Fonio harvest in N'Gountjina.
Credit: Bioversity International/G. Meldrum

Research Brief: Value Chain and market potential of fonio to strengthen climate resilience, food security and women's incomes in Mali

This value chain analysis was carried out by Charlie Mbosso in collaboration with Aminata Berthe Niang, Youssoufa Mohamadou, Stefano Padulosi, Amadou Sidibe, and Gennifer Meldrum as part of the project "Linking Value Chains of Agricultural Biodiversity to Adaptation to Climate Change and Nutrition: Empowering the Poor for Risk Management "funded by the International Fund for Agricultural Development (IFAD), the European Union (EU) and the Research Programs of CGIAR Centers on Climate Change, Agriculture and Security (CCAFS) and Agriculture for Nutrition and Health (A4NH).

Fonio (*Digitaria sp*.) has been cultivated in Sahelian West Africa for thousands of years. It is considered one of the tastiest African cereals and contains essential amino acids methionine and cysteine, which are deficient in rice, wheat, maize and sorghum. With climate change, crops with shorter growth cycles, such as fonio, will become increasingly important for food production and food security. Promoting fonio consumption in urban areas could help improve household food security not only as a source of income, but also as a transitional food that contributes to household energy intake during seasonal food shortages.

Although there is growing awareness of fonio as a nutritious, gluten free, tasty and traditional cereal, the level of marketing of fonio in Mali, as well as the constraints and opportunities for developing the value chain are not well documented. Fonio could provide an opportunity for rural women to improve their incomes, but until now the involvement of women in the fonio value chain has been under-researched in Mali. An investigation was conducted in 2017 by Bioversity International and the Institute of Rural Economy (IER) to help bridge this knowledge gap, and to identify opportunities and constraints for the development of the fonio market in Mali in a gender sensitive way. The study used resource persons to collect data in Koutiala and Sikasso circles in Sikasso region and in San and Tominian circles in Ségou region, as well as in Bamako district in Koulikoro region. A participatory method was used to collect qualitative data at the level of rural communities. In addition, quantitative data were collected using semi-structured questionnaires for surveys of producers, traders and consumers.

Production

The total production of fonio in Mali in 2015 was 20,294 tonnes, representing only 0.25% of national cereal production (Ministry of Agriculture 2016). The highest production was in the Ségou region, which was responsible for 52% of the national fonio crop. Mopti, Koulikoro and Kayes are responsible for 40% of the national production, while the Sikasso region produces 8%. The recordings of fonio production in Mali since 1961 show a high variability of production between 20,000 and

Credit: Bioversity International/G. Meldrum

60,000 tons per year, with large fluctuations and a slightly downward trend (FAOSTAT).

Among the producers surveyed, fonio was produced in family plots and in personal plots, especially by men. The average area of the farmers' fonio plots surveyed was 0.82 ha (Ségou = 0.98 ha and Sikasso = 0.40 ha). In all, 17 varieties of fonio were identified in the surveyed villages. The most common were *Kassambara*, *Finidje*, *Peazo* and *Niatia*. The main reasons given by the producers for the choice of variety were: seed size (large), good yield, early maturation and seed color (white). Ten varieties were identified as having large grains (*Kassambara*, *Finidje*, *Niatia*, *Bacokutra*, *Peribou*, *Petrine*, *Wable*, *Peyibe*, *Finifin* and *Beuike*), eight varieties with a good yield (*Kassambara*, *Niatia*, *Bacokoutre*, *Finiba*, *Petrime*, *Pechine*, *Wable* and *Peyibe*), six for their precocity (*Kassambara*, *Finidje*, *Peazo*, *Bacokoutre*, *Pechine* and *Eden fini*) and six for their white color (*Finidje*, *Peazo*, *Niatia*, *Peyibe*, *Finished Eden* and *Beuike*). Some varieties were of interest to processors because of their ease of dehulling (*Peazo* and *Niatia*), good taste (*Kassambara* and *Pechine*) and quick cooking (*Finidje*). The improved varieties available in the study area are *Kassambara*, *Bacokoutre*, *Peazo* and *Niatia*. The average yield of fonio in Mali is 494 kg/ha but the mean yield estimated by the farmers surveyed was 725 kg /ha, with a maximum of 1000 kg/ha with *Kassambara*, *Niatia*, *Peribou* and *Beuike* varieties.

