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# West Africa Trends

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## The Future of Traditional Cereals

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*The purpose of this newsletter is to monitor trends across the West Africa region for policy makers, researchers and other decision makers in the international community.*

**Disclaimer:** *The views expressed in this newsletter do not represent those of the Rockefeller Foundation.*

## Introduction

For centuries, the traditional cereals of millet and sorghum were the key suppliers of calories in West Africa. However, over the past few decades, these cereals have been steadily losing their share of contribution to calories in the region to rice, maize, and, more recently, wheat. Rice is now the key contributor of calories in West Africa, having overtaken both sorghum and millet, while maize has caught up and is also poised to overtake them. This has serious implications. Traditional cereals are grown mostly by poor subsistence farmers and the loss of market share has important implications for poverty reduction. Replacement foods, rice in particular, tend to be imported, which can negatively affect food security of the region. Growing competition for food has already pushed prices to new heights and increased the import bills of many countries (West Africa is the biggest regional importer of rice in the world). Fears of lessening future food supplies are creating a very unstable global supply situation with occasional panics causing import restrictions. These fears are further compounded by the specter of climate change that will see significant drops in cereals productivity. This newsletter explores the challenges and prospects of traditional cereals. The first article explores trends in consumption and explores emerging opportunities, the second explores the prospects for high-value commercial products derived from traditional cereals, and the third explores the prospects for upgrading traditional products made from millets and sorghums.

# Editorial

Traditional cereals offer a path to food security because they are locally grown and resilient against drought, and therefore can act as suitable insurance in the face of climate change. Millets can be stored for more than 10 years without spoilage, while sorghum is less affected by *aflatoxin* and *fumosis* than maize.

However, because donors tend to support crops they are familiar with, these local crops have historically been neglected when it comes to research funding. The result is that their growers' productivity has remained low and the cereals' prices have become uncompetitive.

Traditional cereals have not been able to adapt to new and dynamic food markets exacerbated by urbanization, particularly in terms of convenience and packaging. Regaining a prominent position at the dinner table should be a strategic imperative of the region's governments. In order to address emerging markets, leaders must go beyond the narrow strategy of improving yield to a broader strategy that addresses image building, product development, and industrial policy. This will ensure that cereal products are competitive in terms of price and suited to new urban markets that call for convenient (easy to buy and quick to prepare) and well-packaged foods. Rice's success has largely been due to its ability to meet these demands.

It will, of course, be an uphill battle to overcome the "image challenge" of sorghum and millets. Regaining a foothold is much harder than finding a foothold as a new entrant. Sorghum and millet will need revamped images if they are to succeed. Mechanisms must be found for marketing sorghums and millets as grains with positive values.

The image of Sorghum and millet as "poor person's food" can be overcome by developing improved products that have attractive, socially acceptable names that appeal to wealthy consumers, in particular the middle class, who influence how diets develop.

A window of opportunity exists as a middle class that is very health conscious is creating new market dynamics.

Traditional cereals have many health benefits over newer cereals. Millet is more nutritious than any other cereal while sorghum is known to fight ageing and various cancers. In the US, a very unlikely location, millet is now being actively promoted as an alternative to the popular and healthy quinoa cereal.

The rise of the organic food movement also provides opportunity. Both millet and sorghum can be grown with little or no chemical inputs, making them suitable for the niche market of wealthy organic food consumers.

However, it is at the product development stage that the real transformative impact of traditional cereals can occur. This will require the development of strong processing sectors and production systems to supply them as well as greater realignment between agricultural and industrial policy.

Traditional products made from cereals can play a key role in the markets they are already serving, but there is also room to upgrade traditional products to make them more acceptable to the emerging afro-centric middle class that seeks an African identity partly through food consumption. This will go a long way in improving the image of sorghum and millets.

Upgrading technologies to make cereals safer and increase their shelf life means moving away from homemade products to upgraded cottage industries or small and medium enterprises (SMEs). However, one must keep in mind that this upgrade may disenfranchise women who generally dominate traditional products markets as they are least able to make the needed investments for upgrading.

How to achieve the needed transformation is a vexing question. A government mandate for use of sorghum rather than barley in Nigeria has been very successful the first time around. However, the very size of Nigeria's market may have forced food companies to go the extra mile to develop the supply chain. It is not clear whether other countries have as much leverage. For smaller markets, incentives coupled with campaigns to popularize may be the way to go.

## Trends in Production and Consumption of Traditional Cereals

Climate change will pose sharp risks to the world's food supply in coming decades, potentially undermining crop production and driving up prices at a time when the demand for food is expected to soar with the world population heading toward the nine billion mark (projected in 2050). Fears about global future food supply and spikes in food prices that have caused global panics have in the recent caused governments to ban cereals exports.

Rice-importing countries in the region are vulnerable to the growing instability in global food supply. Trends show rice and wheat, mainly temperate crops, increasing their share of calories consumption at the dinner table. As Figure 1 shows, rice is now the most consumed cereal and wheat continues to grow its share. Both these trends have been fuelled by rapidly growing imports. (Nigeria is the biggest importer of US hard winter wheat.)

The other big winner has been maize, which has rapidly caught up with sorghum.

