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Reviving Forgotten Grains: The Promise of Fonio, Teff, and Amaranth for Future Food Security

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Abstract

Climate change, population increase, soil erosion, and over reliance on a small number of staple crops including rice, wheat, and maize are all causes of growing concerns about global food security. These crops though very essential, are usually prone to drought, pests, and market shocks. Conversely, the forgotten grains are a collection of old and underused grains, with which there is currently a second wave of hope that a better and more sustainable food future can be constructed. They include Fonio, Teff, and Amaranth, which are outstanding in terms of their excellent nutritional value, flexibility, and cultural backgrounds. Fonio is an example of a West African grain, and is one of the oldest crops to be cultivated, as it has a short growth cycle, and can grow well in poor and drought-resistant soils. It has a high level of crucial amino acids, iron, and fiber and is therefore best used to counter malnutrition and complement climate-resilient agriculture. Teff is a small Ethiopian cereal, which is highly appreciated because it contains a lot of calcium, iron, and protein and is produced in a gluten-free form, so it is also popular in health-conscious markets. Being a grain and a leafy vegetable, Amaranth, which was a sacred crop to the Aztecs and Incas, is a complete source of protein and essential micronutrients. It thrives in dry and marginalized lands that other crops do not do very well. The reintroduction of these grains will do not only improve the nutritional value and dietary diversity but also biodiversity, empower farmer who are small scale farmers and the local economy. Nevertheless, some are still faced such as insufficient research, customer awareness, and poor value chains. These issues can be harnessed by supporting them with policies, technological advancement, and international

cooperation. Integrating Fonio, Teff, and Amaranth into the modern food systems would make a significant contribution to the achievement of the Sustainable Development Goals of the United Nations, especially the ones associated with zero hunger, good health, and climate action. The recovery of these lost grains is not only a change in agriculture, but a move towards regaining ecological balance, cultural heritage and food and nutritional security of future generations.

Introduction

The problem of food security, which can be described as the availability, access, and consumption of adequate, safe, and nutritious food by everyone in the world is one of the most significant problems in the world. As the world is projected to have almost 10 billion people by 2050, it will only keep on increasing the demand of food. However, contemporary farming is based on several staple crops like rice, wheat and maize which supply the world with foods that are more than half of the global calories. The global food system is very susceptible to climate changing, pests and epidemic outbreak because of this overreliance on fewer crops. Mon cropping activities also diminish biodiversity, diminish the quality of soil and augment the strain on natural resources such as water and land. Given these mounting pressures, scholars, and policymakers now find themselves looking to abandoned or lowly utilized grains- ancient foods that were once core to local production, but which have been overlooked in contemporary food production. Being adapted to tough weather and non-fertile soil these grains provide a good chance to diversify food production and enhance the ability to withstand environmental stress. Among them, Fonio, Teff, and Amaranth are receiving a new awakening of interest due to their superior nutritional characteristics, cultural significance, and environmentally-friendly adaptability.

Fonio was long grown in West Africa and grows fast and in dry and sandy soils where other plants would failed. Ethiopia has a small grain known as Teff, which is her ancient staple that is rich in protein, calcium and iron. Amaranth is also a pseudo-cereal and leafy vegetable that is full of vitamins, minerals and complete proteins that were held sacred in the ancient civilizations on

the Americas. These grains in combination act as a sustainable alternative to the traditional staples, and they are both nutritionally and ecologically healthy. Bringing back these lost grains is not purely an agricultural solution but rather a process of bringing back diversity in world food systems. With a combination of them in contemporary diets and market, societies can eliminate their reliance on the susceptibility to staple crops, assist the smallholder farmers, and enhance regional economies. But fulfilling their full potential is achieved by doing more research, investing and creating awareness.

Case of Forgotten Grains.

Over the centuries, there have been diverse types of grains that have been grown by human societies depending on their local conditions. Nevertheless, as industrial agriculture and international commerce grew, the focus was switched to a small number of staple crops which have high yields, e.g. rice, wheat, and maize. This displaced numerous traditional grains, commonly referred to as forgotten or used sparingly. This displacement of these crops was not caused by lack of value, but by lack of easy fitting in the requirements of the mass production and global markets. This led to the homogenization of diets across the world, and the agricultural biodiversity plummeted.

