

Climate Resilient Millets (Shree Anna) for Food Nutritional Security

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Abstract:

Millets, ancient grains with high nutritional value, have regained prominence due to their nutritional composition, climate resilience and their role as future food. Millets possess deep roots, enabling them to withstand drought and poor soil conditions, contributing to climate-resilient agriculture. Millets thrive in arid and semi-arid regions with minimal water and require less labor than other cereals. Additionally, they fix nitrogen and require fewer inputs, mitigating greenhouse gas emissions and promoting sustainable farming. They are a good source of protein, fiber, vitamins, and minerals, promoting digestion, satiety, and blood sugar control. Millets' nutritional richness, gluten-free nature, and diverse culinary uses make them suitable for combating malnutrition and supporting dietary diversity. Embracing millets as future food can foster sustainable agriculture, preserve cultural heritage, and ensure food security amidst climate uncertainties.

Keywords: Millets, Climate Resilient, Gluten free, Nutrition, Food Security

Introduction:

Millets (Shree Anna) are a group of highly nutritious and versatile grains that have been around for thousands of years and are still consumed in many parts of the world. They are known for their high nutritional value, making them an excellent choice for people who are looking for a nutritious alternative to traditional grains. Millets are a good source of protein, dietary fiber, vitamins, minerals and other important nutrients. Their high fiber content aids digestion, promotes satiety, and helps regulate blood sugar levels, making them an excellent choice for individuals managing diabetes or seeking weight management. Additionally, millets are gluten-free, making them suitable for those with gluten sensitivities or celiac disease. They are well-suited to grow in challenging environmental conditions and have the ability to thrive in harsh weather conditions and poor soil quality makes them climate resilient crops. They can be vital in regions where other crops might struggle due to changing weather patterns. India stands out as one of the largest producers and consumers of millets globally. The widespread cultivation and consumption of millets in India contribute to the country's food diversity and security. Millets are not only important in India but also in other parts of Asia and Africa where they contribute to food security in regions facing climate challenges. Millets are of two types that includes major ones like Sorghum (Jowar), Pearl millet (Bajra), Finger millet (Ragi), as well as minor millets like Foxtail millet (Kangni), Little millet (Kutki), Proso millet (Cheena), Kodo millet (Koden), Barnyard millet (Sanwa), Browntop millet (AnduKorralu). Each of these millets has its own nutritional profile and culinary uses.

:Nutritional composition of Millets

Food grains	Protein (%)	Fat (%)	Carbohydrate (%)	Dietary Fiber (TDF)	Iron ((mg	Ca (mg)	Thiamine ((mg	Riboflavin ((mg	Niacin ((mg	Folic acid ((ug

Rice	7.8	0.52	78.2	2.8	0.65	7.5	0.05	0.05	1.7	9.32
Wheat	10.6	1.47	64.7	11.2	3.97	39.4	0.46	0.15	2.7	30.1
S o r - ghum	10.0	1.73	67.7	10.2	3.95	27.6	0.35	0.14	2.1	39.4
P e a r l millet	11.0	5.43	61.8	11.5	6.42	27.4	0.25	0.2	0.9	36.1
Finger millet	7.2	1.92	66.8	11.2	4.62	364	0.37	0.17	1.3	34.7
Foxtail millet	12.3	4.3	60.1	*10.7	2.8	31.0	0.59	0.11	3.2	15
L i t t l e millet	10.1	3.89	65.5	7.7	1.2	16.1	0.26	0.05	1.3	36.2
B a r n - y a r d millet	6.2	2.2	65.5	**12.6	5.0	20.0	0.33	0.1	4.2	-
P r o s o millet	11.5	3.5	64.5	9.6	2.0	30.0	0.41	0.28	4.5	-
K o d o millet	8.9	2.55	66.2	6.4	2.34	15.3	0.29	0.2	1.5	39.5

Adapted from Indian Food Composition Tables-NIN, 2017; Nutritive Value of Indian Foods-NIN, 2007; *) Smita D and Nirmala D Y, 2018; **Roopashree U *et al.*, 2014

Millets As Climate Resilient Crops:

Millets possess several characteristics that make them resilient to climate variations and extreme weather conditions, making them an excellent choice for sustainable agriculture. Millets have a deep root system that allows them to access moisture from deeper soil layers, making them better adapted to water-stressed environments. This feature enables them to withstand periods of low rainfall or limited irrigation, making them suitable for cultivation in arid and semi-arid regions. This resilience reduces the vulnerability of agricultural systems to climate-related risks, ensuring food security in the face of changing climatic conditions. Millet crops contribute to carbon sequestration by capturing atmospheric carbon dioxide (CO₂) through photosynthesis and storing it in the soil as organic matter. Their extensive root systems enhance soil organic carbon content, thereby mitigating greenhouse gas emissions and contributing to climate change mitigation efforts.

One of the additional benefits of millets is their ability to fix atmospheric nitrogen, reducing the reliance on synthetic fertilizers. This characteristic not only enhances soil fertility but also contributes to reducing greenhouse gas emissions associated with fertilizer production and application. Compared to intensive rice and wheat cultivation, millet farming typically requires lower inputs of water, fertilizers, and pesticides. This results in reduced emissions of greenhouse gases, such as methane (CH₄) and nitrous oxide (N₂O), which are associated with flooded rice and nitrogen fertilizer application. By adopting millet cultivation, farmers can mitigate the environmental footprint of agriculture and contribute to climate change mitigation. Millet plants exhibit a high tolerance for extreme temperatures, including heatwaves. They can continue their growth and development even under hot conditions, ensuring a stable yield in regions with high temperatures.

