Cassava: From Toxic Tuber to Food Staple

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Introduction

When eaten raw, cassava is likely to leave a bitter taste in one's mouth. Worse still, the unprocessed plant, containing high levels of cyanide, is poisonous to humans and can paralyze when eaten. Despite these deterring properties, cassava has long been culturally and nutritionally significant. And as a result of Indigenous peoples of Meso- and South America discovering a way to render it edible through extensive processing, today processed cassava is enjoyed by 600 million people.[1] One of the world's major food crops alongside maize, rice, and wheat, cassava is cultivated as far away from its native habitat in South America as Southeast Asia. Nigeria is the world's largest producer of cassava, where it is a primary source of carbohydrates for many and is consumed as part of a popular dish known as *fufu*.

How did cassava come to occupy this pride of place in the global food system? How did cassava transform from a poisonous tuber into a major food staple, and from an exclusive dweller of South America into a cosmopolitan citizen of the world? To answer these questions, this essay looks at how human interactions with cassava helped shape the plant into the significant food crop that it is today. We first look at the elaborate method of processing cassava developed by the Indigenous peoples of Meso- and South America and then turn to the codification and spread of this knowledge, facilitated by European travelers to the New World. This meeting of Indigenous and European knowledge systems, combined with cassava's tolerance for drought, resulted in a food crop that would create new hope for global food security in the twentieth and twenty-first centuries. Furthermore, as knowledge of cassava and its specimens circulated to different parts of the world, the plant took on additional cultural meanings through novel culinary uses and artistic representations.

Cassava field near Bondoukou, north-...

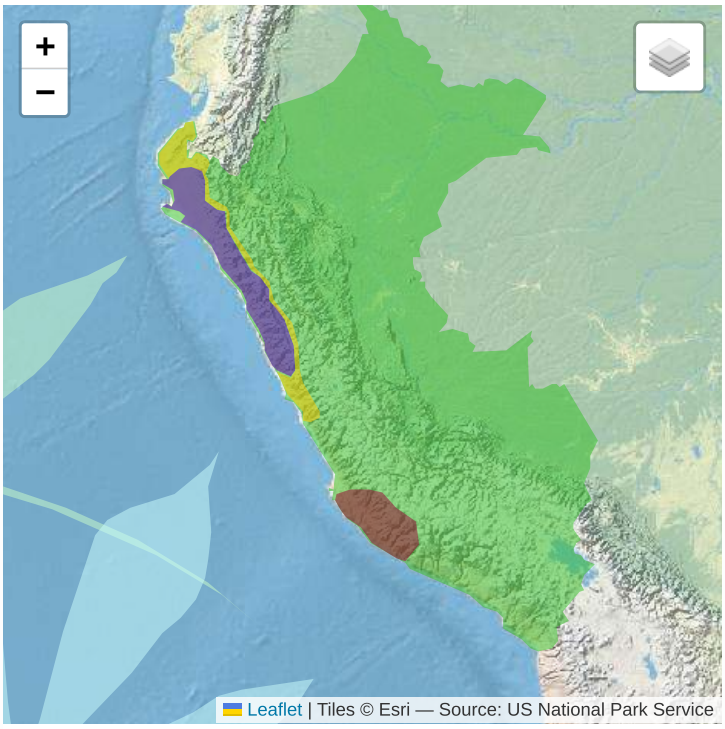
Global distribution of cassava. Cassava's native habitat is...

Of Frogs and Cassava: Early Cultivation in the Andes

Wild ancestors of the domesticated *Manihot esculenta*—known more commonly as cassava, manioc, or yuca—were likely introduced into Meso- and South-American agriculture by Indigenous farmers around 8000 BCE.[2] Cassava was domesticated in these early agricultural plots, and the plant's seeds and stem cuttings were traded over short distances.[3]