In the contemporary world, the societies are in a dire need to reconsider their food systems. Global warming, unpredictable precipitation, and decreased soil fertility pose a threat to the yield of major crops. Meanwhile, millions of people are starving and have micronutrient deficiencies, and others are exposed to increased numbers of diet-related diseases. One significant way out of these mutually reinforcing difficulties is forgotten grains. All these crops are naturally resistant to drought, heat, and poor soils, a combination of which renders them the best to grow in areas where climate stress is the most prominent. In addition to the benefits they have on the environment, forgotten grains have great nutritional worth. Most of them contain the essential amino acids, dietary fiber, vitamins, and minerals, which are usually short in the contemporary diets. Fonio is a source of missing amino acids (methionine and cysteine) in most cereals; Teff is

rich in calcium and iron; and Amaranth is a complete protein equivalent to soy. These crops should be promoted to help fight malnutrition and also to better the health of people particularly in the developing areas. The attempt to revive the forgotten grains also has a good social and cultural implication. These are crops that rather have a deep connection with the traditional farming and culinary systems. Their sustainability enables the local farmers especially women who tend to have control over their production and processing. It is also useful in conservation of cultural heritage, indigenous knowledge and biodiversity. There is a realization by global organizations such as the Food and Agriculture Organization (FAO) that neglected and underutilized species are important in sustainable agriculture. They can be reintroduced into the mainstream food systems by encouraging them to conduct research, conserve seeds and develop the market. In a world that is trying to achieve food security and sustainability, forgotten grains are not only things of the past, but the basis of a stronger and more varied future.

Fonio:

The African traditional diet depends on fonio, the so-called oldest cultivated cereal in Africa, which has been a staple of African diet thousands of years. It is mostly common in Senegal, Mali, Guinea, and Nigeria, where it is not only an important source of food, but also a cultural heritage to people. Although it has a long history, Fonio is not yet globally well-known, though, only a few years ago, when the world started to pay attention to sustainable and nutrient-rich crops.

The outstanding quality of Fonio is its great flexibility. It has a great survival in poor, sandy, and rocky soils where other cereals suffer to survive. It does not use much water, and grows fast- many times within 6 to 8 weeks and so is suitable in areas where rainfall is irregular and drought occurs. These characteristics have made Fonio a climate-cultivar that is more conducive to food security as well as environmental sustainability. Fonio can be harvested when farmers are in the lean season thus a source of income and nourishment at an early time before the other crops are produced. Fonio is a nutritional power house. It is gluten free and so it is suitable to individuals

with celiac disease or those intolerant to gluten. It is also very high in iron, zinc, magnesium, B vitamins and especially rich in methionine and cysteine which are essential amino acids absent in most other cereals. This makes Fonio a very good supplement to other grains and legumes in the diet, to help deal with protein and micronutrient deficiencies in at-risk groups. Fonio has a huge economic and social potential in addition to its nutritional and environmental benefits. Its West Africa processing and marketing are under the control of women in most West African societies, who enjoy essential livelihoods and empowerment of gender. But the small size of the grain and the difficulty of husking Fonio has long made the processing of the grain time-consuming. New technological advances that have emerged recently like enhanced threshers and dehulling machines are starting to address these drawbacks which are providing new market growth opportunities.

Teff:

The smallest grain in the world, teff is a popular food and culture icon of Ethiopia, where it has been grown more than 3,000 years. Although it may be small, Teff has an immensely large contribution to Ethiopian diets, firstly because of being the major component of injera, which is a soft, spongy type of flatbread that is consumed on a daily basis in most households. Resilience, nutritional value and versatility of the grain has recently attracted international focus and the grain is no longer a local crop; it can also be a potential superfood in the future with regard to sustainable food systems. Teff agronomically benefits especially in a fluctuating climate. It is able to develop in very diverse elevations-including sea level to 3,000 meters- and can also flourish in drought-prone as well as in waterlogged soil. It has got a good root system that prevents soil erosion, and it has got a short growing season, meaning that it can be planted under any type of cropping. This is because such traits have rendered Teff a dependable crop even during unpredictable weather conditions and that provides security to the smallholder farmers who rely on agriculture as their means of livelihood.

Teff is unbelievable in terms of nutrition. It is a good source of protein, calcium, iron and dietary fiber and it is naturally gluten-free. The grain is a good quality protein source as it has all the eight essential amino acids. Its complex carbohydrates give slow-energy and its high iron to help fight anemia which is prevalent in most of the developing countries. Teff unlike refined grains can be taken as a whole grain and so it can retain its nutrients thus being a great choice in ensuring balanced childhood diets and preventing lifestyle diseases including diabetes and obesity. In addition to its nutritional and environmental advantages, Teff has increased economic opportunity. Teff-based products, which include flour, pasta and breakfast cereals, have also become a highly demanded product in the world due to the growing population of consumers who are interested in gluten-free and healthy foods. This demand presents the Ethiopian farmers and entrepreneurs with an opportunity to export their goods. Nevertheless, production and marketing on large scale is still constrained by the challenge of limited mechanization, seed improvement, and post-harvest handling. Through proper policy intervention, research funding and better value chain, Teff can contribute significantly to food and nutrition security not only in Africa but worldwide. The revival and marketing of Teff is not just all about a new health food- it is more of a revisiting an antique grains which has a resilience, sustainability and long held wisdom of Ethiopian grains.

