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Shea Nut: The Butter Tree

Gene Fifer

The arid region directly south of the Sahara Desert (the Sahel), which stretches from Senegal to Ethiopia, has limited sources of fats and oils. Dairy products from cows and sheep are scarce and traditional oilseed crops are few. This is problematic for human health since fats and oils contain lipids essential for vitamin absorption and are a high-calorie energy source.

The shea nut tree (*Vitellaria paradoxa*) is a widely distributed and traditional source of vegetable fat in the Sahel for the Bambara, Dyula, Fulani, Hausa, and Wolof peoples. Some of its common names suggest its dietary importance: bambouk butter tree, galam butter tree, and arbre à beurre. Other common names in many different languages include karité, cárei, carité, lulu, sirreh, se, berekunan, tamba, taanga, and kareje. Fruity pulp and butter from shea nut trees are important food sources during the 'hunger months' of the early rainy season, before annual crops are harvested. However, even though the shea nut tree is widespread and traditionally used, it is underutilized because of the high amounts of labor, fuel, and water that are required to process it. The grueling and resource-intensive butter-making process can be streamlined by modern, low-tech methods that could expand its use as a hedge against food insecurity.

Figure 1. Shea nut fruits. *Source: TREEAID, Creative Commons Licence*

Growth, Form, and Use

For centuries, farmers in the Sahel have preserved shea nut trees when clearing cropland. In addition to valuable edible fat, the trees provide edible flowers and bee forage, and parts of the tree can be used medicinally. Farmers also appreciate shea nut trees for their termite-resistant wood and for their ability to survive severe droughts and brush fires (due to a long taproot and to thick bark, respectively). Shea trees provide shade for livestock and act as a windscreen to reduce erosion and crop damage. For all these reasons, preserving shea trees is a logical survival strategy, especially during periods of extreme climate variability.

Shea nut trees provide all these services with little input from farmers. The trees reproduce naturally (by seed) and grow slowly but steadily, reaching a height of up to 20 m and a trunk diameter up to one m. The leaves are tough and clustered at the ends of branches. Shea nut trees are deciduous, but new leaves emerge when the old ones fall. The bark is dark, thick, and deeply cracked into squares. These trees grow in areas with annual rainfall between 400 and 1,800 mm, but can survive multi-year droughts as well as the usual 6 to 8 month annual dry season. Shea nut trees grow up to 1,200 m above sea level in areas with a minimum temperature of 18°C and a high of 45°C (NRC 2006).

Figure 2. Shea nuts. *Source: Bioversity International, Creative Commons Attribution License*

A shea nut tree will start producing fruit after 15 to 20 years, will reach full production at 40 to 50 years, and can live as long as 400 years (NRC 2006). Flowers bloom during the dry season; they provide nectar for honey bees and can be harvested, fried and eaten. Fertilized flowers mature into fruits with green skin and pulp that is sweet and high in vitamins (Figure 1). During the rainy season, ripe fruits fall to the ground and are easily harvested. The inner seed or nut has a smooth, thin, brown outer covering that protects the nutritious kernel (Figure 2).

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A single tree typically produces 15 to 20 kg of fruit; together, the nuts inside those fruits weigh around 3 to 4 kg and contain 1.5 to 2 kg of fat (NRC 2006).

The nutmeats can be eaten fresh or roasted like almonds. They can also be processed to remove the butter, although traditional butter extraction methods (detailed below) only render about half the available fat. Shea butter is rich in Vitamins D, E, and K, and is a good source of calcium and potassium (Maranz *et al.* 2004). Shea butter's mono-unsaturated fatty acid profile is similar to olive and canola oils, and is separated from the saturated fats for many confections. When unseparated, the saturated fat content keeps it solid at room temperature. Shea butter has a long shelf life and is commonly used in villages for frying, baking, and in sauces.

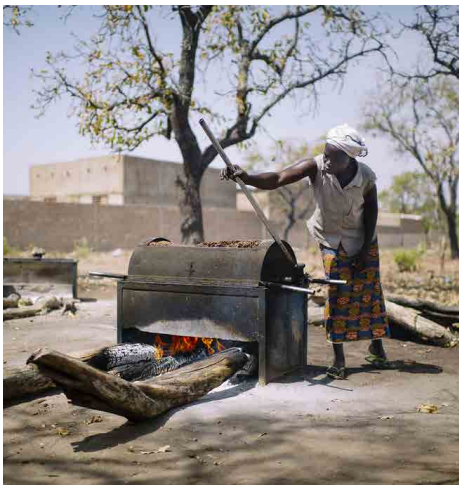

Figure 3. Roasting shea nuts. *Source: CIFOR, Creative Commons Attribution License*

Butter Processing

Extracting the edible oil from shea nuts is a long and arduous process. First, fruits are collected from under the trees. The flesh is either eaten or removed by fermentation. The nuts are cleaned, then boiled long enough to prevent germination. They are then roasted (Figure 3) or dried in the sun for 5 to 10 days. At this stage, dried seeds can be sold or stored for later processing. Most exported shea is sold in dried nut form, and the oil is extracted industrially. Selling at this point makes sense for small-scale farmers, because it is during a busy time of the agriculture cycle when labor is at a premium. It is also a time when stored foodstuffs are dwindling, and most households must purchase food at local markets.

