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DISCOVERING FONIO MILLET: WEST AFRICA'S ANCIENT SUPERFOOD

Teju C M[1] and Abeer Ali[2]

[1]Division of vegetable science, Central Agricultural University, Pasighat-791102, India

[2]Division of fruits and horticultural technology, ICAR IARI, Pusa, New Delhi-110 012, India

*Corresponding Author: cmteju11@gmail.com

Abstract

Fonio millet, scientifically named *Digitaria exilis,* has a rich history of cultivation in West Africa, dating back thousands of years. Its domestication is believed to have occurred in ancient times, possibly around 4500 B.C. The crop's quick maturation and short growing season have made it a vital resource for preventing food scarcity before the main harvest, earning it the nickname 'hungry rice.' While black fonio is also cultivated and used in the preparation of couscous and beer, true fonio is the more preferred food crop in the region due to the easier chaff removal process. Due to its C4 nature, drought tolerance, capacity to thrive in acidic soil with elevated aluminium, and ability to adapt to diverse climatic conditions, fonio millet becomes an excellent choice among farmers. Additionally, its high content of protein, fiber, iron, calcium, zinc, magnesium, and low glycemic index offers a promising solution for future nutritional security. This article emphasizes the unique nutritional and agronomic properties of fonio, as well as its potential as a sustainable food crop for the future.

Keywords: sustainable agriculture, climate change, true fonio, black fonio, nutritional security

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Introduction

Millets play a distinctive role in the agriculture and food security systems of countless impoverished farmers, contributing to unique biodiversity. Despite the growing global recognition of plant genetic resource conservation and local food security concerns, millets have been largely overlooked in scientific research, agricultural initiatives, and policies. To address this gap, it is essential to adopt innovative and integrated approaches that emphasize the critical link between millet biodiversity and food security. A key focus should be empowering small-scale farmers, who serve as both custodians and primary beneficiaries of this valuable agricultural genetic diversity. Ensuring sustainable food and nutrition security in developing countries requires diversifying food crops to address the risks posed by the current heavy reliance on a few major crops, which are vulnerable to pests, diseases, and climate change. In this endeavour, farmers have a valuable option in Fonio millet, a small yet powerful grain that has supported West African communities for generations. It's remarkable nutritional value, adaptability, and rapid growth make it a valuable asset for farmers and an intriguing subject for scientists researching sustainable and resilient crops. Fonio millet is a versatile crop that thrives in diverse agroecological conditions, making it an ideal choice to ensure food security and sustainable livelihoods across West Africa. Beyond its agricultural significance, fonio holds profound cultural value

among the dryland communities in the region, playing a central role in social gatherings and celebrations. Appreciated for its culinary excellence, fonio has garnered attention in prestigious gastronomic markets both nationally and internationally. Moreover, the crop is revered as sacred by rural communities in West Africa due to its remarkable agroecological capabilities, vital role in food security, nutritional and medicinal benefits, and its wide array of culinary applications.

Botany, taxonomy and evolution of Fonio Millet

Fonio millet, scientifically known as Digitaria exilis, has been cultivated for thousands of years in West Africa. The crop's domestication is believed to be ancient, possibly dating back to around 4500 B.C. in the region around the headwaters of the Niger River. From there, it spread throughout the Savanna zone, becoming a vital staple crop for millions of people in countries like Cape Verde, Nigeria, Guinea, Cameroon, and more. In contrast to finger millet, foxtail millet, and tef, which have garnered significant attention, fonio germplasm accessions stored in genebanks of national research systems (NARS) and CGIAR centers are notably scarce. It was not until 2018 that more than 600 fonio accessions were finally collected from six West African countries (Ibrahim et al., 2021). The genus Digitaria includes around 230 species, Digitaria exilis, also called "hungry rice" or "true fonio," and Digitaria iburua black fonio are two domesticated species (Figure 1). The probable natural ancestor of cultivated fonio is the tetraploid annual weed D. longiflora, which is commonly found across tropical Africa. It is a tetraploid species with 2n = 4x = 36. The genome size of tetraploid species was estimated to be 893 Mb/1C (Abrouk et al., 2020).