Amaranth: The Resilient Pseudo-Cereal

One such crop that is starting to appear again as a super grain to the new world is amaranth, an ancient crop that had been held in high regard by the Aztecs and the Incas. Amaranth seeds and leaves are very nutritious but also very versatile, although technically is not a cereal but a pseudo-cereal as it does not belong to the actual cereal family. It was a religious plant of pre-Columbian civilizations accused over 8,000 years, representing life and power. Amaranth is re-finding popularity in the world today; it boasts of excellent resilience, nutritional value and adaptability to various environmental conditions.

The fact that Amaranth can survive in rather adverse conditions is one of its strongest points. It is a drought resistant crop which withstands high temperatures, salty soils, and is a great crop to be used in areas that have suffered the impact of climate change. It is fast growing, low in inputs, and can be grown in the tropics and temperate regions. It has a deep root system that enhances the structure of the soil and eliminates soil erosion, which contributes to sustainable farming. Amaranth is a promising crop that is readily being appreciated by farmers in Asia, Africa, and Latin America as a potential crop in low-input and resource-poor agricultural systems. Amaranth is nutritionally superior. Its seeds have 13-18 percent of high-protein, which also includes lysine, which is essential amino acid and is usually deficient in other grains. It also contains a lot of calcium, iron, magnesium and vitamins A, C and E. In addition, Amaranth is gluten-free, so it is ok to use by individuals with a gluten intolerance or celiac disease. Its leaves are also edible and are more nutritious as compared to the grains, which can be used by the rural population as a source of vitamins and minerals. The edible grains together with the edible leaves render Amaranth a two-fold crop, increasing the food and nutritional security. Amaranth has emerging business prospects both locally and internationally economically. Its grains may be made into flour, popcorn, or even in breakfast cereals, snacks and baked goods. It is becoming a popular cash crop to the small scale farmers in most parts of the developing world. Nevertheless, its adoption is hindered by such challenges as the lack of research, awareness, and a lack of structured value chains. The sustainable agriculture and nutrition across the globe can be reinforced by encouraging Amaranth production through research and training and development, as well as, market development. Its restoration is not merely a reversion to an ancient and traditional aesthetics, but a visionary strategy of creating strong food systems capable of sustaining human populations and safeguarding the planet.

Comparison of nutritional and Environmental.

Comparing the nutritional and environmental benefits of Fonio, Teff, and Amaranth to the traditional staple crops like rice, wheat, and maize, their benefits are evident. Not only do these

ancient grains provide a highly nutritionally balanced and enriched source but also use less resources and therefore can serve as highly viable alternatives in the face of climate change and resource deficiency.

Nutritional Profile:

Fonio, Teff and Amaranth are all naturally gluten-free and contain the necessary nutrients. Fonio is a source of good amino acids such as methionine and cysteine which are normally missing in other cereals. It is also rich in iron, zinc and fiber hence, is a perfect food in fighting anemia and malnutrition. Teff is minute in size; however, it has high nutritional capability. It is rich in protein, calcium and iron, as well as being a source of resistant starch, which can be used to maintain a stable level of blood sugar. Amaranth is a pseudo- cereal that is unique because it provides a complete protein profile that contains all the essential amino acids such as lysine. Its dietary value is also added by its leaves which contain other vitamins A and C. When combined, the grains have the potential to diversify the diets, enhance gut health, and solve nutrient deficiencies in the developed and developing countries.

Environmental Adaptability:

These grains are ecological champions in terms of resilience. Fonio can grow in poor and sandy soils and is fast-growing therefore is an appropriate plant in regions where there is a short growing season and which are affected by drought. Teff is also adaptable to a great variety of altitudes and climates, withstanding drought conditions and interim waterlogging. Amaranth thrives effectively in the presence of heat and salinity stress and is economical with water and helps in the restoration of the soil due to its deep roots. They are also sustainably cultivated with minimal inputs compared to the modern cereals which require intense irrigation, fertilisers and pesticides and this lessens the carbon footprint of agriculture.

Future Potential and Sustainability:

Planting the forgotten grains will help to improve the biodiversity, promote the soil fertility and minimize the environmental degradation through monocropping. They improve food resilience to climate shocks and sustenance of the livelihood of smallholder farmers through their inclusion in farming systems. They also have a flexibility that can enable them to utilize marginal lands that are either degraded or arid, thus increasing the limits of farming.

Difficulties in Resurrection of Forgotten Grains.

Even though Fonio, Teff, and Amaranth have enormous potential to enhance nutrition, sustainability, and resilience, their adoption by numerous people is associated with a number of obstacles. The causes of these barriers have been social, technological, economic and policy factors that have long acted to restrict their incorporation into the contemporary agricultural and food systems.