Figure 4. Cracking shea nuts. *Source: TREEAID, Creative Commons Attribution License*

Seeds kept for processing into butter at the village level are cracked (Figure 4), and the shells are removed by hand. The kernels are then sun-dried again. After drying, the kernels are ground into a paste with mortar and pestle. The paste is boiled in water (Figure 5) and churned to separate out the oils and fats (Figure 6), which float to the surface and are skimmed off the top. This step is repeated up to three more times to further clean and refine the butter; the purer the butter, the higher the price for which it can be sold. These last steps require a lot of firewood and water, which mean major investments of time and energy. The return on investment is meager, which results in a conundrum when it comes to development initiatives; income for rural households must be balanced against increased labor burdens on already overtaxed women, and against potential deforestation and land degradation from fuel demands.

Figure 5. Boiling shea nut meat. *Source: CIFOR, Creative Commons Attribution License*

Figure 6. Rinsing and separating shea butter. *Source: CIFOR, Creative Commons Attribution License*

Export Crop

For over a century, shea butter has been exported to Europe and used as an ingredient in chocolate and as a substitute for cocoa butter. Both shea and cocoa butters are added to candies for texture and as stabilizers. However, shea butter's current popularity and recognition is due to its moisturizing qualities and its use in high-quality cosmetics and in hair and skin care products. These uses make shea butter one of the few cash crops sold from the Sahel region. The processing of shea nuts into butter is traditionally done by women, and shea butter provides the main source of income for many of them.

The demand for high-quality shea butter by the cosmetics and body product industries has led to relatively high commodity prices. The high prices are spurring international development agencies and fair trade organizations to work with rural women in creating poverty alleviation initiatives based on this ancient cottage industry. The Sahel region is in dire need of sustainable livelihoods and diversified incomes, and it makes sense to base livelihood strategies on a common and valued plant that has a long history of sustainable use. But as with all development projects, unintended consequences and potential pitfalls can result. Land degradation from fuelwood harvesting and overuse of scarce water resources will be discussed below.

Collaboration and Alternative Technologies Across the Value Chain

To make a viable income from shea butter, rural producers must add value and receive the highest possible price for their product. This requires low-cost mechanization of oil extraction and filtering. It also requires cutting out the middlemen (local nut buyers and transporters), and instead negotiating direct, fair-trade sales to

high-end industries. One reason Sahelian women get so little money from shea nut sales is that they usually all sell at the same time and have no negotiating power with wholesalers.

Figure 7. Hydraulic oil press; pictured is Daniel Kanter. *Source: Erik Hersman, Creative Commons Attribution License*

Innovative development programs organize producer cooperatives that can market nuts directly to overseas cosmetics companies. These arrangements often include prepayment or credit, so that income is available when it is most needed. Some of the income can be used to invest in shared processing equipment.

Much can be done to reduce the labor involved in processing shea nuts, and to improve the end product. Solar drying cabinets dry nuts more dependably and more quickly than simply laying them out in the sun. Presses that use a turned screw, lever action, or hydraulic jack can extract the fats and oil from nuts more efficiently than boiling (Figure 7), saving time and eliminating the need to gather firewood and water. Mechanical screens and filters can clean the heated oil quicker than repeated rinsing (Figure 8), which also conserves water. The extracted fat can then be cooled in molds to the specifications of the buyer (Figure 9). Producers' cooperatives, building on traditions of group work projects, can increase quality control, dependability, and market empowerment.

Figure 8. Filtering shea oil. *Source: CIFOR, Creative Commons Attribution License*

Figure 9. Shea and neem soap. *Source: TREEAID, Creative Commons Attribution License*

In order to maintain or increase shea exports, vulnerable women's groups must be protected from fluctuations in international commodity prices. Market volatility has had disastrous consequences in coffee, cacao, and palm oil markets, and primary producers have suffered the most. One strategy to control price fluctuations was attempted in Burkina Faso; a state marketing board called the Agricultural Commodity Price Stabilization Board (CSPPA) guaranteed a base price for nuts. The CSPPA was closed in 1994, but a regional market board might be viable at this point due to increased export demand and the African Union's efforts to establish regional trading blocks. Another way to improve incomes and investment opportunities is to increase value-added processes at the village level. To achieve resilience and sustainability, communities must reduce dependence on export crop incomes--so development initiatives should focus on diversifying crops and incomes.

