



STATE OF THE WORLD 2011

Innovations that Nourish the Planet



AFRICA'S INDIGENOUS CROPS



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Introduction

Finding ways to alleviate hunger and poverty doesn't always depend on new crop varieties that are bred in a laboratory. Instead, reigniting an interest in—and a taste for—indigenous and traditional foods can help improve nutrition, increase incomes, restore agricultural biodiversity, and preserve local cultures.

Worldwatch Institute's Nourishing the Planet team traveled to 25 countries across Africa talking to farmers, agricultural experts, and others about fruits, vegetables, and grains that can be found close to home and include a bounty of flavors. We've compiled this list of indigenous African crops—some lesser known than others—that deserve wider attention as the global agricultural community looks for effective ways to nourish both people and the planet.

To learn more about the Nourishing the Planet project, visit www.NourishingthePlanet.org.

African Eggplant

The Fruit That's Enjoyed as a Vegetable

While there are many varieties of the African eggplant, with a range of shapes, sizes, and colors, the eggplant most commonly found across sub-Saharan Africa is *Solanum aethiopicum*. This variety has a brilliant red exterior and is about the size and shape of an egg, giving it the name “garden egg.” It is also known as mock tomato, *ngogwe*, and *nyanya chungu*.

Although technically a fruit, garden egg is usually picked when it is green and eaten as a vegetable, cooked into stews and sauces or even consumed raw. If it is picked after it ripens, it can be enjoyed as a fruit, although some varieties are sourer than others. Even the plant's leaves provide a nutrient-rich meal: in the markets of Kampala, Uganda, they are the most popular vegetable for sale.

Most garden eggs sold in markets in sub-Saharan Africa are grown locally on small plots of land, and as much as 80 percent of total production comes from small-scale growers. Women, in particular, use the eggplants as an additional source of income.

Garden eggs have proven to be resistant to molds, mildews, and certain soil-borne pathogens. The plant itself can grow in agricultural “wastelands,” is somewhat drought resistant, and has the ability to grow in humid areas. It can be grown alongside other crops or in small pots, providing a high yield of fruit from a small area.

Farmers will typically first harvest the fruit after 70 to 90 days, when it is still immature, and after that anywhere from 8 to 10 weekly harvests can be reaped. Once harvested, the eggplant can be stored for up to three months, and some consumers dry the fruit to eat later in the year. Although the garden egg is not well known for its nutritional content—it is 92 percent water—it provides vitamin B, beta-carotene, and vitamin C, in addition to calcium, iron and potassium.

Like many other crops indigenous to Africa, the eggplant is easy to grow and high yielding, making it a good plant for research. Scientists at the World Vegetable Center have been working to improve the African eggplant since 1993 and released a new variety, DB3, in Tanzania in 2006. Since 2007, the Center has been working in countries within three different agroecological zones—Cameroon, Madagascar, and Mali—to test and release different varieties of eggplant.

Developing these new and different varieties of eggplant will help increase the availability and consumption of the fruit. These improved traits will be needed to resist the effects of climate change and meet the rising demand for crops across the African continent.

Bambara Bean

A Native Solution to Africa's Food Crisis?

Ever heard of the Bambara bean? How about *nyimo* or *Vigna subterranea* or the African groundnut? No matter what you call it, this little bean, indigenous to tropical Africa, is highly overlooked by scientists, development agencies, and humanitarian programs, even though it packs a lot of nutrition.

The Bambara bean may have originated in Mali, but it is also popular in Burkina Faso, Cameroon, Nigeria, and Zimbabwe. It is now widely distributed and grown in Asia, parts of northern Australia, and South and Central America, and is often found for sale on street corners in Johannesburg, South Africa.

One reason the bean is growing in popularity is because it is a hardy plant, able to withstand high temperatures and dry conditions. It also has a variety of uses. The leguminous plant, in the same family as the peanut, produces seeds that taste somewhere between a chick pea and a haricot bean or garden pea. The seeds are typically boiled, canned, roasted, or fried, then ground and blended into many traditional African dishes. When boiled, they are eaten as a snack, but they can also be added to stews and used to produce flour. In addition, the seeds can be extracted for oil.

The Bambara bean is high in protein, particularly methionine, which makes the protein more complete than that in other beans. In addition, the bean has the highest concentration of soluble fibers, a trait that has been shown to reduce heart disease and certain types of cancer. According to a 2006 report from the U.S. National Academies of Science, "the nutritional balance [of the Bambara Bean] is so good that some consumers claim they could live on the seeds alone."

Its high protein level makes the Bambara bean not only a low cost and dependable cash crop for subsistence farmers, but also a valuable weapon in the battle against hunger across Africa. This little bean could go a long way in helping to fight Africa's food crisis.

Baobab

Mother of the Sahel

The basic needs for human survival include food, water, and shelter. Baobab, a tree indigenous to the semi-arid regions of sub-Saharan Africa, can provide all three—and more. Baobabs are found in mainland areas of the continent from Senegal’s coast to northern South Africa, as well as on Madagascar, where seven out of the eight species occur.

The baobab’s leaves, fruit, and seeds are all edible. In West African countries, including Burkina Faso and Ghana, the leaves are commonly ground up and used in soups, as well as for condiments and sauces served with yam, cassava, maize, millet, and sorghum. The leaves are high in protein and contain a wide spectrum of essential amino acids, among them lysine, which is often missing in the diets of poor populations who consume mostly cereals and tubers and little meat. Baobab leaves are also high in vitamin A, and frequent consumption would benefit pregnant women and children, since it can help prevent blindness and birth defects that result from vitamin A deficiency.