Most of the producers surveyed (72%) recognize that rainfall (excess or lack) has an effect on fonio yield. The major constraints for fonio production are labor availability for weeding, inadequate access to fertilizers (due to cost) and the lack of a dehusking machine. Harvesting and weeding are the most difficult tasks and take the longest time. In Sikasso the harvest of cotton coincides with that of fonio, and priority is given to cotton. Producers report a very low purchase price at the village level as well as the non-possibility of negotiation. Poor knowledge of production techniques is another challenge for some farmers. Producers lose much of their crops during planting, harvesting, drying (before threshing) and dehulling. The essential factors that allow and promote the production of fonio are the availability of land and work equipment (especially a multifunctional tractor for soil preparation).

Marketing

On average, the farmers surveyed estimated that 50% of the fonio they produce is used for domestic consumption while 30% is used for sale, 10% for seed and 10% for gifts. Farmers sell their fonio on the spot in the village. The value chain includes producers, input suppliers, mills, processors, vendors, consumers and support services. The main fonio products marketed in Mali are: paddy fonio, milled fonio, washed-dried fonio, parboiled, and djouka (mixed with peanut). The first distribution channel for fonio (paddy and milled) is a local network where farmers harvest and sell their produce directly to on-site collectors or consumers in the market of the village or neighboring village. The second chain consists of collectors who in turn supply traders (retailers, semi-wholesalers and wholesalers) before they reach consumers and exporters. The third channel (processed products) consists of processing units that supply traders (retailers, semi-wholesalers) before they reach consumers and exporters.

The market study found a diversity of proportions of fonio traders in the three regions. In the markets where the survey took place, retailers, semi-wholesalers and wholesalers were selling fonio paddy and whitened fonio. Retailers, semi-wholesalers and wholesalers were selling washed-dried fonio, djouka, and precooked fonio at market outlet counters or trays. The whitened fonio and washed-dried fonio traders were found more often in the Koulikoro - Bamako and Ségou regions than in Sikasso.

The major constraints in marketing paddy fonio are the slow pace of product flow (60%), low capital of

Fonio harvest in Burkina Faso. Credit: Bioversity International/G. Meldrum

Dehulling machine at processing centre in Tominian. Credit: Bioversity International/G. Meldrum

traders (20%) and the addition of sand by producers (20%). For bleached fonio, the constraints are at the level of the lack of buyers (62%), the low capital of the traders (31%) and inaccurate scales of the traders (9%). Traders of washed-dried fonio have difficulties in terms of lack of processing equipment (60%) and drying (40%). For precooked fonio, the lack of processing equipment (71%), drying (14%) and the presence of sand (14%) were the constraints noted. In terms of fonio djouka, the constraints are also the lack of processing equipment (44%) and the presence of sand (22%) as well as the small amount of peanuts in the product (11%).

For the production of fonio, the variable costs (labor, fertilizer purchase, etc.) are higher in Sikasso than in Ségou (110 675 Fcfa Vs 78 875 Fcfa) and the fixed costs higher in Ségou than in Sikasso (185,085 Fcfa Vs 62,045 Fcfa). At the merchant level, during the period of shortage, the volume sold per month is estimated at 1,535 kg for paddy fonio and 81 kg for milled fonio. During this same period, this monthly volume for processed products is estimated at 71 kg for washed-dried fonio, 118 kg for precooked and 163 kg for djouka fonio. Gross monthly margins amounted to 164,245 Fcfa, 6,480 Fcfa, 11,573 Fcfa, 31,506 Fcfa and 46,944 Fcfa respectively for fonio paddy, milled, washed-dried, pre-cooked and djouka. In addition to bleached fonio, other types of fonio are profitable for traders during periods of scarcity.

