w	M	N
idiku ire	Black manioc	*tepũkæ ire* 'dirty manioc'; pærukæ *ire* 'dark-colored manioc'	Highly regarded for making sweet beer; characterized by very dark brown-black tuber skin	2	c, ws	w	C	Y
ĩdĩyũtũ ire	Scorpion manioc	*Idiyu ukʷæ ire* 'scorpion food manioc'		1	c	w	C	Y
(i)sæpʰa(tɨ̃) ire	Gray dove (*Leptotila rufaxilla*) manioc	*iteyũ(tũ) ire* 'dove (Leptotila sp.) manioc	Leaf characterized by a grayish- cottony dust color which resembles color of this bird	2[f]	c, m, ws[f]	w	M,C	Y
(i)sæpʰã(tɨ̃) ire, bære	Gray dove (*Leptotila rufaxilla*) manioc, large variety			2	c, m, ws	w	C	Y
ĩwã(tɨ̃) (ukʷæ) ire	Sloth (*Bradypus* spp.) manioc	*pereza ire* 'sloth manioc'	Grows very slowly, therefore slothlike	1	c, m	w	M,C	Y
kɛ̃ræba ire	Round root manioc		Characterized by large round tuber; recognized as type of sweet manioc	4	m, ws, r, b	w	M	Y
kɛ̃ræsa ire	Flaky manioc	*ɛ̃tʰɛ̃wɛ̃ ire awarua/ihæwa,* 'roasting manioc relative/ younger brother'	Said to resemble jobo tree (*Spondias mombin*) whose fruit falls to ground; named as such because the tuber skin falls or flakes off	4[f]	c, ws, b, r	w	M,C	Y
kariwi ire	Piranha (*Serrasalmus* sp.) manioc	*Miɛ̃ ire* 'piranha (*Serrasalmus* sp.) manioc'; *pærewa ire* 'viejita fish (*Cichlidae*) manioc'		3	c, m	w	M	N

Table 5 (continued)

Primary name	Translation	Alternative name(s)	Comments	Acid[a]	Use[b]	Col[c]	Loc[d]	Anc[e]
kataniapu ire	Cataniapo (River) manioc		Borrowed from Cataniapo River region	1	c, m	w	M	N
kubœwœ ire	Iguana (*Iguana* sp.) manioc		Leaves are commonly pockmarked by insect galls which resemble tiny iguana eggs	1	c	w	C	N
k'uræme ire	Niña tree (*Humiria balsamifera*) manioc			3	c, m	w	M	Y
kuræsikæ ire	Curachicano manioc		Borrowed from Curachicano (Yabarana subgroup) ethnic group	1	c, m	y[f]	M, C	N
kusiwa ire	White beer manioc		Takes name from fermented white beer traditionally brewed by Yekuana ethnic group	3	ws	w	M	N
kuweyu ire	?			1	c, m	y[f]	M	?
k^{w}œip^{h}ã ire	Unidentified tree manioc		Tuber described as soft and very damp	1	c	w	M	?
k^{w}œuse(tɨ̃) ire	Spix's guan (*Penelope jaquacu*) manioc			1	c	w	C	Y
mœč'œ ire	Yagrumo tree (*Cecropia* spp.) manioc		Characterized by flaky tuber bark	1	c	w	M	Y
mærotɨ̃ (uk^{w}æ) ire	Quail-dove (*Geotrygon* sp.) manioc		Characterized by distinctive reddish leaves	1–2[f]	c, ws[f]	w	C ?	Y
mɨ̃t^{h}ãkɨ̃ ire	Freshwater shrimp (*Macro-brachium atabapense*) manioc		Root inside is white, like the shrimp	2–3	c, ws	w[f]	M,C	Y
mɨ̃t^{h}ãkɨ̃ ire, p^{h}õɨ̃	Freshwater shrimp (*Macro-brachium atabapense*) manioc, small variety		Produces smaller tuber than other *mɨ̃t^{h}ãkɨ̃ ire*	2	c, ws	w[f]	M,C	Y
marawœka ire, bœre	Coiled manioc, large variety		*Marawœka* 'coiled, rolled up', refers to the appearance of the underground stem arrangement	3[f]	c, m, ws	w	M,C	Y
marawœka ire	Coiled manioc	marawœka ire, *p^{h}õɨ̃* 'coiled manioc, small variety'		3[f]	c, m, ws	w	M,C	Y
marawœka ire, tuwo	Coiled manioc, yellow variety			2	c, ws	y	M	N
mœ̃hĩyœ̃ ire	Savanna manioc			1	c	w	M	N
mœ̃hĩyœ̃ (inœsoto) ire	Savanna (stony creek) manioc		Imported from savanna (rock creek) region	1	c	w	C	Y
meretɨ̃ ire	Minnow (*Hemibrycon* sp.) manioc	*tuwañu'sa ire* 'minnow (Bryconamericus sp.) manioc'		1	c, m	w	M,C	Y
mɨ̃yœ̃tɨ̃ ire	Orinoco dolphin (*Inia geoffrensis*) manioc		Large root, like dolphin	1			M	N
mip^{h}i ire	Naranjilla tree (*Platonia insignis*) manioc			1		w	C	Y