Other Obstacles

Some problems faced in shea butter production are inherent in wild shea nut trees. First, the trees grow slowly. Second, shea nut trees are prone to "irregular bearing," which usually results in one large harvest and two reduced harvests in a three-year period. The third problem stems from shea nut flowers' low rate of pollination, which can be as low as ten percent. The fourth problem stems from four types of parasitic mistletoe (*Tapinanthus* spp.) that weaken, and sometimes kill, shea nut trees in much of their natural range (NRC 2006).

Shea nut trees have not been selectively bred for superior fruit size, oil content, regular bearing habit, flower viability, or pest resistance. Since the trees reproduce naturally, farmers end up with seedlings that have widely varying genetics and characteristics. Despite the profitability of shea butter, little has been done to create superior cultivars that could be vegetatively reproduced and actively managed. One of the few research efforts is by the Cocoa Research Institute of Ghana, which is motivated to maintain reliable sources of cocoa butter substitutes. Basic management to control mistletoe infestation may become necessary to maintain shea butter production at present levels. This requires climbing tall trees and cutting infected branches, which is quite dangerous. Increasing production, whether for food security or export income, will require more intensive management and more efficient processing.

When it comes to increasing commercial production of shea nut trees, several other potential obstacles exist. One is women's frequent lack of land tenure and access rights to trees. Another is the possibility of village conflict over an increasingly valuable resource (Elias and Carney 2005). Finally, planting more shea nut trees carries with it an opportunity cost. The trees could compete for space with sorghum, millet, and sesame crops; shea trees reduce grain yields by an average of 50 to 70 percent in their immediate vicinity due to competition for light and nutrients, in contrast to some nitrogen-fixing tree species that improve yields when grown as companion plants (Kessler 1992).

Conclusion

The Sahel is experiencing increased risk of famine, water shortages, and environmental deterioration due to land clearing and poor agriculture practices. At the same time, we have seen global trends for high-quality natural products, fair trade networks, and NGO support for equitable economic development for women. Combined, these realities suggest that

initiatives to promote shea will accelerate (Elias and Carney 2005). If done well and carefully, promotion of shea nut trees could be a winning strategy for poverty reduction, food security, and landscape restoration. Expanding shea butter production could be a crucial piece of the puzzle in promoting stability and security in a land of scarcity.

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(This article describes two villages in Northern Ghana that have taken different paths to economic development.)

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For How Long Should Chaya Leaves be Boiled?

by Danielle Hepler, Abigail Hing, Sharon Kauffman, Tjia-Ern Lau, Mallory Ziegler, Richard Schaeffer, and Kathryn Witt, Messiah College Departments of Chemistry and Biochemistry and Health, Nutrition, and Exercise Science

Introduction

Chaya (*Cnidoscolus aconitifolius*) or tree spinach is a nutritious, fast growing perennial shrub (*TN* 53). It is one of many food plants that contain cyanogens, chemical compounds that can produce toxic hydrogen cyanide (HCN) when the food is consumed (Table 1). Hydrogen cyanide is produced when the plant cells are damaged, because an enzyme located in one part of the cell is then able to act on the cyanogen, which is kept in a different part of the cell. Microorganisms living in the intestines of animals also contain small amounts of enzymes which release HCN from cyanogens (Teles 2002).

The provisional guideline for the maximum daily long-term intake of HCN is 0.02 mg HCN equivalents/kg body weight (FAO/WHO Expert Committee on Food Additives 2012). This corresponds to a daily intake of about 1.4 mg/day HCN equivalents for a 70 kg adult or 0.24 mg/day for a 12 kg child. Food processing techniques such as grinding, drying, fermenting, and cooking release HCN into the air or cooking water, reducing the amount of HCN in the plant that is consumed (Teles 2002). Surprisingly, freezing chaya has been shown to increase the amount of HCN produced (Kuti and Konoru 2006). Although raw chaya leaves produce much less HCN than cassava, consuming raw chaya could pose a risk, especially for young children. The risk is also greater for people lacking protein [in particular, the sulfur-containing amino acids methionine and cystine, found in eggs, fish, chicken, beef and pork] because they are less able to detoxify HCN (Teles 2002).

