Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 05, Issue: 05 (SEP-OCT, 2025)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Finger Millet (*Eleusine coracana*): A Climate - Resilient Nutri-Cereal for Sustainable Agriculture and Nutritional Security

*Prakhar Rai
Department of Agronomy, Prof. Rajendra Singh (Rajju Bhaiya) University, Prayagraj, Uttar Pradesh, India
*Corresponding Author's email: raiprakhar0022@gmail.com

Finger millet (*Eleusine coracana* L. Gaertn.), a hardy and ancient cereal predominantly cultivated in Asia and Africa, is gaining renewed attention as a climate-resilient and nutrition-rich crop. Renowned for its exceptional calcium and iron content, high dietary fiber, and low glycemic index, it holds immense potential to combat malnutrition and lifestyle diseases such as diabetes and obesity. Agronomically, finger millet thrives under drought, heat, and nutrient-poor soils, making it a dependable crop for low-input and rainfed farming systems. Its cultivation supports sustainable agriculture through efficient water use, minimal fertilizer demand, and enhanced soil fertility when integrated into intercropping and organic systems. Furthermore, its gluten-free nature and diverse food applications align with growing global demand for functional and health-promoting grains. Despite its multiple benefits, adoption remains limited due to low yields, processing challenges, and weak market linkages. Strengthening research on biofortified and high-yielding varieties, improving value chains, and promoting consumer awareness can accelerate its mainstreaming. Thus, finger millet emerges as a vital crop for future-ready, climate-smart, and nutrition-secure food systems.

Keywords: Finger millet, nutri-cereal, sustainable agriculture, crop management, nutritional security, climate resilience.

Introduction

Millets have long been the backbone of food security in the semi-arid and hilly regions of Africa and Asia. Among them, finger millet (*Eleusine coracana*) stands out as a "nutri-cereal" due to its remarkable nutritional richness and ability to thrive under harsh agro-climatic conditions. Once a staple food, it was gradually replaced by rice and wheat during the Green Revolution; however, its role in sustainable and climate-resilient food systems is being rediscovered, especially after the International Year of Millets 2023. Finger millet belongs to the family *Poaceae* and is well adapted to low rainfall areas and poor soils, growing successfully with 400–1000 mm rainfall and temperatures of 26–30°C. Globally, it is cultivated on around 4.5 million hectares, mainly in India, Nepal, Ethiopia, and Uganda, with Karnataka alone contributing nearly 60% of India's production. Despite its hardiness, cultivation has declined due to changing food preferences. However, rising concerns over climate change, soil degradation, and malnutrition have renewed its importance. Rich in carbohydrates, calcium (344 mg/100 g), iron (4.6 mg/100 g), dietary fiber (18%), and essential amino acids, finger millet serves as a climate-smart, gluten-free food that supports both health and sustainable agriculture.

Importance of Finger Millet as a Nutri-Cereal

Finger millet is a powerhouse of nutrients compared to rice and wheat.

Table 1: Nutritional Profile of Finger Millet vs Rice & Wheat (per 100 g grain)

Nutrient	Finger Millet	Rice	Wheat
Protien	7-9	6.8	11.8
Carbohydrate	72-75	78.2	71.2
Dietary Fibre	18	2.8	12.5
Calcium	344	10	41
Iron	4.6	0.7	3.5
Glycemic Index	42-52	72	69

Health experts highlight its multiple benefits — its high calcium supports bone strength, iron content combats anemia, fiber aids digestion and weight management, and its low glycemic index helps regulate blood sugar, making it ideal for diabetic patients. Being gluten-free, it also serves as an excellent food for individuals with gluten intolerance.

Beyond nutrition, finger millet offers remarkable nutraceutical value. It contains polyphenols, flavonoids, and antioxidants that possess anti-inflammatory and antidiabetic properties, helping prevent chronic diseases. Its versatility allows it to be processed into flour, porridge, biscuits, noodles, and health drinks, contributing to both food diversity and rural entrepreneurship. Thus, finger millet stands as a vital crop for ensuring both nutritional security and economic opportunity in a changing climate.

Finger millet (*Eleusine coracana* L. Gaertn.)

Climate-Resilience Potential of Finger Millet

Finger millet (*Eleusine coracana*) is widely recognized as a climate-resilient crop due to its ability to thrive under drought, heat, and nutrient-poor soils where other cereals fail. It grows successfully with as little as 350 mm annual rainfall and can tolerate temperatures up to 40°C, making it ideal for rainfed and marginal environments. Its deep fibrous root system enables efficient moisture extraction, ensuring stable yields under water stress.In comparison with major cereals, finger millet requires only 600–800 liters of water to produce one kilogram of grain—far less than wheat (1600–2000 L) or rice (3000–5000 L). It also demands fewer fertilizers (40–60 kg/ha), reducing input costs and minimizing environmental impact. The crop's strong adaptability makes it suitable for organic and low-input farming systems.

