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Millet Based Farming System & Sustainable Livelihood Security of Small Farmers: A Case Study of Vijayapur District of Karnataka

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Abstract

The present study investigates the role of millet based farming systems in increasing sustainable livelihood security among marginal farmers in Vijayapur District, Karnataka. Study area being semi-arid area which faces many challenges. Millets are adaptable to a wide range of environmental conditions and demonstrate both tolerance and resistance to environmental stress. The objectives of this study is to assess the impact of millets on food security and income stability of farm and to identify the social, institutional and market constraints to expanding millet farming in the region. Methodology constitutes secondary data on meteorology, input costs and market prices. Findings indicate that millet based systems (including Sorghum, Pearl Millet) deliver lower but more stable yields under rainfall variability, require lower external inputs, and enhance household resilience in drought years. The study concludes that, millet based farming systems constitute a viable pathway to improve sustainable livelihood security among small farmers. Further study recommendations include promoting improved millet varieties, strengthening value chains (processing, storage, marketing), and instituting price supports to make millet production more attractive.

Key Words: Millet, Livelihood, Sustainable, Farming system and Marginal farmers.

Introduction

In an era marked by climate uncertainty, resource degradation, and rising food insecurity, the global agricultural sector faces the challenge of producing more with less. Conventional high-input cereal systems—dominated by rice, wheat, and maize—have reached ecological limits in many regions, intensifying the search for climate-resilient alternatives (FAO, 2021). Against this backdrop, *millets*—a

diverse group of small-seeded grasses including sorghum, pearl millet, finger millet, foxtail millet, and others—are emerging as powerful agents of agricultural transformation (ICRISAT, 2022).

Millets are among the oldest cultivated grains, deeply rooted in the food traditions of Asia and Africa. Once marginalized as "coarse grains," they are now being rediscovered for their multifaceted benefits. Agronomically, millets thrive in arid and semi-arid environments with minimal water and chemical inputs, making them vital in the context of global warming and erratic rainfall (Yadav et al., 2023). Nutritionally, they are rich in micronutrients, fiber, and antioxidants, offering a sustainable solution to the "hidden hunger" that affects millions in developing regions (Devi et al., 2021; Saleh et al., 2013).

Globally, the push for millet revival aligns with the **United Nations Sustainable Development Goals (SDGs)**—particularly SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). The declaration of **2023 as the International Year of Millets** by the UN has further stimulated international attention, policy initiatives, and market interest in these climate-smart crops. India, as one of the leading producers, has positioned millets at the center of its agricultural diversification and nutritional security strategies (Ministry of Agriculture & Farmers Welfare, 2023).

Moreover, millet-based farming systems contribute significantly to **soil health, biodiversity conservation, and livelihood resilience** among smallholder farmers, particularly in marginal regions. By reducing dependency on costly inputs and improving climate adaptability, millets foster ecological sustainability while strengthening rural economies (FAO & ICRISAT, 2023).

Karnataka is one of the leading millet-producing states in India, and Vijayapur (formerly Bijapur) district sits within a semi-arid zone where rain fed farming predominates. District-level extension records and agricultural surveys indicate millet varieties remain cultivated in the region and that local Krishi Vigyan Kendra (KVK) initiatives and research networks have actively promoted improved millet varieties, cropping sequences and low-input practices tailored to the district's edapho-climatic conditions. Despite these advantages, Vijayapur's small farmers face constraints such as variable market access, uneven adoption of improved practices, groundwater pressures in irrigated pockets, and limited consumer awareness of millet value chains — all factors that influence whether millet cultivation actually translates into sustainable, resilient livelihoods. (millets.res.in 2024)(kvkvijayapura.org)

Why Millets Need the Nation's Attention

1. Millets are climate resilient.

Millets are adaptable to a wide range of environmental conditions and demonstrate both tolerance and resistance to environmental stress. They are characterised by better growth and productivity under low nutrient and input conditions, need less irrigation, are least vulnerable to biotic and abiotic stresses, and less reliant on synthetic fertilizers.