Table 1: Cyanogen content of food plants

Plant	Approximate volume of 100 grams (raw)	Approximate cyanogen content (mg HCN/100 grams raw)
cassava - root	120 mL[e]	1.5-100[a]
flax seed - meal	110 mL[e]	36-39[a]
giant taro - leaves	860 mL[e]	2.9-3.2[a]
bamboo – young shoots	160 mL[e]	10 - 800[a]
bitter Almond - kernels	210 mL[e]	470[a]
chaya - leaves	1200 mL	0.08-1.48[bc]; 27-42[d]

[a]FAO/WHO Expert Committee on Food Additives 2012; [b]Kuti and Konoru 2006; [c]Jaramillo *et al.* 2016; [d]Ross-Ibarra and Molina-Cruz 2002; [e]USDA 2015

A very rough estimate of the HCN content of a food can be obtained by sealing food in an air-tight plastic bag with Cyantesmo paper (*EDN* 130). ECHO staff used this method to determine that boiling 80 grams of chaya leaves and stems for 20 minutes reduces their HCN content to levels too low to be detected by the Cyantesmo paper. Our aim was to use a more precise method to determine the extent to which shorter boiling times would reduce the HCN content of chaya leaves below the maximum daily long-term intake level of 0.02 mg HCN equivalents per kg body weight. Shorter boiling times require less fuel and may better maintain the nutrient levels of the plant.

Methodology

We obtained Cyantesmo paper from CTL Scientific and attached strips of the paper to rubber stoppers so the paper would hang just above the solution we wanted to measure. We created a standard color scale using glass flasks, to which we added potassium cyanide solutions that would release (respectively) 0.10, 0.25, 0.30, or 1.0 parts per million (ppm) HCN. We also added a drop of 18 molar sulfuric acid, as recommended in the Cyantesmo paper directions. We sealed the flasks with the rubber stoppers, and noted the color of the paper in each flask after 24 hours (Figure 10).

Chaya leaves were harvested at ECHO Florida during the months of February and March. They were shipped overnight to Pennsylvania and refrigerated for 2 days until the analysis could be completed. The leaves were chopped into 1.5 cm pieces and the volume of 10 grams of leaves (raw and cooked) was placed into each flask. Raw

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Figure 10. Color of Cyantesmo paper corresponding to 0.25 ppm cyanide. *Source: Danielle Hepler*

leaves were placed in glass flasks with 75 mL distilled water. The leaves to be cooked were placed into boiling distilled water and boiled for 5.0, 6.5, 7.0, 8.5 and 10 minutes. The cooking water was discarded and fresh distilled water was added. The leaves were mashed, a drop of 18 molar sulfuric acid was added, and the flasks were stoppered. The color change was evaluated after 24 hours (Figure 11) by comparing the Cyantesmo paper from each flask of leaves to the color scale obtained from the potassium cyanide solutions. All measurements were repeated at least 3 times. Safety measures for this method included use of disposable gloves, goggles, and a ventilated hood.

Figure 11. Raw chaya leaves turned the Cyantesmo paper dark blue, indicating ≥ 1 ppm cyanide. *Source: Danielle Hepler*

Results

Ten grams of chopped raw leaves had a volume of 120 mL, while ten grams of chopped, cooked leaves had a volume of 60 mL. As expected, all of the raw leaf samples had a color change indicating a HCN content of >1 part per million (> 0.02 mg HCN per 240 mL serving of chopped, uncooked leaves). After 5 minutes of boiling, the color corresponded to a HCN concentration of about 0.10 to 0.25 ppm (0.004 to 0.01 mg HCN per 240 mL serving of chopped, boiled leaves). From 7 minutes on, the color corresponded to an HCN concentration of <0.10 ppm. The blue color for the 0.1 ppm standard and for the boiled leaves varied from flask to flask. This variability probably occurred because the amount of HCN was near or under the lowest amount of HCN the Cyantesmo paper can detect (0.2 mg/L). The air leaving the flask while cooking and the cooking water also turned Cyantesmo paper light blue, but the color was not compared to the standard color scale.

Conclusion

Although the Cyantesmo paper method does not precisely measure the amount of HCN likely to be produced from a food, our results suggest that 5 to 10 minutes is sufficient to reduce the HCN to levels safe for consumption. Other reports show a slightly wider but similar range of 5 minutes (Gonzalez-Laredeo *et al.* 2003) to 15 minutes (Ross-Ibarra and Molina-Cruz 2002) of boiling time. Boiling for only 5 minutes would save on fuel, but extending the boiling time a little longer would provide a margin of safety, which seems prudent considering the wide variation in the amount of HCN in chaya (Table 1).

Findings of our study support the possibility of HCN being present after boiling, but at concentrations below those considered unsafe. It is possible that the chaya leaves we analyzed lost HCN while they were shipped and stored, or that our method did not measure all of the HCN present in the chaya leaves. That said, our findings suggest that the boiling time to reduce HCN to safe levels is less than the 15-20 minutes reported in *EDN* 130 for eliminating color change of the Cyantesmo paper.

Several questions remain.

1. Do HCN levels differ if the chaya leaves are in the water while it is brought to the boiling point?
2. How much HCN does the cooking water contain?
3. Does storage, chopping, baking, or frying change the HCN level of chaya leaves?
4. Does cooking chaya in an aluminum pot have adverse health effects? [We at ECHO have heard mention of this, but have not come across well-researched evidence.]
5. What factors explain the wide range in reported HCN values for chaya? To what extent are HCN values influenced by method of analysis, cultivar, young versus older leaves, and/or varying environmental factors?