Consumption

All the producers surveyed appreciate the taste of fonio and say that their children also like the taste. They are well aware of its nutritional value and importance in their daily diet. Djouka is the most popular recipe among the producers surveyed, in addition foyo and tô are also preferred by some. Similarly, among consumers surveyed in the markets, djouka is the most popular recipe, but other favorite recipes are fonio couscous with peanut sauce, onion sauce, and chicken or fish sauce. Consumers are looking for a well prepared product, without sand, without grass, husked, clean, and with lots of peanut (for the djouka). Most consumers do not have a preference for variety but some indicate a preference for varieties with large grains, more often of a white variety but sometimes of a black variety.

Fonio is consumed all year but more often during the period of abundance, after harvest, when it costs less and is more generally available. It is also particularly consumed during festive periods (Ramadan, Tabaski, Christmas, Easter). Half of the consumers surveyed are interested in buying more fonio. However, the price of fonio djouka is not very affordable for consumers (989 Fcfa / kg), which is why it is more consumed during the holidays. Poor availability of fonio on the market is another constraint to promote higher consumption. The other half of the consumers were not interested in buying more fonio because the amount consumed was already sufficient or because they do not like the food enough to consume more. Most traders of fonio paddy (75%) and whitened fonio (91%) confirmed that they would not sell much more if they increase the quantity due to lack of customers. On the other hand, for processed fonio products, almost all traders said that consumers would buy much more if they increased the quantity.

The potential of fonio in Mali

Despite the scant efforts of scientific research for enhancing the cultivation and marketing of fonio, this crop still contributes substantially to the diet of many households in Mali. The

Processed fonio made by women in Somo. Credit: Bioversity International/G. Meldrum

advantage of fonio over other cereals is at the level of being harvested in the "lean season" before other grains (millet, sorghum) are ripe. The results of our study revealed that rainfall abundance has a negative effect on yield and, in the same vein, the rarity of rainfall also has a negative effect on yield. To overcome these meteorological challenges, farmers plant hedgerows or cultivate on plots in elevation, or they use late and early varieties. However, difficult access to quality seed is a hindrance to good yield. It is important to train quality seed producers in the villages and to share good production techniques that can help them cope with rainfall variability. There are many losses in the production of fonio due to the delay of harvest and because of other farm tasks. It is advisable for producers to harvest on time and to make visits regularly to identify when to harvest.

At village level the volume of fonio produced is very low and it is grown on small plots. In the same vein, fonio has a very unstable market and bad price at the village level. A warrantage system could be a means to support fonio production and profitability, enabling farmers to sell at times with higher prices. With this system, a maximum amount of product can be available at the village level while allowing the producer to solve his personal problems in parallel regardless of the sales period. Group sales are an alternative to get around this gap. There is a need for producers to organize into groups and associations, set the purchase price before production and agree on this price between producers. As a neglected and underutilized crop competing with cotton and maize, a good producer organization can help negotiate a more competitive purchase price, which can allow them to choose fonio as a priority. To be functional, groups need financial support from their partners. The absence of mills to process fonio in the villages decreases the gain at the level of the producers.

Fonio offers great opportunities for food security, sustainability, income diversification, food diversification and product development. If the adoption and improvement of the crop is achieved, it can make an important contribution to improving food and nutrition security and reducing poverty in Mali and elsewhere in Africa.

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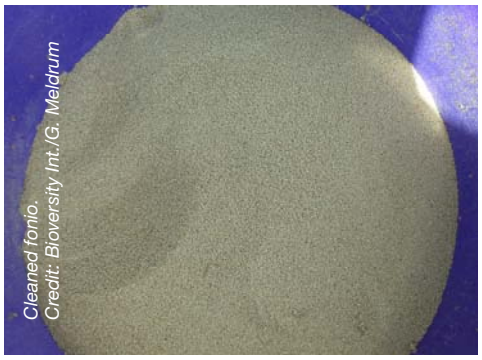
Women serving fonio in Bolimasso.
Credit: Bioversity International/G. Meldrum



Cleaned fonio.
Credit: Bioversity Int./G. Meldrum

Fonio lunch
Credit: Bioversity International/G. Meldrum