2. Millets contribute to healthy and nutritious diet.

Millets thrive in challenging conditions, are nutrient rich and can be superior to commonly grown cereals. They contain protein similar to wheat, along with various vitamins and minerals[1]. Millets provide critical supplementation to carbohydrate-rich diets with micronutrients to help combat malnutrition. They are rich reservoirs of dietary fibers, and photochemical of diverse therapeutic uses. The biochemical profile of millet grains is comparable to major cereals.

3. Millets offer livelihood opportunities for small-scale and marginalised farmers.

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Millets have considerable potential to generate livelihoods, increase farmers' income and ensure food and nutritional security. The comparatively low input requirements of millet cultivation offer a key advantage to small-scale farmers, who often lack access to extensive irrigation systems and expensive agricultural inputs. Since millets can flourish in nutrient-deprived soil and under restricted irrigation, farmers have the potential to lower their production expenses while maximising their profits. By incorporating millets into their cropping systems, small-scale farmers can also build climate resilience, safeguarding their livelihoods against the uncertainties posed by climate change. Millets also present a diverse range of market opportunities for small-holder farmers. The past decade has witnessed an increasing global demand for gluten-free and nutritious foods. Millets, with their nutrient-rich and gluten-free profile, align well with this emerging market trend for products with a millet flour base. This opens up new avenues for small-scale farmers to diversify their income streams by participating in value-added activities such as processing, packaging, and marketing of millet-based products. By promoting millet cultivation and facilitating access to markets, policymakers and agricultural organisations can empower small-scale farmers, enhance food security.

4. Millet Value Chains and Markets:

The millet value chain encompasses local production systems, market linkages, processing enterprises, and policy interventions that support their commercialization. Local markets play a crucial role in connecting smallholder farmers with consumers, while small-scale processing units add value through dehusking, milling, and product diversification. Policy support measures—such as inclusion of millets in public procurement programs like the Public Distribution System (PDS), school mid-day meals and government nutrition initiatives—have significantly strengthened market demand and ensured stable prices for producers.

Major Millets

Sorghum (Jowar or Jola)

Sorghum is the most widely grown crop among millets, as a main staple crop by marginalised farmers across the semi-arid tropics. It is used for a variety of purposes including food, feed, fodder, and bio fuel. The crop also has a historical presence in the Indian Subcontinent, with evidence of early cereal cultivation dating back 4,500 years. Sorghum grains contain a varying energy value between 296.1 to 356.0 kcal per 100 grams.

Pearl Millet (Sajje)

Pearl millet is the sixth most important cereal crop in terms of area and production in the world. It is typically cultivated for food consumption in Asia and Africa. Pearl millet was first domesticated approximately in 4500 BC in the region of Africa. Today, it remains a prominent cereal crop in southern Africa, as well as in semi-arid to arid regions of India. It is mostly grown on marginal lands with an annual average rainfall of 250 mm. Even in areas of severe drought, it can produce large quantity of grains. Pearl millet contains a range of free lipids between 5.6% and 7.1%, along with bound lipids ranging from 0.6% to 0.9%.

Finger Millet (Ragi)

Finger millet is widely cultivated in Africa and Asia as a staple food grain. This millet gets its name due to its "finger-like" panicle branching. It was introduced in India more than 4,000 years ago. Finger millet is considered highly nutritious as it provides substantial quantities of proteins, minerals, calcium, and vitamins. Products made out of finger millet are beneficial for the growth of bone mass in growing