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Green Leafy Vegetables: Leaf Powder for Improved Nutrition

by Dawn Berkelaar

Green leafy vegetables are an important source of vitamins and minerals. In areas where eating leaves is not part of the culture, leaf powder can be an important addition to the diet. We have written in the past about the positive difference that leaf powder can make in terms of nutrition. Here we share again the importance of leafy greens and of leaf powder, especially since many in our network may not have read early issues of *EDN*.

Last year's EIAC included a workshop led by Andrea Suarez, a Food Science student at Universidad Nacional de Agricultura (UNA, National Agriculture University) of Honduras. In her workshop, titled "Fortifying local foods with leaf powder to combat child micro-nutrient deficiencies," Suarez told participants about leaf powder, showed the steps used to dry and powder leaves, and prepared a green smoothie for participants to sample. She also shared some helpful tips for preparing and using leaf powder:

Figure 12. Andrea Suarez, Kathy Bryson, and Cecilia Gonzalez (left to right) during a 2017 ECHO International conference workshop. *Source: Andrea Suarez*

- Harvest leaves before a plant flowers, for highest nutrition.
- Before drying leaves, clean them by submerging them in clean, cooled water for about five minutes.
- Boil chaya leaves for 25 minutes before drying them, to remove the cyanogenic glycosides. [The same would be true of cassava leaves.]
- Smoothies are a good way to consume leaf powder. Bananas are a helpful addition to smoothies, both to add sweetness and to help keep leaf powder suspended.
- In recipes (e.g. for tortillas), up to 20% of flour can be replaced with leaf powder. This will maximize both nutrition and palatability.

Read more about Andrea Suarez's involvement in projects to address malnutrition in Honduras in Issue 4 of Latin America and Caribbean Notes (LACN).

Documents about Green Leafy Vegetables from Leaf for Life:

At her workshop, Suarez passed around several books written by David Kennedy from Leaf for Life. These helpful resources are available for free online:

21st Century Greens: Leaf Vegetables in Nutrition and Sustainable Agriculture From the preface: "The premise of this book...is that everyone's health can benefit significantly from eating a serving of greens once a day instead of once a week. It's notoriously difficult to change your eating habits. This book offers practical help for making this change. You will find out how to eliminate tough textures and unlock the nutrients in leaf vegetables….You will discover some simple secrets to get vegetable avoiders, including children, to start happily eating greens. You will learn the best ways to preserve greens at the peak of their freshness for use the whole year. You will be introduced to some impressive new leaf crops from all over the world and to some new aspects of crops that are already familiar. You will be able to start producing an abundance of nutritious greens for your family, no matter where you live. What's more, you will learn ways to integrate edible greens into your homes and gardens in ways that are ecologically sound."

Leaf for Life Handbook: How to Combat Malnutrition and Improve Food Security with Green Leaf Crops (available in English, French and Spanish). From the Introduction: "This book is written mainly for people who work with low-income communities: agricultural extension workers, health care workers, teachers, development groups, students of agriculture and public health, farmers, and gardeners. The language is generally simple so that it can be easily understood and easily translated. Drawings help to describe the suggested techniques. This book is a practical companion to *21st Century Greens: Leaf Vegetables in Nutrition and Sustainable Agriculture*."

Drying Green Leaves in the Sun From a review in *EDN* 73: "*Drying Green Leaves in the Sun* contains information about characteristics of the best leaves, the best plant families for leaves, and other leaf crops. The booklet also has information about how to grow leaves, basics of food drying, making a solar leaf dryer, how to dry leaves and how to use dried leaves. For example, if you are going to store leaf powder for a long time, you can blanch leaves for three minutes in steam or in a microwave oven before drying to improve flavor and to reduce the risk of spoilage."

Specifics about Choosing Green Leaves

We at ECHO are sometimes asked which leafy greens work well for drying into powder. Here are some tips to consider about leafy greens in general. Look for dark green leaves; generally, the darker green the leaves are, the more nutrients they will contain. Plant perennials like moringa and katuk, which can provide leaves for years after planting. Eat a variety of green leaves. Avoid leaves that are known to be poisonous/toxic, including tomato and rhubarb leaves. Leaf for Life has a list of 16 top-recommended leaf crops here and a list of 50 "honorable mentions" here. The *Leaf for Life Handbook* has a chapter listing nutritious leaf crops; so does *21st Century Greens* (starting on page 151). The Leaf for Life website lists some helpful tips for finding edible leaves: do not eat leaves from the side of the road [or from a location where plants may have been sprayed with chemicals]; avoid leaves with white milky sap, which might contain toxic alkaloids; and introduce leaves one at a time, in small quantities.