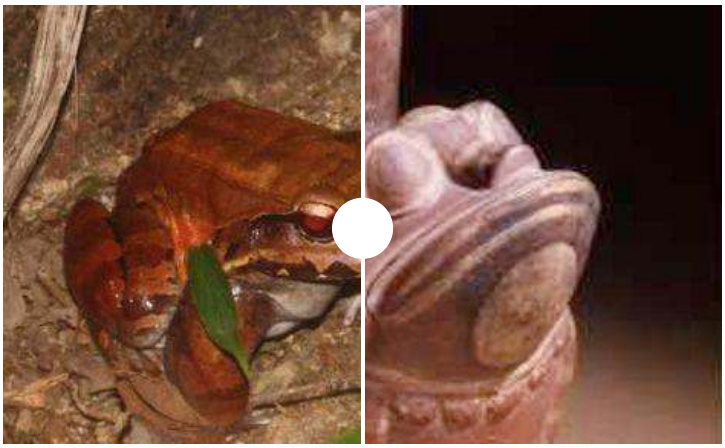
Meso- and South-America

Archaeological evidence suggests that cassava became an important food staple for several ancient cultures in present-day Peru, including the Chavin (1000–200 BCE), Nazca (200 BCE–600 CE), Moche (250–750 CE), and Chimú (1000–1470 CE).[4]

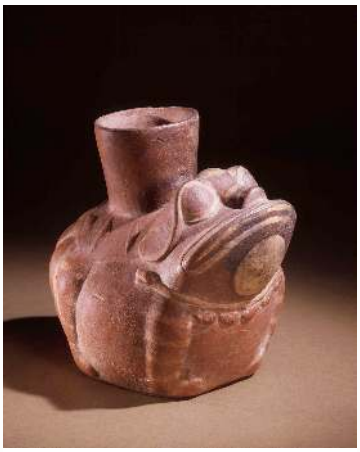


Locations of Pre-Columbian Andean civilizations:...

Representations of cassava made by Moche artists provide clues as to how the plant was understood and appreciated by Andean peoples in the first millennium of the Common Era. Moche artists often represented cassava together with *Leptodactylus pentadactylus*—a frog found throughout the Amazon—as shown in this ceramic from Dumbarton Oaks's collection. The smoky jungle frog, as this species is commonly called, was likely associated with agriculture, and representations of frogs may have been used in harvest-related rituals.[5] Cassava may have held similar significance to Andean peoples, and ceramics such as this one may have been used to ensure a bountiful cassava harvest.



The Moche ceramic contains further clues as to early Andean understanding of cassava. Moche artists may have chosen to pair the cassava plant with the frog to highlight characteristics they share. Both were known for being poisonous and for their capacity to survive underground for long periods of time.[6] Indeed, while cassava roots are the most commonly eaten part of the plant, they go bad quickly when dug up from the soil. However, if cassava is left in the ground, it can survive for up to four years and be harvested periodically.[7]



Jar Depicting the...

Cassava tubers, October...

Rayed figure in a litter carried by...

Indigenous Knowledge: How to Process Poison

Saliva Indian Women Making Cassava Bread,...

While storing cassava in the soil addresses the issue of perishability, additional steps need to be taken to ensure that its roots can be safely eaten upon harvesting. In the Amazon, cassava is popularly divided into two major types—sweet and bitter—depending on the level of toxicity. Sweet cassava can be eaten simply by peeling and boiling it. Bitter cassava must be processed using a specific method before being safely consumed.[8] The danger lies in cyanogenic glucosides, the amount of which varies depending on the type of cassava, the climate, and the season in which it is cultivated.[9] Women in Meso- and South America are primarily responsible for the processing of cassava and transforming the poisonous plant into flour for *casaba*, or cassava bread, and into a fermented beverage known as *chicha*. It is a multi-step process that includes washing and grating the cassava root, mashing it into a pulp, then hanging, dehydrating, and finally baking the dried pulp on a hot surface.[10]

Some of the implements used for processing cassava include graters, strainers or squeezers, and sieves. Cassava graters are generally constructed by embedding small stones or nails into a wooden surface.[11] The cassava root is rubbed along the device so that the stones or nails shred the tuber into small pieces. These pieces are soaked in water to form pulp, which is placed into a strainer or squeezer to remove the liquid. The toxins are removed during this straining process.[12] Cassava squeezers have a similar form throughout South America: a circular woven tube that is designed to be hung from up high. The woven designs, however, may differ according to culture. After the liquid is drained, the cassava pulp is further passed through a sieve, after which it is suitable for cooking and consumption.

Cassava grater, WaiWai people...

Probably Carib [Guyana], Basket sieve or sifter for manioc (cassava)...

Tipiti, Manioc Squeezer, Tukuna, Ticuna, Maguta, Guyana, cutting,...