The baobab’s fruit, known as “monkey bread,” can be used to make flour or stirred into drinks or porridges. Its pulp has 10 times the vitamin C of an orange, which explains the tart flavor. It is often beaten into pancakes and dried in the sun. The kernels of baobab seeds, which have a taste similar to almonds, can be roasted and made into creamy butter. Due to their long shelf-life and high energy and protein content, both the seeds and the kernels can be important food sources in times of low crop yields and natural disaster.

Beyond its uses as a staple food, parts of the baobab tree such as its bark are used as cooking fuel for stoves, kilns for firing pottery, and ovens. In dry areas, the extremely large, hollow stem holds a valuable water resource, as it can store as much as 10,000 liters of water for many months. Local populations often build shelters and keep livestock inside baobab trunks. In Australia, home to the only baobab species outside of Africa, there is even a prison built inside a baobab trunk.

While the baobab can act as a reliable provider for sub-Saharan Africa’s malnourished populations, some species require special care and protection. Poor land management and deforestation have left the Giant Madagascar baobab, honored widely as the dwelling place of spirits and known locally as *renala* (Mother of the Forest), scattered in degraded lands. It is classified as an endangered species by the International Union for Conservation of Nature.

Some people are reluctant to grow baobab because of cultural taboos and the tree’s slow seedling process. But several villages in Niger have been producing seedlings in nurseries since the 1960s. Once mature, baobab is resilient and almost “immortal”: results from carbon dating found some baobab species to be over 2,000 years old.

Nutrition and poverty-relief programs should explore more widely the baobab tree’s potential role in improving food security for generations ahead.

Cowpea

The Little Legume that Could

The cowpea, a legume that is known as the *kunde* in Swahili and the *black-eyed pea* in the Americas, originates in the center of Africa and is one of the continent's oldest known crops. First discovered as a small, creeping vine in the Sahel desert, cowpea is extremely drought resistant and adapted to poor soil, making it a useful staple crop for farmers in areas that face increasingly water scarcity and hot temperatures due to climate change.

Perhaps for this reason alone, it is understandable that cowpea is the second most widely grown legume in Africa. Only the peanut—originating in the Americas—covers more farmland. Although the cowpea is not widely known in other parts of the world, in Africa an estimated 200 million people subsist on a diet consisting mainly of the crop.

Cowpea is an important source of protein and other nutrients. A member of the grain legume family, it improves the body's absorption and breakdown of other staple foods such as rice, maize, and cassava. Cowpea is also rich in oil and digestible carbohydrates.

Cowpea can be eaten at different stages throughout its development and forms the basis of a wide variety of meals. The leaves and young pods are eaten like vegetables, and the seeds are consumed as a side dish or made into sauces or dry grain. The seeds are also ground into flour that can be pressed into deep-fried cakes called *akara balls* or steamed cakes known as *moin-moin*. Cowpea meal is used to make puddings, porridges, and soups. During very dry years, when animal feedstocks are low, the stems and leaves of cowpea are used to feed livestock. The stems and leaves can also be dried and stored for the off-season when fodder for livestock is scarce.

In addition to being a healthy option for the people who cultivate and eat it, the cowpea is beneficial to the soil in which it grows. The plant's deep tap root—the part that makes it so tolerant to dry growing conditions—helps to stabilize the soil, while its shade and dense cover help preserve moisture. Like all legumes, cowpea fixes nitrogen in the soil, making the locations where it grows more hospitable to other vegetables and staple crops. An annual crop, the cowpea bears seeds that remain viable for several years, and it is generally grown intercropped or in relay with maize, cassava, groundnuts, sorghum, or pearl millet.

Although cowpea is a hardy plant, it can be difficult to store after harvest. To help prevent crop loss to infestation and disease, Purdue University developed a storage bag called Purdue Improved Cowpea Storage (PICS). PICS are hermetically sealed to prevent oxygen, moisture, and pests from contaminating the cowpeas. By 2011, the PICS project hopes to reach 28,000 villages in Benin, Burkina Faso, Cameroon, Chad, Ghana, Mali, Niger, Nigeria, Senegal, and Togo.

Dika

West Africa's Most Eligible Wild Tree

When forests are cleared in West Africa for firewood or farmland, the Dika trees are, more often than not, left untouched. Farmers have too much to gain from harvesting the tree's fruits and seeds to burn or discard a Dika found in the wild.

Indigenous to West Africa, a Dika tree can grow as tall as 40 meters and produces a small green-and-yellow fruit that looks, at first glance, like a small mango. The fruit ranges in taste from sweet to bitter and can be enjoyed (especially the sweeter varieties) fresh off the tree or made into jelly, jam, or "African mango juice."

But while the fruit is a delicious treat, the seeds are where the real value can be found. Harvesters crack open the Dika seeds, which resemble smooth walnuts, to collect the edible kernels inside. These kernels can be eaten raw or roasted, but most are processed and pounded into Dika butter or bars, or pressed to produce a cooking oil.

The seeds also produce a unique flavor when crushed and are combined with other spices to make *ogbono* soup, a common dish. The wide popularity of *ogbono* soup has created a large market for Dika seeds, and harvesters can trade Dika kernels both locally and regionally. Out of season, Dika seeds bring an especially high price: it has been estimated that a farmer can make up to US\$300 off of the seeds produced by just one tree.

