Climatic Suitability for Breadfruit

The safest ecoforest is one that is also a treasured source of carbohydrate. JCM

Over 80% of the world’s hungry live in areas suitable for breadfruit cultivation.

Tropical Africa's Breadfruit Revolution
AD 2011-????

Jeff Marck - September 2017

"Money doesn't grow on trees but a certain kind of bread flour does..." JCM

Is your flag missing?
jeff@jeffmarck.net

A Samoan contribution to nutrition in tropical Africa

If a man plants ten breadfruit trees in his life, which he can do in about an hour, he would completely fulfil his duty to his own as well as future generations.

Joseph Banks, 1769, Captain Cook’s botanist, reporting on the situation in Tahiti

"Breadfruit is a popular daily dietary dinner food in Ile-Ife, about eighty km from Ibadan. It is used for generating a type of pounded 'yam' called Iyan Jaloke. It is also very common in other parts of Osun State of Nigeria where it is cooked and eaten as 'yam'. It is assumed that one breadfruit tree in a compound/homestead can supply dinner to a family of four for a year."

Anonymous, 2010

(...that is the Tahitian variety Africa has had since the 1840s... but the Samoan variety outshines...it)

Breadfruit! You can have your ecoforest and eat it, too! JCM

But for breadfruit, there is NO ecoforest solution that is also a carbohydrate solution...JCM

The Dilemma

The West African population of 2050 is expected to be ten times that of 1950. Thus, tropical peoples fallowing fields back to forest cover as reported in early and middle twentieth century sources are becoming dated for more and more of tropical West Africa. Growth is slowing... and is mainly associated with growth of rural education.

The Promise of Breadfruit

From the 1840s and perhaps slightly before, a Tahitian seedless variety of breadfruit spread along the West African coast from Senegal to Southeastern Nigeria, having come by way of the
Caribbean. Nowhere is it included in the agricultural census so areas that are breadfruit rich can appear carbohydrate poor in those reports. The Tahitian variety is known to produce at about the same rate as yam and cassava while certain Samoan varieties introduced to Ghana (2011), Kenya (2013) and now Liberia and other countries produce at about twice that rate.

Dry Weights

Comparison to traditional tropical West African crops above is made in terms of harvest weights. Once dried to 14% moisture, the productivity of the new variety Samoan breadfruit can be compared to the grain productivity of the world's highest producers per hectare. Of course the grains produce at lower rates in tropical Africa. So it is clear that certain Samoan (and Micronesian) breadfruit varieties are a sensible low tech solution for Africa and that it can be assumed they will outproduce the carbohydrate production per hectare of the world's most developed nations (even Tahiti is [2013] importing them).

Introduction: The Promise of Breadfruit

Money doesn't grow on trees but a certain kind of bread flour does.

A common film industry vision of Pacific Islanders is one of lounging about... pleasantly, indolently, well fed, wanting for nothing.

This is often a true picture, indeed, which is typically due to breadfruit. The Breadfruit Institute in Hawaii, to which I am a volunteer and an Africa liaison, now enters into perhaps 25-50 years of work to bring this pretty picture to tropical Africa.

A Breadfruit Revolution in tropical Africa now seems quite certain, having been set in motion by the Breadfruit Institute (BI) (Hawaii USA), by certain new propagation technologies from the University of British Columbia and by propagation and distribution systems established by Global Breadfruit (GB) (a Cultivaris multinational).

I am part of endeavours to launch the African Breadfruit Revolution which counts its beginning with the successful large scale planting of a Samoan breadfruit variety in Jamaica in 2009, the first successful large scale planting of mass in vitro propagation plantlets, and now, their first large scale planting in Africa which began its nursery stage in Ghana 14 October 2011.
Breadfruit is the national food in Jamaica, saved many thousands or tens of thousands people during the Ghana famine of the early 1980s and both nations are highly motivated, dedicated to success and in the process of bringing the world’s top producing breadfruit varieties to their shores.

One rarely hears of famine among Pacific Islanders. The single most important human variable in that happy situation is typically the cultivation of breadfruit, which as the Joseph Banks quote above suggests, requires precious little time or care (see also Glenn Petersen, *Micronesia’s Breadfruit Revolution and the Evolution of a Culture Area*). Archaeology in Oceania.