The result has been that traditional cereals, in particular sorghum and millet, have continued to lose their share at the dinner table, a trend that does not bode well for the future of food security. Traditional cereals have important properties, particularly in the face of climate change, that make them a key part of addressing future food security.

Sorghum, for instance, has a number of morphological and physiological qualities that help it adapt to dry conditions. This includes an extensive root system, a waxy bloom on its leaves that reduces water loss, tolerance to water logging, and the ability to stop growth in periods of drought and resume growth when conditions are favorable. The crop also grows on a wide range of soils: sand, loam, sandy loam saline, and alkalines with a pH range of 4.0–8.5. When compared to its fast growing competitor, maize, sorghum has two distinct advantages in semiarid regions: First, it has

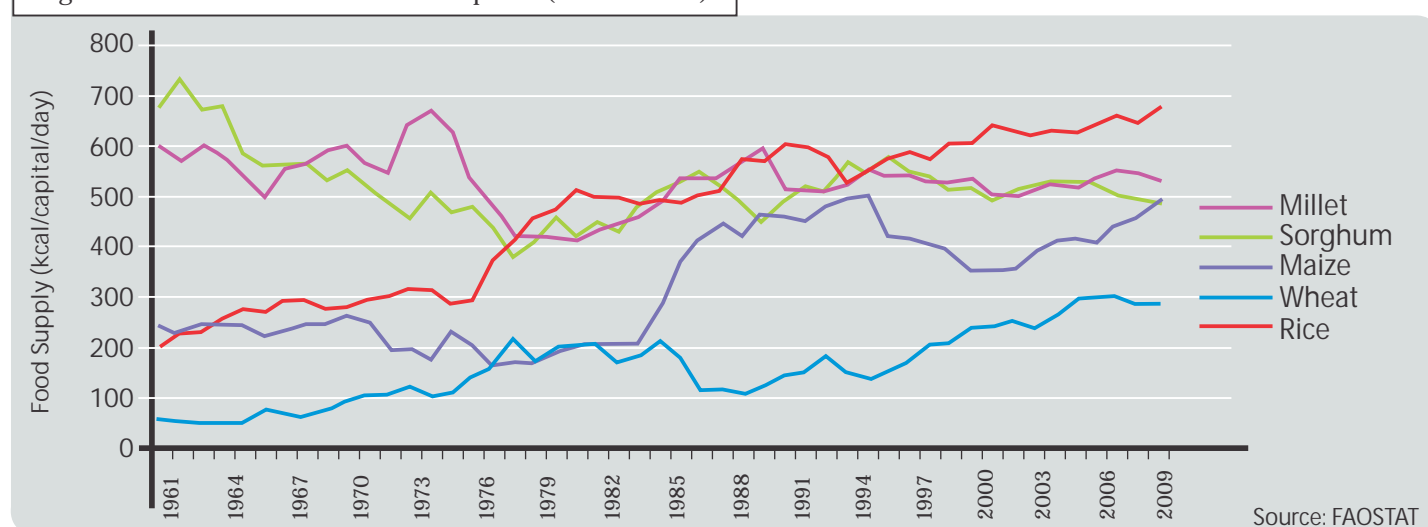
more tolerance to drought and lower soil fertility. Second, sorghum is more tolerant to mycotoxins, particularly aflatoxin and fumosin.

Millet can rightly be called the silver bullet crop for Africa. Beyond being well suited for Africa's agro-ecological conditions, it is very nutritious. It has more fiber and essential amino acids than maize and a better nutritional profile in terms of minerals, e.g., iron, manganese, copper, and especially calcium. It has 40 times the amount of calcium found in maize and rice and 10 times that in wheat<sup>1</sup>. Finger millet grain is high in methionine, an amino acid lacking in the diets of the poor who live on starchy foods such as cassava, plantain, and maize meal. It is higher in protein, fat, and minerals than rice and maize<sup>2</sup>. Beyond good nutritional qualities, millet can survive in areas with as little as 300 mm (possibly even less) of seasonal rainfall (the minimum water requirement is 500–600 mm for maize). Millet is also better adapted than most other crops to dry, infertile soils, to high temperatures, short growing seasons, and acidic soils with poor water-holding capacity. At the same time, millet grains can be stored for over 10 years without significant deterioration.

Today, finger millet and sorghums are important crops grown in low-input farming systems by resource-poor farmers in West Africa and play a critical role in agriculture and food security of poor farmers that inhabit arid, infertile, and marginal lands.

The importance of these two cereals that are uniquely suited to Africa's agro-ecological conditions and highly resilient especially in face of climate change make them central to the future of food supply in the region and should be considered as strategic crops and given the priority that reflects this. However, despite the highly desirable qualities of millet and sorghum, there is still a declining trend in their shares at the dinner table. Some of the drivers of this trend are discussed below.

Figure 1: Trends in Cereals Consumption (West Africa)



<sup>1</sup><http://www.icrisat.org/what-we-do/publications/digital-publications/icrisat-publications-2007/icrisat-ebook-2007-fingermillet-east-africa.pdf#page=60>

<sup>2</sup>[http://mcknight.ccrp.cornell.edu/program\\_docs/event/nairobi05/nairobi05\\_paper\\_oduori\\_jun05.pdf](http://mcknight.ccrp.cornell.edu/program_docs/event/nairobi05/nairobi05_paper_oduori_jun05.pdf)

## Drivers of Trends in Cereal Consumption

### Low priority of millets and sorghums in research support

While there have been efforts to address the risk of food crisis in the region, they have mainly served to increase support for less regionally traditional crops. Significant resources have been devoted to increasing self-sufficiency and production of rice and maize, for example, to keep pace with fast-rising demand.