Each year, thousands of tons of "Dika nuts" are harvested throughout western Africa, and the popularity of the wild tree has led to many attempts at commercial cultivation. The Dika is a slow-maturing plant: it takes 10 to 15 years for a tree to begin bearing fruit. Breeders, motivated by the value of this fruit, are working to develop faster growing varieties of the Dika as well as varieties with shells that are easier to crack open.

But whether or not the Dika is successfully tamed by breeders and made more commercially viable as a domestic crop, the tree in the wild is already providing a critical income to millions of farmers and harvesters throughout West Africa.

Egusi

The Miracle Melon

Egusi, a wild member of the gourd family, has the potential to spread its popularity on the global market nearly as quickly as it grows. Native to parts of western Africa, this peculiar-looking plant can grow just about anywhere, from humid gullies and dry savannahs to tropical highlands—making it a possible food source for farmers in even the worst conditions.

Although the egusi looks almost identical to its cousin the watermelon, don't be fooled: they are actually quite different. Because the egusi is filled with very dry, bitter flesh, the seeds are the true delicacy of this melon. Composed of nearly 50 percent edible oil and another 30 percent pure protein, the little seeds pack a lot of nutrition into a very small package. In many parts of Africa, where farmers lack access to meat or dairy, the high oil and protein content can make an excellent dietary supplement.

Although the seeds are often shelled and eaten individually as a snack, many processed forms of the seeds have made their way into common cooking practices as well. After soaking, fermenting, or boiling, the seeds take on different flavors and are frequently added to thicken soups and stews. On their own, the seeds can also be roasted and ground into a spread like peanut butter. With further preparation, egusi-seed meal can be pressed into patties to be used like a meat substitute, and the oil can be used for cooking.

The egusi plant is easy to grow. It is extremely resilient to pests and diseases, and because it blankets the ground as it grows, it can help suppress weeds. Because of this, farmers often intercrop egusi with other crops, including sorghum, cassava, coffee, cotton, maize, and bananas. Mature egusi melons can remain in the field for a long time without rotting, so crop loss and waste is rare. Once the seeds are harvested, they can be a reliable year-round food source because they store well.

The egusi is also an important supplementary baby food that can help prevent malnutrition. Blending the seeds with water and honey produces a milky liquid that can be used as formula if breast milk is unavailable, making the plant as diverse in its uses as it is easy to grow.

Enset

“Tree Against Hunger”

A member of the banana family, the enset (*Ensete ventricosum*) is often confused with its yellow, more widely known, cousin. But unlike the banana, enset is not grown for its fruit but for the starchy pulp in its stem and corm, the below-ground portion of the stem that resembles a potato. Although it is grown in some parts of the world as an ornamental plant, enset has been a staple food in Ethiopia for roughly 5,000 years.

Growing up to 10 meters tall and one meter in diameter, enset yields an incredible amount of food in every plant. But harvesting it is a laborious process that involves prying the entire plant out of the ground. Once harvested, enset can be used to make several different kinds of foods.

Kocho is made by scraping the starchy pulp out of the stem and fermenting it with yeast, traditionally in a dug-out pit. The resulting mixture is used to make porridge or a fermented bread that is similar to the Ethiopian favorite *injera*. *Bulla* is similarly extracted but, instead of being fermented, it is dehydrated to make a flour that can be stored for extended periods of time. *Amicho* is the corm boiled and served like potatoes or other root vegetables. None of these foods are particularly high in nutrients, but they are very calorie-dense, forming the basis of many people's diets.

Highly adapted to Ethiopia's highlands, enset is capable of weathering drought and has helped many Ethiopians survive famine in years of bad weather. In a 1997 report, a group of researchers from the American Academy for the Advancement of Science went so far as to call it the “Tree Against Hunger.”

Despite its apparent usefulness, enset has received little research or extension support, and many farmers now overlook it in favor of introduced cereal crops or yams. But enset is still a staple for many of Ethiopia's peoples, including the Gurage, who grow it in large plantations.

With a nearly 5,000-year history of cultivation, enset is a distinctly Ethiopian crop that could be used to increase the country's food security.

Finger Millet

A Once and Future Staple

Although rarely consumed in the West, millet has been cultivated for thousands of years and is a staple grain for much of the world's population, particularly in South Asia and East Africa. The African native variety, finger millet, likely originated in the highlands of Ethiopia and Uganda and is one of the most nutritious of the world's major cereal crops. It can be used to make porridge, bread, malt, animal feed, popped millet (like popcorn), an Ethiopian liquor called *arake*, and even beer.

Finger millet is high in starch and is considered to be "superior" to wheat because its proteins are more easily digested. It has the third highest iron content of any grain, after amaranth and quinoa. Some varieties, such as those in Uganda and southern Sudan, have high levels of methionine, an amino acid that is lacking in the diets of hundreds of millions of poor people who eat primarily starchy foods such as cassava. The millet grain is generally ground into flour for making flatbreads. In the north of Africa, it is made into a porridge called *tuo zaafi*, and in the Sahara it is the main ingredient of a flatbread called *taguella*.

Finger millet can be an ideal crop in dry areas because it can lie dormant for weeks. Once the rains come, the grain springs to life and can be ready to harvest in just 45 days. The grain is resistant to rot and insects and keeps well in storage, making it an important staple when no other food is available. If kept dry, it can store for as long as five years.

Finger millet has an annual global production of 4.5 million tons of grain, and Africa produces some 2 million tons. Although it was a predominant crop in Africa until relatively recently, production has declined significantly. Despite its value as a food crop, policymakers in countries that grow finger millet generally regard it as a "poor person's" crop, and the scientific community has largely ignored it. Many farmers have abandoned the labor-intensive finger millet in favor of maize, sorghum, and cassava.