The breadfruit of West Africa, Tahitian varieties via the Caribbean and present since at least the 1840s, has some new cousins since 13 October 2011... 870 plantlets of two Samoan varieties arrived to Ghana from a German mass propagation facility, varieties licensed to the Breadfruit Institute in Hawai‘i by the Government of Samoa. They were planted into 5 litre containers 14 October at a Ghanaian agricultural station. They were committed to field plantings in May 2012 when the late rains finally began in earnest. These seedless variety breadfruit are now available on a large scale from Global Breadfruit and produce up to 500 kg of fruit per adult tree per year in complementary fruiting seasons.

Translating to the level of all the carbohydrate needs of a family of five, five trees supply them completely with all their recommended caloric requirements and more.

Breadfruit is also a superior tree for reforestation work. It grows quickly and the forest ground cover can grow and diversify under its canopy. The timber is a sturdy, dense, water resistant softwood used by Pacific Islanders for their ocean-going sailing canoes of 12 metres and more with which they conquered the Pacific one, two, three thousand years ago and more. They can be directed to household or commercial use. Existing regimes of breadfruit cultivation will be complemented and expanded through tropical Africa for human or livestock consumption according to practice and adaptation.

We are all familiar with “ground fruits”: annuals and perennials whose flowers' ova are fruits in the technical sense and like tree fruits in texture, flavour and nutrition: strawberries, melons, pineapple and others. Similarly, the world’s top “tree vegetable” is breadfruit which is in many ways more like rice, wheat, or, especially, potatoes, yam and cassava than a fruit and is easily processed into bread flour and turned to many other uses associated with starchy staples... most such uses, actually, from nutritious baby food to snack foods similar to potato crisps / chips. Those breadfruit pictured on the left are a seedless Samoan variety whose fruit are about 20 cm in diameter (~8 inches). Seeded varieties may also come to be commercialised due to their seeds high protein content and other nutrition variables.

The year 2009 will be remembered as the beginning of an essentially irrepressible process where, by fits and starts, new “super” varieties of seedless breadfruit began to arrive to the tropics and thrive in the Caribbean and Americas, then tropical Africa and Asia - coming from where the earliest breadfruit of Southeast Asia, then the Caribbean and Americas and then Africa first came: the Pacific Islands - the “Bird’s Head” of New Guinea, specifically.

Ancestors of the Polynesians found the trees growing in that northwest New Guinea area over 3500 years ago. Singularly, amongst the MalayPolynesian speaking peoples emerging out of the Philippines, they gave up the rice cultivation their linguistic/cultural ancestors brought with them more archly from Taiwan. They spread and raised breadfruit wherever they went in the Pacific Islands (except Easter Island and New Zealand which are too cold). Their ancient eastern Indonesian cousins spread the plant west and north through insular and coastal Southeast and South Asia. Thousands of years later, in the era of Captain Bligh and the Mutiny on the Bounty (1789), the famously foiled first attempt at bringing Tahitian breadfruit to the Caribbean, European colonial powers brought breadfruit from the Pacific to the Caribbean and the tropical Americas. Missionaries brought Tahitian varieties from the Caribbean to tropical West Africa by the 1840s.

We can call this present, new process “irrepressible” with some confidence on a fifty or one hundred year basis. YOU CAN HAVE YOUR ECOFOREST AND EAT IT, TOO will occur at both the bottom of the economies of scale: individual tropical African farmers, and at the top of the scale: national and international agribusiness corporations. NOTHING holds the promise of breadfruit in terms of adequate, nay, abundant tropical forest carbohydrate production.

At the level of the individual African farmer, the revolution will begin fitfully, as funds become available - from a mix of donors, their own governments, and their university and other agricultural stations, Farmer Based Organisations and their eventual ability to make individual purchases through co-ops - bringing certain new, vastly more productive Samoan, Pohnpeian and eventually other Pacific Island breadfruit varieties to their nations and making them available to such farmers for evaluation.

At the level of agribusiness corporations, those same, world’s top-producing seedless varieties will arrive by the thousands, then tens and hundreds of thousands because finished product per hectare is of the same order as oil palm: $3-4,000. Why wouldn’t they? And breadfruit plantings establish ecoforests rather than destroying them like some of the other...
Introduction

Why Now?

Population in West Africa

Breadfruit Nutrients

Breadfruit in West Africa

Joseph Banks’ Little Fib

The Breadfruit Institute, UBC and

Global Breadfruit

Frequently Asked Questions

Breadfruit Links and Resources

Why now?