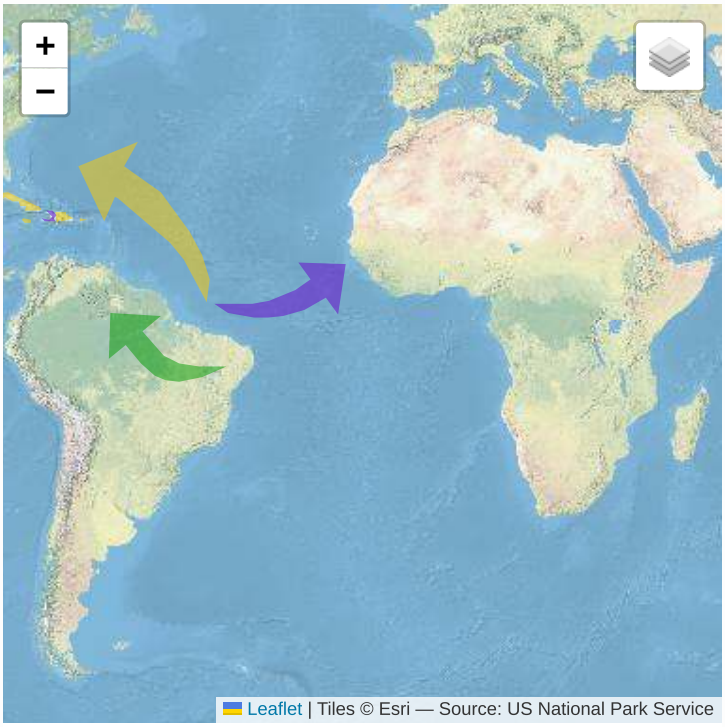
Despite the amount of work required to process cassava with high levels of cyanide, bitter cassava is more popularly cultivated than sweet cassava in the Amazon today. The indigenous Tukanoans of the Yapu village in the northern Amazon, for example, grow 100 different types of cassava, 98 of which are bitter.[13] Archaeologist Warren Wilson and anthropologist Darna Dufour have demonstrated that bitter cassava yields a higher harvest than does its sweet counterpart, possibly due to its resistance to disease and insects.[14] It is perhaps for this reason that bitter cassava is favored as a food crop over sweet cassava, despite the additional processing to render it edible.

Louise von Panhuys, Bitter...

Louise von Panhuys,...

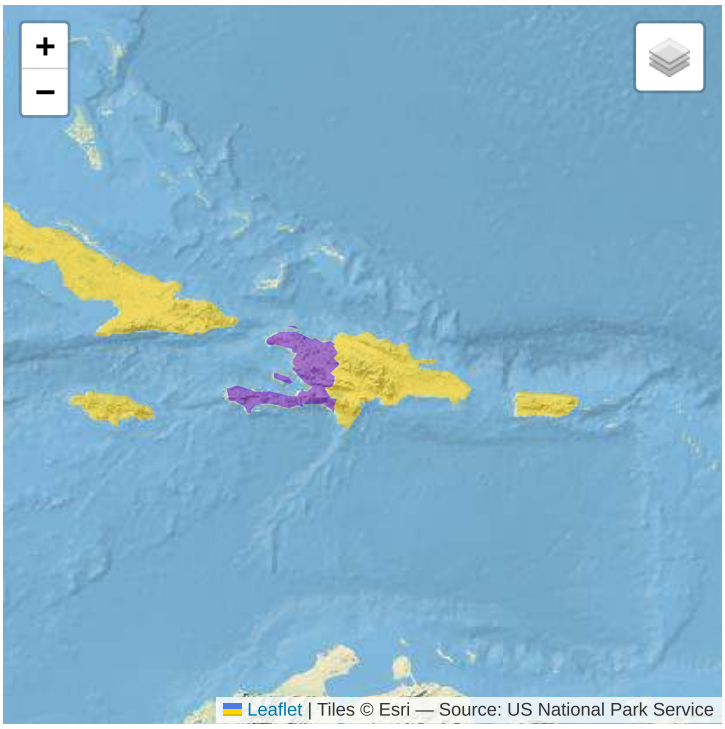
Early Modern Encounters: European Codification of Indigenous Methods

Knowledge of how to process cassava so that it could be safely consumed was communicated to Europeans who encountered the plant and brought it to other regions of the world in the sixteenth and seventeenth centuries. The mobility of cassava, therefore, lay not only in the movement of the plant itself, but also in the transmission of this knowledge. As explorers, traders, and enslaved peoples moved across South America and the Caribbean and over the Atlantic Ocean to Africa, so too did cassava cultivars and indigenous knowledge of how to process the plant.