Africa is experiencing somewhat of a finger millet resurgence, however. In Kenya, the grain currently sells at more than twice the price of sorghum and maize. And in Uganda, where finger millet is an important food, half of all cereal cropland is producing the grain. Finger millet bread is served during harvest celebrations to impress visitors and neighbors, and Ugandans commonly serve finger millet porridge with sugar or banana juice.

The crop appears to be as beneficial in Asia as it is in Africa. India has increased yields by 50 percent in the last 50 years, and in Nepal finger millet acreage is expanding at the rate of 8 percent per year. This nutritious grain could also be useful in weaning foods and other cereal products in parts of the world where it is not currently cultivated, such as South and Central America.

One hurdle in finger millet production is that it is a labor-intensive crop. In Africa, it is harvested most often by hand, and individual heads are cut off with a knife. The small size of the seeds makes the grain difficult to handle, and a lot of skill and effort is required to make it into flour, especially by hand. Weeding is also problematic because the dominant weed in African finger millet fields is a relative of the crop and is hard to discern from finger millet itself.

Fonio

Africa's Oldest Cereal Needs More Attention

You may not have heard of fonio, but it is Africa's oldest cereal. For the Dogon people of Mali, fonio is "the seed of the universe," an appropriate name considering its high nutritional value and adaptability to the region's soil and climate. From Lake Chad to the savannah regions of Senegal and Guinea, fonio is an important food source for some 4 million people across West Africa.

Fonio is one of the most nutritious of all grains. It is rich in important amino acids that are not found in wheat, rice, maize, or sorghum—such as methionine and cystine, which help synthesize protein. And fonio's low sugar content makes it an ideal food for people with diabetes.

The plant can tolerate poor soils, which are often too infertile for other cereals such as sorghum and pearl millet. Given its adaptability, fonio is widely cultivated across the Fouta Djallon Plateau of Guinea because it can grow on acidic soils that have a high aluminum content that is harmful to other crops. In Sierra Leone, when low rainfall makes it difficult to grow rice in paddies, farmers often turn to fonio to protect them from total crop failure.

Fonio is among the world's fastest maturing cereals. The crops produce grains as quickly as six to eight weeks after planting and are ready to be harvested long before most other grains. During Africa's hungry season, when farmers are waiting for other crops to mature, fonio becomes the "grain of life." It is this property that gives fonio its popular English name, "hungry rice." But people also grow fonio because they love how it tastes.

Black fonio, as well as the more popular white varieties, are characterized by very small seeds, which are an important ingredient in traditional dishes. When cooked, fonio has a consistency similar to couscous, and is served with a peanut sauce or chicken stew. It is also used to make porridge and gruel, and fonio is frequently found served at religious and traditional ceremonies. The Lambas in northern Togo brew a traditional beer (*tchapalo*) from white fonio, and the plant's grain, chaff, and straw make excellent fodder for cattle, sheep, goats, and donkeys. The straw can also be chopped and mixed with clay to build walls, or burned to provide heat for cooking.

Although fonio's value is evident, the grain has not received the attention it deserves. Farmers speak of the need for better processing equipment that can help reduce labor, as well as the need to develop greater demand for the crop and better access to markets. As innovative efforts to preserve Africa's food security crop up across the continent, people are starting to refocus on fonio.

Lablab

The Bountiful, Beautiful Legume

Although it is often sold as an ornamental flower in the United States, the lablab has numerous benefits. This legume, native to sub-Saharan Africa, is both a versatile food staple and a tool for land restoration.

From humid lowland areas to dry highlands, the lablab is easy to plant and even easier to care for. It stays green and productive throughout the dry season, when food is generally hard to come by. It is popular as a food crop in sub-Saharan Africa as well as many other parts of the world, including India, the Philippines, and other Asian tropical countries.

The pods, seeds, and leaves of the lablab are all edible and are utilized in a variety of meals, although the raw, dry seeds can be poisonous if not prepared correctly. The young pods are most often picked from the stalk and eaten like green beans or snow peas, but they can also be cooked and added to soups and stews. The leaves can be eaten whole or made into a seasoning herb for other dishes.

The pods and leaves of the lablab look similar to those of other legumes, but they have much higher protein content and are an excellent source of iron. They also contain a good balance of amino acids, making lablab pods a good complement for cereal-based diets.

In India, dried seeds are split like lentils and used in making stews and soups. They are also sprouted, soaked in water, shelled, boiled, and smashed into a paste, which is fried with spices and used as a condiment. In Africa, lablab seeds are often boiled with maize, ground and fried, or added to soups. They are also included in a traditional dish that is a mixture of maize, beans, bananas, potatoes, and green vegetables, all boiled down into a protein-rich paste.

In addition to being used as a source of food, lablab grows quickly and provides high yields, making it an ideal grazing crop for cattle, sheep, goats, and pigs. It can be intercropped easily, restoring nitrogen to soils and helping to repair degraded farm land. It is considered a good cover crop in coffee and coconut plantations and is often planted as a second recovery crop in rice fields following harvest.

Although they are best known for their rural uses, lablab plants are also used to form hedges in urban settings. In Guyana, the government has encouraged city dwellers to grow ornamental varieties along fence lines to provide both protein for households and decoration for yards and streets.

The lablab's popularity has spread throughout much of South and Southeast Asia. The legume has received less attention in Africa because its use is eclipsed by its popular cousin, the soybean. In the face of climate change and drought, however, this resilient and delicious plant is likely to make a quick—and beautiful—comeback.