It has been the finding of the Breadfruit Institute that if one wishes to engage in mass propagation and plantings of breadfruit for food security, as a source of product for food processing factories, or for reforestation (Haiti needs many hundreds of thousands just as a start, really), it is particular Pacific Islands seedless varieties that, by far, produce the greatest yields. And now they can be generated in short time in laboratories by the tens of thousands as will be mentioned presently.

It has been more than 240 years since Joseph Banks (top of page) alluded to a most basic advantage of breadfruit from a farmer’s point of view: the absence of the annual planting and cultivation labours (inputs) associated with grains and tubers. One need only pluck from homestead, grove or forest stands all that one needs so long as oneself or one’s parents or grandparents exercised the most minimal diligence in thinking of the future, ensuring about one tree per capita.

Why have most of 250 years passed since Banks’ observation and somebody taking action?

Actually transhipments seem to have occurred from about the time of Banks’ observation, events bringing certain Philippine, Tahitian and other varieties to the Caribbean and Central American coast, the first dedicated British shipment famously foil by the mutiny on the Bounty (1789). The early plants became prized possessions in the West Indies and breadfruit became and remains the national food of Jamaica and an important food throughout much of the Caribbean and coastal Central America. All together, at least five or six varieties from the Pacific Islands and Insular Southeast Asia seem to have been established in those parts of the New World before modern times.
Traditional larger root cuttings

A Community house of breadfruit timber in Samoa

Introduction
Why Now?
Population in West Africa
Breadfruit Nutrients
Breadfruit in West Africa
Joseph Banks’ Little Fib
The Breadfruit Institute, UBC and
Global Breadfruit
Frequently Asked Questions
Breadfruit Links and Resources

Our goal is hearty children who are never hungry.
And WHEN has one EVER seen a picture of a hungry looking Pacific Islander child?

--------------------------------
cassava                                12
yam                                     12
most breadfruit in Afr.   15–20
Global Breadfruit               ~30
metric tons per hectare
60 breadfruit trees per hectare

Population in West Africa
population pyramids and breadfruit pyramids
One BI/GB Samoan breadfruit tree per capita?
The magic bullet? Why not?

A widely quoted/reproduced set of Population Fund estimates of the world's population 1950 to 2050 includes the following figures for West African nations. It is mainly the coastal nations which are at least partially endowed with tropical rain forest climates well suited to breadfruit cultivation:

<table>
<thead>
<tr>
<th>Country</th>
<th>1950</th>
<th>2000</th>
<th>2025</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>1950</td>
<td>2000</td>
<td>2025</td>
<td>2050</td>
</tr>
<tr>
<td>Nigeria</td>
<td>29,790</td>
<td>113,862</td>
<td>202,957</td>
<td>278,788</td>
</tr>
<tr>
<td>Ghana</td>
<td>4,900</td>
<td>19,306</td>
<td>30,936</td>
<td>40,056</td>
</tr>
<tr>
<td>Cameroon</td>
<td>4,466</td>
<td>14,876</td>
<td>23,986</td>
<td>32,284</td>
</tr>
<tr>
<td>Côte d'Ivoire</td>
<td>2,775</td>
<td>16,013</td>
<td>25,024</td>
<td>32,185</td>
</tr>
<tr>
<td>Senegal</td>
<td>2,500</td>
<td>9,421</td>
<td>16,511</td>
<td>22,711</td>
</tr>
<tr>
<td>Guinea</td>
<td>2,550</td>
<td>8,154</td>
<td>14,120</td>
<td>20,711</td>
</tr>
<tr>
<td>Benin</td>
<td>2,046</td>
<td>6,272</td>
<td>11,992</td>
<td>18,070</td>
</tr>
<tr>
<td>Liberia</td>
<td>824</td>
<td>2,913</td>
<td>7,638</td>
<td>14,370</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>1,944</td>
<td>4,405</td>
<td>9,052</td>
<td>14,351</td>
</tr>
<tr>
<td>Togo</td>
<td>1,329</td>
<td>4,527</td>
<td>8,219</td>
<td>11,832</td>
</tr>
<tr>
<td>Guinea-Bissau</td>
<td>505</td>
<td>1,199</td>
<td>2,170</td>
<td>3,276</td>
</tr>
<tr>
<td>Gambia</td>
<td>294</td>
<td>1,303</td>
<td>2,077</td>
<td>2,605</td>
</tr>
<tr>
<td><strong>Coastal West Africa</strong></td>
<td><strong>53,923</strong></td>
<td><strong>202,251</strong></td>
<td><strong>354,682</strong></td>
<td><strong>491,239</strong></td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>3,960</td>
<td>11,535</td>
<td>25,227</td>
<td>46,304</td>
</tr>
<tr>
<td>Mali</td>
<td>3,520</td>
<td>11,351</td>
<td>23,461</td>
<td>41,724</td>
</tr>
<tr>
<td>Niger</td>
<td>2,500</td>
<td>10,832</td>
<td>25,725</td>
<td>51,872</td>
</tr>
<tr>
<td>Chad</td>
<td>2,658</td>
<td>7,885</td>
<td>16,383</td>
<td>27,732</td>
</tr>
<tr>
<td>Mauritania (less known)</td>
<td>825</td>
<td>2,664</td>
<td>7,500</td>
<td>12,000</td>
</tr>
<tr>
<td>Sahel West Africa</td>
<td><strong>13,463</strong></td>
<td><strong>42,267</strong></td>
<td><strong>96,147</strong></td>
<td><strong>176,084</strong></td>
</tr>
</tbody>
</table>
As can be seen, most of the countries roughly doubled twice in population 1950-2000 but are expected to approximately double only about once 2000-2050, the slowing of the rate expected to be more pronounced 2025-2050 than 2000-2025, declining mainly as a function of expanding rural education. This is seen, for instance, in the Nigerian case which has accounted, through time, up to now and probably into the future, for about half these nations’ total population and about half these nations’ total growth.