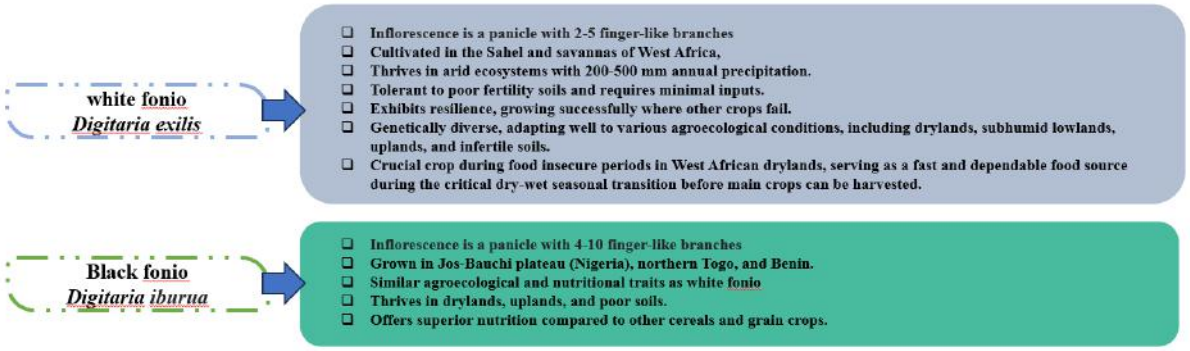

Figure 1: cultivated species of fonio

Notably, the seeds are extremely small and enclosed by glumes and lemmas, resembling the appearance of finger millet, barley, and rice. (Ibrahim et al., 2021). In comparison to D. exilis, the untamed D. longiflora exhibits more pronounced seed shattering and spikelets covered in hair. This implies that there might have been a process of selection favouring decreased seed shattering and reduced hairiness in fonio. Due to its rapid maturation and short growing season fonio is commonly cultivated to prevent food scarcity during the period before the main harvest, leading to its nickname as ‘hungry rice’. True fonio is more popularly grown over black fonio, black fonio is used to prepare couscous and beer, but its chaff removal process makes true fonio more preferred as a food crop in the region. Fonio, a compact, yearly herbaceous C4 plant, yields extremely tiny grains (about 1 mm in size) enclosed within a husk. It can be grown in a wide variety of environmental settings, ranging from a tropical monsoon climate in western Guinea to a hot and dry desert climate in the Sahel zone. These cereals are used both as food, fodder, brewing even ceremonial purposes. Fonio has an impressive

adaptability to diverse climatic conditions, making it an excellent choice for farmers in the region.

Sustainable Investment in the Future

This level of adaptation is crucial, especially considering the uncertainty of climate. The distribution of high-yielding grain crops has been fragmented and reduced to remnants over time due to historical and modern changes. As a result, Fonio, a drought-tolerant, C4 crop that doesn't rely on external inputs, emerges as a crucial plant to cultivate. Guinea and Nigeria are the primary producers, accounting for 76% and 12% of the total production, respectively, while several other producing nations are also experiencing a notable resurgence. The cultivation of fonio necessitates minimal land preparation and is well-suited to grow in less fertile soils. Moreover, fonio is commonly cultivated on acidic soils with elevated aluminum levels using monocultural systems following a fallow period.