Locust Bean

An Answer to Africa's Greatest Needs in One Tree

The locust bean's name might seem deceiving: while only distantly related to beans, this plant is actually a tree. Indigenous to the savannah regions of Africa, it is most commonly found in the band of terrain stretching from Senegal to Uganda. The tree's fruit pulp and seed extracts provide nutritious ingredients for traditional soups, sweetmeats, and condiments across West Africa.

The locust bean is extremely hardy: it is well suited to a wide range of soils, survives fires, thrives in semi-arid tropical climates, and has a low susceptibility to pests and diseases. The tree has a wide-reaching crown and can grow to more than 20 meters tall. People climb to the very top to pick the fruit—long pods that can grow as long as your forearm, and that contain small seeds and a sweet edible pulp. The sugary pulp can be eaten raw, used in traditional sweetmeats, or mixed with water to make a refreshing drink. Given its sweet taste, children love the pulp, and, because it keeps well for days, it is also popular among travelers.

Although the pulp makes for a good energy snack, the seeds are the locust bean's most sought-after product. Rich in protein, starch, fiber, sugar, and fat, as well as vitamins and minerals such as calcium and iron, they are about as nutritionally balanced a food as you can find. The seeds are famous for their greasy extract, which is fermented and pressed into cakes or balls, known in West Africa as *dawadawa*. Dawadawa has a pungent odor, often compared to that of aged cheese, and is used as a condiment or an ingredient for soup.

Because the locust bean pods mature during Africa's "hunger season," when most other vegetation has dried, the tree is a true lifesaver: it can be a source of emergency food with a high nutritional value. But the tree provides much more than a local source of nutrition. Dawadawa's widespread popularity makes the locust seed an important commercial item across West Africa. It is estimated that 200,000 tons of the seeds are collected annually for dawadawa just in northern Nigeria. The production and sale of dawadawa constitutes an important economic activity for women.

In addition, the locust tree provides much-needed shade and shelter from desert winds in thousands of villages across Africa. It is beneficial to the underlying soil as well, which is improved by the dung and urine of livestock that shelter under the tree's shade. Its leaves are so rich in nitrogen and other minerals that they are often collected as manure for soil improvement.

Most of the existing locust trees are found in the wild, and although the species' response to horticulture remains unclear, its multiple benefits make it an ideal candidate to promote in other regions across Africa. The locust tree combines in a single species two of Africa's greatest needs: food security and tree cover.

Marama

The Green Gold of Africa

Often called the “magic” marama or the “green gold” of Africa, this plant is working its secret charm both above and below ground in southern Africa. Above ground, it produces seeds similar to the peanut or soybean, but it is higher in nutritional value than either. Below ground, it produces a high-protein tuber that is bigger and healthier than potatoes, yams, or sugar beets. To top it off, the plant also can generate a high-quality vegetable oil.

Native to the Kalahari Desert of Botswana, Namibia, and South Africa, marama has been part of the indigenous diet for generations. It serves as an important weapon to fight malnutrition by providing a concentrated source of protein and energy in a region where food security is a high priority. Yet the marama has not been introduced into wide-range cultivation and remains one of the most neglected native vegetables in Africa.

Nutritious beans and tubers aren’t the marama’s only benefits. The plant thrives in the poor-quality, sandy soil of the desert, withstanding blistering summer temperatures, freezing winter nights, and highly erratic—and often absent—rainfall. Although marama seeds are virtually inedible straight from the pod, they are delicious once they harden and are often roasted, comparing to the nutty flavor of cashew nuts. In addition to the oil that can be produced from the seeds, the plant is particularly good fodder for livestock.

The marama’s ability to nourish goes well beyond food. The plant likely survives in its dry environment because of its ability to store water in its tubers, which can hold up to 250 kilograms of the liquid. In arid regions, marama are often referred to as “living cisterns” that provide an emergency source of water. In addition, the marama is capable of battling desertification. The highly drought-tolerant plant sprawls across the landscape, creating biomass that protects the soil from erosion.

While most agronomists agree that the marama is not yet ready for large-scale cultivation, research is needed urgently to develop management techniques that would harness the plant’s enormous potential in the right environments. Given its affinity for dry areas, testing it in projects aimed at alleviating rural poverty and malnutrition in drought-prone areas of southern Africa could have great results in both benefiting communities and mitigating climate change.

Marula

Food, Function, and Sustainable Development

The marula is an African native tree prized highly for its fruit. Found in 29 sub-Saharan countries, from Cape Verde to South Africa, it is a good source of nutrition because the fruit is high in vitamin C and contains a protein-rich nut at its core.

Although the marula tree is not domesticated, it has been cultivated intentionally in the wild for hundreds of years, and its distribution closely matches human migration patterns. In many African cultures, a gift of marula nuts is a sign of friendship, and a large marula tree is often a gathering place for village rituals. People appreciate the tree for its shade and beauty, but it also supplies valuable food and provides a supplement to farmer incomes.

Beautiful and leafy, yet drought resistant, an average marula tree grows to some nine meters tall and bears up to 500 kilograms of fruit per year. Marula fruits fall off of the tree when they are still green and hard, and ripen within five days. Farmers often build fences or a thorny barrier to keep animals—including elephants, rhinos, giraffes, kudus, and baboons—from getting to the fruit first. Fully ripe marula fruits are tart, with a pleasant sweet-and-sour taste. The juice has four times as much vitamin C as orange juice. Some fruits are eaten raw, but most are processed into beverages or jellies.

