

## Millets: Future Smart Food

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### INTRODUCTION

The global food system is currently facing multiple challenges, including climate change, declining natural resources, population pressure, malnutrition, and increasing prevalence of non-communicable diseases. Conventional cereal-based food systems, heavily dependent on rice and wheat, have led to monocropping, excessive water use, soil degradation, and nutritional imbalances. In this context, there is a renewed global interest in alternative crops that are nutritious, environmentally sustainable, and economically viable. Millets, often referred to as “nutri-cereals” or “coarse cereals,” have emerged as an important solution to these challenges.

Millets are a group of small-seeded cereal crops that have been cultivated for thousands of years, particularly in Asia and Africa. They have traditionally formed an integral part of indigenous food systems but were gradually marginalized due to the Green Revolution and changing dietary preferences. However, increasing awareness about nutrition, health, and sustainability has brought millets back into focus. The Food and Agriculture Organization has recognized millets as “future smart foods” because they are good for consumers, farmers, and the planet. Their ability to thrive under harsh climatic conditions, coupled with high nutritional value, makes them ideal crops for ensuring future food and nutritional security.

### 2. Concept of Millets as Future Smart Food

The term “future smart food” refers to foods that are nutritionally dense, climate resilient, economically viable, and culturally acceptable. Millets fit this definition perfectly as they address multiple dimensions of sustainability simultaneously. They are nutritionally superior to major cereals, environmentally sustainable due to low resource requirements, and socially inclusive as they support smallholder farmers and marginal communities.

Millets include crops such as sorghum, pearl millet, finger millet, foxtail millet, little millet, kodo millet, barnyard millet, and proso millet. These crops are characterized by their adaptability to diverse agro-ecological conditions, short growing periods, and resilience to drought and heat stress. Their multifunctional role in agriculture, nutrition, and livelihoods positions them as smart foods for the future.

### **3. Nutritional Importance of Millets**

Millets are widely recognized for their exceptional nutritional profile. They are rich sources of complex carbohydrates, dietary fiber, plant-based protein, essential amino acids, and healthy fats. Unlike refined cereals, millets have a low glycemic index, which helps regulate blood sugar levels and makes them suitable for people with diabetes.

Millets are particularly rich in micronutrients such as iron, calcium, zinc, magnesium, and phosphorus. Finger millet, for instance, is one of the richest plant sources of calcium, while pearl millet contains high levels of iron and zinc. Millets also contain significant amounts of B-complex vitamins, antioxidants, and polyphenols, which play a crucial role in preventing oxidative stress and chronic diseases.

The high dietary fiber content of millets aids digestion, improves gut health, and helps in weight management. Regular consumption of millets has been associated with reduced risk of cardiovascular diseases, obesity, diabetes, and certain cancers. Thus, millets contribute significantly to nutritional security and health promotion.

### **4. Millets and Food Security**

Food security is not only about availability of food but also about access to nutritious and safe food. Millets play a vital role in strengthening food security, particularly in rainfed and marginal areas where cultivation of water-intensive crops is risky. Their ability to produce stable yields under adverse conditions makes them reliable food sources for vulnerable populations.

Millets mature quickly and can be cultivated as contingency crops during droughts or delayed

monsoons. Their storability and resistance to pests reduce post-harvest losses, ensuring year-round food availability. By diversifying cropping systems and diets, millets reduce dependence on a few staple crops and enhance resilience of food systems.

### **5. Agronomic and Environmental Advantages of Millets**

Millets are inherently climate-resilient crops with several agronomic advantages. They require significantly less water compared to rice and wheat and can grow in poor soils with minimal fertilizer input. Their deep root systems improve soil structure and enhance water-use efficiency. Millets are also less susceptible to pests and diseases, reducing the need for chemical pesticides.

From an environmental perspective, millet cultivation contributes to biodiversity conservation and ecological sustainability. These crops have a low carbon footprint and play a role in mitigating climate change by reducing greenhouse gas emissions associated with intensive agriculture. Millets are well-suited to organic and natural farming systems, making them environmentally friendly choices for sustainable agriculture.