The result is that millet and sorghum yields have remained much lower than possible. Some sorghum varieties are capable of reaching a yield of 3–4 tons per hectare; the current average yield in the region is 700kg.

Maize has also enjoyed subsidies over the years, disrupting the natural supply and demand cycles of sorghum and millet, and helping to cement the perception that sorghums and millets are inferior.

### Urbanization

Urbanization has created demand for foods that support urban lifestyles—food that can be prepared quickly, foods that meet certain quality thresholds, and foods that are properly packaged and easy to access through urban distribution channels. Sorghum and millet—largely grown for subsistence—have not adapted quickly enough to urban demand.

Urbanization has introduced new outlooks and aspirations for people, which have created demand for what are seen as “modern foods.” So, in addition to convenience, rice and wheat have benefitted from the perception that consuming these foods is a mark of an attainment of a higher class.

### Product development

Related to the impact of urbanization is a low level of product development. Traditional processing remains the main mode by which traditional cereals are processed.

Products tend to be low in quality and characterized by a short shelf life. Most modern processing of these cereals is restricted to flours and packaged grains.

Low yields in combination with poor quality and lack of appropriate equipment have impeded the development of value-added markets. As a result, sorghum and millet products have remained largely unchanged despite an evolving market.

### Globalization and trade liberalization

Globalization and trade liberalization have opened markets for food imports. Due to poor infrastructure, it is often cheaper to import food from overseas rather than from the hinterlands. Most millet and sorghum is produced in the Sahel and the Savannah belt, far from the more lucrative urban markets located mainly in the coastal areas. Globalization has also brought a taste for foreign foods, especially wheat-based goods.

Also related to globalization is unfair competition from imported products linked to food security programs. Food aid can import with it an acquisition of taste for new types of foods from abroad.

### Image

Perhaps the biggest challenge for traditional cereals is their public perception. They are perceived as poor person's crops, compounded by their poor quality when processed as food. Millet and sorghum are often threshed in open ground and resulting products can contain stones and other impurities. Millet and sorghum grains in existing markets are extremely variable in kernel size, color, and cleanliness. In a recent fact-finding trip, processors in Senegal clearly indicated that they want cleaner and less variable grain and would be willing to pay for it. It is essential that we find more efficient methods to thresh and clean the grains to remove sand and other impurities.



## Prospects for Traditional Cereals

While traditional cereals seem to have been losing market share, a window of opportunity is opening and can be leveraged to allow these staples to regain lost ground.

### Rising health consciousness

Health awareness is spreading throughout West Africa. People are paying more attention to nutrition and other health qualities of food. Millet is well positioned to tap into this trend, given its superior nutritional qualities. In the US, for example, an unlikely consumer market for millet, the state of Colorado is marketing millet as an alternative to the popular quinoa seed.

The superior antioxidant qualities of sorghum are also being given attention as anti-cancer, anti-aging, and anti-cholesterol agents. In an interesting twist, the anti-nutritional qualities of sorghum—in particular the presence of phytates that make its proteins unavailable unless malted (through fermentation)—has seen it being promoted in Australia as a weight-loss food. Eating un-malted sorghum fills the stomach with very few calories released. Sorghum and millet are also well suited to celiacs, people who need gluten-free foods, and are preferred by people suffering from diabetes (because of its lower hydrolysis). The many health benefits of sorghum are enumerated here:

<http://wholegrainscouncil.org/whole-grains-101/health-benefits-of-sorghum>.

A more immediate and serious concern is aflatoxin. Aflatoxin is highly toxic to poultry and can cause liver cancer in humans. Maize varieties are prone to production of aflatoxin in the field prior to harvest. Another health concern with maize is fumosin. There has been documentation of a positive association between HIV transmission frequency and maize consumption in Africa due to corn fumonisin. It has been posited that 1,000,000 HIV transmissions could be avoided annually (cutting transmission rates by 50%) by reducing maize consumption. Fumonisin has also been attributed to the epidemic of squamous carcinoma of the esophagus among black southern Africa where diets have shifted from sorghum to maize.

### Organic food movement

Directly related to the continental increase in health awareness is the rise of the organic food movement, which combines the desire for healthy food with a concern for the environment. Sorghum and millet are environmentally friendly and require minimal fertilizers and pesticides. While increasing yield might necessarily require use of more inputs, production through traditional farming methods can also be leveraged to create an organic food sector. With greater attention (as organic farming is more

than simply avoiding fertilizers and pesticides, but also utilizing particular systems to allow for certification), a high-value niche market that combines organic certification with health benefits can be developed.

### Local purchasing of food aid

Conventional food aid programs in the region purchase grains, maize in particular, from donor countries for distribution to areas in need. This may help explain the growing popularity of maize in the Sahel, traditionally a millet and sorghum territory. Recently, however, there has been discussion of focusing on locally grown foods for food aid, and purchasing them from local women and small producers. The World Food Program's (WFP) Purchase For Progress initiative is targeting millet and sorghum for food distribution, and a critical part of Nigeria's Sorghum Transformation Programme is supplying food aid.