At the center of each fruit is a large nut stone that contains a soft, macadamia-like kernel. The highly nutritious kernels, which are eaten raw and roasted, are rich in antioxidants. They are about 25 percent protein and contain calcium, magnesium, phosphorus, and potassium. The nuts are some 60 percent oil, which is used to treat burns and wounds and is believed to have anti-aging properties for the skin. Dry marula nuts keep for months without spoiling and can be stockpiled as emergency food or dietary supplements during off-seasons.

In addition to being highly productive, the marula indirectly supports other agricultural activities. The flowers produce high quantities of nectar, and bees raised near marula trees produce a light-colored honey with excellent flavor. The marula leaves are used for livestock fodder. Marula wood is very hard and is used to make mortars and pestles, bowls, drums, beehives, and stools. And the tree's bark has medicinal properties and is used to treat dysentery and diarrhea, rheumatism, and insect bites. Many Africans believe that marula-root tonics have anti-malarial properties as well.

Many communities brew their own local version of marula beer. In southeastern Zimbabwe, the beverage is known as *mukundi*, and in Swaziland the potent local marula drink is so popular that beer sales drop dramatically after the trees bear fruit. Namibia has an official marula wine season. But marula is most famous for South Africa's commercially produced Amarula Cream liqueur, which is similar to an Irish cream.

Marula trees can tolerate very inhospitable climates and terrain and have few pests or diseases. The tree thrives in hot, dry climates, tolerates saline water, and grows well even during droughts. It is also an excellent species for reforestation and is planted in areas hit by deforestation and desertification.

The crop has strong potential to be grown more widely. In South Africa alone, some 500 tons of marula fruit are processed commercially for juice, and 2,000 tons for Amarula Cream, every year. Oil from the marula nut is high in unsaturated fatty acids and could be marketed as a specialty salad oil. The oil's non-drying and anti-aging properties could make it useful in cosmetic products as well.

The marula tree holds major income-generating opportunities in poor rural communities. In Botswana, Namibia, South Africa, and Zimbabwe, villagers often collect and sell the fruit to marula processing facilities. Wider promotion of the tree could foster sustainable development throughout Africa, with the potential to alleviate poverty, support human and animal food security, and help regenerate degraded environments.

Monkey Orange

Mouthwatering Potential

Monkey oranges have all the characteristics of a successful crop: high productivity, high prices, extended shelf-life, pest resistance, delicious flavor, and high demand. But the fruit remains undomesticated and has rarely undergone organized cultivation.

Monkey orange trees are similar in shape and size to apple, pear, and orange trees and are a highly coveted African wild fruit tree. Farmers will often leave them standing when they are clearing the land to cultivate field crops. Indigenous to tropical and subtropical Africa, the trees are capable of growing in arid and semi-arid areas and in poor and rocky soils.

Monkey orange trees bear abundant fruit, which sells at very high prices in local markets. A mature tree can bear 300 to 400 fruits per year. The grapefruit-sized fruit tends to be yellow, orange, or brown and emits a sweet scent with a touch of clove. It is known for its delicious sweet-and-sour flavor and is rich in vitamins B and C. The fruit is traditionally eaten raw or made into jam, juice, or fruit wine.

The fruit is difficult to find and in short supply because of the high demand, which is typically unmet in African markets. The tough outer shell makes the fruit resistant to fungi and fruit flies and protects it from damage during transport and storage. It has an exceptional ability to remain edible in tropical heat for months after maturity.

Monkey oranges are an important indigenous African resource, supporting farmers in times of crop failure and serving as a supplemental food in rural areas. By adding the trees to crop fields, gardens, parks, fence lines, and street sides, communities can boost food security and nutrition. The trees are a source of shade and erosion protection, and the wood is commonly used for firewood, tool handles, and building poles.

For many reasons, promotion of monkey orange trees could help foster sustainable development in rural sub-Saharan African communities. Monkey oranges could also be used commercially to produce juices and dry fruit rolls, and the tree has been introduced to Israel for potential commercial crop development.

Moringa

The Giving Tree

Referred to as a “supermarket on a trunk,” moringa is potentially one of Earth’s most valuable plants. In addition to serving as a reliable source of diverse foods, the tree provides lamp oil, wood, paper, liquid fuel, skin treatments, and the means to help purify water. But despite its multiple uses and well-earned nickname, the moringa is relatively unknown to most people outside Africa.

The moringa tree comprises four different edible parts: pods, leaves, seeds, and roots. The green bean-like pods are the most sought-after portion, not only because of their taste—similar to asparagus—but also because they are highly nutritious. The pods provide a good balance of amino acids and minerals and possess one of the highest vitamin C levels of any tropical vegetable.

Moringa leaves are an excellent source of nutrition as well. People commonly boil the tiny leaflets and eat them like spinach. Like the pods, the leaves contain vitamins A and C as well as more calcium than most other greens. They also contain such high levels of iron that doctors frequently prescribe them for anemic patients.

Before they are fully mature, the pods can be picked for their soft seeds. The seeds can be boiled and eaten like fresh peas, or fried to taste more like peanuts. Seeds can also be pressed for oil that can be used for cooking, medicinal ointments, lamp fuel, or even as an ingredient in soap. The thick, soft roots are another important food resource, and are usually used to make a condiment similar to horseradish. Boiling roots and shoot tips is common because of their high-protein content.