As the world faces mounting challenges related to climate change and food security, embracing crops like Fonio millet becomes crucial. Fonio is a small, gluten-free grain that is native to West Africa. It is one of the fastest-growing cereals in the world, reaching maturity in as little as six to eight weeks. Its low water requirements and minimal need for chemical inputs align with the vision of eco-friendly farming practices. They are considered persistent crops as they can thrive under challenging agricultural conditions, from semi-arid to sub-humid, especially during droughts, without requiring intensive cultivation. It has C4 metabolism and drought resistance. It serves as a staple crop in certain regions, providing food for 3-4 million people during ecologically challenging months. Fonio has a short growing season of 40 days to three and a half months. Due to its rapid maturation, fonio is commonly cultivated to prevent food scarcity during the period before the main harvest, leading to its nickname 'hungry rice'. Additionally, Fonio millet can thrive in soils that are otherwise unproductive, making it a valuable asset for turning barren land into arable fields. By including this nutritious grain in their crop rotation, farmers can enhance soil fertility and reduce pest and disease pressure. Continuous cropping of fonio millet for three years has been reported to effectively eliminate soil pest and disease infestations, such as charcoal rot caused by *Macrophomina phaseolina*. This is a remarkable advantage, as it reduces the need for chemical interventions.

Nutritional and culinary point of view

Fonio millet packs a nutritional punch that rivals some of the more popular grains. It is rich in essential nutrients like iron, calcium, zinc, and magnesium. Fonio millet plays a significant role in ensuring food security and generating income for households due to its considerable yield (up to 1 ton per hectare) and excellent nutritional value (over 1400 kJ per 100 g). It is an excellent source of dietary fiber and provides a good amount of protein, making it a valuable addition to balanced diets. In an era where malnutrition is a concern, Fonio millet stands out as a potential solution to provide wholesome nutrition to communities. Its cultivation could help combat deficiencies and improve the overall health and well-being of the population. Beyond its remarkable agronomic qualities, fonio millet is a nutritional powerhouse. Packed with essential nutrients like protein, fiber, and vitamins, fonio offers a healthful alternative to refined grains. Its gluten-free nature makes it suitable for individuals with dietary restrictions, while its low glycemic index makes it an ideal choice for those managing blood sugar levels. Fonio is also very nutritious, high in protein, fiber, and iron. It is a good source of vitamins B1 and B6, as well as magnesium and phosphorus.

For generations, the inhabitants of West Africa have been involved in the cultivation and consumption of Fonio, preserving their ancestral recipes and culinary knowledge. This versatile grain has inspired a wide range of dishes, including Fonio porridge, couscous, and flour used for bread, pancakes, and baked goods. Even Fonio beer is crafted from it. Whether used in couscous, stews, gruels, or brewed beverages, fonio millet's unique nutty taste and fluffy texture add a delightful touch to every meal. Moreover, its remarkable ability to absorb flavors makes it a perfect companion for both savory and sweet culinary creations.

Empowering Local Communities

By embracing Fonio, consumers are not just adding a nutritious grain to their diets; they are also supporting local communities in West Africa. As international demand for Fonio grows, the economic opportunities for farmers and producers in the region increase, leading to more significant social impact and sustainable development. The global spotlight on Fonio has led to its availability in specialty stores and online markets worldwide. Food enthusiasts are experimenting with new recipes, and restaurants are showcasing innovative dishes featuring this ancient grain. However, like many neglected crops, fonio faces challenges that hinder its use as a reliable food source. These challenges include the presence of anti-nutrients, low digestibility, unappealing taste, small seed size, lodging, and seed shattering, which reduce yield and grain quality.

Conclusion

Fonio millet stands as an undiscovered gem with vast potential, offering adaptability, nutrition, and sustainability in challenging conditions. By unlocking the potential of this small but mighty grain, we can combat hunger and malnutrition worldwide. Embracing Fonio millet holds the key to a sustainable and nourishing future, symbolizing rediscovery and appreciation for the diverse gifts of our planet. In the realm of neglected small cereal crops, such as Fonio millet, research efforts must focus on identifying superior genotypes with enhanced nutritional value and agricultural characteristics. These traits, including tolerance to various stresses, are crucial to creating inclusive value chains and income-generating activities through market-based methods. This approach will enable the widespread commercialization of small millet products, making them more competitive and enhancing food and nutrition security for farmers with limited resources, especially in the face of climate change and variability.

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