Millet cultivation often involves agro-ecological practices that promote biodiversity, soil health, and ecosystem resilience. Intercropping millets with legumes or other crops enhances soil fertility, reduces pest

and disease pressures, and improves overall ecosystem stability. These diversified cropping systems are more resilient to climate extremes and contribute to climate change adaptation by enhancing ecosystem services and reducing vulnerability to crop failure. Millets are known for their efficient use of water resources, requiring lower irrigation inputs compared to water-intensive crops like rice. By cultivating millets, farmers can conserve water and reduce pressure on freshwater resources, particularly in regions prone to water scarcity and drought. This promotes sustainable water management practices and enhances agricultural resilience to climate change-induced water stress.

Millets-Smart crops:

Millets are highly nutritious, rich in essential nutrients such as proteins, dietary fiber, vitamins, and minerals. They offer a balanced nutritional profile, contributing to overall health and well-being. Compared to other staple grains like rice and wheat, millets often have higher levels of micronutrients such as iron, zinc, and calcium, making them an important dietary component, especially in regions where malnutrition is prevalent. They contain quality plant-based proteins that are easily digestible and provide all the essential amino acids required by the body. Including millets in diet, can help us to meet protein needs, supporting muscle growth, repair, and maintenance.

Millets are abundant in dietary fiber, both soluble and insoluble. This fiber content aids in digestion, regulates bowel movements, and promotes gut health. Regular consumption of millets can help prevent constipation, reduce cholesterol levels, and lower the risk of gastrointestinal disorders such as diverticulosis and colon cancer. Millets are naturally gluten-free, making them suitable for individuals with gluten intolerance or celiac disease. They offer a safe and nutritious alternative to gluten-containing grains like wheat, barley, and rye. Incorporating millets into a gluten-free diet ensures adequate nutrient intake while avoiding gluten-related health issues and promoting digestive comfort.

The nutrient composition of millets, particularly their high fiber and magnesium content, confers cardiovascular benefits. Regular consumption of millets can help lower blood pressure, reduce cholesterol levels, and decrease the risk of heart disease and stroke. Their anti-inflammatory and antioxidant properties further contribute to heart health by protecting against oxidative stress and inflammation. Millets are also used as fodder for livestock, providing an important source of nutrition for animals such as cattle, sheep, goats, and poultry. Millet straw, the plant residue left after harvesting the grains, is rich in fiber and can be fed to livestock as forage. Millet straw can be harvested and stored for use during the dry season when natural forage availability is limited. Additionally, millet grains can be used as supplemental feed for livestock, offering a nutritious source of energy, protein, and essential nutrients. By incorporating millets into livestock feed, farmers can improve the health and productivity of their animals, supporting sustainable livestock farming practices and enhancing rural livelihoods.

Millets as Future Food:

- 1. Climate Resilience:** As climate change continues to pose challenges to agriculture, the resilience of millets to extreme weather conditions such as drought, heat, and flood makes them a promising crop for future food security. Their ability to thrive in diverse agro-climatic conditions ensures a stable food supply even in the face of climate uncertainties.
- 2. Environmental Sustainability:** Millets require fewer inputs such as water, fertilizer, and pesticides compared to conventional crops like rice and wheat. Their efficient use of resources and minimal environmental impact make them environmentally sustainable options for future food production, particularly in regions facing water scarcity and environmental degradation.

3. **Nutritional Superiority:** Millets are nutritional powerhouses, packed with essential nutrients such as protein, fibre, vitamins, and minerals. They offer a balanced nutritional profile that can help address malnutrition and dietary deficiencies, making them an ideal choice for improving public health outcomes.
4. **Diverse Culinary Applications:** Millets are versatile ingredients that can be used in a wide range of culinary preparations, including porridges, bread, pancakes, salads, and even beverages. Their adaptability to various cooking methods and cuisines makes them an attractive option for diversifying diets and promoting culinary innovation.
5. **Resurgence of Traditional Foods:** In many cultures, millets have been traditional staples for centuries. The resurgence of interest in traditional foods and indigenous crops aligns with the promotion of millets as future food. Embracing millets can help preserve cultural heritage while promoting sustainable food systems.
6. **Market Potential:** With increasing consumer awareness about health and sustainability, there is a growing market demand for nutritious and environmentally friendly food products. Millets cater to this demand, offering a unique selling proposition as future food products in both domestic and international markets.
7. **Support for Smallholder Farmers:** Millet cultivation often involves smallholder farmers in rural areas, providing them with opportunities for income generation and livelihood improvement. By promoting millets as future food, policymakers and agricultural stakeholders can support small-scale agriculture and rural development.

Conclusion:

Millets offer a combination of resilience to climate stressors, environmental sustainability, and nutritional value, making them an attractive option for promoting sustainable agriculture practices worldwide. Millets emerge as future food due to their climate resilience, environmental sustainability, nutritional superiority, culinary versatility, cultural significance, market potential, and support for smallholder farmers. Embracing millets as a key component of future food systems can contribute to building more resilient, sustainable, and equitable food systems worldwide. As the world faces the challenges of climate change, the cultivation of millets may play an important role in promoting sustainable agriculture practices and ensuring food security for communities around the globe.

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