So what would things look like if all these countries suddenly decided that they would create a year-round national caloric surplus by 2025 and continue to expand the surplus through to 2050 by establishing enough new variety breadfruit trees to produce 180 kg of bread flour for each resident of each nation each year?

This would mean approximately one tree per resident. One tree per resident fruiting at 500 kg per year (150 kg dry weight bread flour - packaged and stored at 14% moisture content = ~175 kg - almost precisely the target). About 500 gm per day. 500 gm of bread flour provides about 1700 calories/ 7000 kj - rather at the low end of a grown man’s requirements but there would be women and children with their lower needs in the equation and taken together with - west to east - rice, cassava and yam (and some sweet potato) production, this all adds up to a general goal of one tree per capita (including a tree on the farms for each of these nations’ persons in dense urban areas and agricultural areas where breadfruit does not thrive - a general vision of each tropical rain forest dweller making up the difference by having a second tree or, on average, 1.5 trees or whatever would serve to bring the national average to 1 new variety tree per person.

Jumping to the conclusion... I take the view that it might well require the commercial production of bread flour from breadfruit to see breadfruit creeping into a more favoured-food category in more sub-regions and that would, in turn, stimulate more planting labours/inputs on the part of the average West African farmer and more breadfruit-as-a-packaged-food demand on the part of these nation’s urban and dry climate residents.

It seems most prudent to imagine fits and starts at every level including more processing of seasonal surpluses from existing trees, micro and macro processing concepts, a slower encroachment of the new varieties than might be hoped for due to both funding and cultural constraints... and momentum only after a decade or two of all these variables feeding and growing on each other before farmers, processors and consumers across the region develop the necessary curiosity and motivation to make the desired commitments, changes and inputs.

The goals are simple and based upon Global Breadfruit’s initial experiences with their shipments where the first shipment to be placed in the hands of professionals - the Jamaican Ministry of Agriculture - 2009 - has been thriving and creating such excitement that Global Breadfruit has been getting Caribbean orders for thousands of trees as a result.

That happy story from Jamaica where a project took all Global Breadfruit advice and achieved ~100% survival is one whose project procedures and results emulated in the first shipments to Africa.

For Africa and elsewhere it is best not to draw straight lines on graph paper when serendipitous circumstance may become involved and all we can do for the moment is to keep the ball rolling and see what we shall see.

I’m guessing that for West Africa on a 5 to 10 year basis there will be an initial round of successful donor-funded farmer-oriented projects, all adding up to $1 million or less, by which time the agricorporations start taking an interest and bring their resources into the equation, those economies of scale seeing purchase price savings to co-ops and small farmers as well. It would bring them $3000 to $4000 per hectare, as do palm oil tree plantings, and could occur in the context of general biodiversity and reforestation plantings that are more difficult to achieve with other tree crops.

