Shea Nut

Gene Fifer

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

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.

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 (https://www.nap.edu/catalog/11763/lost-crops-of-africa-volume-ii-vegetables)).

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

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

(https://www.nap.edu/catalog/11763/lost-crops-of-africa-volume-ii-vegetables)). 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). 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 (https://www.nap.edu/catalog/11763/lost-crops-of-africa-volume-ii-vegetables)).

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 (http://www.bioone.org/doi/abs/10.1663/0013-0001(2004)058%5B0588:NVAIPF%5D2.0.CO%3B2)*et al. (http://www.bioone.org/doi/abs/10.1663/0013-0001(2004)058%5B0588:NVAIPF%5D2.0.CO%3B2)* 2004 (http://www.bioone.org/doi/abs/10.1663/0013-0001(2004)058%5B0588:NVAIPF%5D2.0.CO%3B2)). 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.

Butter Processing

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

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.

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

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.

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

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 8. Filtering shea oil. *Source: CIFOR, 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.

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.

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

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 (https://www.nap.edu/catalog/11763/lost-crops-of-africa-volume-ii-vegetables)).

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 (https://zodml.org/sites/default/files/A_Companion_to_Feminist_Geography.pdf#page=113)). 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 (https://link.springer.com/article/10.1007%2FBF00053116)).

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 (https://zodml.org/sites/default/files/A_Companion_to_Feminist_Geography.pdf#page=113)). 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.

References

Elias, M., and J. Carney. 2005. "Shea Butter, Globalization, and Women of Burkina Faso (https://zodml.org/sites/default/files/A_Companion_to_Feminist_Geography.pdf#page=113)." In *A Companion to Feminist Geography*, edited by Lise Nelson and Joni Seager. Blackwell Publishing Ltd.

Kessler, J.J. 1992. "The Influence of Karité ((https://doi.org/10.1007/BF00053116)*Vitellaria paradoxa (https://doi.org/10.1007/BF00053116)*) and Néré ((https://doi.org/10.1007/BF00053116)*Parkia biglobosa (https://doi.org/10.1007/BF00053116)*) Trees on Sorghum Production in Burkina Faso (https://doi.org/10.1007/BF00053116)." *Agroforestry Systems* 17 (2). Kluwer Academic Publishers:97–118.

Maranz, S., W. Kpikpi, Z. Wiesman, A. De Saint Sauveur, and B. Chapagain. 2004. "Nutritional Values and Indigenous Preferences for Shea Fruits ((https://doi.org/10.1663/0013-0001(2004)058%5b0588:NVAIPF%5d2.0.CO;2)*Vitellaria paradoxa (https://doi.org/10.1663/0013-0001(2004)058%5b0588:NVAIPF%5d2.0.CO;2)* C.F. Gaertn. F.) in African Agroforestry Parklands (https://doi.org/10.1663/0013-0001(2004)058%5b0588:NVAIPF%5d2.0.CO;2)." *Economic Botany* 58(4):588–600.

NRC. 2006. "Shea (https://doi.org/10.17226/11763)." In *Lost Crops of Africa: Volume II: Vegetables*. Washington, DC: The National Academies Press.

Further Reading

Chalfin, B. 2004. (https://www.cabdirect.org/cabdirect/abstract/20066710100)*Shea Butter Republic: State Power, Global Markets, and the Making of an Indigenous Commodity (https://www.cabdirect.org/cabdirect/abstract/20066710100).* Routledge.

Naughton, C.C., T.F. Deubel, and J.R. Mihelcic. 2017. "Household Food Security, Economic Empowerment, and the Social Capital of Women's Shea Butter Production in Mali (https://doi.org/10.1007/s12571-017-0706-y)." *Food Security* 9 (4):773–84.

Tom-Dery, D., F. Eller, C. Reisdorff, and K. Jensen. 2018. "Shea ((https://doi.org/10.1007/s10457-017-0080-y)*Vitellaria paradoxa (https://doi.org/10.1007/s10457-017-0080-y)* C. F. Gaertn.) at the Crossroads: Current Knowledge and Research Gaps (https://doi.org/10.1007/s10457-017-0080-y)." *Agroforestry Systems*, 92(5):1353–1371.

International Union for Conservation of Nature. 2018. Decisions have consequences: Contrasting stories of shea butter & community conservation in Ghana (https://www.iucn.org/news/forests/201809/decisions-have-consequences-contrasting-stories-shea-butter-community-conservation-ghana)

> This is a tale of two villages in Northern Ghana taking different paths to economic development.