Home-grown school feeding (HGSF) programs are also gaining popularity. These programs emphasize the purchase of local foods, and are helping to spur new markets in regions where millet and sorghum are grown. HGSF shows that schools can be used as platforms to develop tastes and preferences that can persist to adulthood.

### High food costs leading to diet changes

Surging global food prices are changing life-long habits and forcing people to switch to cheaper staple foods. In Liberia, which imports 90% of its rice, roadside chefs are innovating in a bid to offer lower priced foods. Chefs are substituting rice dishes with spaghetti made from millet. Indeed diets are not that sticky in face of high prices, the 2007–2008 global food crisis saw Guinea shift from rice to *attieke*, a granular form of cassava that has texture similar to rice.

### Urbanization

While urbanization has brought a shift towards foods that are easily prepared—giving an advantage to rice and wheat over millets and sorghum—the resilience of cassava, a traditional staple, in the region shows that urban markets present an opportunity for millet and sorghum as well. Urban markets will respond to ready-to-eat and appropriately priced products.

### Rise of Afrocentric identity

Many Africans are searching for an identity that is uniquely African. The most visible sign is the rise of African clothes, but food nationalism, where middle-class Africans identify with their foods, is also on the rise. There are a number of upscale restaurants serving traditional food as their key value proposition, e.g., Maquis Tante Marie restaurants in Ghana.

## Interventions

### Increasing yields

One farm demonstration under the USAID-funded Sorghum, Millet and other Grains Collaborative Research Support Program (INTSORMIL) in Senegal, Mali, and Niger demonstrated to farmers that improved seed, inorganic fertilizer, and improved agronomic practices, often including tied ridges for water harvesting, could more than double yields of sorghum and millet. However, transition from demonstration to working farms is always a challenge.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is training farmers to use microdosing—applying small amounts of fertilizer with the seed at planting time to increase yields. This technique, which has been very successful in Niger, is now being diffused to other West African countries. Another project called HOPE, or *Harnessing Opportunities for Productivity Enhancement of Sorghum and Millets in Sub-Saharan Africa (and South Asia)*, which is funded by the Bill & Melinda Gates Foundation, is providing support to 110,000 households in 10 Sub-Saharan Africa countries. More than 6,000 copies of the “Fighting Striga” DVD (with 10 modules), which instructs farmers on how to fight one of Africa’s most dangerous weeds, have been distributed in several languages to individual farmers, farmer groups, and extension partners.

An innovative approach that involves farmers in variety selection is being tried in Nigeria’s northern Katsina State. Farmers in 40 villages were asked by the Katsina State government to test improved millet varieties from across Africa to see which grow best in dry conditions. In Sabon Gari Ganu village, for example, farmers divided their plots into 56 rows, which they planted with improved seeds gathered from 16 African countries. They also tried different methods of fertilization and weed control. The farmers watched through the growing season and noted the varieties that produced the higher yields. Later, the farmers—both men and women—voted on which seed varieties they preferred. In the end, four were chosen. The preferred seeds will be multiplied and intensively promoted across the state. This approach has already allowed one local farmer to increase his millet production by more than 50%, and as a result, he has been able to purchase two soil-tilling machines.

### Multi-pronged interventions

Real impact comes when rising yield programs are combined with market support interventions. One INTSORMIL project, for example—involving 300 hectares

of sorghum and approximately 400 sorghum producers in the three countries (Niger, Senegal, and Mali)—consisted of: (1) a technology component aimed at increasing output through the use of improved technologies (the combination of an improved variety, inorganic fertilizers, water harvesting techniques, and other agronomic improvements); (2) a marketing component aimed at getting a price premium for grain quality and taking advantage of the price recovery later in the year by not selling at harvest; and (3) a capacity building component to develop farmers’ associations into viable marketing organizations. Farmers in this project made income gains from both yield and price increase. Sorghum yields of 118 project farmers in Gabi, Niger, increased 428% (2.14 tons/ha) over traditional farmer average yields (0.5 t/ha). The average total income gain was 179% in Gabi with 92% due to yield (technology) and 87% due to price effects (marketing strategy). Total income gain for the best farmers (who correctly applied the technology and had good field management) was an exceptional 445%. Total income gain in Senegal was 58% with the best farmers gaining 196%, and 43% in Mali with the best farmers gaining 121%.

A similar collaboration between the cooperative Malicounda and Yaourt Jabootin in Senegal raised farmers’ income by 278%. This very high gain was due to processors’ willingness to pay a high premium for the assurance of clean steamed millet in their yogurt.

### Improving image

An intervention by the USAID Expanded Agribusiness & Trade Promotion (E-ATP) project aims to support associations of processors (and other interested, participating inter-professional organizations) in developing and implementing campaigns to promote new and existing millet and sorghum products. With these promotional campaigns, USAID is hoping to change current consumer perceptions about millet and sorghum products; the goal is to move away from the idea that they are only for food security and consumers from lower socio-economic classes. USAID E-ATP will support participating associations with grants and technical assistance in the development and implementation of campaigns. Illustrative activities in a stakeholder-led promotional campaign include: (1) Advocacy efforts to encourage public authorities to increase demand for millet and sorghum products in public institutions (e.g., military, schools, universities), and (2) Advocacy efforts to suspend, for a limited time, VAT on millet- and sorghum-processed products.

