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Millets, Farmers Best Friends: resilient crops that save water, cut costs and boost livelihood

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Abstract: -

Millets are not a nostalgic throwback to grandma's kitchen, they are among the most practical, science-backed crops a farmer can choose today. Small-seeded cereals such as pearl, finger (ragi), foxtail, little, proso and barnyard millet are drought-tolerant, nutrient-dense and low-input. For millions of smallholder farmers in semi-arid and marginal lands they function as true "farmers friends": stabilizing yields when rains fail, reducing input costs, supporting livestock feed and improving household nutrition. Low external input needs reduce cultivation costs and improve benefit–cost ratios for smallholders in dryland regions. Millets also provide superior nutritional value and valuable fodder, strengthening both food and livestock security. With growing markets and supportive policies, millets offer a practical pathway to resilient, low-cost and livelihood-enhancing agriculture.

Key words: Millets, Nutritional value, farmers friends, drought tolerant etc.

Introduction:

Millets, a diverse group of small-grained cereals traditionally cultivated across Asia and Africa, have emerged as vital **climate-resilient crops** capable of addressing the escalating challenges facing modern agriculture. Increasingly erratic weather patterns, recurrent droughts, rising temperatures and declining soil health have heightened the vulnerability of resource-poor farming communities, particularly in dryland regions. Unlike input-intensive cereals, millets are adapted to harsh environments due to their C4 photosynthetic pathway, short growth duration, efficient root architecture, heat tolerance and ability to produce under low-fertility soils. These traits enable them to

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thrive with minimal external inputs often requiring up to **70% less water** than rice or wheat, while maintaining stable yields even in years of climatic stress. As global concerns around food security, sustainability and resource depletion rise, millets stand out as crops that combine ecological adaptability with nutritional richness, offering a strong foundation for climate-smart agriculture.

In addition to their agroecological advantages, millets play a crucial role in improving farm-level economics and rural livelihoods. Their low requirement for fertilizers, pesticides and irrigation reduces production costs for farmers, particularly smallholders who struggle with the financial burden of high-input farming. Incorporating millets into diversified cropping systems enhances soil health, suppresses pests and weeds, and provides both grain and valuable fodder, strengthening mixed crop–livestock systems. Emerging markets for millet-based foods driven by growing consumer interest in nutrition and health further contribute to income opportunities. Collectively, the water-saving potential, low-cost cultivation, and livelihood benefits position millets as "farmers best friends" offering a sustainable pathway to climate resilience, economic stability and improved food and nutrition security.

Built-in resilience: why millets survive stress

Millets evolved in hot, dry environments and use highly efficient water-use physiology, enabling them to produce yields with only a fraction of the water required by rice or maize. Their tolerance to heat, drought and poor soils allows them to remain reliable even when major cereals fail under erratic rainfall. With a far lower water footprint than rice and wheat, millets reduce irrigation needs and directly cut farmers' water-related costs.

Millets are recognized as highly climate-resilient crops, especially as production of major cereals becomes increasingly unstable due to erratic weather, land degradation and nutrient-depleted soils. Communities in drylands are most vulnerable to these changes, as declining land productivity intensifies risks of food insecurity and poverty (Padulosi *et al*., 2015). Climate-suitability models highlight the future potential of millets: Global Agro-Ecological Zoning (GAEZ) projections indicate that areas suitable for pearl millet cultivation are expected to expand by 2050 as warming occurs at higher latitudes and elevations (FAO, 2023). In contrast, foxtail millet is projected to shift towards higher latitudes with some decline in tropical regions. Compared to other major cereals, millets also maintain higher productivity under high-temperature conditions and have a much shorter growing season (8-12 weeks) than other staple cereals (20-24 weeks), making them an ideal choice in challenging environments.

Millets possess several agronomic traits that allow them to survive prolonged drought, heat and low-fertility soils, including short stature, small leaf area, thick cell walls and deep, dense roots (Babele *et al*., 2022). Some species can grow with as little as 40 mm annual rainfall and tolerate salinity levels of 11–12 dS/m, nearly four times what rice can withstand. Their C4 photosynthetic pathway gives them superior photosynthetic efficiency, carbon fixation and enhanced water- and nitrogen-use efficiency-1.5 to 4 times higher than C3 crops like rice and wheat (Lancelotti *et al*., 2019). These advantages are realized within the crop's short 2–3-month growth period, making millets exceptionally well suited to climate-stressed agricultural systems (Kaushik *et al*., 2022).