When it comes to leaf powder, the *Leaf for Life Handbook* suggests the following criteria:

1. **Leaves that are edible in large amounts**. Some leaves are safe to eat in small amounts but may not be safe to eat in large amounts. This is true of katuk. It is also true of *Leucaena leucocephala* leaves, which contain mimosine.
2. **Leaves with good flavor and texture**. Avoid leaves that have a very bitter taste. Also avoid leaves that are very dry and fibrous; according to Leaf for Life, "many leaves from trees have this limitation, as do the leaves from annual plants after they have flowered."

3. **Highly nutritious leaves.** As mentioned, darker green leaves generally have more nutrients.
4. **Leaves that grow wild or that are easy to grow**. Many common wild plants and weeds don't require planting or care. Examples include nettles and lambsquarters. Perennials like moringa are easy to grow.
5. **Leaves that are easy to harvest**. Leaves growing high in trees or on thorny plants will be difficult to harvest. Plants very near the ground may be difficult to clean. Some plants, like moringa, can be pruned to a height that makes the leaves easy to harvest.
6. **Leaves that are easy to dry**. Leaves that contain a lot of water will dry slowly and produce less dried leaf powder than leaves containing less water. Moringa leaves contain a relatively high amount of dry matter and are easy to dry. Leaf shape also impacts drying time; "leaves that are curly, like parsley, will allow air to pass through easily and as a result dry faster than leaves that lie nearly flat, such as Swiss chard."
7. **Leaves that are free of contaminants**. Do not eat green leaves from plants grown where trash is dumped or burned, where there is sewage nearby, or where the soil contains paint scraped from buildings.

Other Helpful Resources about Green Leafy Vegetables (with brief excerpts from the articles):

Dark Green Leafy Vegetables of the Mustard Family by Grace Ju (from *EDN* 87). This article focuses on leaves of plants in the mustard family, including collards, kale, pak choi, mustard greens, turnip greens, and Ethiopian kale. "Dark green leafy vegetables [DGLV] are good sources of vitamin A, vitamin C, riboflavin, folic acid, carotenes, iron, calcium, magnesium and potassium. DGLV are sources of trace minerals that take part in key enzymatic reactions in our body. They also are great sources of fiber. As a rule of thumb, the darker the leaves, the higher the nutrients."

Indigenous Leafy Vegetables (from *EDN* 103). "In recent years...organizations such as the Asian Vegetable Research and Development Center (AVRDC) [and] Bioversity International...have been influential in promoting [indigenous leafy vegetables (ILVs)]. Consequently, there may well be growing interest in and new opportunities to market ILVs. Resource-poor farmers can easily grow ILVs, as these plants are well-suited to local conditions and thrive with minimal inputs (e.g. water and fertilizer). Moreover, ILVs are important sources of vitamins A and C, iron and other nutrients. They are readily incorporated as supplements to carbohydrate-based staples."

A Second Look at Green Leafy Vegetables as a Source of Vitamins and Minerals by Laura Meitzner Yoder (from *EDN* 62). "I made a survey of recent research reports on nutrition and leaf vegetables, and encountered some surprises. Many studies show that the amount of several important substances in leaves, both nutritional and harmful ones, varies greatly even within the same species and variety of plant. The amount of these substances can vary depending on such factors as season of growth and harvest, stage of maturity when harvested, storage time and conditions, whether the plants are grown in sun or shade, amount of rain, soil fertility, etc.… What clearly is known is that the quality of leaves deteriorates very quickly after harvest. The reports can be summarized simply as follows: a variety of fresh greens should be eaten as soon after picking as possible, stored cool and moist or sealed in plastic bags, and cooked quickly for maximal retention of nutrients."

Baobab Gardens for Leaf Production (from *EDN* 103). "Baobab (*Adansonia digitata*) leaves are also a kind of indigenous leafy vegetable. They are a staple food in the Sahel of West Africa. Baobab leaves are nutritious (particularly high in vitamin A) and are eaten almost daily in sauces.… The World Agroforestry Center in Mali has experimented with and promoted baobab gardens. Tiny baobab plants produce tender leaves that can be harvested every two weeks.…Jonathan and Ali Nichols tried the technique of baobab gardens in Burkina Faso. They contacted the World Agroforestry Center to learn specifics."

Advantages of Perennial Vegetables (from *EDN* 107). "Perennial vegetables often have high nutritional value, high yields and provide food over an extended season. I am always struck by the enormous quantity of edible green leaves on a chaya bush, compared to the much smaller amount that can be harvested from an annual leafy vegetable like spinach or lettuce, which would take up the same space in the garden. I have seen chaya producing edible leaves in Haiti after four months without rain. An added benefit is that leaves of the perennial vegetables regrow soon after harvesting."