World map with arrows indicating mobility of...

Although the Caribbean is not considered cassava's native habitat, the plant was already cultivated by the indigenous Arawak peoples who lived in the Greater Antilles when Christopher Columbus arrived in the New World.[15] Through European colonization, cassava was further introduced to other places in the Caribbean, such as Barbados and Haiti, becoming subsistence food for enslaved labor on plantations.[16] Cassava was established as a staple across the Caribbean by the seventeenth century, and it was represented in naturalist Maria Sibylla Merian's (1647–1717) *Metamorphosis insectorum Surinamensium* (1719), which describes the plants and insects that she studied during her stay in Dutch Surinam between 1699 and 1701.



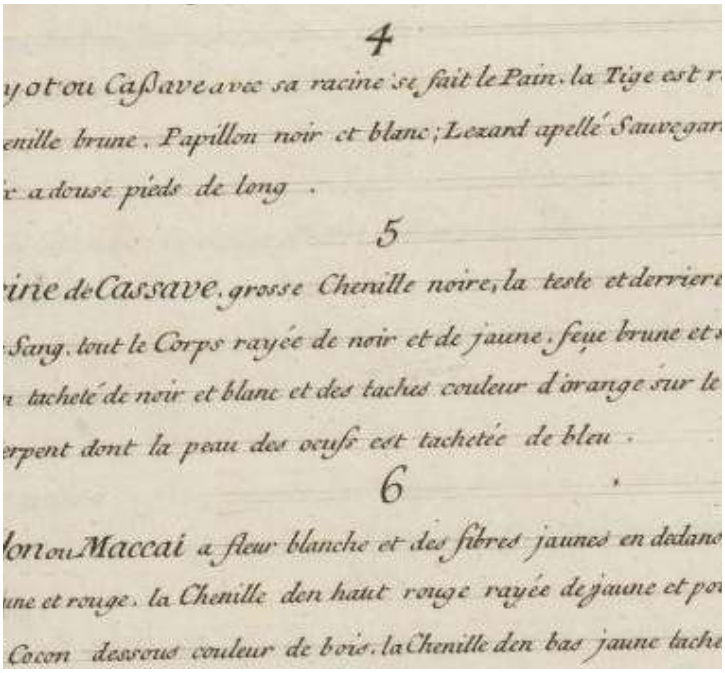
Greater Antilles (yellow) including Haiti (purple), a...

Merian's book exemplifies how knowledge accumulated and circulated through Europe, drawing on earlier texts that were in turn referenced in later publications. Her entry on cassava, for example, refers to English naturalist Hans Sloane's (1660–1753) catalogue of Jamaican plants. Merian's illustrations, which were based on keen in-situ observations, were disseminated by other artists who made copies of her work. As works by an accomplished artist, Merian's books were published in various editions and widely circulated, ensuring a broad transmission of her botanical knowledge.[17]


Merian, Maria Sibylla, 1647-1717. Metamorphosis...


Merian, Maria Sibylla, 1647-1717. Metamorphosis...

In her book, Merian describes cassava root as the ingredient for cassava bread that was a common food among both the Indigenous Peoples and Europeans living in the American colonies by this time.[18] Descriptions of cassava bread recur in other European texts, praising its value as a food source in the colonies as well as a provision for sea voyages.[19] The original method of making cassava flour practiced by the Indigenous Peoples of South America, as well as variant methods used later on the African continent, can be found in these European texts.



4

yot ou Caſſave avec ſa racine ſe fait le Pain. la Tige eſt r

enille brune. Papillon noir et blanc; Lezard apellé Sauvegar

e a douze pieds de long.

5

rine de Cassave, groſſe Cheniſle noire, la teſte et derriere

Sang, tout le Corps rayée de noir et de jaune, feue brune et

tacheté de noir et blanc et des taches couleur d'orange ſur le

erpent dont la peau des oeufs eſt tachetée de bleu.

