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# Utility of Underutilized Crops in the Era of Climate Change for Nutritional Security and Sustainable Development

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## INTRODUCTION

Global agriculture is facing unprecedented challenges due to climate change, rapid population growth and the depletion of natural resources. Modern food systems rely heavily on a narrow range of staple crops such as rice, wheat and maize, making them increasingly vulnerable to environmental stresses. Climate change has intensified droughts, floods, salinity intrusion, pest infestations and disease outbreaks, resulting in yield instability and rising food insecurity, particularly in developing countries. Underutilized crops including millets, pseudo-cereals, indigenous legumes, roots, tubers and traditional leafy vegetables have historically supported local food systems but have been neglected due to agricultural modernization and commercialization. These crops are well adapted to marginal environments and possess inherent tolerance to climatic extremes. Reviving and integrating underutilized crops into mainstream agricultural systems can play a crucial role in enhancing climate resilience, achieving nutritional security and advancing sustainable development goals.

### Underutilized Crops and Climate Resilience

Underutilized crops are naturally adapted to diverse agro-ecological conditions, including drought-prone, saline and low-fertility soils. Crops such as sorghum (*Sorghum bicolor*), pearl millet (*Pennisetumglaucum*), finger millet (*Eleusinecoracana*), cowpea (*Vignaunguiculata*), adzuki bean (*Vignaangularis*) and quinoa (*Chenopodium quinoa*) exhibit high tolerance to heat and water stress. Their deep root systems, efficient water-use mechanisms and relatively short growth cycles make them particularly suitable for climate-stressed environments. Moreover, these crops require fewer external inputs such as chemical fertilizers and pesticides, thereby reducing greenhouse gas emissions and environmental pollution. Integrating underutilized crops into diversified farming systems enhances resilience by minimizing dependence on climate-sensitive major cereals.

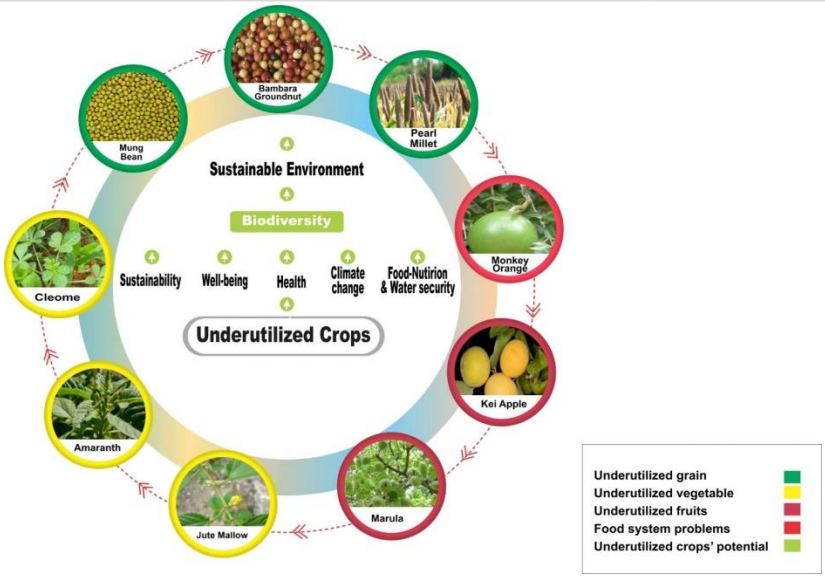


**Figure-1: Schematic presentation of underutilized crops' potential to transform the food system under climate change, illustrating pathways to food, nutrition, and water security (adapted from Grovermann *et al.*, 2025).**

## Contribution to Nutritional Security

Underutilized crops offer significant potential to enhance food and nutrition security due to their superior nutritional composition compared to many widely cultivated staples. These crops are often rich sources of high-quality protein, dietary fiber, essential vitamins, minerals, and diverse bioactive compounds that contribute to improved human health. Millets, for example, are well recognized for their high levels of iron, calcium, zinc, and complex carbohydrates, making them particularly valuable in addressing micronutrient deficiencies and promoting metabolic health. Indigenous legumes such as cowpea and adzuki bean provide substantial amounts of plant-based protein, dietary fiber, and iron, supporting muscle development, digestive health, and anemia reduction. In addition to their macronutrient and micronutrient content, many underutilized crops contain antioxidants and phytochemicals with potential protective effects against non-communicable diseases.