**Breadfruit Nutrients**

*Breadfruit (Artocarpus altilis) is an underutilized staple crop developed over thousands of years by the indigenous peoples of Oceania. The current study evaluated protein and mineral content,*
Introduction

**Why Now?**

Population in West Africa

Breadfruit Nutrients

Breadfruit in West Africa

Joseph Banks' Little Fib

The Breadfruit Institute, UBC and Global Breadfruit

Frequently Asked Questions

Breadfruit Links and Resources

---

**Traditional post-harvest technology of perishable tropical staples**

FAO 1984

---

A REALLY good read:

**Global Breadfruit “plug”**

---

**Frequently Asked Questions**

**Breadfruit Links and Resources**

---

**Breadfruit in West Africa**

population pyramids and breadfruit pyramids

One BI/GB Samoan breadfruit tree per capita?

Where the history of breadfruit's arrival to the West Indies is known in various general and specific ways, there seems less certainty about the origin and distinctiveness of varieties of breadfruit now spread along West Africa's coast from southern Senegal to southwest Cameroon and thence through the Congo Basin rain forest. Missionaries with West Indies connections in West Africa were perhaps part of the story of their introduction. The earliest allusions to Pacific Island breadfruit in West Africa presently known to me come from Ghanaian sources beginning in about the 1840s and Ghana is known to have one or perhaps more, popular, Tahitian seedless varieties.

D.K. Gamedoagbao and S.O. Bennett-Lartey ("Conservation and Use of Breadfruit: Ghanaian Perspective", Acta Hort. 757, 2007) describe regular planting and utilisation of what is perhaps a single seedless variety of *Artocarpus altilis* (Pacific Island breadfruit) in southern Ghana and the cultural memory that "Breadfruit was one of the few trees that withstood the 1983 droughts and was eaten extensively during that time." All grain and tuber crops failed in that year.

Southeast Nigeria is said in internet sources to have a vibrant "culture" of breadfruit use involving a seeded variety identified as what is called "African breadfruit", *Treculia africana* (Decaisne ex Trécul) by Taiwo O. Omobuwajo ("Breadfruit as a Key Component of Sustainable Livelihoods in Nigeria: Prospects, Opportunities and Challenges", Acta Hort. 757, 2007). "African breadfruit" is native to Africa and more distantly related to the many varieties of Pacific Island breadfruit than the Pacific varieties are to each other. Both are members of the mulberry family (Moraceae).

Omobuwajo also mentions *Artocarpus altilis* (Pacific Island breadfruit) being common in southwest Nigeria and a description of vibrant usage in Osun State, southwest Nigeria has arrived in correspondence (see quotation below that of Banks at top of page). Omobuwajo seems to be speaking of a seeded variety in southwest Nigeria where J.O.I. Obasuyi and S.O. Nwokoro ("Physical and Chemical Characteristics of Breadfruit (Artocarpus altilis) Seeds Collected from Three Locations in Edo State, Nigeria" *Pakistan Journal of Nutrition* 5(3), 2006) specifically studied a seeded variety from south central Nigeria (Endo State), also ultimately of Pacific Island origin, presumably by way of the English, French or other plantings in the West Indies in the 1700-1800s.

Between Ghana and Nigeria is Benin and regular household use of a seedless variety is described for the south, the author (Gualbert Gbéhounou) wondering "Why Does *Artocarpus altilis* Remain a Backyard Tree in the Republic of Benin?" (Acta Hort. 757, 2007).

Possibly there is a continuous area of efficient homestead use from Sierra Leone to southwestern Nigeria, involving Pacific Island seedless varieties (which are *Artocarpus altilis*) and "African breadfruit" (*Treculia africana* Decaisne ex Trécul), the African breadfruit of southern Nigeria, extending into Cameroon and into the Congo Basin. The seedless varieties from southwest Nigeria in the coastal nations over and up to Senegal are not yet know, in every case, to be either the same or different varieties except that all are presumed to be amongst those found in the West Indies (which has, perhaps, less than 5 seedless varieties and less than 3 seeded varieties, where there are at least 120 breadfruit varieties overall in Asia and the Pacific).
"Enthusiasm" is difficult to evaluate from reports about West Africa. To many observer-writers apparently accustomed only to tubers and grains, breadfruit plantings often seem haphazard around homesteads and entirely random or limited to small stands in the forest. This has been interpreted as indifference, lack of planning or purpose and opportunistic use of trees that have sprung up on their own in the forests. Reports sometimes speak of breadfruit as a "protected" species, this definition also suggesting that they were not purposely planted. But what they describe would also be seen on many Pacific Islands where breadfruit is purposely planted and is acknowledged and celebrated by the islanders as a critical source of carbohydrates - sweet potato, taro and yam often simply making the diet more interesting (and demanding vastly higher production inputs), much as the breadfruit-cassava-yam cultures which occur along coastal West Africa (add 'rice' from at least Liberia and to its west), breadfruit often being called 'yam' when cooked or processed like yam in parts of Nigeria and perhaps further west..