Finger millet cultivation contributes to soil health through organic matter addition and intercropping with legumes, which enhances nitrogen levels and biodiversity. Its cultivation emits significantly lower greenhouse gases since it does not produce methane like rice, thereby supporting low-carbon agriculture.Moreover, finger millet supports multiple Sustainable Development Goals (SDGs), including Zero Hunger, Good Health, Climate Action, and Life on Land. Its proven success in India and East Africa shows its potential as a "climate-smart" cereal that safeguards food security, farmer livelihoods, and environmental sustainability in the face of climate change.

Role of Finger Millet in Sustainable Agriculture

Finger millet plays a crucial role in promoting sustainable agriculture through efficient resource use, ecological balance, and livelihood security in rainfed and marginal areas. It grows well in degraded and low-fertility soils with minimal fertilizer input, while its stubble and root biomass improve soil organic matter and microbial activity. When intercropped with legumes such as pigeonpea or cowpea, it enhances nitrogen availability and prevents soil exhaustion.In terms of water efficiency, finger millet requires 70–80% less water than rice and needs only 3–4 irrigations per season, making it one of the most water-efficient cereals. It also fits well into organic and eco-friendly farming systems, performing well under compost, farmyard manure, and biofertilizers, with very low pesticide requirements. Its cultivation supports biodiversity conservation by reducing monoculture dependence and integrating well into mixed and agroforestry systems. Beyond environmental benefits, finger millet ensures livelihood security for small and marginal farmers by serving as an "insurance crop" during drought years.By contributing directly to Sustainable Development Goals such as Zero Hunger, Good Health, Responsible Consumption, Climate Action, and Life on Land, finger millet exemplifies a truly sustainable crop. Its ecological and nutritional advantages make it a vital component of climate-smart, resource-efficient, and resilient farming systems.

Finger millet (*Eleusine coracana* L. Gaertn.)

Table 2: Sustainability Comparison of Finger Millet vs Major Cereals

Parameter	Rice	Wheat	Finger Millet
Water requirement (L/kg grain)	3000–5000	1600–2000	600–800
Fertilizer demand (kg/ha)	150–200	120–150	40–60
GHG emissions	High (CH_4 release)	Moderate (N_2O emissions)	Low
Nutrient density	Low	Moderate	High (Ca, Fe, Fiber)
Drought tolerance	Poor	Moderate	High

Future Prospects and Research Priorities for Finger Millet

Finger millet (Eleusine coracana) is gaining recognition as a climate-resilient, nutrition-rich, and sustainable crop crucial for future food and nutrition security. In the face of climate change, hidden hunger, and soil and water challenges, it serves as a strategic crop for sustainable agriculture. Its high tolerance to drought, heat, and poor soils makes it ideal for semi-arid and rainfed regions, acting as a climate-insurance crop when major cereals fail. Rich in calcium, iron, fiber, and essential amino acids, it effectively combats malnutrition, anemia, osteoporosis, and lifestyle diseases. The rising global demand for gluten-free "superfoods" further enhances its potential for value-added products like biscuits, porridges, noodles, health drinks, and ready-to-eat mixes.Unlocking its full potential requires multi-disciplinary research across genetics, agronomy, nutrition, and socio-economics. Priorities include developing high-yielding, biofortified, disease-resistant varieties, conserving landraces, improving nutrient and water management, and promoting mechanization. Post-harvest innovations for dehusking, milling, and shelf-life, along with nutritional studies on glycemic index and antioxidant properties, are vital.The roadmap for mainstreaming focuses on five pillars—biofortified cultivars, cropping system integration, industrial incentives, policy support (MSP and procurement), and consumer awareness. Digital tools like drones, remote sensing, and AI-based advisory systems can modernize cultivation. With strong research and policy backing, finger millet can emerge as a global health cereal fostering climate-smart, sustainable agriculture and rural livelihoods.

Conclusion

Finger millet (*Eleusine coracana*), often referred to as a "climate-resilient nutri- cereal," represents a powerful solution to the twin challenges of sustainable agriculture and nutritional security in the 21st century. Its remarkable ability to thrive under drought, heat, and low-fertility soils makes it a reliable crop for rainfed and marginal environments, while its nutrient-dense profile—rich in calcium, iron, fiber, essential amino acids, and antioxidants—positions it as a natural remedy to widespread malnutrition, anemia, osteoporosis, and lifestyle diseases. Beyond nutrition, finger millet contributes to soil health, crop diversification, and low-carbon farming, making it central to climate- smart agriculture. Yet, despite these advantages, challenges such as low yields, blast disease, labor-intensive practices, inadequate processing facilities, weak market linkages, and low consumer awareness hinder its mainstream adoption. To unlock its full potential, targeted efforts are needed in genetic improvement, mechanization, post-harvest innovations, biofortification, and consumer-oriented product development. Stronger policy support, MSP procurement, and integration into PDS, mid-day meals, and ICDS programs will ensure wider access and farmer incentives. Simultaneously, awareness campaigns, food industry collaborations, and international trade promotion can expand its role as a superfood in global markets. With strategic interventions, finger millet can move from being a "neglected crop" to a cornerstone of food and nutrition security, directly contributing to Sustainable Development Goals on hunger, health, and climate action. Thus, finger millet emerges not only as a crop of tradition but as the cereal of the future, vital for resilient farming and healthier societies.