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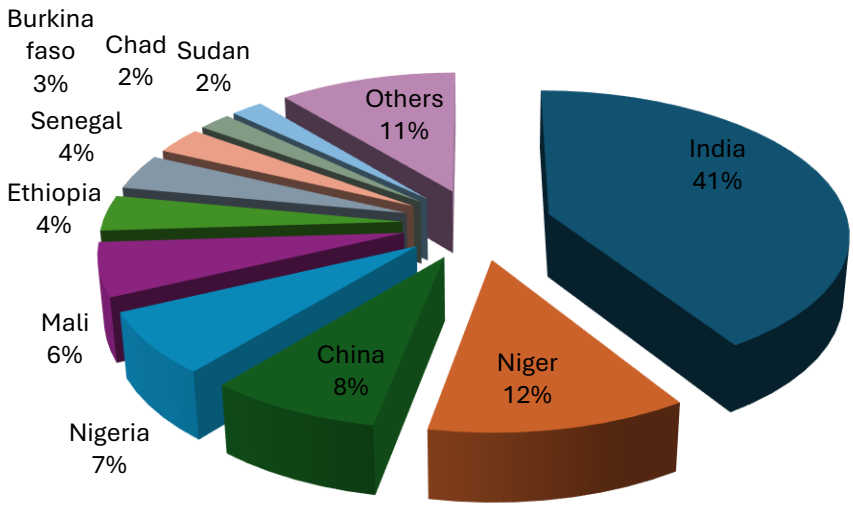
children, as well as for the prevention of osteoporosis and other bone disorders in adults, specially the elderly.

Small Millets

Small millets refer to a group of minor cereal crops that include **foxtail millet (Navane), little millet (Same), barnyard millet (Oodalu), kodo millet (Harka), and proso millet (Baragu)**. These crops are highly resilient to drought and poor soil conditions, making them suitable for rainfed and marginal areas. In Karnataka and other semi-arid regions of India, small millets contribute significantly to **food and nutritional security**, especially among smallholder and tribal farming communities.

Despite their ecological and nutritional advantages, small millets often face challenges such as limited market access, low productivity, inadequate processing infrastructure, and minimal policy attention compared to major millets like sorghum and finger millet. Recent initiatives by government and NGOs have begun to promote small millets through **value chain development, inclusion in public nutrition programs, and the revival of traditional food systems**.

Millet Production



Source: (FAOSTAT, 2022).

Fig 1: Country-wise production share of different millets, 2022

Figure 1 illustrates the global share of millet production, highlighting that **India** remains the leading producer, accounting for **41%** of total output, followed by **Niger (12%)** and **China (8%)**. The figure clearly indicates India's dominant position in global millet production, maintaining a substantial lead over other producing nations. This strong performance also reflects India's potential to further expand

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millet cultivation and productivity, even under changing climatic conditions, given its diverse agro-ecological zones and growing policy emphasis on climate-resilient crops.

Table 1: Area, Production and Yield of Millet Crops in India from 2010–11 to 2019-20

(Area in '000 Ha, Production in '000 Tonnes and Yield in Kg/Ha)

Year	Finger Millet (Ragi)			Small Millets			Pearl Millet (Bajra)			Sorghum (Jowar)			Total		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
2010-11	1286.19	2,193.45	1,705.38	774.93	429.97	554.84	9,612.34	10,369.90	1,078.81	7,381.73	7,003.15	948.71	19,055.19	19,996.47	1049.4
2011-12	1175.78	1,929.24	1,640.81	798.78	451.53	565.28	8,776.70	10,276.00	1,170.83	6,245.08	6,006.47	961.79	16,996.34	18,663.24	1098.07
2012-13	1131.00	1,574.40	1,392.04	754.09	435.65	577.72	7,297.42	8,741.98	1,197.96	6,214.36	5,281.48	849.88	15,396.87	16,033.51	1041.35
2013-14	1193.60	1,982.90	1,661.28	682.3	429.91	630.09	7,810.72	9,250.09	1,184.28	5,793.44	5,541.81	956.57	15,480.06	17,204.71	1111.41
2014-15	1208.10	2,060.90	1,705.90	589.59	385.87	654.47	7,317.95	9,184.22	1,255.03	6,161.39	5,445.30	883.78	15,277.03	17,076.29	1117.78
2015-16	1138.20	1,821.90	1,600.69	649.8	390.84	601.48	7,128.61	8,066.63	1,131.59	6,077.03	4,238.02	697.38	14,993.64	14,517.39	968.237
2016-17	1016.10	1,385.10	1,363.15	619.11	441.94	713.84	7,458.50	9,729.84	1,304.53	5,624.42	4,567.90	812.15	14,718.13	16,124.78	1095.57
2017-18	1194.29	1,985.24	1,662.27	546.27	438.99	803.6	7,480.60	9,208.85	1,231.03	5,024.45	4,803.38	956.00	14,245.61	16,436.46	1153.79
2018-19	890.98	1,238.70	1,390.34	453.75	333	734	7,105.03	8,664.13	1,219.00	4,092.87	3,475.09	849.06	12,542.59	13,710.92	1093.15
2019-20	1004.46	1,755.06	1,747.27	458.35	370.81	809	7,542.68	10,362.68	1,374.00	4,823.76	4,772.10	989.29	13,829.25	17,260.65	1248.13
2020-21	1159.40	1998.36	1723.62	444.05	346.95	781.32	7652.10	10863.17	1419.63	4377.87	4812.07	1099.18	13,633.42	18,020.55	1321.79
CAGR (%)	-.0.94	-0.84	0.10	-4.94	-1.93	3.16	-2.05	0.42	2.53	-4.64	-3.35	1.35	-3.00	-0.94	2.12