### Impact on the poor and vulnerable

Beyond providing future food security, support of traditional staples can have a positive impact on the poor, the main growers of these crops. In Mali, a recent study on fertilizer subsidy suggests that a fertilized sorghum

technology package is higher yielding than a maize production package. The authors point out that while improving sorghum seed with fertilizer has only a small effect on increasing income, it has a large effect on raising food consumption and reducing food purchases, particularly in drought years.

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# Prospects for development of high-value commercial product

Market development and added-value products are key to generating broad-based benefits for sorghum and millet producers. With the potential of these cereals to be used as a base for a variety of high value foods products, the value-capture opportunity of sorghum and millet lies in product development.

Products that can be developed from sorghum and millet include: high-quality milled products for flours, agglomerated products such as couscous, leavened bread-like products and pastries (blended with wheat flour), and malted foods and beverages. Millet and sorghum can also be used as feedstocks for poultry and ruminants.

## Future Prospects

The future of millet and sorghum will be tied to their ability to meet emerging demands, especially in towns and cities. In Nigeria, towns and cities now absorb close to 30% of millet and sorghum crops. But capturing urban markets is going to be an uphill battle. Urban consumers want food products that deliver convenience, taste, texture, color, and shelf-stability at an economical cost. Upscale sorghum and millet products that meet these requirements are usually not available in urban areas, underscoring the urgency of product development.

While the resilience of cassava suggests strong growth and potential, trade in processed millet and sorghum products is highly localized and the industry faces a number of challenges that will need to be addressed to ensure growth.

### Product development

Across the region, value-added food products derived from millet and sorghum are limited to grains and flours with few of the more lucrative Ready-To-Eat (RTE) products.

Figure 2: Product Development Trajectory



Elsewhere in the region, breweries are actively training farmers to supply sorghum for their operations as locally grown sorghum can be more reliable and more competitively priced than imported barley (barley is a temperate crop). In Sierra Leone, Heineken has had success developing a local sorghum supply chain for its breweries.

Lately attention has shifted to wheat substitution. The region is a huge importer of wheat, so substitution presents great opportunity.

Consumer acceptance trials in Nigeria have shown that bread made with 30% sorghum flour was comparable to 100% wheat bread. The Institute of Food Technology in Dakar, Senegal, has prepared a bread consisting of 30% millet and 70% wheat using popular millet varieties *souna* and *sanio*. While composite breads experiments are still small-scale, they have highlighted the interest shown by consumers and other sectors in composite flour bread.

The West Africa Agricultural Productivity Program (WAAPP) is actively promoting the dissemination of composite bread technology on a larger scale. Senegal has supported the production of 270,000 composite flour baguettes in the Dakar region using grassroot producers organization and linking them to bakeries. This program should result in a reduction in the price of baguettes, and provide producers with more remunerative prices (with a price margin of over CFA 15/kg).

Nigeria is also experimenting with sorghum as a wheat substitute in non-bread products. Scientists have developed noodles of acceptable quality using 100% sorghum and also biscuits using sorghum-wheat composites with up to 60% wheat substitution.

Identifying potential market opportunities and product offerings to meet market demands requires concerted and coordinated effort of specialists in several areas, including consumer economics, grain and milling science, food science, business development, and entrepreneurship. This

type of coordination is severely lacking with the exception of a few incubation centers being piloted in Senegal, Mali, and Niger.

### Strong processing sectors

In addition to product development, a successful millet and sorghum products market requires a strong processing sector. However, processors face a myriad of challenges, including an insufficient supply of raw materials that meet their requirements in terms of quantities and quality, resulting in operational inefficiencies and higher processing costs related to the time-consuming and labor-intensive processes of cleaning and drying grains to remove impurities.

Further the success of a modern sorghum and millet sector will depend on the development of modern equipment optimized for these cereals, a development that has been a challenge thus far. Because they are the dominant cereals, a majority of modern commercial equipment is optimized for wheat and maize. Milling sorghum using standard maize flour milling machines, for example, results in 30% loss and higher energy costs due to the coarse nature of the grains. In addition, millet, which has very small grains, requires many passes to get properly milled, resulting in higher energy costs.

Another challenge is weak marketing capacity and limited access to quality packaging and labeling solutions, impeding access to higher end markets at the local, national, and regional levels.

### Product awareness and image building

Consumers are not aware of the range of foods derived from local cereals available in the marketplace nor are they aware of their nutritional benefits. Product development needs to be accompanied with well thought-out market campaigns to raise awareness and change perceptions of millet and sorghum products.



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## Interventions

The development of a modern food industry based on traditional cereals has been approached in two ways (import substitution) and development of new products.

### Import Substitution

In Nigeria, government policy has been the driver the driver import substitution drive. In the 1980s, Nigeria banned imports of barley, forcing food and brewing firms

to use alternatives to the grain. Today, Nigeria has a very well developed sorghum malting industry (Aba Sorghum Malting Plant is one of the biggest in the world). The industry has developed so much that even after the ban on barley import was lifted in 1999, sorghum has continued to be the crop of choice for malting. The of mandates is now being substituted by incentives as outlined in the Sorghum Transformation Plan that is now being implemented (see box).