Millets: A Key Driver of Sustainable and Diversified Cropping Patterns

Millets offer strong potential for diversified and resilient cropping systems, as their short growing season allows them to fit easily into rotations with cereals like maize and wheat or legumes such as soybean, helping break pest and disease cycles, suppress weeds, curb erosion and improve soil health. Their inclusion in rotations enhances land productivity, resource-use efficiency and soil nutrient retention across both small- and large-scale farms. In high-income regions, foxtail and pearl millet function effectively as cover crops that conserve soil moisture and biomass, while browntop millet can suppress nematodes in tomato and pepper systems (Myers, 2018). Proso millet contributes to effective weed control, especially preceding winter wheat and "summer smothering" with millet varieties enriches soil organic matter, improves biodiversity and provides nutrient-rich warm-season pasture for livestock (Reed & Duiker, 2021). In Ethiopia, teff plays a central role in crop diversification and addressing food and nutrition shortages. Millet stalks also serve as valuable forage after harvest, making rotational cropping with livestock an important and integrated feature of many millet-based systems. Overall, including millets in rotations, especially during drought years, ensures food, income and fodder security for farming households.

Low external inputs, economics that farmers feel

Millets are inherently low-external-input crops, enabling farmers especially smallholders in rainfed regions to reduce production costs without compromising stability. Unlike input-intensive cereals, most millets require minimal fertilizers, pesticides and irrigation, largely due to their hardy physiology, efficient root systems and tolerance to abiotic stress. Studies show that millets can yield reasonably well even on nutrient-poor, marginal soils, reducing farmers' dependence on costly chemical fertilizers (Babele *et al*., 2022). Their ability to grow with 40–250 mm of seasonal rainfall significantly lowers irrigation demand, leading to direct savings in electricity or diesel used for pumping groundwater (Lancelotti *et al*., 2019). Research by ICRISAT demonstrates that input costs for millets are 30–70% lower than for rice or wheat because they thrive under low-input management and exhibit natural resistance to many pests and diseases (Mishra *et al*., 2020).

Economically, these low external input requirements translate into higher net returns, especially in risk-prone drylands where investment capacity is limited. A multi-location study by ICRISAT revealed that small and marginal farmers adopting millet-based farming systems reported 20–40% higher benefit–cost ratios than those dependent on input-intensive cereals (Rao *et al*., 2017). Further, millet cultivation reduces vulnerability to crop failure because the crops can withstand prolonged dry spells, high temperatures and poor soil conditions minimizing the need for "rescue inputs" like late irrigation or nutrient boosters. FAO highlights that low-input millet cultivation enhances economic resilience, allowing farmers to maintain stable incomes even under climatic stress and fluctuating fertilizer prices (FAO, 2023).

Nutritional and multifunctional value food, feed and more

Millets are nutritionally rich compared with common staples: many millets provide more dietary fiber, minerals (iron, calcium, zinc) and beneficial phytochemicals. Finger millet (ragi) is celebrated for high calcium content; barnyard and foxtail millets have low glycemic indices and can be helpful in diabetic diets. Beyond human food, several millets serve as high-quality green fodder or stover, supporting livestock in mixed farming systems giving farmers flexibility between grain and forage use. Recent scientific reviews summarize these nutritional and therapeutic attributes. (Jacob *et al*., 2024)

Market and livelihood opportunities

Millets are experiencing renewed consumer interest (health foods, gluten-free products, ready-to-eat snacks), and several public programs have supported millet promotion since the International Year of Millets (2023). Case studies from Indian states show farmer collectives and producer companies increasing incomes by marketing millet grains, value-added products and supplying local institutional markets. Where value chains and processing exist, millets can improve cash returns substantially.

Limits and realistic expectations

Millets are not a universal substitute for rice or wheat everywhere. Yields per hectare are typically lower than irrigated rice or maize under optimal conditions, and market linkages may be weak in some regions. Processing (dehusking, milling) and consumer preferences (taste, cooking time) influence adoption. Public investment in value chains, processing technologies and consumer awareness is needed to turn agronomic advantage into sustained farmer profit.

Conclusion

For farmers on fragile, rain-fed lands and for those wanting to lower input costs, improve resilience and diversify income millets are pragmatic allies. Science shows they conserve water, tolerate heat and poor soils, provide important nutrition, and deliver fodder when needed. With simple improvements in seed, agronomy and market access, millets help smallholders manage risk while contributing to healthier diets and more sustainable landscapes. For policy makers and extensionists, supporting millet value chains, seed systems and processing will unlock wider farmer benefits.

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