| Crop | Protein (g) | Dietary fiber (g) | Iron (mg) | Calcium (mg) |
|---|---|---|---|---|
| Rice (polished) | 6.8 | 0.2 | 0.7 | 10 |
| Wheat | 11.8 | 1.2 | 3.5 | 34 |
| Finger millet | 7.3 | 3.6 | 3.9 | 344 |
| Pearl millet | 11.6 | 1.3 | 8.0 | 42 |
| Sorghum | 10.4 | 2.7 | 4.1 | 25 |
| Cowpea | 24.0 | 6.3 | 8.3 | 110 |
| Adzuki bean | 20.0 | 7.3 | 5.0 | 66 |

**Table-1: Nutritional comparison of selected underutilized crops and major cereals (per 100 g, approximate values)**

## Role in Sustainable Development

Underutilized crops contribute to sustainable development by supporting environmental sustainability, economic viability and social equity. Their cultivation enhances agro-biodiversity, which is essential for ecosystem stability and long-term food security. Diverse cropping systems improve soil health, reduce pest and disease pressure and enhance carbon sequestration. From an economic perspective, underutilized crops provide livelihood opportunities for smallholder and marginal farmers by lowering input costs and increasing resilience to climate risks. Many of these crops hold cultural significance and local market relevance. Value addition through processing, branding and niche markets can

further enhance farmer incomes while preserving indigenous knowledge systems.

**Challenges Limiting Adoption**

Despite their substantial potential, underutilized crops face multiple constraints, including limited research investment, lack of improved varieties, weak seed systems, insufficient extension services and poor market access. Policy support and subsidies continue to favour major cereals, reducing incentives for diversification. Consumer awareness regarding the nutritional and environmental benefits of underutilized crops also remains limited.

**Evidence from Field Experiences**

The integration of underutilized crops into climate-smart agricultural systems has emerged as a promising strategy to address the dual challenges of climate change and food and nutrition insecurity. These crops, often neglected by mainstream agricultural research and policy, possess inherent traits such as drought tolerance, heat resilience, and efficient nutrient use, making them well suited to increasingly variable climatic conditions. Evidence from regions that have actively promoted crops such as millets, cowpea, and adzuki bean indicates notable improvements in yield stability, particularly under conditions of water scarcity and elevated temperatures. Unlike many conventional staples, these crops are able to maintain reasonable productivity despite climatic stress, thereby reducing the risk of total crop failure for smallholder farmers.

Beyond agronomic benefits, the inclusion of underutilized crops has contributed significantly to enhanced dietary diversity and improved nutrition outcomes. Millets and legumes such as cowpea and adzuki bean are rich sources of essential micronutrients, dietary fiber, and plant-based protein. Their increased availability and consumption have helped diversify diets that are otherwise dominated by a few staple cereals, addressing hidden hunger and micronutrient deficiencies.

The adoption of these crops has also played a role in strengthening the resilience of farming communities. By diversifying cropping systems, farmers reduce their dependence on a narrow range of climate-sensitive crops and spread production risks across species with different stress tolerances. In many regions, underutilized crops are well adapted to local agroecological conditions and require fewer external inputs, lowering production costs and enhancing sustainability. Additionally, their integration into local markets and value chains has created new income opportunities, further reducing household vulnerability. Their ability to stabilize yields, improve nutrition, and enhance community resilience highlights the need for greater policy support, research investment, and extension efforts to scale their adoption and fully realize their potential in adapting food systems to climate variability.

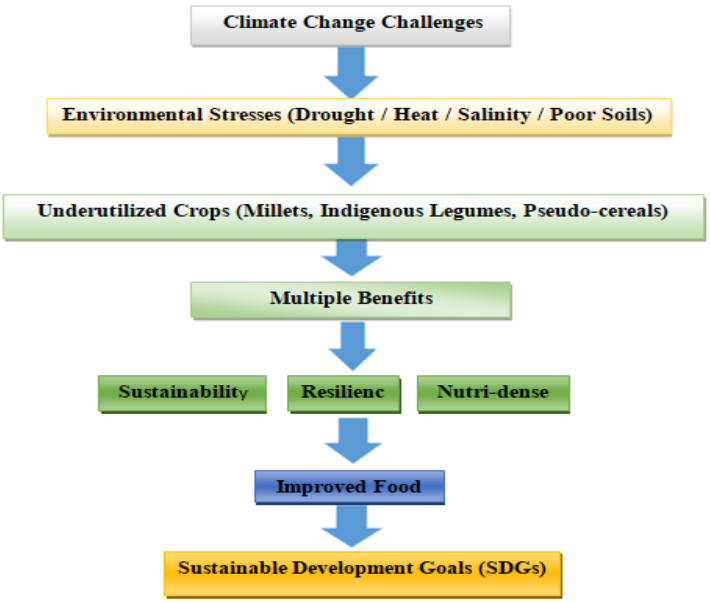


***Figure-2:*** **Underutilized crops offer a systemic response to climate change by enhancing resilience, nutrition and sustainability.**