### Nigeria Sorghum Transformation Plan

The government of Nigeria has singled out sorghum as a key strategic crop under its new agricultural transformation plan. The Sorghum transformation plan focuses on contributions to three value chains, including:

- I. FORTIFIED FOODS: Sorghum flour blended with soybean, e.g., “Soy-Akamu,” for the School Feeding Program, lactating mothers, children, and convalescing adults; and an eventual export commodity to World Food Program and the Food and Agriculture Organization of the United Nations (FAO) for use in other African regions
- II. MALT BEVERAGES, FOODS, AND DRINKS: “DawaMalt,” also for the School Feeding Program
- III. HIGH QUALITY SORGHUM FLOUR (HQSF): In convenient packaging such as “TUWOMeal,” for compositing with wheat (up to 20% sorghum) to bake bread, and to produce noodles, macaroni, couscous, pancake, breakfast burns, and biscuits (up to 40% sorghum)

The program is targeting, the northwest and the northeast, with a total of six cluster states including Borno, Adamawa and Bauchi, Kaduna,

In an effort to further cement sorghum as an industrial crop, the Government of Nigeria has signed a memorandum of understanding with an indigenous bio-fuel producer, Global Biofuels Limited, for the construction of 15 integrated bio-fuel plants in Nigeria valued at \$750 million. The project is a collaborative work and research between Global Biofuels and indigenous research institutes in China, Brazil, and India. The project is an agro-based industrial activity involving the production of ethanol, biomass electric power, and food using sorghum as the raw material. The pilot project is expected to be concluded in Nigeria's Ekiti State soon and would subsequently be replicated in 14 sorghum-growing states. If the project is implemented as planned, it could significantly increase demand for sorghum in Nigeria. The project is expected to boost sorghum utilization, using every part of the plant except the grain.

[http://www.premiumtimesng.com/docs\\_download/President\\_Jonathan%27s\\_Progress\\_Report.pdf](http://www.premiumtimesng.com/docs_download/President_Jonathan%27s_Progress_Report.pdf)

## Animal feeds

A growing middle class in West Africa is creating demand for protein that is being met mostly by imported poultry. Where there is a local poultry industry, imported soy and maize are the main feeds. Sorghum and millet has an opportunity to replace maize and soy as feedstock. In Niger, for instance, locally produced sorghum is generally less expensive than imported maize and should play an important role in diets for livestock and poultry.

Yet poultry producers are fearful of sorghum-based diets due to misconceptions about the effect of tannins on poultry that has led to low utilization in animal feeds. To overcome these misconceptions, research has been conducted in Niger by Kansas State University (KSU) scientists in collaboration with Niger's National Institute for Agricultural Research (INRAN).

The objective was to determine the different nutritional values for broiler chicks and laying hens of diets based on imported maize and sorghum varieties, respectively. The study found that that sorghum was equal to maize as measured by the carcass weight, carcass yield, and carcass fat of the broilers at the end of the 60-day feeding period. The number of days to reach 20% production for laying hens that were fed improved sorghum was 133 compared to 141 days for those fed maize. At the end of the 18-month feeding period, hens fed the improved sorghum weighed 64g more than the hens fed maize. In general, sorghum performed much better than maize, underscoring the need for improved information dissemination to dispel misconceptions

### Impact of millet and sorghum commercialization

Millet and sorghum continue to be largely grown by marginalized people, particularly poor women. Commercialization of these crops can have significant impact on their lives, in addition to broader economic benefits.

The West Africa Agricultural Productivity Program (WAAPP), which has been promoting composite flour, says

that broader use of composite flour bread technology is expected to have broad positive impact. By encouraging the use of local resources, especially at the primary sector level, this technology brings together a large section of the country's working population; creates new commercial outlets for family agricultural operations, processing units, and bakeries; and, finally reduces wheat imports, which has a positive impact on the current account balance of payments.

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### Product development

Efforts are also underway to develop pre-cooked sorghum flours, which have the advantage of reducing the time and energy required to prepare sorghum in traditional ways. In addition to saving time and labor for women, an instant sorghum-based food can be sold by street vendors and consumed on the street. This is crucial, especially in towns and cities where time is limited and where for many poor residents energy is costly. Pre-gelatinized extruded flour is cheaper to transport, easier to handle, and can be stored for a long time because it is less susceptible to microbial spoilage. Foods prepared from pre-gelatinized flours also have increased digestibility.

A study in West Africa Purdue University researchers have shown that, overall, preference for instant sorghum flour was higher than its comparable conventionally-prepared counterpart in every location tested. The results of the study indicated that because of its good taste, attractive white-yellow color, smooth textural characteristics, and health benefits, as well as its ready-to-eat food potential, West African consumers prefer instant thick and thin porridges to the porridges prepared by the slow and time-consuming conventional manner. More than 97% of those surveyed would purchase instant sorghum flour if available.

Product development is also being supplemented by development of incubation centers to help develop SMEs that can commercialization product innovations.

USAID, through its INTSOMIL project (now known as SMIL under the U.S. Government's Feed the Future initiative), has been experimenting with incubation centers that bring food researchers and entrepreneurs together. In Niger, at the INRAN processing lab, 10 women's associations have been trained and use the facility to sell high-quality flour and agglomerated products (couscous, degue, boulet). A local funding group has lent \$60,000 to one of the groups to build a mechanized processing facility, and is funding a fabricator to make equipment pieces for the enterprise.