Source: Directorate of Economics and Statistics, Ministry of Agriculture

Table 1 presents the trends in the area, production, and yield of millets from 2010 onwards. As observed from the data, millet production registered a negative Compound Annual Growth Rate (CAGR) of **–0.94%**, indicating a marginal decline over the period. Similarly, the area under millet cultivation exhibited a negative CAGR of **–3.00%**, reflecting a contraction in the extent of land devoted to millet farming. However, despite the reduction in area and overall production, the yield demonstrated a positive growth trend with a CAGR of **2.12%**, suggesting improvements in productivity, possibly due to better crop management practices, improved varieties, and technological interventions.

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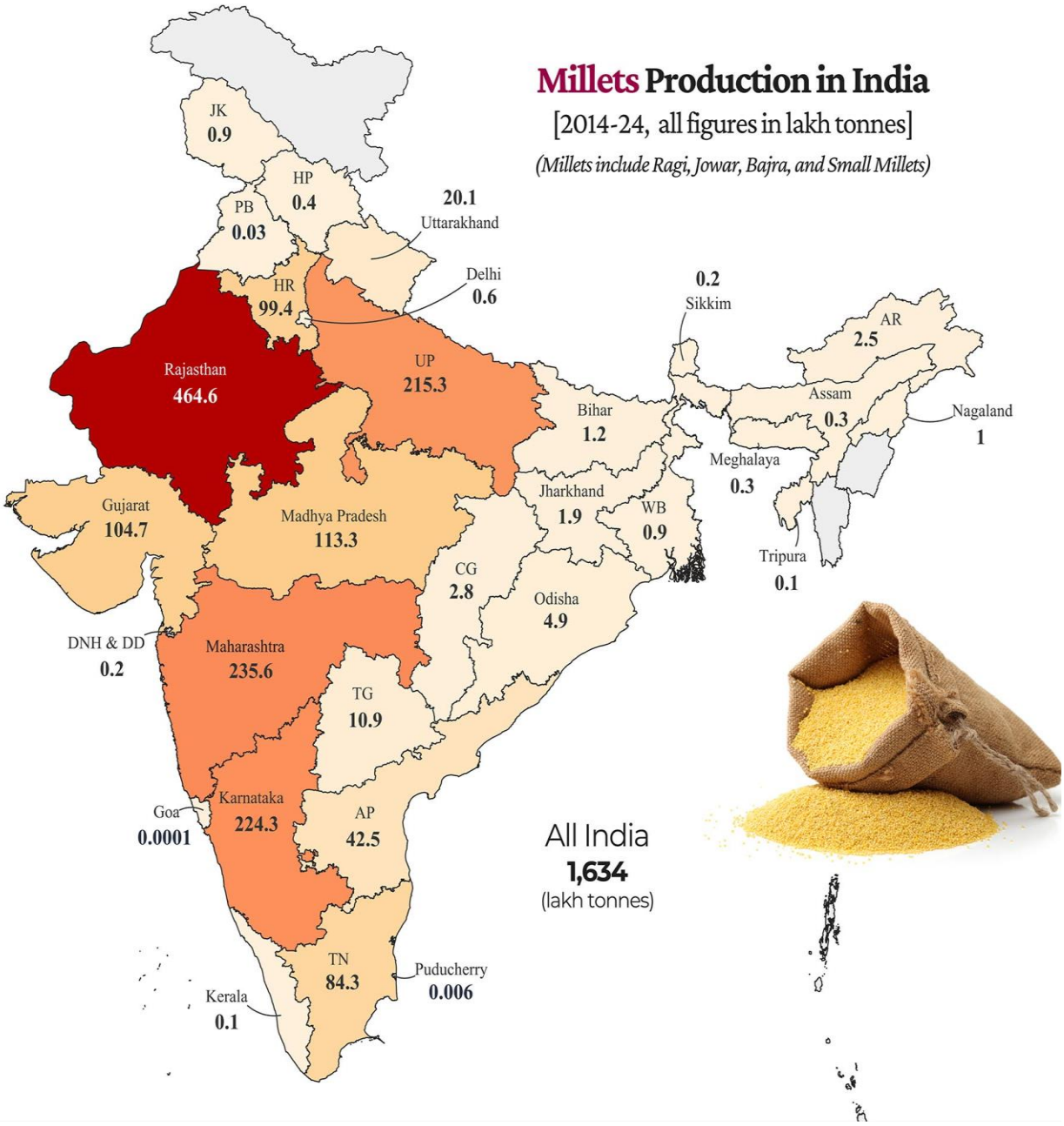