Table 5 (continued)

Primary name	Translation	Alternative name(s)	Comments	Acid[a]	Use[b]	Col[c]	Loc[d]	Anc[e]
nẽnẽ̃œ̃(ĩ) ire	Manaca palm (*Euterpe precatoria*) manioc		Long, thin lobes resemble leaflets of *E. precatoria*; produces small tuber	1–2[f]	c, m, ts, ws[f]	w	M,C	Y
norikæ ire	Crooked manioc		Stem habit is very crooked, like liana	1	c, m	w	M	Y
ok'ič'ũ ire	Delicate manioc		Name refers to thin, delicate leaves	2	m, ws	w	M	Y
ow^{h}õtɨ̃ ire	Tapir manioc	*buopa ire* 'large body manioc', *kareba ire* 'tapir manioc', *æwe(tɨ̃) ire* catfish (Leiarius marmoratus) manioc		2–3[f]	c, ws[f]	w	C	Y
pæ̃hæ̃rẽ ire	Peach palm (*Bactris gasipaes*) manioc		The root is a little red, like the color of peach palm	1–2[f]	c, m, ws[f]	y[f]	M,C	Y
p^{h}ĩyũ(æ̃) ire	Passerine bird manioc			1	c, m, ws	w	M	Y
pæruwani ire	Rio Paru manioc		Name refers to region from where it came; violet-colored plant and tuber skin; borrowed from Yekuana ethnic group	2	c, m, ws	w	M	N
p^{h}ãnɨ̃ ire	Mealy parrot (*Amazona farinosa*) manioc	*padæ ire* 'mealy parrot manioc', tatapæ*i* ire '?'	Leaf is same shade of green as the mealy parrot	1	c	w	C	Y
pare ire	Padre manioc		Named for priest who introduced it into the region	3[f]		w	M	N
p^{h}õœtɨ̃(yũ) ire	Juvenile-like manioc	*t^{h}ɨ̃'æ̃tɨ̃ ire* small fish (*Creatochanes* sp.) manioc	Name refers to small size of overall plant habit, however root is large and leaves are long	2–3[f]	c, m, ws	w	M,C	Y
pũhæ̃ ire	Cotton (*Gossypium barbadense*) manioc	*sa'ni ire* 'sweet manioc', *ẽt^{h}æ̃wæ̃ ire* 'roasting manioc'		4	r, b, ws		M	N
pũnæ̃ ire	Large seje palm (*Oenocarpus bataua*) manioc	*bære pi'ori ire* 'large seje palm (O. bataua) manioc'		1		w	C	Y
ræsakæ ire	Drooping manioc		Name refers to characteristic appearance of leaves	1	c, m, ws	w	M	Y
redæk'a ire	Soil manioc	*naña itek'a ire* 'cecilid (Typhlonectes sp.) feces manioc'		1	c	w	C	?
redeti ire	Leaf cutter ant (*Atta* sp.) manioc			?	?	?	M	?
remɨ̃tɨ̃ ire	Giant armadillo (*Priodontes giganteus*) manioc		Borrowed from Bare ethnic group	1	c, m	w	M	N
rẽrɨ̃ ire	Turtle (*Phrynops nasutus*) manioc	*rere ire* 'turtle (Phrynops nasutus) manioc'		1	c, m	w[f]	M	Y
sæbæræri ire	Criollo (i.e. mestizo) manioc		Obtained from outside region and therefore named for criollos	3	c, ws	?	C	N
sayaku ire	Sayago manioc		Brought from Puerto Ayacucho and named for exgovernor Sayago,	1	c, m	w	M	N
sok'ɨ ire	Dwarf manioc		Name refers to small size of adult plant	?	?	w	M	?