And Pacific Islanders might say, "Well, there's always breadfruit," but they also say, "Well, you know what they say about people who don't preserve breadfruit..."

"Valorisation", as it is called in the food preferences literature - but Pacific Islanders valorise breadfruit only to a certain level or degree - taro, sweet potato, yams and banana typically having more main-dish prominence at feasts, breadfruit preparations often shifting to special desserts for those occasions.

I wonder. Little groves of breadfruit develop where they are allowed to keep springing up on their own - thankfully they have almost zero "intrusiveness" (ability to expand into unwanted environtments) - but West African descriptions often involve trees standing singly here and there and of course there is no question that the homestead breadfruit tree(s) has been purposely planted.

As in the Pacific Islands, every intensively utilised West African tree tends to have individual owners - when observers / investigators have inquired at that level - owners who do not necessarily own the land upon which the tree is planted. Across the Pacific Islands and West Africa there are perhaps millions of variations on a story which might involve, for instance, a paternal grandparent in a patrilocal society or a maternal grandparent in a patrilocl society taking a grandchild out and planting a tree for the child on the matriand or patriland to which the child does not "belong", or of the grandparent simply planting a tree where he or she has a right to do so and informing the parents of what they have done and that the tree is to belong to a particular child. These plantings are often in the forest / bush in the Pacific Islands and it may well be such purposeful plantings that observers are often reporting in West Africa as well - unaware that there are fixed systems for provisioning the generations coming to the fore by their eldermost relatives or parents.

What do we know about breadfruit in West Africa today? Precious little. Except that it is quietly already more important than many people seem to realise (and largely unmeasured when much is known about yields of grain and tuber crops - it saved some tens or hundreds of thousands of Ghanaians from death or wasting during the 1983 famine but is still nowhere to be found in an African agricultural census).

Bank's statement quoted at the top of this page that ten trees could be planted in an "hour" was, perhaps, a thoughtful exaggeration, bringing home to his audience in England such things as the lack of annual labour inputs involved in the crop's production - so they might take action and spread the tree through the rest of the tropical world - an effect that actually soon occurred. The French, as well, had such expert opinion in hand at about that time and taking action, both the British and the French and perhaps others soon brought breadfruit to the New World; some of the varieties involved first appearing on West Africa's shores from the West Indies some decades after the West Indies first got theirs.

But perhaps Banks was speaking of seeded breadfruit where what he said, precisely, is all but precisely true. One does little more than break open a mature seeded fruit and plant its seeds. But it is certain seedless varieties that are unusually productive and are the focus of current international efforts at crop introduction or crop improvement. And it is only Global Breadfruit who are making them available by the tens or hundreds of thousands.

The common African and Pacific Island custom of individual trees having individual
Our goal is sturdy children who are never hungry.

Pacific Island breadfruit at the market

Picking breadfruit

Global Breadfruit "plug"

owners (and of trees even having individual names) was not borrowed with breadfruit. It was a more ancient practice in both culture areas that was simply applied to breadfruit to some extent when and where it found its new homes in Africa.

To answer Gbéhounou's question of why breadfruit remains a "backyard tree" in Benin I would first say "because that is normally quite sufficient." But the essence of his question goes deeper, asking why, we might imagine, neither Western nor Asian food processing industries ever responded to the presence of breadfruit in the tropics.

Up until now, it seems, it has always been easier to impose known crops (all of which bear seeds) and known processing technologies (cocoa, oil palm and the others).

