

## Why Millets Are Back: The Genetics Behind Nutri-Cereals

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### INTRODUCTION

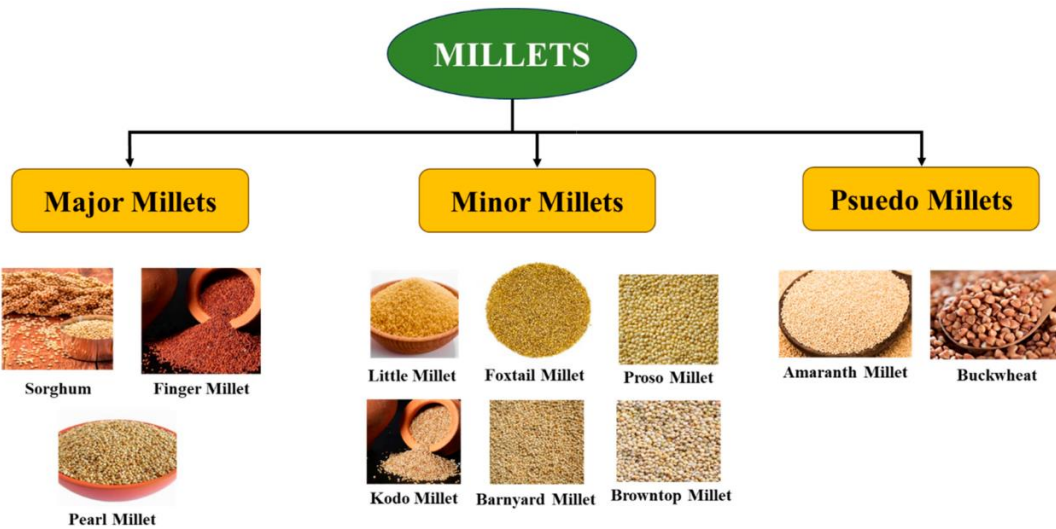
For decades, millets were dismissed as “poor man’s food” in many parts of the world, especially in India. Yet today, they are re-emerging as superfoods, climate-resilient crops, and nutri-cereals. This dramatic comeback is not accidental it is rooted in a powerful combination of genetics, nutrition, sustainability, and changing consumer awareness. Millets are among the oldest cultivated grains, consumed since ancient civilizations across Asia and Africa. Over time, however, they were replaced by high-yielding crops like rice and wheat during the Green Revolution. Today, with rising health concerns, climate challenges, and advances in crop science, millets are reclaiming their place on our plates and in our research laboratories. This article explores not just why millets are back, but also how their genetic makeup makes them uniquely suited for the future of agriculture and nutrition.

### 1. What Are Millets

Millets are a group of small-seeded grasses cultivated as cereal crops. They are widely grown in semi-arid and dry regions, where other crops struggle to survive. Their adaptability is a direct result of their genetic resilience, which we will explore later.

### Classification of Millets

Category	Common Name	Local Name (India)
Major Millets	Pearl Millet	Bajra
	Finger Millet	Ragi
	Sorghum	Jowar
Minor Millets	Foxtail Millet	Kangni / Kakum
	Little Millet	Kutki
	Barnyard Millet	Sanwa / Jhangora
	Kodo Millet	Kodo



## 2. Why Millets Disappeared-and Why They're Back

### 2.1 The Decline

During the mid-20<sup>th</sup> century, agricultural policies promoted high-yielding rice and wheat through irrigation, fertilizers and subsidies, pushing millets to marginal lands. Their decline was further driven by lack of processing technologies, low market demand, social stigma as “inferior grains” and changing dietary preferences toward refined cereals.