Table 5 (continued)

Primary name	Translation	Alternative name(s)	Comments	Acid[a]	Use[b]	Col[c]	Loc[d]	Anc[e]
t'ot'e ire	*Clusia* spp. manioc	*t'oœ(kæ) ire* 'Clusia spp. (tall) manioc'	Takes name from plant genus whose fruits typically dehisce; the tuber emerges from earth and splits open under the sun, similar to the way *Clusia* fruit splits open; very hard tuber	2–3	c, m, ws[f]	w	M,C	Y
tædæsa(kæ) ire	Dark purple (tall) manioc			1	c	w	C	Y
tæmɨ ire	Elders manioc		Variety imported from Suapure region	1	c, ws	w	M	N
te'æba ire	White round manioc			3	c, m, ws	w	M, C	Y
te'æma ire	White streaked manioc	*teæwa ire 'white mass manioc'*	Very sweet taste, favored for making very sweet beer	2	c, m, ws	w	M, C	Y
teɨ ire	White manioc			1	c, m	w	M	Y
tep^{h}a ire	'Lizard (*Ameiva ameiva*) manioc			1	c	w	C	Y
turi ire	Red berry tree (*Brosimum* spp.) manioc			1–2[f]	c, m, ws	w	M,C	Y
tuwækæ ire	Red tall manioc	*tuwæč'ekæ ire* 'reddish tall manioc'	Named for reddish appearance of branches and leaves	1–2[f]	c, ts	w[f]	C	Y
tuwækæ ire, p^{h}õɨ̃	Red tall manioc, small variety		Characterized by slightly smaller plant habit than tuwækæ ire	1–2[f]	c, ts	w	C	Y
tuwæræ ire	Deep red manioc	*tuwori ire* 'red point manioc'	Named for reddish-brownish tuber skin	1–2[f]	c, m, tis	w	M,C	Y
tuwo ire	Red manioc	*wiru tuk^{w}æ ire* 'Maco dietary manioc'	Borrowed from Maco ethnic group	2–3	m, ws	y	M	N
tuworẽ ire	Sapotaceae tree manioc			1	c	?	C	?
wãrusã(kæ) ire	Dark brown (tall) manioc	*sut'ukæ ire*	Takes name from brownish colored plant and dark brown tuber skin; also the tuber is white but has egg-yolk yellow colored center	1	c	yw	M,C	Y
wæ̃čæ̃ ire	Cucurito palm (*Attalea maripa*) manioc	*kuruwæ ire* 'coroba palm (Attalea macrolepsis) manioc'	So named because the tuber is very small, approaching the size of this palm fruit; originates from Suapure region	3–4	b, w	w	M,C	Y
w^{h}eɨ ire	Straight (up) manioc	*w^{h}eæč'u ire* 'straight-erect manioc'	Name refers to tall, erect stem; very large tuber; highly regarded for making mañoco	1	c, m	y	M,C	Y
wæri ire	Moriche palm (*Mauritia flexuosa*) manioc		Considered to be traditional uplands variety	1	c, m	w	M,C	Y
wãyãmɨ ire	Guaniamo manioc		Named for region from which it was introduced	3[f]	c, m, ws	w	M	N
wæhiwæ tuk^{w}æ ire	Hiwi dietary manioc		Borrowed from Hiwi ethnic group	1	c, m, ws	y	M	N
wæikuni ire	Fairy manioc		Considered to resemble wild manioc species or variety	2	c, m, ws	w	C	Y
wæ̃ĩnɨ̃ (tuk^{w}æ) ire	Yekwana (dietary) manioc		Borrowed from Yekwana ethnic group	1	c	w	C	N

Table 5 (continued)