FROM ECHO'S SEED BANK

Jewels of Opar: An edible ornamental

by Gene Fifer

Rarely is an easy-to-grow and attractive ornamental also a tasty, edible leafy green, suitable for salads, sandwiches, soups, and stews. Jewels of Opar (*Talinum paniculatum*), also called fameflower, grows similarly to purslane. As such, it can reseed itself and grows easily, with little need for attention and without pest problems. Its light green leaves and small pink flowers brighten gardens and also make a good addition to container gardens.

Figure 13. Jewels of Opar plants in-field.
Source: Holly Sobetski

Leaves are eaten raw or cooked. They have a mild taste and are only slightly mucilaginous. The leaves remain tasty throughout the flowering and seed-producing phase; they do not turn bitter like many herbaceous salad greens do when the plant flowers. Nutritional composition is thought to be similar to that of a related plant called waterleaf (*Talinum triangulare*). Thus, Jewels of Opar is likely to be a good source of nutrients (Okon and James 2014 on *T. triangulare*). Consume uncooked leaves in modest amounts to minimize consumption of oxalic acid, an anti-nutrient that can cause kidney stones.

Jewels of Opar grows as a perennial in the tropics, and as an annual in the subtropics and warmer temperate regions. It flowers abundantly and seeds can be collected when they turn black and become dry. It reseeds readily from seeds that fall to the ground. Be aware of the potential for unwanted seedlings in deciding where to plant it. The plant does best in full sun but can tolerate partial shade. Frequent watering is necessary during early growth, but full-grown plants are drought tolerant. Jewels of Opar can withstand poor sandy soils and does well in containers. Development workers may request trial packets of seed from the ECHO Global Seed Bank. Enjoy!

Further reading:

Fern, K. 2018. Tropical Plants Database.

Arseniuk, Adam. 2016. "*Talinum triangulare* - Philippine Spinach, Waterleaf, Leaf Ginseng, Cariru." Herbs From Distant Lands.

Mosango, M. 2004. *Talinum paniculatum* (Jacq.) Gaertn. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands.

Okon, O.G. and U.S. James. 2014. Proximate and Mineral Composition of Some Traditional Vegetables in Akwa Ibom State, Nigeria. *International Journal of Scientific and Research Publications* 4(8).

Irena, 2015. "A Heat-Tolerant Leafy Green Vegetable Disguised as a Flower." Southern Exposure Seed Exchange.

BOOKS, WEB SITES AND OTHER RESOURCES

SPRING Nutrition-Sensitive Agriculture Training Resource Package: Two Perspectives

Kelly Wilson *spent time as an Agricultural Consultant in Guatemala, extending her ECHO internship with the Latin America/ Caribbean Regional Team and network partner Maya Health Alliance from January to July 2018. While there, she used a helpful resource called the SPRING Nutrition-Sensitive Agriculture Training Resource Package. Here she shares some information about the resource, and about nutrition and agriculture.*

According to "Strengthening Partnerships, Results, and Innovations in Nutrition Globally" (SPRING), a USAID funded project, "cross-sectoral capacity building is essential for developing the collaboration that effective nutrition-sensitive [agriculture] activities require." To help with this, SPRING developed the Nutrition-Sensitive Agriculture Training Resource Package (SPRING 2018b). These training materials help equip program leaders, managers, and decision makers to design, implement, and document nutrition-sensitive agriculture programs. The seven modules cover essential concepts for nutrition, agriculture, agriculture-to-nutrition pathways, behavior change concepts, and effective design. The training materials seek to create common ground for shared understanding between the fields of agriculture and nutrition.

Nutrition-oriented approaches to address malnutrition may be described as nutrition-specific or nutrition-sensitive. Nutrition-specific interventions target the immediate causes of malnutrition. Examples include micronutrient supplementation, child growth monitoring, support for breastfeeding, and treatment of severe malnutrition. By contrast, nutrition-sensitive interventions address the underlying causes of malnutrition, changing the environment that sustains it. Studies have shown that scaling up nutrition-specific interventions to cover 90 percent of the at-risk population would only address about 20 percent of chronic malnutrition, making nutrition-sensitive interventions necessary to address the remaining 80 percent (SPRING 2018a). Reducing chronic malnutrition worldwide requires integrated programming involving nutrition, agriculture, WASH (water, sanitation and hygiene), and women's empowerment (SPRING 2018a; Luna-González and Sørensen 2018).

An agricultural intervention—even a successful one—will not necessarily improve nutrition. To improve nutrition status, programming must intentionally include activities that are nutrition sensitive. One way to do this is to involve nutrition practitioners in the design and implementation of programs.

I experienced this firsthand as an ECHO agricultural consultant working with the Maya Health Alliance (MHA) nutrition team. As a public health organization that works with indigenous Mayan people in Guatemala, MHA has spent over a decade developing and refining a high-quality nutrition program. Now it is investigating adding a nutrition-sensitive home gardens component. A pilot project will demonstrate if this home gardens addition impacts child nutritional status. I worked on an integrated nutrition and agricultural team to design a nutrition-sensitive agriculture program, and was able to see the value of both perspectives and the necessity of the questions each one poses. Our nutritionists evaluated the proposed garden crops according to the daily nutritional requirements of growing babies, pregnant women, and lactating mothers, while our agronomist and I considered the local sources of organic matter that would keep the soil fertile and feed plants.