6

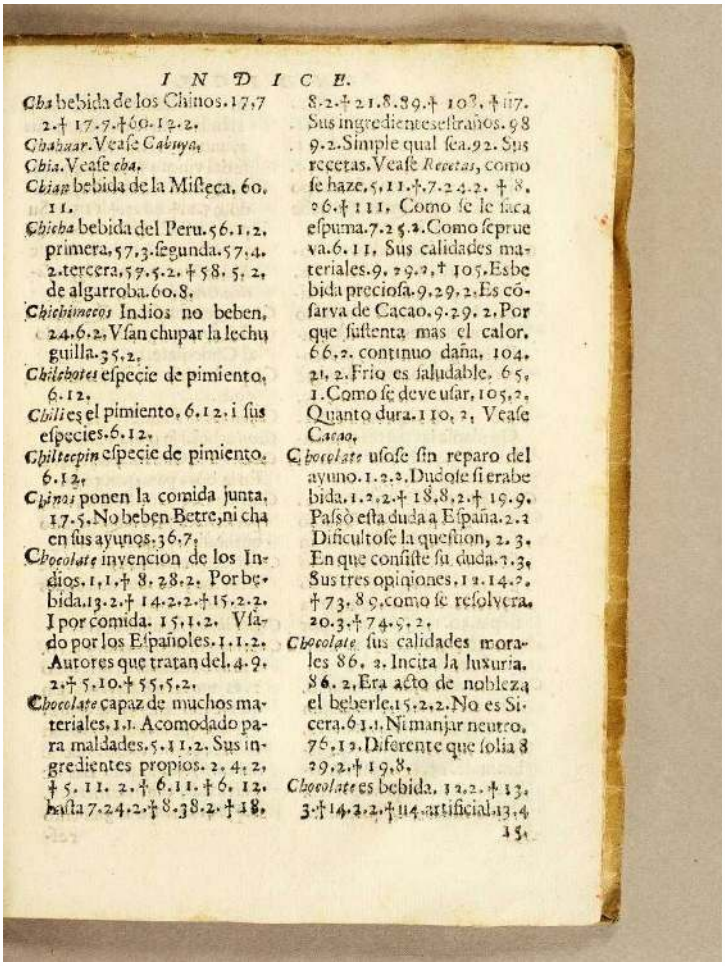
lon ou Maccai a fleur blanche et des fibres jaunes en dedans

une et rouge. la Cheniſle den haut rouge rayée de jaune et po

Cocon deſſous couleur de bois. la Cheniſle den bas jaune tache

Merian, Maria Sibylla, 1647-1717. Metamorphosis...

European travelers also described the process of making cassava into fermented beverages. In his 1578 publication *History of a Voyage to the Land of Brazil*, French explorer Jean de Léry recorded a recipe for the alcoholic beverage *chicha*. Cassava was cut into pieces, then boiled, chewed in the mouth for some time to combine with saliva, then boiled again in a different vessel, and finally left to ferment for several days until it was ready for consumption.[20] A few decades later, Spanish historian Antonio de León Pinelo recorded a similar account of the process in Peru, and British explorers Bedford Pim and Berthold Seemann encountered the same process of cassava fermentation in nineteenth-century Nicaragua.[21] Depending on the location, the beverage was called *chicha*, *massato* (a non-alcoholic variant mixed with honey), *acca*, *kufa*, or *mushla*.[22]



I N D I C E.