Although the moringa tree is best known for its seemingly endless supply of food, one of the most innovative uses of the plant has been to treat water and waste water. Researchers at Leicester University in the United Kingdom have found that mixing crushed moringa seeds with polluted water helps settle silt and other contaminants. This is highly cost-effective because the seeds can substitute for the expensive imported materials usually used for water purification in rural areas. The seed-filtered water still requires a final filtration round to be completely drinkable, but the seeds make the process easier and help other water filters last longer.

Moringa trees are used in both agroforestry and mixed cropping approaches because the tree’s shade can protect other crops from the sun. Meanwhile, the soft, spongy moringa wood burns cleanly with little smoke or smell, making it a healthier source of fuel than many other tree species.

Pigeonpea

A Little Crop That's Come a Long Way

The pigeonpea has recently begun to provoke groundbreaking research. This is because its versatility, productivity, and high nutritional value suggest the plant's high potential to boost food security for millions of Africans and Asians.

This small legume is grown by subsistence farmers in warm semi-arid and sub-humid tropics, often in poor soils with little-to-no chemical inputs thanks to the pea's hardiness and drought-tolerance. Historians believe that the pigeonpea originated in India and then traveled to East Africa and up the Nile Valley to West Africa. Today, the food is a dietary staple in India, southern and eastern Africa, and Central America.

The pigeonpea can help improve food security because it requires minimal water or inputs and can cope with poor soil and little water. Yet it still produces yields of grain that contain more than 20 percent protein, which is especially important for countries facing hunger and malnutrition.

In addition to its nutritious and hardy qualities, the pigeonpea is a nitrogen-fixing legume, which gives it great potential to improve soil quality and—when grown in combination with other pasture plants—to create a highly fertile, productive, and sustainable livestock feeding system. The leaves, flowers, seed pods, and peas all provide a nutritious animal fodder, while also attracting bees that help the plant to self-propagate.

When planted around young fruit trees, the pigeonpea provides shelter without overshading, and the trimmings can be used as mulch, with the nitrogen from the root nodules nourishing the trees. The plant is used extensively as a cover crop, to create a hedge or windbreak, or as green manure in many sustainable farming systems and home gardens in the tropics and subtropics because of its ability to grow in warm temperatures.

This protein-packed little legume, if cultivated more broadly and in collaboration with other plants, has the potential to prevent hunger and improve not only farmer's abilities to feed their families, but also farmer incomes. The International Crops Research Institute (ICRISAT) claims that if there were only one legume that assured food security in the semi-arid tropics, it would be pigeonpea.

Potato

Potato, *Potahito*

No matter how you say it, there's no denying that the African "potato" is an impressive crop. Unlike other non-native roots and tubers grown in many parts of the continent—such as cassava or sweet potatoes—African potatoes are high in protein and resilient to many pests and diseases. They also are easy to raise and even easier to cook.

Despite their name, these "potatoes" are not actually related to the common potato, or even to other potato relatives like sweet potato, yam, or cassava. They are members of the mint family, which includes herbs such as lavender, rosemary, sage, thyme, oregano, and basil. African potatoes are similar to their family brethren in that they grow fragrant leaves above ground that can be used for cooking, but they differ because of their large, edible roots beneath the soil.

These native potatoes grow throughout Africa but are often divided into two varieties based on where on the continent they grow. The northern variety (*S. rotundifolius*) is often referred to as the hausa potato, Zulu potato, fabourama, or frafra potato, and produces small, oval-shaped roots. The southern variety (*P. esculentus*) is known as the Livingstone potato or Madagascar potato, and produces long, fingerlike roots. Across their diverse growing environments, both varieties can produce large amounts of food from a very small land area.

Both the northern and southern varieties of the potato are extremely versatile. They can be boiled, roasted, baked, or fried to replace common potatoes in everyday recipes. The Hausa potato can be ground into flour used in porridges, and the Livingstone potato is easily dried and stored for later use.

In addition to their versatility, the two potatoes varieties provide twice the protein offered by common potatoes and are an excellent source of calcium, vitamin A, and iron. Compared to common potatoes and most cereal grains, African potatoes are one of the most nutritionally complete staple crops available. In areas where a shortage of vitamin-rich vegetables leads to endemic malnutrition, native potatoes could be a helpful, hearty solution.

Safou

The “Butterfruit”

Native to the humid, tropical forests of West and Central Africa, safou (*Dacryodes edulis*) is known as the “butterfruit” for its rich and oily pulp. But safou is more than just creamy and delicious. It is quickly becoming an important cash crop for small farmers in Africa and has proven useful in both agroforestry systems and preventing hunger.

People in West and Central Africa have been eating safou for centuries, either as a fresh fruit between meals or cooked as a main course. When roasted or boiled quickly in salted water, the pulp separates from the skin and seed and takes on a buttery texture. In Nigeria, cooked pulp is combined with starchy foods such as maize to make a main course. If cooked for even longer, a healthy oil, made primarily of unsaturated fats, can be extracted from the pulp and seed.

Like its namesake, safou is high in fats and is very calorie-dense. But unlike butter, safou is also high in amino acids, the chemical building-blocks of proteins. Concentrations of some of the safou’s essential amino acids, such as lysine and leucine, are comparable to those found in eggs and meat. The fruit is also high in micronutrients and minerals, particularly potassium, calcium, and magnesium, making safou a “superfood” with the potential to help alleviate hunger and malnutrition.

Aside from producing nutritious fruits, safou trees yield a variety of other products. The wood is stiff and elastic, making it useful for tool handles. The bark produces a resin that makes both glue for mending pottery and a topical treatment for jiggers, a parasitic flea that embeds itself in the skin. And safou leaves and roots are found in a variety of traditional medicines used to treat everything from dysentery to joint pain.