Fig 2: State-wise production of millets 2025

Figure 2 shows the millets production in different states of India for the 2014-24 time periods. It highlights the major millets producing states in India, with Rajasthan being the largest producer at 464.6 lakh tonnes, followed by Maharashtra at 235.6 lakh tonnes and Karnataka at 224.3 lakh tonnes. Other key millets producing states include Gujarat, UP, Tamil Nadu, Madhya Pradesh, Andhra Pradesh, and Haryana. The total millets production for India during this period is 1,634 lakh tonnes. Millets include crops like Ragi, Jowar, Bajra, and Small Millets.

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Table 2: Area, Production and Yield of Millets in Karnataka from 2018-19 to 2022-23.

Area : In lakh hectares, Production: In lakh Tonnes, Yield : In Kgs per hectare

Sl. No.	*Crop*	*Particulars*	*2018-19*	*2019-20*	*2020-21*	*2021-22*	*2022-23*
1	*Sorghum (Jowar or Jola)*	*Area*	*9.94*	*9.14*	*7.65*	*6.28*	*5.67*
		Production	*8.49*	*10.30*	*8.58*	*7.15*	*7.19*
		Yield	*899*	*1186*	*1145*	*1162*	*1295*
2	*Pearl millet (Sajje)*	*Area*	*1.94*	*3.39*	*2.26*	*1.51*	*1.31*
		Production	*1.72*	*3.69*	*3.11*	*1.65*	*1.79*
		Yield	*930*	*1147*	*1405*	*1116*	*1397*
3	*Finger millet (Ragi)*	*Area*	*5.55*	*6.74*	*8.00*	*8.64*	*8.29*
		Production	*6.36*	*11.32*	*13.35*	*10.56*	*11.28*
		Yield	*1205*	*1769*	*1701*	*1248*	*1389*
4	*Small Millets*	*Area*	*0.19*	*0.62*	*0.27*	*0.30*	*0.35*
		Production	0.15	0.44	0.16	0.20	0.16
		Yield	843	750	627	695	464

Source: The Directorate of Economics & Statistics, Government of Karnataka

Table 2 presents 2018–19 to 2022–23 millet cultivation in Karnataka showed varied trends across crops. The area under Sorghum (Jowar) declined from 9.94 to 5.67 lakh hectares, but yield improved from 899 to 1295 kg/ha. Pearl millet (Sajje) also saw reduced area yet higher yield, rising from 930 to 1397 kg/ha. Finger millet (Ragi) recorded growth in both area and production, though yield fluctuated. Small millets had limited area with inconsistent trends and declining yield. Overall, while millet acreage has decreased, productivity has generally improved due to better management and technological adoption.