Purdue University researchers have pioneered a number of incubation centers in the region. The Purdue model consists of an "incubation center," a building or structure equipped with the fully mechanized entrepreneur-scale processing equipment necessary to make products targeting specific markets. Several activities are conducted at the center with a goal of empowering entrepreneurs to provide markets for local farmers. The activities include:

- Training entrepreneurs and food technologists
- Processing demonstrations using mechanized equipment
- Testing of learned skills by the processors with oversight from experts
- Market testing of developed products
- Scaling-up to increase production capacity
- Improving existing technologies and products, and developing new ones with R&D

### Research on varieties optimized for processing

Research on identifying millet and sorghum varieties that are well-suited for modern processing is also ongoing. In Mali, N'Tenemissa, has demonstrated excellent processing properties and has been processed into composite flours and decorticated rice-like products, while Thlack, a millet variety in Senegal, has helped make excellent composite bread with increased loaf volume.

### Strengthening regional trade in millet and sorghum

Growth of large-scale millet and sorghum processing has also been impeded by restrictive policies, notably the unofficial restrictions on cross-border trade in cereals that are a component of governments' policies of self-sufficiency in food security. This has hindered a more efficient and vibrant flow of information and cereals between surplus and deficit areas across the region. USAID E-ATP is aiming to address the challenge of cross border trade through:

- Increasing regional trade in millet- and sorghum-processed products by promoting opportunities for processors to (i) access diversified markets for millet and sorghum-based products in the region, (ii) upgrade equipment and operations, and (iii) develop consumer markets for new and existing millet- and sorghum-processed products
- Promoting long-term, cooperative trade relations between suppliers and traders in millet and sorghum cereals and collaboration between stakeholders to advocate and implement campaigns to lift seasonal restrictions on cereals trade



## Upgrading Traditional Millet and Sorghum Products

Sorghum (and millet) malting is a widespread traditional practice in West Africa. It is used to produce fermented and unfermented beverages and is incorporated into infant cereals.

Malting is largely a cottage industry, usually performed at home by women, and one that requires great expertise.

Due to the nature of preparation, traditionally prepared products tend to be unhygienic and also have very short shelf life, making it difficult to trade them beyond the area of production. However, since the products are already well known there is an untapped market beyond villages and especially in urban areas.

Thus, hand in hand with development of modern millet and sorghum products, there is also a need to upgrade traditional products to make them more competitive in newer markets, urban and middle-class markets in particular.

### Prospects for Traditional Millet and Sorghum Products

Some developments are showing good promise and can serve as a platform for further developing the traditional sector.

#### Development of new marketing channels

An emerging afro-centric middle class is starting to identify with traditional foods, and a traditional foods market using modern retailing channels is now starting to emerge. In Ghana, for example, Koko King is pioneering the sale of millet and sorghum products that are packaged properly and sold at roadside kiosks, replacing the old ways where porridge was served in unappealing and unsafe plastic bags. It is not unusual nowadays to see motorists stopping to buy millet porridge in the morning.

#### Improving agronomics

Food scientists are working to improve agronomics and develop breeds well suited to making traditional products. In Burkina Faso, scientists have recommended that the production of sorghum grain and malt with the needed characteristics for high quality *dolo* traditional beer would require the use of water management techniques that improve soil water conditions. In Ghana, it was found that the shelf life of a popular traditional millet drink, *Pito*, could be increased by more than two months using a simple treatment of filtration, pasteurization, and bottling.

A project called the "Production of quality sorghum or millet malts for small-scale or semi-industrial food production in West Africa" sought to create the necessary conditions for small-scale production, as well as marketing, of high-quality sorghum and millet malts for beverage and baby food undertakings. The idea was to take advantage of indigenous knowledge of sorghum and millet varieties and traditional production practices while also evaluating the

various markets' quality and quantity requirements; developing and validating production methods suited to the scale of these undertakings; and promoting and optimizing the production and marketing of malt and malt derivatives. Improved malt production methods were validated in the field at two pilot SMEs: ALITECH Industries in Benin and Unité de Maltage de Ouiditinga (UMAO) in Burkina Faso. The project was carried out in three stages:

- Surveys were done in the field to gather data on the socioeconomic production environment, crop varieties, and traditional processing methods used.
- The malting process for traditional products—*gowé* (Benin) and *dolo* (Burkina Faso)—was optimized in the laboratory, then at the SMEs. Good manufacturing practices were developed and transferred to personnel through training.
- Product awareness and promotional campaigns took place on local radio stations and at trade fairs and shows.

#### Technology upgrade

Limited availability of, and poor access to, affordable processing equipment (grinders, graders, dryers, etc.) adapted for millet and sorghum processing has limited what products are available and their quality. For instance, particle size of sorghum flour must be sufficiently fine in order to substitute for wheat flour in baking recipes. Further traditional processes, in addition to being tiring and time consuming (for instance, traditional dehulling takes three women 15 minutes to dehull 2-3kg sorghum, and also leads to losses of 15–50%).

