



# Yolélé: Improving Fonio Utilization to Help West Africa

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**Fonio** is an indigenous grain native to West Africa. Studies have shown fonio to have a complete amino acid profile, low glycemic index, and high iron level. However, it is unpopular even in West Africa due to its underdeveloped postharvest processing methods and its unavailability. Yolélé, a U.S.-based food company, has been developing and improving fonio processing techniques to increase efficiency, reduce wastes, and make fonio more accessible to West Africa populations. Yolélé believes that increasing fonio consumption would greatly help malnutrition in much of West Africa.

## Food Science in Action:

- ✓ Food processing
- ✓ Food engineering
- ✓ Nutrition
- ✓ Product development

## Introduction

West Africa is the region that includes such countries as Burkina Faso, Ghana, Ivory Coast, Mali, Nigeria, and Senegal. This area is part of sub-Saharan Africa, which includes all parts of the continent south of the Sahara Desert. Many crops are traditional to the region: sorghum, millet, fonio, teff, and amaranth.<sup>1</sup> According to the FAO, in Western Africa the prevalence of moderate and severe food insecurity has increased from 2014 to 2020 from just under 40% to nearly 70%.<sup>2</sup> This means a majority of the population is facing constraints on their ability to

find an adequate amount of food daily. More recent information (April 2023) from the United Nations tells that the situation is only getting worse; 42,000 people in Burkina Faso and Mali are at risk of experiencing catastrophic levels of hunger.<sup>3</sup> There is strong evidence indicating that long-term malnutrition can also lead to Type-2 diabetes.<sup>4</sup> A number of factors are contributing to the problem: the combined effects of conflict, climate shocks, the COVID-19 pandemic, and high food prices, which continue to drive up hunger and malnutrition in the region.<sup>3</sup>

There are agencies and groups that are attempting to alleviate the problem with food products developed locally, such as the Bonbon Bouye Nutrition Bar.<sup>5</sup> But for a problem as big as the one that exists in Africa, multiple responses are needed. Improving the use of locally grown crops is one way of helping the people, since the food is familiar and sales can improve the economy. Importing foreign foods can add costs and complications if there is political strife.

Fonio (Figure 1), genus *Digitaria*, is a crop that is native to Africa. It is thought to be the “most ancient traditional cereal.”<sup>1</sup> Since it has been grown for so long, it is suited to West Africa and marginal lands, which are increasing in proportion with climate change.<sup>6</sup>



**Figure 1.** Fonio stalks with tiny fonio grains.  
(Photo courtesy of Yolélé)



**Figure 2.** Manual harvest of fonio.  
(Photo courtesy of Yolélé)

Fonio is a very attractive grain from a nutritional perspective.<sup>1,6,7</sup> As a grain, it has the standard composition of hull, germ, and endosperm (protein and starch). It is gluten free, has a low glycemic index (which is beneficial to people with diabetes), has a complete amino acid profile (including methionine and cysteine), and is high in iron.<sup>7</sup> These attributes make fonio nutritionally superior to wheat, rice, sorghum, and barley.<sup>8</sup> Fonio has been evaluated as an ingredient in a wide variety of baked goods, for example, breakfast cereal, crackers, cake, bread, and biscuits.<sup>6</sup> When considering the use of fonio, the small size (< 1-mm of the grain kernel) makes handling difficult.<sup>6</sup> Traditionally, a manual process (Figures 2 and 3), which is labor intensive and requires a long time to dehull the grain, was used.<sup>7</sup> The postharvest loss amounts are quite high, and reducing them is a goal of Yolélé to improve the amount of fonio available for

consumption. Fonio is dependable for farmers to prevent starvation (a 'bridge' food) because it grows when other crops fail, or before they mature.

Because of the effort required for processing, other grains are consumed, which are more readily available at attractive prices. There is also the perception that imported foods are better and therefore consumers prefer to purchase them over local crops.

Currently in West Africa, rice is the predominant grain consumed as the main dietary energy source. Rice has been grown in Africa for 3000 years. Rice cultivation represents the principal source of income for more than 35 million smallholder farmers and provides a pathway out of poverty.<sup>9</sup> Local rice production covers only about 60% of demand in West Africa, with demand growing at 6% per year.<sup>9</sup> As a result, imported rice is needed to help fill the gap. This situation also creates a key market opportunity for fonio.

Yolélé is a food company formed in the United States in 2014 by Pierre Thiam (originally from Senegal) and Philip Teverow with the intent to introduce African tastes and flavors to U.S. consumers. Their partnership began by bringing fonio to the U.S., both incorporated into consumer packaged goods and also by selling as a raw material to the food industry. In doing so, they realized the opportunity not only to export fonio from West Africa, but to increase consumption in West Africa as a means of improving the nutrition in the population there. Yolélé is working to improve the supply chain of fonio and the amount



**Figure 3.** Labor-intensive threshing by jumping (left picture) and cleaning with water bowls (right picture) will be replaced by equipment being developed by Yolélé. (Photo courtesy of Yolélé)

of processing done in Africa, with the goal of decreasing postharvest loss and improving consumer acceptability.

## Project Overview

Yolélé wants to improve the supply chain and processing of fonio to increase availability in Africa, and as an export crop. There are four steps for fonio processing after harvest (Figure 2): (1) threshing to obtain the grain (Figure 3), (2) dehulling to remove the outer shell on the grain, (3) thermal processing, and (4) drying.