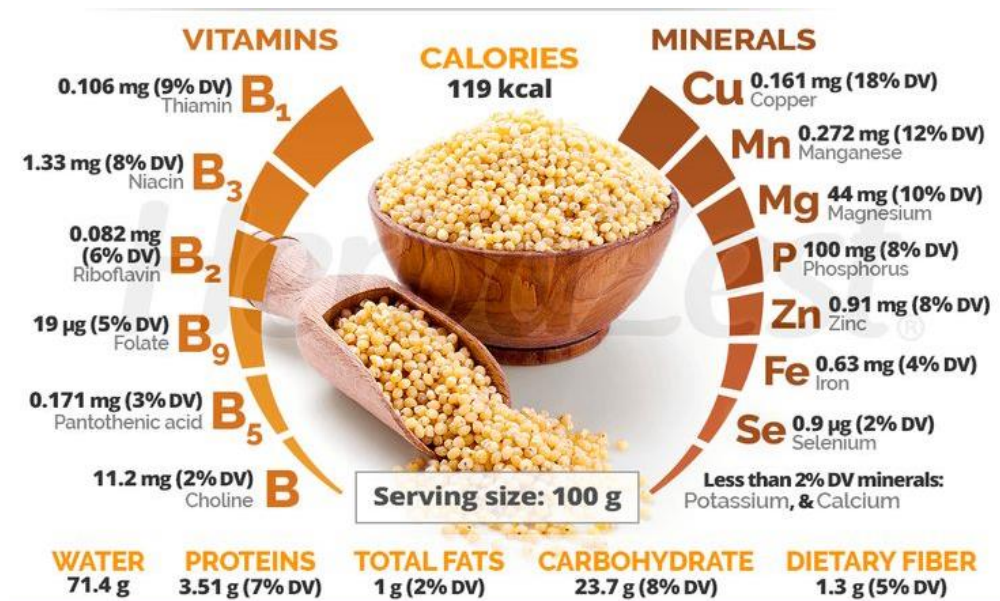
### 2.2 The Comeback

Today, millets are resurging due to several key factors. Growing health awareness has increased demand, as millets help manage diabetes, obesity, and cardiovascular diseases

due to their high fiber and nutrient content. Climate change has further boosted their importance, as they are naturally drought-tolerant and climate-resilient. Strong policy support from governments and global organizations has promoted millets as “nutri-cereals” for food and nutritional security. Additionally, changing lifestyles and the “back-to-roots” movement have encouraged urban consumers to rediscover traditional, healthier foods.

### 3. The Genetics Behind Millets' Superiority

The real secret behind millet revival lies in their genetic architecture. Unlike highly bred crops like wheat and rice, millets retain a high level of genetic diversity, which provides several advantages.



### **3.1 Genetic Diversity: The Foundation of Resilience**

Millets exhibit wide genetic variability, which enables different varieties to tolerate a range of environmental stresses and adapt to diverse agro-ecological conditions. This strong genetic diversity also allows millets to evolve relatively faster under changing climatic conditions. As a result, millets are well-suited for cultivation in challenging environments such as poor soils and low rainfall regions.

### **3.2 Stress Tolerance Genes**

Millets possess specific genes that provide resistance to major abiotic stresses such as drought, heat stress, and salinity. These genes help regulate important physiological processes including efficient water use, development of deep root systems, and maintenance of osmotic balance under stress conditions. For instance, pearl millet carries genes associated with high water-use efficiency, while finger millet is known for its strong ability to accumulate calcium, making it nutritionally rich and physiologically resilient.

### **3.3 Nutritional Genetics**

One of the most promising aspects of millet genetics is their strong biofortification potential. Certain millet varieties naturally possess high levels of essential nutrients such as iron, calcium, and improved amino acid profiles. These desirable traits are governed by specific genes that control nutrient uptake from the soil, their efficient storage in grains, and key metabolic pathways.

### **3.4 Short Growth Cycle Genes**

Millets are early-maturing crops, typically completing their life cycle within 60–90 days. This rapid maturity is controlled by genes responsible for early flowering and fast grain filling. As a result, farmers benefit by being able to grow multiple crops in a year and avoid

major yield losses by escaping drought periods.

## **4. Advances in Millet Genomics**

### **4.1 Genome Sequencing**

Scientists have successfully decoded the genomes of several millet crops, including pearl millet and foxtail millet. This genomic information has been instrumental in identifying key genes responsible for stress tolerance, improved nutritional quality, and enhanced yield traits.