**Future Directions**

Future efforts to mainstream underutilized crops must adopt a holistic and systems-oriented approach to enhance their contribution to sustainable food and nutrition security. Priority should be given to the development of high-yielding, climate-resilient varieties that can withstand biotic and abiotic stresses while meeting farmer and market preferences. Strengthening seed systems and extension services is essential to ensure the timely availability of quality planting material and effective knowledge transfer. Equally important is the promotion of value addition, innovative processing technologies, and market integration to improve profitability and reduce post-harvest losses. Integrating underutilized crops into national food and nutrition programs can enhance dietary quality and resilience. Raising consumer awareness and encouraging dietary diversification will further stimulate demand. Participatory and interdisciplinary approaches are vital to ensure inclusive, context-specific, and sustainable adoption

## CONCLUSION

Underutilized crops, including millets and indigenous legumes, represent viable solutions to the intertwined challenges of climate change, nutritional insecurity and unsustainable agriculture. Their resilience to environmental stresses, superior nutritional composition and contribution to agro-biodiversity make them indispensable components of future food systems. Strategic policy interventions, strengthened research support and market development are essential to unlock their full potential and ensure a resilient and nutritious food future.

## REFERENCES

Acheampong, R., Osei Tutu, C., Owusu-Bempah, J., Kumador, D.K., Mahama, S. and Kortei, N.K. (2025). Underutilised legumes in regenerative agriculture: Implications for food and nutritional security – A review.*Applied Food Research*,5(2), p.101313.

Das, A., Kumar, S.K.S., Kasala, K., Nedumaran, S., Paithankar, P. andAvinandan, V. (2025).Effects of climate change on food security and nutrition in India: A systematic review.*Current Research in Environmental Sustainability*, 9, pp. 1–18.

FAO. (2019).The nutritional value of pulses. *Food and Agriculture Organization of the United Nations.*

Grovermann, C., Umesh, K. B., Quiédeville, S., Ganesh Kumar, B. and Srinivasaiah, S. (2025).*Leveraging Africa's underutilized crops to combat climate change, water scarcity, and food insecurity in South Africa.Scientific Reports***,** 15, Article 03853.

Khundrakpam, R. andKotiyal, A.(2024).Unveiling the impact of climate change on underutilized fruit crops: A review.*International Journal of Advanced Biochemistry Research*,8(5), pp.552–558.

Knez, M., Gurinović, M. andRanić, M. (2023).Underutilized plants increase biodiversity, improve food and nutrition security, reduce malnutrition and enhance human health and well-being: Let's put them back on the plate!*Nutrition Reviews*,82(8), pp.1111–1124.

Kumar *et al.* (2023). Role of underutilized crops in nutrition security under climate change. *Frontiers in Nutrition*.

Odeku, O. A., Ogunniyi, Q. A., Ogbole, O. O. and Fettke, J. (2024). Forgotten Gems: Exploring the Untapped Benefits of Underutilized Legumes in Agriculture, Nutrition and Environmental Sustainability. *Plants*, *13*(9), pp.1208.

Padulosi*et al.* (2013).Underutilized crops and climate change: Current status and outlook. *FAO*.

Pandiyaraj, P., Sri Lekha, S. and Vijaya Lakshmi, N. (2024).Underutilized vegetable crops: Potential sources of nutrition and livelihood

security.*European Journal of Nutrition & Food Safety*, 16(7), pp.248–254.

Revoredo-Giha*et* .(2025). Assessing the impact of climatic factors on underutilized crops: Novel evidence from Nigeria.*Theoretical and Applied Climatology*.

Saleh, A.S.M., Zhang, Q., Chen, J. and Shen, Q. (2013). Millet grains: Nutritional quality, processing and potential health benefits. *Comprehensive Reviews in Food Science and Food Safety*, 12(3), pp.281–295.

Siddique, K.H.M. and Gruber, M.Y. (2025).Integrating neglected and underutilized crops (NUCs) in South Asian cropping systems and diets: Challenges and prospects.*Regional Sustainability*,6(4), Article 100242.

Upadhyaya, H. D. and Vetriventhan, M. (2018). Underutilized climate-smart nutrient-rich small millets for food and nutritional security. *APAARI*.