Primary name	Translation	Alternative name(s)	Comments	Acid[a]	Use[b]	Col[c]	Loc[d]	Anc[e]
waruwaru tuk^{w}æ ire	Hoti dietary manioc	*yucæna ire* 'blowgun manioc'	Characterized by very long tuber; borrowed from Hoti ethnic group	4	r, b	w	M	N
w^{h}ɨ'ætɨ̃ ire	Leafcutter ant (*Atta* sp.) manioc		Named as such because the leaves look like they have been eaten by leafcutter ants	3–4	m, ws, r	w	M	N
wi'æ itek'a ire	Earthworm feces manioc	*naña itek'a ire* 'cecilid (Typhlonectes sp.) feces manioc'		1	c	w	C	Y
wiriyæ ire	Sweet potato (*Ipomea batatas*) manioc	*idiku ire* 'black manioc'	Highly regarded for making sweet beer; the whole plant is purple, like the *idiku wiriyæ* 'black sweet potato' variety	2–3[f]	c, m, ws	w	M	?
wodu ire	Fish poison vine (*Lonchocarpus* spp.) manioc			1	c	w	M	?
yɨ'ɨ ire	*Micropholis egensis* manioc			1	c	w	M,C	Y
yæmæ iæt^{h}e ire	Deer tobacco (*Asteraceae*) manioc			3	m, ws	w	M	N
yæ̃rũtẽ(tɨ̃) ire	Golden-headed manakin (*Pipra erythrocephala*) manioc			2	c, ws	w	M, C	Y
yæwæræ̃næ tuk^{w}æ ire	Yabarana dietary manioc		Small plant habit; borrowed from Yabarana	2–3[f]	m, ws	w	M,C	N
yæwære (tuk^{w}æ) ire	Oppossum (*Didelphis marsupialis*) (dietary) manioc			2	c, ws	w	C	?
yãmɨ̃(sok'a) ire	Maize (*Zea mays*) ears (tied in bundle) manioc		*yãmɨ̃sok'a* refers to various maize ears tied together and hung up (to be used as seed corn)	2	c, m, ws	y	M	Y
yuæ(kæ) ire	Blowgun cane (*Arthrostylidium schomburgki*) (tall) manioc	*yuwæna ire* 'blowgun tube manioc'	Grows erect like blowgun cane; so named because it is the driest and hardest variety of all;	3[f]	c, m	w	M	?
yũæ̃sĩ ire, bære	Yopo (*Anadenanthera peregrina*) cake manioc, large variety	*yũæ̃(se) ire* 'yopo (Anadenanthera peregrina) manioc'	Large stem habit	1	c	w	C	Y
yũæ̃sĩ ire, p^{h}õɨ̃	Yopo (*Anadenanthera peregrina*) cake manioc, small variety		Smaller stem habit	1	c	w	C	Y
yuruwæ(kæ) ire	Blowgun palm (*Iriartella setigera*) (section) manioc	*wæ̃ĩnɨ̃ (tuk^{w}æ) ire* 'Yekwana (dietary) manioc'; mækiritære *tuk^{w}æ ire* 'Yekwana (dietary) manioc'	Borrowed from Yekuana ethnic group	2	c, m, ws	w	M,C	N

Table 5 (continued)

Primary name	Translation	Alternative name(s)	Comments	Acid[a]	Use[b]	Col[c]	Loc[d]	Anc[e]
?	Name unknown		A gift from a Wayuu gardener after national conference. The variety was so new that it did not yet have a name.	1	c, m	w	M	N

( ) Optional form, *?* collaborator disagreement or uncertainty
[a] Acidity: *1* highly acidic (*t'oroɨ̃*, *rei, niñu), 2 mildly acidic (hik'ičaneta t'oroɨ̃*, *amonæt t'oroɨ̃*), *3* not acidic (*t'oro'oki), 4 sweet (sa'ni, t*^{h} *æ̃2wæ̃*)
[b] Use: *c* casabe, *m* mañoco, *ws* sweet potato yarake (*wiriyæ sarĩ*), *ts* red manioc yarake (*tuwo ire sarĩ*), *r* roasted tuber, *b* boiled tuber, *w* raw tuber, *z* animal food
[c] Color: *r* red (*tuwo*), *w* white (*tei, tea'a), yw yellow-white (tuækæ̃ - tea'a*), *rp* red-purple (*tuwæse tæda'a*)
[d] Location: *M* Manapiare region, *C* Upper Cuao region
[e] Ancestral Variety: *Y* yes (*t*^{h} *æbot*^{h} *ihæ tukwæ ire 'ancestor's dietary manioc'); N no*
[f] Informant disagreement regarding this character

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