References

1. Baath, G. S., Northup, B. K., Gowda, P. H., Rocateli, A. C., & Turner, K. E. (2018). Adaptability and forage characterization of finger millet accessions in US Southern Great Plains. *Agronomy*, 8(9), 177.
2. Devi, P. B., Vijayabharathi, R., Sathyabama, S., Malleshi, N. G., & Priyadarisini, V. B. (2014). Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: a review. *Journal of Food Science and Technology*, 51, 1021– 1040.
3. Ghimire, K. H., & Mainali, R. P. (2024). Conservation and utilization status of small millets in Nepal. In S. Mishra, S. Kumar, & R.C. Srivastava (Eds.), *Genetic improvement of small millets* ,6(2), 17–33

4. Gowda, P. H., Prasad, P. V. V., Angadi, S. V, Rangappa, U. M., & Wagle, P. (2015). Finger millet: An alternative crop for the southern high plains. *American Journal of Plant Sciences*, 6(16), 2686.
5. Gupta, N., Gupta, A. K., Gaur, V. S., & Kumar, A. (2012). Relationship of nitrogen use efficiency with the activities of enzymes involved in nitrogen uptake and assimilation of finger millet genotypes grown under different nitrogen inputs. *The Scientific World Journal*, 2012(1), 625-731
6. Gupta, S. M., Arora, S., Mirza, N., Pande, A., Lata, C., Puranik, S., Kumar, J., & Kumar, A. (2017). Finger millet: a "certain" crop for an "uncertain" future and a solution to food insecurity and hidden hunger under stressful environments. *Frontiers in Plant Science*, 8, 643.
7. Jacob, J., Krishnan, V., Antony, C., Bhavyasri, M., Aruna, C., Mishra, K., Nepolean, T., Satyavathi, C. T., & Visarada, K. B. R. S. (2024). The nutrition and therapeutic potential of millets: an updated narrative review. *Frontiers in Nutrition*, 11,198-201
8. Kumar, A., Gupta, N., Gupta, A. K., & Gaur, V. S. (2009). Identifying biomarkers for determining the genotypic potential of nitrogen-use-efficiency and optimizing the nitrogen inputs in crop plants. *Journal of Crop Science and Biotechnology*, 12, 183–194.
9. Kumar, A., Pathak, R. K., Gupta, S. M., Gaur, V. S., & Pandey, D. (2015). Systems biology for smart crops and agricultural innovation: filling the gaps between genotype and phenotype for complex traits linked with robust agricultural productivity and sustainability. *Omics: A Journal of Integrative Biology*, 19(10), 581–601.
10. Mbinda, W., & Mukami, A. (2021). A review of recent advances and future directions in managing salinity stress in finger millet. *Frontiers in Plant Science*, 12, 734798.
11. Opole, R. A., Prasad, P. V. V, Djanaguiraman, M., Vimala, K., Kirkham, M. B., & Upadhyaya, H. D. (2018). Thresholds, sensitive stages, and genetic variability of finger millet to high-temperature stress. *Journal of Agronomy and Crop Science*, 204(5), 477–492
12. Pradhan, A., Nag, S. K., & Patil, S. K. (2010). Dietary management of finger millet (*Eleusine coracana* L. Gaerth) controls diabetes. *Current Science*, 98(6), 763–765.
13. Reddy, B. H. R., Thankachan, P., Hatakayama, M., Hiremath, N., Moretti, D., Nanjareddy, Y. A., Thumilan, M. B., Ravikumar, R. L., Phadnis, S., & Bose, B. (2022). A natural low phytic acid finger millet accession significantly improves iron bioavailability in Indian women. *Frontiers in Nutrition*, 8, 791392
14. Reddy, Y. A. N., Reddy, Y. N. P., Ramya, V., Suma, L. S., Reddy, A. B. N., & Krishna, S. S. (2021). Drought adaptation: Approaches for crop improvement. In M. Singh & S. Sood (Eds.), *Millets and pseudo cereals* , 11, 183–194.
15. Tadele, Z. (2016). Drought adaptation in millets. In A.K. Shanker & C. Shanker (Eds.), *Abiotic and biotic stress in plants—Recent advances and future perspectives. Agricultural and Biological Sciences* ,7(2), 271-284
16. Thilakarathna, M. S., & Raizada, M. N. (2015). A review of nutrient management studies involving finger millet in the semi-arid tropics of Asia and Africa. *Agronomy*, 5(3), 262–290.