Global Breadfruit report initial purchases of "plugs" for planting large groves by agricorporations which find that the subsistence and small market plantings around their proposed factory sites have too small a surplus to support planned factories’ capacities. Global Breadfruit’s extensive knowledge of the world breadfruit situation also leaves one source within the company expressing the impression that nowhere in the world is there presently sufficient surplus breadfruit to support a medium-sized food processing plant. But now Global Breadfruit can produce masses of plugs to order. This solves both a factory’s uniformity problems associated with casting about the countryside for cuttings (which would nowhere be sufficient in number for their needs) and the problem of delayed returns in forestry: the plugs sprout up and start fruiting within 2 or 3 years while cuttings from mature trees take 4 to 9 years to fruit as mentioned previously. So cuttings are the answer to neither the food processing factories’ immediate needs nor would there initially be enough cuttings (of the highest producing varieties - worldwide) to satisfy the demands of national programs for greater subsistence and cash crop plantings. And there are sometimes soil-borne disease issues with cuttings if sending them from one place to another. The Global Breadfruit plugs never start out in farm or other soils and arrive to their destinations around the world having, since “birth”, been committed to “growth media” that are sterile and devoid of any kind of disease or pest. Alternately, they are simply grown hydroponically which makes them lighter for shipping and eliminates “soil”-related agricultural importation issues.

There is an important fact about all breadfruit that produced traditional usage constraints, and now, factory supply constraints. All varieties of breadfruit must be consumed, processed or preserved within about three days of being plucked from a tree - after which the fruits go soft and sour. No variety be carried unrefrigerated to far places on long rough roads in terms of West Africa’s farmers markets. And it can’t be stored for long or transported far like some tubers or most field-dried grains before processing by food factories.

With certain planning - and counter-balancing the “shelf life” issue in both the commercialisation models and in traditional household uses - an additional fact now comes to the fore: the fruits can be picked and dried (after grating), cooked or otherwise processed at any stage of growth. After a short initial light vegetable sort of stage, the fruits become mainly starchy and cook up with the same taste and the same texture no matter how “mature” the fruit might be when picked - unless overripe.

So whether for household consumption or food processing factories, one can harvest for carbohydrate content at any early-mid to late maturation point during a fruit’s growth.

This is well since factories may specify an optimal size for mechanical processing for each variety (short of when they fall to the ground from their own weight - where they crack and attract flies). Grove owners will harvest, one might imagine, a size of fruit just smaller than that at which they most often fall from their own weight while the trees crop fairly well continuously through the two varieties’ peak seasons of the two main Samoan varieties presently involved. Farmers with small plantings will learn the required dimensions and have a new cash crop when times are good and a resource for their families and the community beyond, even when drought is severe enough to devastate all other crops. Breadfruit was the only crop that didn’t completely fail in much of southern Ghana in 1983 - a famine in which all grain and tuber crops failed and many other species of trees died.
The Breadfruit Institute, the University of British Columbia and Global Breadfruit

There are now Jamaican, Honduran, Haitian, Ghanaian, Kenyan, Liberian and other projects developing operations which are or will stimulate activities along the lines of oil palm and its commercial utilization: large individual farmer and corporate plantings and commitment of those crops to food processing factories.

The difference between just six or seven years ago and now can be seen in the "in vitro" pictures to the left of the "germs" - "germinating, and the lovely "plug" below them as emphasised before. Cuttings may not produce the thousands and tens of thousands of uniform trees with high survival rates and early age of fruiting needed for plantings committed to food processing factories. The Global Breadfruit plugs have nearly 100% survival rates when flown in as air freight or excess baggage (if not delayed by customs or quarantine) and thrive in standard agricultural station shade houses, under outdoor shadecloth or in the shade of large-boughed trees where they grow in three and five litre plastic potting bags for 3-6 months until they are mature enough to be planted into the ground of their permanent home.

So now the breadfruit propagation story has changed and it is this. Dr. Diane Ragone [rah-goh-neh], having collected and studied 120 of the world's breadfruit varieties since the 1980s, founded the Breadfruit Institute at the United States' National Tropical Botanical Gardens (Hawa'i), and had long been aware that the most productive varieties were seedless - mainly from Samoa and Pohnpei (Micronesia).

With tissue from Ragone's most productive seedless varieties, Dr. Susan Murch of the University of British Columbia, by 2004, developed and perfected a method for in vitro propagation from vegetative material of "parent" plants or fruit and the ability to produce thousands or tens of thousands of genetically identical plant "germs" which sprout as seen in the two pictures, left and above.

The bottom picture to the left is what becomes of them after some weeks in a greenhouse setting.

The original breadfruit tissue for what is now available commercially was licensed to the Breadfruit Institute by government bodies in Samoa and Pohnpei and the Breadfruit Institute has in turn licensed mass production rights to Global Breadfruit.