During the course of the home gardens program design, we implemented a Seasonal Calendar activity, drawing upon Session Five of the SPRING Training Resource Package (among other materials). The easy-to-use guides emphasize the effect that each categorical theme (such as seasons, celebrations, and food sufficiency) has on health and nutrition. The purpose of our activity was to learn about seasonal patterns of climate and crop cultivation from the women in the community where the pilot will be implemented. Having worked in the area for several years, MHA already had a good understanding of the health context, but had yet to investigate the agricultural context. Through this activity, we learned when frost would pose a problem; discovered an unanticipated month of no rain during the rainy season; and determined when crops are currently being produced. These insights were invaluable as we planned and implemented the home gardens program.

If you work on a cross-sectoral team, or hope to make your agricultural programs more nutrition sensitive, the SPRING Training Resource Package provides a common vocabulary and shared priorities that can help make your efforts more effective.

References:

Luna-González, D.V., and M. Sørensen. 2018. "Higher Agrobiodiversity Is Associated with Improved Dietary Diversity, but Not Child Anthropometric Status, of Mayan Achí People of Guatemala." *Public Health Nutrition* 21(11): 2128–41.

SPRING. 2018a. "Strengthening Agriculture-Nutrition Linkages: Why It Matters. Session Guide One of the Nutrition-Sensitive Agriculture Training Resource Package." Arlington, VA: Strengthening Partnerships, Results and Innovations in Nutrition Globally (SPRING) project.

———. 2018b. "Webinar May 24 | New Nutrition-Sensitive Agriculture Training Resources." Arlington, VA.

* * *

*Intern **Savannah Froese** also explored the SPRING Nutrition-Sensitive Agriculture Training Package when she was working on a seminar presentation about nutrition. She shared the following:*

The SPRING resource…was helpful for my seminar, although I ended up mainly just using graphics from the resource. I mostly referenced the second session: "Essential Nutrition Concepts for Nutrition-Sensitive Agriculture." The information was well organized and easy to understand. The handouts were especially helpful, at least for my purposes. There were also several suggested activities that I did not use but that seem to be relevant and culturally sensitive. Throughout the resources, there are "Lessons Learned" boxes that are notes from trainers around the world to help explain why the resource is written the way it is, incorporating feedback from trainings.

The SPRING website in general has many good resources. If I could recommend another link…it would be to their "Agriculture and Nutrition Resource Review" page. This is a list of recommended articles. Unfortunately it is organized by date reviewed and not by topic. However, I was very impressed with the quality of the research articles that I found on this page. I ended up referencing several of the articles in my seminar."

* * *

SPRING recently posted an update about the project, with links to some popular resources. Take a look! For example, this infographic illustrates five ways to improve nutrition through agriculture.

UPCOMING EVENTS

ECHO Florida Events:

Location: ECHO Global Farm, USA
Presented by: ECHO

ECHO's 25th Annual International Agriculture Conference
November 13 - 15, 2018

Dear ECHO network members,

Did you know that registration for our Florida Conference in International Agriculture is still open? Check your schedules and register before Nov. 9, 2018.

Remember, even if you can't make it this year, you'll still be able to watch the morning Plenary Speakers recorded on our website. Check back in mid-January to see the recordings.

Follow us on our facebook page (ECHO International) to watch live-streamed conference sessions.

We are asking for 1-2 minute cell-phone videos of network members sharing their journey in agriculture and community development. Everyone will watch these stories at our conference in November. You can upload your video here.

Tropical Agriculture Development I: The Basics
January 7 - 11, 2019

Tropical Agriculture Development 101
February 18 - 22, 2019

Gain practical experience! This introductory course will cover key topics and will allow our participants even more hands-on practical experience.

Agroforestry
July 22 - 26, 2019

Seed Saving & Banking
September 16 - 20, 2019

More information and registration details can be found on www.ECHOcommunity.org.

Latin America Events:

Upcoming Las Cañadas Events
Location: Veracruz, Mexico
Presented by: Las Cañadas

ECHO East Africa Event:

5th ECHO East Africa Symposium on Sustainable Agriculture and Appropriate Technologies
February 12 - 14, 2019

Location: Naura Springs Hotel, Arusha, Tanzania

ECHO West Africa Events:

Please contact Noemi Kara (knoemi@echonet.org) for information on trainings.

PLEASE NOTE: At ECHO we are always striving to be more effective. Do you have ideas that could help others, or have you experimented with an idea you read about in *EDN*? What did or did not work for you? Please let us know the results!