Given their many uses, safou trees are highly coveted in West and Central Africa. Farmers and smallholders go to great lengths to cultivate wild seedlings and to protect them from being removed. Despite its popularity, safou is not widely domesticated or commercially produced. But over the past decade, researchers and nonprofit groups have realized the tree’s usefulness and begun endorsing it as a viable new crop.

The World Agroforestry Center has been promoting the safou as a key tree species in agroforestry systems, where it can be intercropped with food crops to provide shade and biomass while also producing edible fruit. The U.K.-based International Centre for Underutilised Crops has been searching for safou varieties that combine high-quality taste, nutrition, and disease-resistance.

The recent interest in safou has led to a proliferation of safou plantations in Africa as well as serious efforts to domesticate and breed varieties for commercial use. Fruits are sold at local markets, and the oil is extracted for use in both cooking and natural cosmetics. Safou has even gained popularity in European markets, where immigrant communities import the fruit in large quantities.

High in calories and nutrients, safou is a food that could prove useful in reducing hunger and malnutrition, and the tree’s many other uses make it a practical option for small farmers in Africa.

Sorghum

Rise to Prominence

Sorghum is Africa's contribution to the world's major food crops; only rice, wheat, maize, and potatoes play a larger role. Collectively, these five crops provide more than 85 percent of all human energy.

Sorghum was eaten in Egypt some 4,000 years ago, and today it is Africa's second most important cereal. Ethiopia is the center of the crop's diversity, and sorghum is still an important staple food for most of the Horn of Africa. It has long been a staple in South Asia as well, brought by traders as many as 20 centuries ago.

Sorghum is an extremely versatile crop. It can be cooked like rice, made into porridge, malted for beer, baked into flatbreads, and popped like popcorn. The sorghum plant is often used as hay, and the stems are used for buildings, fences, and firewood. The seeds are commonly used as livestock feed. The sorghum kernel is about 70 percent carbohydrate and 12 percent protein—very much like wheat and maize—but the grain has more vitamin B than maize.

Sorghum is drought resistant, can withstand water-logging from heavy rain, and can grow in both temperate and tropical zones. It is an important mainstay in sub-Saharan Africa's most food-insecure communities. Sorghum thrives in many marginal and difficult croplands and can produce up to three harvests a year.

Long established in Asia and Africa, sorghum has now become important in Latin America as well. The crop has gained prominence in Mexico over the past half-century, in part because it requires less water than maize and wheat. Mexico has large areas of dry farmland, and between 1958 and 1980 the country's sorghum acreage grew more than 1,000 percent. Sorghum is used mainly as an animal feed in Mexico and now supplies 74 percent of domestic feed stocks.

Africa produces some 20 million tons of sorghum per year, a third of the world total. The crop's production in Africa has increased steadily—by about 55 percent—during the last 25 years. But for all of its prominence, sorghum is not heavily supported by policymakers and scientific research. It is still largely a subsistence crop, and there has not been extensive research to develop improved varieties.

But this could change as demand for sorghum increases. The grain is becoming an increasingly popular ingredient for beer, instant porridge, vegetable oil, adhesives, waxes, and dyes. In 2009, Ethiopian agronomist Gebisa Ejeta won the World Food Prize for his hybrid varieties of sorghum, which are more drought resistant and hold up well against striga, a parasitic weed that attaches itself to the roots of cereal crops and deprives them of necessary nutrients. Dr. Ejeta's hybrids have dramatically increased production of sorghum and made it a more viable food crop for millions of people in sub-Saharan Africa.

Teff

A Grain with Many Reasons to Grow

Indigenous to the dry plateaus of northeastern Africa, teff is a grain that is also cultivated deep in America's breadbasket and in the valleys of Australia's Murray-Darling basin. Its name is thought to come from the Amharic word *teffa*, meaning "lost," because the grains of the plant are very small and are often dropped by farmers. Also known as "lovegrass" and "mil éthiopien," teff originated in what is today Ethiopia and Eritrea, where it has been grown for centuries and continues to play a central role in the regional cuisine.

Ethiopian farmers plant nearly 1.4 million hectares of teff annually, and the crop accounts for about a quarter of the country's total cereal production. Teff grows very well under difficult conditions such as unpredictable rainfall and is usually left alone by pests and disease, making it a promising export crop to areas facing food security. The U.S. National Research Council, in its publication *Lost Crops of Africa*, noted that teff has the "potential to improve nutrition, boost food security, foster rural development, and support sustainable landcare."

Teff is rich in nutrients, providing all eight essential amino acids, and is a great source of carbohydrates and fiber. It is also high in the nutritionally important minerals calcium, phosphorus, magnesium, aluminum, iron, copper, zinc, boron, barium, and thiamin. In Ethiopia, teff is commonly consumed as a homemade fermented beverage, as a gruel called *muk*, and as a sweet and dry unleavened bread called *kita*. It is also made into flour and cooked into *injera*, a flat, spongy, slightly sour bread that is consumed with most meals.

Teff is not just good for eating, it is also a common construction material, with the straw being used to reinforce houses built from mud and plaster. It also is given to livestock as fodder, and farmers in Eritrea and Ethiopia say that cattle prefer it to other types of animal feed.

Today, teff is in vogue around the world, particularly among "foodies" and people with gluten allergies, making it more popular than ever. With its high nutrient content and adaptability to different growing conditions, there is good reason for farmers everywhere to grow this multi-use grain crop.