The in vitro procedures are carried out at Cultivaris / Global Breadfruit laboratories in the Americas, Europe, New Zealand and elsewhere. The resulting "germs" are committed to "weaning" facilities at those locations and elsewhere from which breadfruit and other kinds of pathogen-free starter plant orders are then shipped around the world.

Frequently Asked Questions

Commercial processing of breadfruit:

Like potatoes, sweet potatoes and yam, fresh *Artocarpus altilis* breadfruit is about 70% moisture and responds well to the same machinery and processes for handling commercial quantities. The washing equipment, peeling equipment, slicing and grating equipment, and such processes as drying and grinding into bread flour which are used in processing potatoes, sweet potatoes and yam are all suitable and successful when applied to most seedless breadfruit varieties.

Breadfruit, jackfruit and "African breadfruit":

Breadfruit, jackfruit and African breadfruit are all of the mulberry family but are evolutionarily quite distinct from each other as they were in their native distributions before agricultural and semi-agricultural peoples began moving them to new places thousands of years ago. Their scientific names are:

Breadfruit: (Moraceae [mulberry]): *Artocarpus altilis*

Link: [AgroForestryTree Database - Artocarpus altilis](http://www.agroforestrytree.org/tree/Artocarpus_altilis)

Jackfruit: (Moraceae [mulberry]): *Artocarpus heterophyllus*

Link: [AgroForestryTree Database - Artocarpus heterophyllus](http://www.agroforestrytree.org/tree/Artocarpus_heterophyllus)
African breadfruit: (Moraceae [mulberry]): *Treculia africana*

Link: [AgroForestryTree Database: *Treculia africana*](#)

---

**Breadfruit flour:**

Link: *“In Barbados and Brazil there is a way to substituting breadfruit in part for wheat flour in breadmaking, and it is called Breadfruit flour. Breadfruit flour is much richer than wheat flour in lysine and other essential amino acids. This new combination has been found more nutritious than wheat flour alone...”*  

---

Breadfruit flour in biscuit making: effects on product quality  
Olaoye, O.A., A.A. Onilude C.O. Oladoye  
[download]

Functional and pasting characteristics of breadfruit (*Artocarpus altillis*) flours  
Adepeju, A.B, S.O. Gbadamosi, A.H. Adeniran, and T.O. Omobuwajo  
[download]

Chemical composition, rheological properties and bread making potentials of composite flours from breadfruit, breadnut and wheat  
Malomo, S.A., A.F. Eleyinni, and J.B. Fashakin  
[download]

Storability of breadfruit and its hazard analysis in Nigeria  
Arowora, K.A., B.A. Ogundele, and A.O. Ajani,  
[download]

---

**Breadfruit Links**

A good place to start:  
D. Ragone, M.B. Taylor 2007  
*International Symposium on Breadfruit Research and Development*

Available for free downloading:  
Diane Ragone 1997  
*(her classic study of)*  
*Breadfruit Artocarpus altillis* (Fosberg)  
Promoting the conservation and use of underutilized and neglected crops #10  
International Plant Genetic Resource Institute (IPGRI), Rome, Italy. 97 pp.  
*(med. quality [1Mb]) (hi quality [5MB])*

Diane Ragone 2009  
*Farm and Forestry Production and Marketing Profile for Breadfruit*  
Diane Ragone and Catherine G. Cavaletto  
*Economic Botany* 60(4):335-346 2006  
*Sensory evaluation of fruit quality and nutritional composition of 20 breadfruit...*
Our goal is sturdy children who are never hungry.

Introduction
Why Now?
Population in West Africa
Breadfruit Nutrients
Breadfruit in West Africa
Joseph Banks' Little Fib
The Breadfruit Institute, UBC and Global Breadfruit
Frequently Asked Questions
Breadfruit Links and Resources

(Artocarpus, Moraceae) cultivars

*Traditional post-harvest technology of perishable tropical staples*
FAO 1984

*Breadfruit (Artocarpus altilis)*
Purdue University Department of Horticulture

*Effects of some processing methods on the toxic components of African breadfruit (Treculia africana)*
Ugwu, F. M.* and Oranye, N. A.
Ebonyi State University, Abakaliki, Ebonyi State, Nigeria.
*African Journal of Biotechnology*

Wikipedia's "breadfruit"

Other good reads:

Most images from the Breadfruit Institute, Global Breadfruit, and the Ghana Alliance against Hunger and Malnutrition.
All are used with permission.