### **6. Role of Millets in Climate-Smart Agriculture**

Climate-smart agriculture aims to increase agricultural productivity, enhance resilience to climate change, and reduce greenhouse gas emissions. Millets align closely with these objectives. Their tolerance to drought, heat, and erratic rainfall makes them ideal crops for climate adaptation. By diversifying cropping systems with millets, farmers can reduce climate risks and ensure stable income.

Millets also contribute to climate mitigation by requiring fewer external inputs and energy resources. Their cultivation promotes sustainable land use and reduces pressure on water resources. Integrating millets into climate-smart agricultural strategies can enhance resilience of farming systems and support sustainable development goals.

## 7. Millets and Sustainable Livelihoods

Millets play an important role in supporting the livelihoods of smallholder and marginal farmers, particularly in dryland regions. These crops require low investment and provide stable returns, making them economically viable for resource-poor farmers. Millet-based value addition, processing, and marketing offer opportunities for income generation, employment, and entrepreneurship, especially for women and rural youth.

The revival of millets has also led to the development of diverse value-added products such as millet flour, flakes, ready-to-eat foods, bakery products, and traditional snacks. These products cater to urban health-conscious consumers and create new market opportunities for farmers.

## 8. Millets in Traditional and Modern Food Systems

Historically, millets have been integral to traditional food systems, cuisines, and cultural practices. They were commonly consumed in the form of rotis, porridges, fermented foods, and beverages. However, changing food habits and urbanization led to their decline. In recent years, there has been a resurgence of interest in millet-based foods due to growing awareness about health and nutrition.

Modern food processing technologies have improved the acceptability and convenience of millet-based products. Incorporation of millets into institutional feeding programs, school mid-day meals, and public distribution systems can enhance nutritional outcomes and promote dietary diversity.

## 9. Policy Support and Global Recognition

Recognizing the importance of millets, several national and international initiatives have been launched to promote their production and consumption. India has taken a leading role in advocating millets at the global level, culminating in the declaration of the International Year of Millets. Government policies now emphasize millet cultivation, processing, marketing, and inclusion in food security programs.

Research institutions, extension agencies, and non-governmental organizations are actively working to improve millet varieties, production technologies, and value chains. Awareness campaigns and nutrition education programs are helping to change consumer perceptions and increase millet consumption.

## 10. Challenges in Popularizing Millets

Despite their benefits, millets face several challenges that hinder their widespread adoption. These include limited availability of quality seeds, inadequate processing infrastructure, lack of standardized value chains, and low consumer awareness. Traditional perceptions of millets as “poor man’s food” also affect their acceptance among urban populations.

Addressing these challenges requires coordinated efforts in research, policy, market development, and consumer education. Improving processing technologies, branding, and market access can enhance the attractiveness of millets for both farmers and consumers.

## 11. Future Prospects of Millets

The future prospects of millets are highly promising in the context of sustainable agriculture, nutrition security, and climate resilience. With increasing focus on healthy diets, sustainable food systems, and climate adaptation, millets are likely to play a central role in future food strategies. Integration of millets into mainstream agriculture, food industries, and public nutrition programs can significantly enhance their impact.

Continued research and innovation in millet breeding, processing, and product development will further strengthen their role as future smart foods. Promoting millets through education, extension, and policy support can transform food systems and contribute to a healthier and more sustainable future.

## CONCLUSION

Millets truly represent future smart foods due to their unique combination of nutritional richness, climate resilience, environmental sustainability, and livelihood potential. In a world facing increasing food and nutrition challenges, millets

offer practical and holistic solutions. Reviving and mainstreaming millets can improve dietary diversity, strengthen food security, empower farmers, and promote sustainable agriculture. A concerted effort involving policymakers, researchers, farmers, industry, and consumers is essential to harness the full potential of millets. Embracing millets is not merely a return to traditional foods but a strategic step toward building resilient, nutritious, and sustainable food systems for future generations.

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