Traditionally, threshing and dehulling involve the use of tarps, and simply providing new ones to replace those that have developed holes can decrease the number of seeds that are lost and improve yield. Currently, during the dehulling step, nearly 50% of the grain is lost. Efforts by Yolélé have demonstrated that the number can be reduced to 20%.

Once the fonio is dehulled, the next step is to steam the grain. This thermal process is important. The heat is a kill step for any organisms that may be present, and enzymes are inactivated to prevent any deleterious reactions from occurring. Also, the steam partially cooks the grain, which results in the final product that is more easily prepared by the end consumer and gives a desired fluffy texture, similar to couscous. Then, the moisture must be removed through a drying step. This can be done by leaving the fonio outside on a screen, covered with cheesecloth. Ovens may be used if available.

After the grain has been dehulled, it is considered a “whole grain” since it still has the germ and bran. These two components are very difficult to remove on the small fonio kernels. The greater proportion that can be removed, the whiter the flour that results, which can be desirable for appearance, but less nutritious. Engineers are developing equipment that can husk the kernels with greater efficiency.<sup>10</sup> Milling to flour is an alternative processing step to provide another output beyond the kernel for side dish preparation. Yolélé is leading efforts to develop and improve handling and processing for increased availability and affordability of this indigenous crop consumption by the local population.

In order to improve the nutrition of the people of Africa, there is a great interest to make fonio more accessible to the people of urban Africa, who prefer to purchase more inexpensive rice. However, the rice is not as nutritious as fonio. For the rural consumers in Africa, fonio is considered a bridge food and not a regular part of the diet. One of the ways fonio flour is used is as an ingredient in a common steamed bun in Africa. Yolélé is working to prepare flours with local ingredients that are fortified with micronutrients that can compete with imports from multinationals. These flour blends make it easier for consumers to prepare the dough for the buns that are commonly eaten with main meals.

By selling fonio products in the U.S., Europe, and China, Yolélé is building capital to work toward their fonio goals in West Africa.

## Successes

Currently, Yolélé provides income to approximately 1000 smallholder fonio farmers in Mali. This success was achieved by working with a local partner company in Mali that has a relationship with many women farmers from previous business activities. That company was able to set up contracts for fonio production and collection, as well as payment (primarily to women farmers). This local partner provides field agents to organize the women farmers, as they know the culture and can collaborate effectively with them.

Yolélé exports fonio to the U.S. to make products like chips and pilaf that can be purchased in national grocery stores. For the U.S. market, the snacks are a useful way to introduce fonio, which is a new food for many people. For example, for Yolélé’s Fonio Chips (Figure 4), the size of the package gives ample room to provide information to consumers about the benefits of fonio. Fonio also provides a sustainable unique grain for use in the brewing industry. Special beverage formulas with limited time offers are being produced in Europe, the UK, and China.

## Looking Ahead

Yolélé is working toward building an aggregation center in Mali to serve as a fonio collection site



**Figure 4.** Fonio as a ready-to-eat snack.  
(Photo courtesy of Yolélé)

and act as a hub for management. With a cost of \$100,000, this facility would provide a regional manager to work with local farmers to improve fonio crops, and a central location for delivery of the harvest, initial cleaning, and quality control. A longer-term goal is to have a larger automated processing facility that would increase the final yield and reduce postharvest loss. Collaborative efforts are ongoing to develop milling equipment to mechanize the unit operations, with a goal of being operational by 2026.

By reducing processing cost and increasing the yield, fonio would be more affordable to the West African consumers. In addition, this aggregation center would provide West African consumers with fonio ready to cook without the current washing steps, something that does not currently exist. Yolélé hopes to provide fonio as pilaf, as hot cereal, and in chips, as well as fonio grains to the West African population.

In addition, Yolélé is in conversation with local companies that make flour mixes that are interested in incorporating fonio (possibly fonio fortified with micronutrients). These companies would blend fonio flour with other flours to make “swallow” or “ball flours” or “fufu”—dumplings used to eat saucy foods. If these companies are not able to grind the fonio into flour at their facilities, Yolélé would install equipment at their aggregation center to do the grinding.

Some research has been done into fonio flour’s gelling and pasting properties.<sup>11</sup> But Yolélé believes that more research into applications is the key to unlocking fonio’s potential for addressing poverty and malnutrition in West Africa. The company is looking for food scientists to help uncover unique attributes for fonio that are not yet known.

Yolélé believes that by building this aggregation center that processes fonio into ready-to-cook pilaf, as well as finished CPG products, they can change the perception of fonio among West African consumers, which in turn will help alleviate the current malnutrition problem. Fonio is currently viewed as a family-feeding crop, consumed mainly by farmers who grow it. People who live in urban areas consider fonio “poor country food.” Once fonio is readily available in more convenient offerings, Yolélé hopes that consumers will choose fonio over white rice at least once each week.

The company is doing well and is currently reviewing information gathered during a recent in-depth survey of 140 farmers in Mali, which will quantify the value of Yolélé and the ability to sell fonio locally. This information will provide data to assist in obtaining financing to execute the plans Yolélé developed for an aggregation center and manufacturing equipment.

Yolélé is working hard to develop an improved supply chain and mechanized processing of fonio, which will increase income and quality of life for the farmers. Improved availability of a nutritious local ingredient will help provide more food in a region that has a deficit.

#### **Farmer comments in recent survey by Yolélé (2024):**

**79%** said that they would like to increase their fonio production if Yolélé will buy from them.

**71%** of respondents said that they prefer selling unprocessed fonio; the increased price from manual processed fonio is not worth the effort.

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