The efficient dehulling and milling of traditional grains to produce flours of appropriate quality, nutritional status, and cost is a constraint on the development of foods using small grains in the traditional and informal sectors

A technology developed in South America by Compatible Technology International (CTI) of Minneapolis, Minnesota, USA, is being piloted in the region. The CTI grinders are hand-cranked burr mills, or grinders, which produce flour from various grains and are designed specifically for families in developing countries to process crops for consumption in the home and to sell in local markets. Sturdy and easy to use, CTI's grinders are built to withstand challenging environments. These grinders can also be manufactured locally. The grinder body can be constructed of wood, aluminum, or sheet metal; components are easy to reproduce and the assembly cost of a mill with an adapted motor is about \$500 and the one with pedal systems is around \$300 depending on the materials used. They have proven themselves to be quite versatile. After an hour of using traditional methods, a group of women can produce six kilograms of grain. With CTI's grain processing suite, they can produce 45 to 60 kilograms in the same amount of time.

Building image

In order for millet and sorghum to be successful, it will be crucial to work on the “image problems” of these traditional cereals. In general, they are seen as low-value and unhygienic. The move by Ghanaian music star Samini to go into commercial production of Ghanaian brewed Pito will be a big boost to the image of the product.

Impact

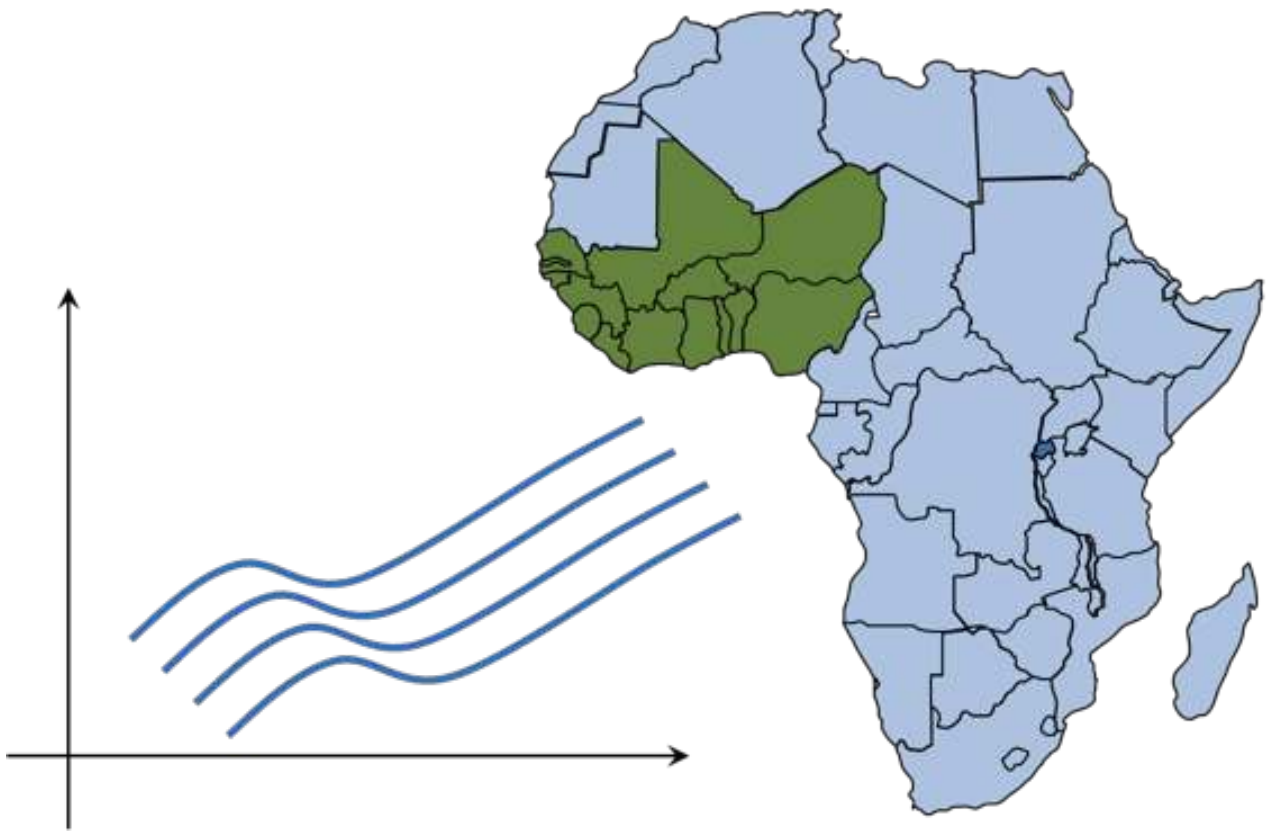
The commercialization of traditional products is a double-edged sword for women. On the one hand, it is women who usually prepare and sell traditional foods. However, it is not clear that they will be able to compete in a commercialized environment that will necessarily require significant capital injection. For instance, the very successful Koko King venture in Ghana is slowly displacing women vendors who have traditionally sold millet porridge along the roadsides of Accra.



Ghanaian music star and millet entrepreneur, Samini

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## West Africa Trends Team

Editorial	Dr. Julius Gatune Kariuki (Coordinator)
Layout	Koku Dotse, Esq.
Editorial Advisor	Dr. Ed Brown
Research	Mr. Francis Kobbina Appiah Abebrese