Cha bebida de los Chinos. 17,7 2.† 17.7.†60.12.2.
Chabaar. Veaſe *Cabuya*.
Chia. Veaſe *cha*.
Chian bebida de la Miſteca, 60. 11.
Chicha bebida del Peru. 56.1.2. primera, 57,3. ſegunda. 57,4. 2. tercera, 57.5.2.† 58. 5. 2. de algarroba. 60.8.
Chichimecos Indios no beben. 24.6.2. Vſan chupar la lechuguilla. 35.2.
Chilchotes eſpecie de pimiento. 6.12.
Chiles el pimiento. 6.12.1 ſus eſpecies. 6.12.
Chiltecpin eſpecie de pimiento. 6.12.
Chinos ponen la comida junta. 17.5. No beben Betre, ni cha en ſus ayunos. 36.7.
Chocolate invencion de los Indios. 1,1.† 8.28.2. Por bebida. 13.2.† 14.2.2.† 15.2.2. I por comida. 15.1.2. Vſado por los Eſpañoles. 1.1.2. Autores que tratan del. 4.9. 2.† 5.10.† 55.5.2.
Chocolate capaz de muchos materiales. 1.1. Acomodado para maldades. 5.11.2. Sus ingredientes propios. 2. 4. 2. † 5. 11. 2.† 6.11.† 6. 12. haſta 7.24.2.† 8.38.2.† 18. 8.2.† 21.8.89.† 103.† 117. Sus ingredientes eſtraños. 98 9.2. Simple qual ſea. 92. Sus recetas. Veaſe *Recetas*, como ſe haze. 5.11.†.7.24.2. † 8. 26.† 111. Como ſe le faca eſpuma. 7.25.2. Como ſe prueva. 6.11. Sus calidades materiales. 9. 29.2.† 105. Es bebida preciosa. 9.29.2. Es cóſarva de Cacao. 9.29.2. Por que ſuſtenta mas el calor. 66.2. continuo daña. 104. 21.2. Frio es ſaludable. 65. 1. Como ſe deve uſar. 105.2. Quanto dura. 110.2. Veaſe *Cacao*.
Chocolate uſoſe ſin reparo del ayuno. 1.2.2. Dudoſe ſi era bebida. 1.2.2.† 18.8.2.† 19.9. Paſsò eſta duda a Eſpaña. 2.2 Dificultoſe la queſtion. 2. 3. En que conſiſte ſu duda. 1.3. Sus tres opiniones. 12.14.2. † 73.89. como ſe reſolvera. 20.3.† 74.9.2.
Chocolate ſus calidades morales 86. 2. Incita la luxuria. 86. 2. Era acto de nobleza el beberle. 15.2.2. No es Sicera. 63.1. Ni manjar neutro. 76.12. Diferente que ſolia 8 29.2.† 19.8.
Chocolate es bebida. 12.2.† 13. 3.† 14.2.2.† 114. artificial. 13.4

15.

Entry for chicha in index, Antonio de León Pinelo

Even today, many Indigenous Peoples in Meso- and South America still follow these recipes for fermented cassava beverages that were established by their ancestors and recorded by European travelers. In addition to such descriptions in travel writings, knowledge of cassava also entered other eighteenth-century European texts, such encyclopedias, and informed various fields of knowledge production, from baking and chemistry to agriculture.[23]

Charles Theodore Middleton,...

Cassava in Circulation

As Europeans moved between continents, knowledge of cassava preparation, together with the plant itself, traveled with them. Cassava was initially transplanted to the west coast of Africa by Portuguese traders as early as the sixteenth century.[24] At first, traders and slavers transported it in the form of a finished product, *farinha* (manioc flour), that had been produced in Brazil.[25] Eventually, Amerindian peoples from the New World who knew how to process the plant were also brought to Africa.[26] Similarly, Africans brought back knowledge of cassava processing they had learned in the New World.[27] Once it started being cultivated in Africa, cassava and the knowledge of its preparation became localized along the west coast of Africa, subsequently spreading inland and to other parts of the continent.[28]

Global distribution of cassava. Cassava's native...

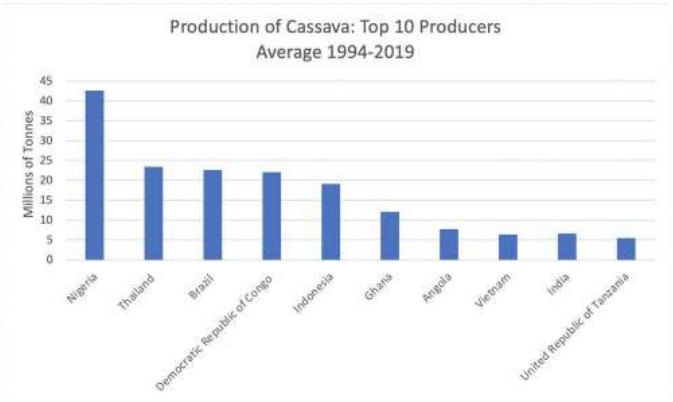
With this transfer of knowledge from South America to Africa, other innovations emerged. For example, African women learned that the bitter cassava root was poisonous and learned how to prepare its leaves instead.[29] They discovered that young cassava leaves could be safely consumed after being boiled. A new method of processing the root also developed, which involved pressing it with stone weights instead of using the hanging method favored in South America.[30] Another African innovation emerged in the form of *gari*, or toasted flakes, made from the dried pulp of processed cassava. They are not as refined as the *farinha* produced in South America, but can be stored for a long period of time.[31]

Food of the Future?