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Table 3: Area, Production and Yield of Millets in Vijayapur district from 2018-19 to 2022-23.

Area : In lakh hectares, Production: In lakh Tonnes, Yield : In Kgs per hectare

Sl. No.	Crop	Irrigated			Un Irrigated			Irrigated + Un Irrigated		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1	Sorghum (Jowar or Jola)	8454	11591	1399	38015	31681	850	46469	43271	950
2	Pearl millet (Sajje)	4946	5863	1210	14531	14530	1020	19477	20393	1068
3	Finger millet (Ragi)	76	110	1478	39	50	1300	115	160	1417
4	Foxtail millet (Navane)	-	-	-	-	-		107	40	381
5	Little millet (Same)	-	-	-	-	-		24	12	501
6	All other small millets	-	-	-	-	-		289	52	183

Source: The Directorate of Economics & Statistics, Government of Karnataka

Table 3 presents the area, production, and yield of major millets cultivated in Vijayapura district. **Sorghum (Jowar / Jola)** is the largest millet crop, occupying about **0.46 lakh ha** and contributing **over 90%** of the total millet area and production. The average yield of **950 kg/ha** indicates moderate productivity, with irrigated fields performing significantly better (**1,399 kg/ha**) than unirrigated ones (**850 kg/ha**). **Pearl millet (Sajje)** is the second most important millet, covering about **0.19 lakh ha** with a yield of **1,068 kg/ha**, slightly higher than that of sorghum, reflecting its strong adaptation to semi-arid conditions—nearly **75%** of its area remains unirrigated. **Finger millet (Ragi)** is cultivated on a very small scale (**0.001 lakh ha**), yet records a high yield of over **1,400 kg/ha**, typical of better soils and irrigated micro-regions. In contrast, **foxtail, little, and other small millets** occupy a **very limited area (< 0.01 lakh ha combined)**, with **low yields (183–501 kg/ha)** that indicate marginal cultivation and traditional management practices.

Overall, millet production in Vijayapura district is **dominated by sorghum**, followed by **pearl millet**. The district's total millet area stands at approximately **0.47 lakh ha**, with production around **0.43 lakh tonnes**, giving an **average yield of 920–950 kg/ha**. Although irrigated millets cover a small proportion of the total area, they produce **30–40 percent higher yields** than rainfed fields. Small millets remain minor crops, primarily cultivated for **household consumption and local use** rather than commercial production.

Conclusion

This study on *Millet-Based Farming Systems and Sustainable Livelihood Security of Small Farmers in Vijayapura District of Karnataka* underscores the pivotal role of millets in fostering climate-resilient

agriculture and enhancing livelihood security in semi-arid regions. In Vijayapura, **sorghum (jowar)** and **pearl millet (sajje)** are the predominant millet crops, occupying approximately 0.46 lakh hectares and 0.19 lakh hectares, respectively. These crops contribute significantly to food and fodder security for smallholder farmers. Despite a gradual decline in total millet area over the years, productivity has improved due to better crop management practices and limited but effective irrigation (DES Karnataka, 2022).

Millet-based farming systems offer multiple benefits, including improved soil health, water conservation, and reduced dependency on chemical inputs. For small and marginal farmers facing erratic rainfall and market uncertainties, millets provide a stable source of income and nutrition. However, challenges such as low market access, inadequate processing infrastructure, and limited price incentives hinder the large-scale adoption of millet cultivation (ICAR-IIMR, 2024).

To bolster livelihood security, it is essential to focus on value-chain development, farmer training, and promotion of millet-based enterprises. Government initiatives like the International Year of Millets (2023) have raised awareness, but sustained institutional and financial support is necessary to make millet cultivation economically viable. Empowering small farmers through technology dissemination, cooperative marketing, and integrated farming approaches will be key to transforming millets into a cornerstone of sustainable rural development in Karnataka.

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