1. Inadequate Research and Development:

The forgotten grains have not gained much attention as compared to major cereals like wheat, rice, and maize because agricultural scientists and policymakers have not given them much attention. Their genetics, breeding and agronomic practices are not researched. This has impeded the production of better, high yielding and resistant to pests varieties that would rival those produced conventionally. Farmers can also not adopt them with a lot of confidence due to the lack of information about their potential in production.

2. Processing and Post-Harvest Problems:

Most of such grains contain small seeds and therefore, processing is time-consuming and labor intensive. An example is that Fonio needs dehusking, and Teff has very small grains that might be challenging to work with machines. The absence of effective post-harvest technology raises the cost of production and restricts massive commercialization. It is difficult to satisfy the

increasing demand of these crops in the market unless there is an investment in modern processing equipment and value addition.

3. Weak Market and Value Chains:

The unavailability of good market places makes farmers discouraged to produce forgotten grains. These are crops that are usually grown as domestic or home produce as opposed to being sold commercially. The market awareness of the consumers is also low, especially when they are not in their traditional markets. The lack of quality standards, lack of good infrastructure and organization of supply chains also limits their access to mainstream food industries.

4. Policy Neglect and Institutional Barriers:

The various agricultural policies and subsidies have been geared towards large staple crops hence not much support to the under utilized species. It has little coverage of overlooked grains on government food programs, funding research and extension services. In addition, there are cases of export and commercialization of traditional grains such as Teff being curtailed by global trade regulations and intellectual property in order to narrow down their economic potential.

5. Consumer Awareness and Cultural Perception:

In other areas, forgotten grains are perceived as food of the poor man, and this makes their acceptance socially inferior. Their health and environmental benefits are the way to create awareness to restore the consumer demand.

Conclusion

Bringing back the lost grains like Fonio, Teff and Amaranth is a way forward in ensuring that the world is food and nutritionally secure in an age of climate insecurities and environmental destruction. These ancient crops, which have fallen out of favor in the modern agricultural systems, have the resiliency, nutritional benefits, and adaptation capabilities required to bolster

food systems that are already over-dependent on several specific major staples. The fact that they grow well in low soils, can withstand droughts and provide high nutritional significance makes them indispensable both to farmers and consumers. The brief growing period and the ability of fonio to thrive in degraded soils and arid environment bring out the potential of fonio as food security crop in arid zones. Teff, not only supplies millions of people in the Ethiopian market with its superb protein and mineral composition but also provides global customers with a healthy, gluten-free substitute. The nutritional benefit offered by amaranth as a grain as well as a leafy vegetable also offers food and nutrition security in addition to sustaining food farming systems. Taken together, the crops are a symbol of the diversity, resilience and sustainability that modern agriculture is desperately seeking. Nevertheless, to achieve their potentials, they need to overcome the prevailing obstacles to low awareness, insufficient research, limited processing facilities and poor market structures. Governments, researchers, and development organizations have to collaborate to assist in developing enabling policies that can facilitate cultivation, processing, and marketing of these crops. They can be converted into high value crops that can be traded internationally by investing in value addition, capacity building, and international collaborations. In addition to the economic and nutritional utility, the reintroduction of forgotten grains also implies connection with the cultural heritage and the recovery of the biodiversity that was erased by industrial agriculture. It is a chance to empower small holder farmers especially women who are at the center of their production and processing.

Reference

1. Msora-Kasago, C. (2021, February 3). Fonio: Nutrition, benefits, uses, and more. Healthline.

2. Ijeomah, O. C., & Okpala, M. O. (n.d.). Bioavailability of nutrients in a fonio (Digitaria exilis) / ricebean (Vigna umbellata) based complementary food. American Journal of Food Sciences and Nutrition.

3. Giacomini, A., & Lante, A. (2021). Fatty acid profile, lipid quality and squalene content of teff (Eragrostis tef) and amaranth (Amaranthus caudatus) varieties from Ethiopia. Applied Sciences, 11(8), 3590.

4. “Fonio (Acha) | Lost Crops of Africa: Volume I: Grains.” (n.d.). In The National Academies Press.

5. “Teff flour: Uses, nutrients, and benefits.” (n.d.). Healthline.

6. Ajmera, R. (n.d.). "Amaranth: An ancient grain with impressive health benefits." Healthline.

7. Sharma, A. (2017). Amaranth: A pseudocereal. Nutrition & Food Science International Journal, 3(3).

8. Yadav, A., & Yadav, K. (2024). From humble beginnings to nutritional powerhouse: The rise of amaranth as a climate-resilient superfood. Tropical Plants, 3, e037.

9. “Grain amaranth: A versatile untapped climate-smart crop for enhancing food and nutritional security.” (2024, August 6). Discover Agriculture, 2, 44.

10. “Teff: A healthy crop of the century – Challenges and opportunities for enhancing productivity under climate change.” (2025, February 27). Discover Agriculture, 3, 31.