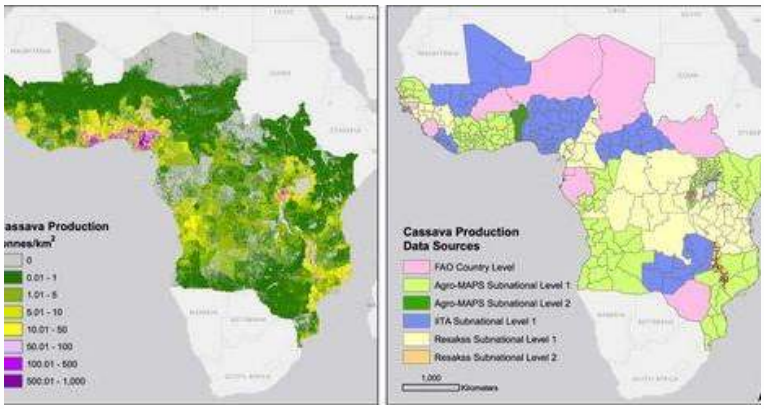
Today, Nigeria is the world's largest producer of cassava, with over 34 million tons of cassava roots produced every year. A study carried out by Nigeria's Department of Agriculture notes that cassava is a particularly suitable crop for the country's predominantly smallholder farming. The plant's most important characteristics that make it a crucial for household food are its year-round availability and resistance to drought, pests, and diseases.[32] As more regions of the world face desertification, cassava's ability to grow in dry climates will become even more important for preventing food scarcity in the future.

International Institute of Tropical Agriculture,...

In spite of cassava's potential for aiding global food security, the Food and Agriculture Organization (FAO) of the United Nations noted in 2002 that research on the plant has lagged behind other popular food crops.[33] The FAO report further observed that cassava production had fallen behind its yield potential in Africa and that marketing attempts by cassava farmers had similarly been consistently lower than expected. Increases in cassava productivity had also consistently lagged behind other top food crops, such as rice, wheat, and corn.[34] As a result, the FAO launched a biotechnology development program to increase cassava production by increasing its pest and disease resistance and improving its starch quality to ensure better marketability and higher nutrient levels.



Production of Cassava, after Food and...



Disaggregated cassava production in sub-Saharan...

Place and Mobility: Njideka Akunyili Crosby's Cassava Garden

In addition to food security, cassava plays an increasingly important and diverse role in both local and transnational cuisines. It is the star ingredient in what is the quintessentially African dish, *fufu*, and has equivalents in Brazil, the Dominican Republic, Puerto Rico, and Cuba, serving as a testament to the diasporic communities that carried this plant enriched with new cultural meanings back to its native habitat.[35]

Fufu being made in the...

Cassava processing in Benin, wall mural, March 7, 2015.

Associated with specific cultures across the globe, but also symbolizing mobility—having spread from its native habitat in South America, across the ocean to Africa, and back to South America and the Caribbean via diasporic African communities—cassava has also been celebrated in contemporary art. Nigerian-American artist Njideka Akunyili Crosby, for example, features cassava prominently in her work as she explores the ability of people, plants, and paintings to inhabit multiple spaces.

Njideka Akunyili Crosby, Obodo...

In her painting *Cassava Garden*, Crosby juxtaposes a cassava plant with an Indian rubber tree, two species of plants growing in Los Angeles, where she lives and works. Crosby is well aware that neither of these plants is native to the United States, having been brought there by people from different parts of the world. By representing them together, she speaks to different meanings of place-making. On the one hand, the painting represents an imagined garden, where two plants of different geographic origin can happily coexist.[36] The juxtaposition of these plants refers to modern Los Angeles, where they *do* coexist today.

Njideka Akunyili Crosby, Cassava Garden, 2015,...

On the other hand, Crosby associates cassava with Nigerian village life, which is why her painting incorporates imagery from her childhood in Nigeria. Along the right side of the painting, we see a textile featuring a portrait of her mother, which came from her mother's funeral.[37] Photographs from Nigeria are also incorporated into the cassava's leaves, creating a layered effect that Crosby refers to as a "visual vibration."[38] This melding of present and past in the juxtaposition of a South American-cum-Nigerian plant and an Indian rubber tree makes these connections across time and space so strong. Much like its vegetal subject itself, Crosby's painting seems to ask, "When does something belong to a place?"[39]

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