### **4.2 Marker-Assisted Breeding**

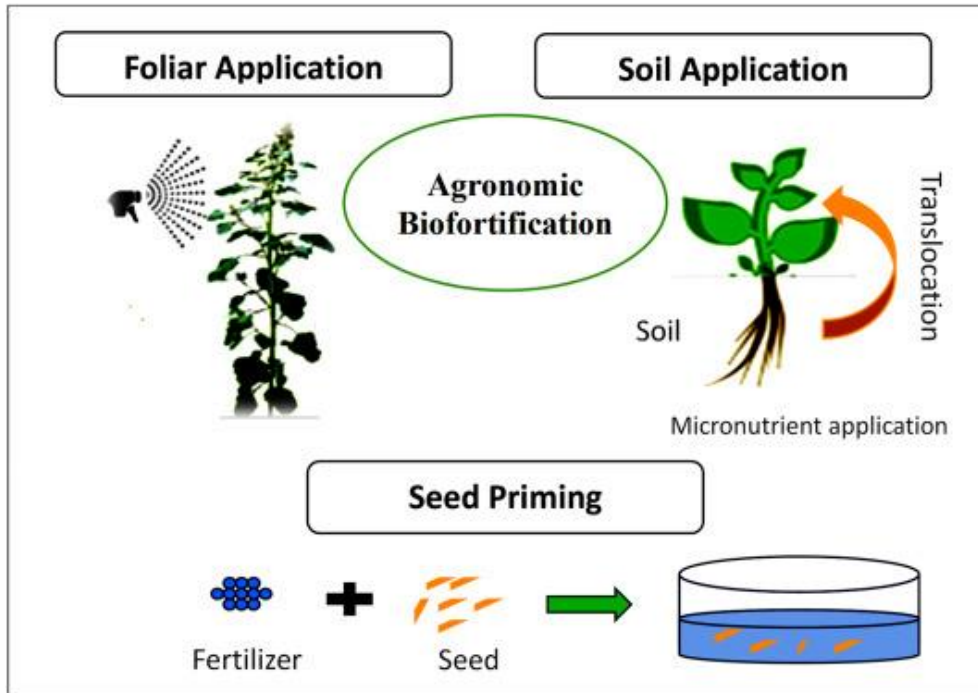
Using genetic markers, breeders can rapidly identify and select desirable traits in millets, enabling the development of improved varieties in a shorter time. This approach significantly accelerates the breeding process by improving accuracy and reducing the time required for selection and variety development.

### **4.3 CRISPR and Gene Editing**

Emerging technologies such as CRISPR enable precise gene editing in millets, allowing targeted modification of specific traits. This technology helps in enhancing nutritional quality, improving stress resistance, and accelerating the development of superior millet varieties for future agricultural needs.

## **5. Millets and Sustainable Agriculture**

Millets require very low agricultural inputs, such as minimal irrigation, fertilizers, and pesticides, making them highly cost-effective for farmers. They are also naturally climate-resilient, capable of thriving under drought, heat, and erratic rainfall conditions. In addition, millets contribute to soil health by improving soil structure, enhancing organic matter, and supporting sustainable farming systems. Millets are not just nutritious—they are environmentally sustainable.



## 6. Role in Food and Nutritional Security

Millets are crucial for addressing global food challenges:

Theme	Key Points	Impact / Benefits
Combating Malnutrition	High nutrient density	Helps reduce iron deficiency anemia, calcium deficiency, and protein-energy malnutrition
Supporting Small Farmers	Grows in poor soils, requires fewer inputs, stable yields	Ensures low-cost cultivation and livelihood security for marginal farmers
Diversifying Diets	Promotes dietary variety beyond rice and wheat	Improves nutritional balance and reduces overdependence on a few staple cereals

## 7. Processing and Value Addition

Processing challenges have limited millet consumption, but recent innovations have improved their usability. Millets are now used in noodles, ready-to-eat snacks, bakery products, and functional foods. Techniques such as fermentation, sprouting, and malting enhance nutrient availability, digestibility, and taste, making millets more acceptable in modern diets.

## 8. Consumer Perception and Market Trends

Millets are being rebranded from “coarse grains” to “nutri-cereals” and from traditional foods to “superfoods.” Urban consumers increasingly associate them with health, fitness, and sustainability. However, challenges such as taste preferences, limited awareness, and cooking inconvenience still

exist. Despite these issues, demand for millets is steadily increasing due to growing health-conscious lifestyles.

## 9. Challenges in Millet Promotion

Despite their numerous benefits, millets still face several challenges such as limited processing infrastructure, comparatively lower yields in some cases, market fluctuations, and low consumer awareness. Overcoming these constraints requires strong policy support, increased research investment, and the development of efficient value chains to strengthen production, processing, and marketing systems.

## 10. Future Prospects: The Genetic Road Ahead

The future of millets lies in genomics-driven agriculture, focusing on the development of climate-smart varieties, biofortified millets,

high-yielding hybrids, and integration with digital agriculture technologies. With continuous advances in genetic research and breeding, millets have the potential to regain status as staple crops, serve as functional foods for modern health-conscious diets, and act as important tools for climate change adaptation.

### CONCLUSION

The resurgence of millets is not a temporary trend-it is a scientifically grounded movement shaped by genetics, nutrition, and sustainability. Their rich genetic diversity

enables them to thrive under harsh conditions while delivering superior nutritional benefits. In a world facing climate uncertainty, resource scarcity, and rising health concerns, millets represent a powerful solution. They are not just relics of the past but crops of the future, bridging traditional wisdom with modern science. The phrase “nutri-cereals” is more than a label-it reflects a deeper understanding of how genetics and nutrition intersect to create resilient, health-promoting food systems. Millets are back and this time, they are here to stay.