Understanding India's Millets Ecosystem

A Karnataka Focus



SELCO Foundation

What Are Millets?

Millets are small-seeded grasses grown for their grain, and a staple food in many parts of the world, particularly Africa and Asia.

They adapt well to a wide range of agro-climatic conditions.



Millets, a staple food across Africa and Asia

Why Millets Matter Now?

Millets are climate-resilient crops that support both sustainable agriculture and better nutrition. Their ability to thrive with limited water makes them a reliable crop where rain is irregular and water is scarce - climate challenges faced by majority farming communities today.



Climate-resilient

Millets are drought-tolerant and pest-resistant.



Sustainable

Millets support sustainable farming practices.



Nutritious and Healthy

Help combat malnutrition and lifestyle diseases such as diabetes. Especially valuable in rural diets.

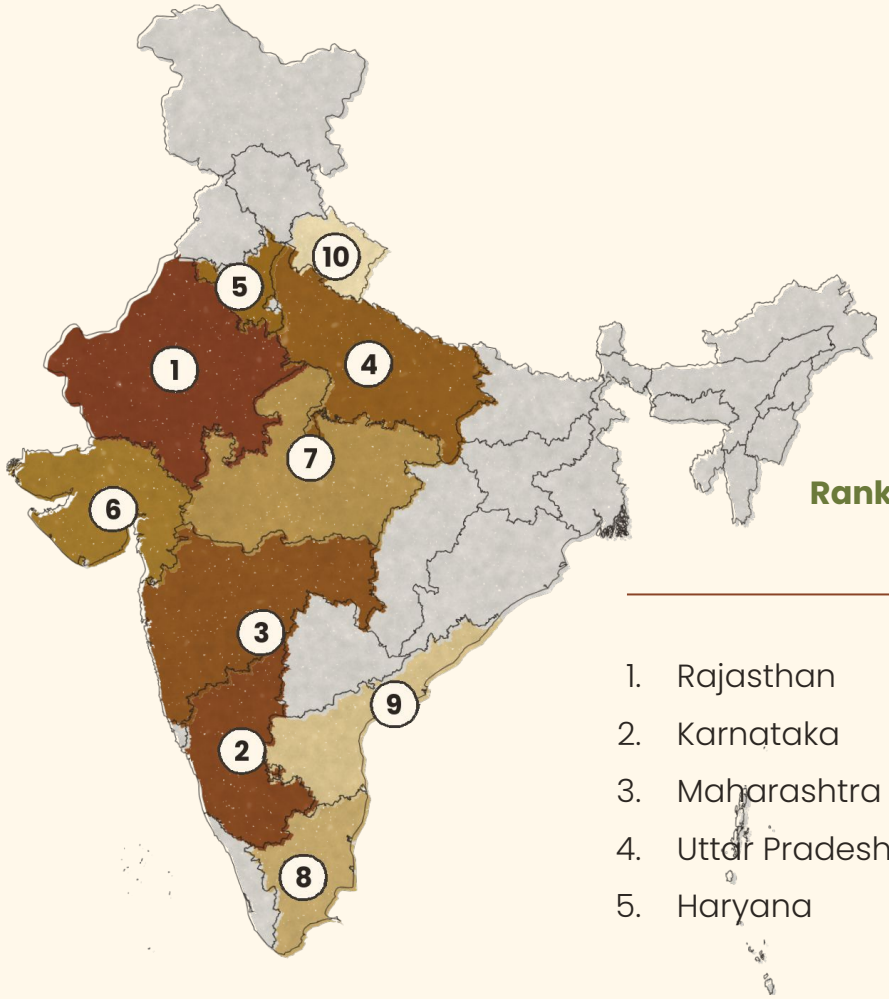
India Leads the World

India is the world's largest producer of millets.

The United Nations declared 2023 as the International Year of Millets, to raise awareness of their benefits and encourage production and consumption worldwide.

~40% of global millet production happens in India

~80% of area and production of millet in India and the world comes from jowar (sorghum) and bajra (pearl millet)

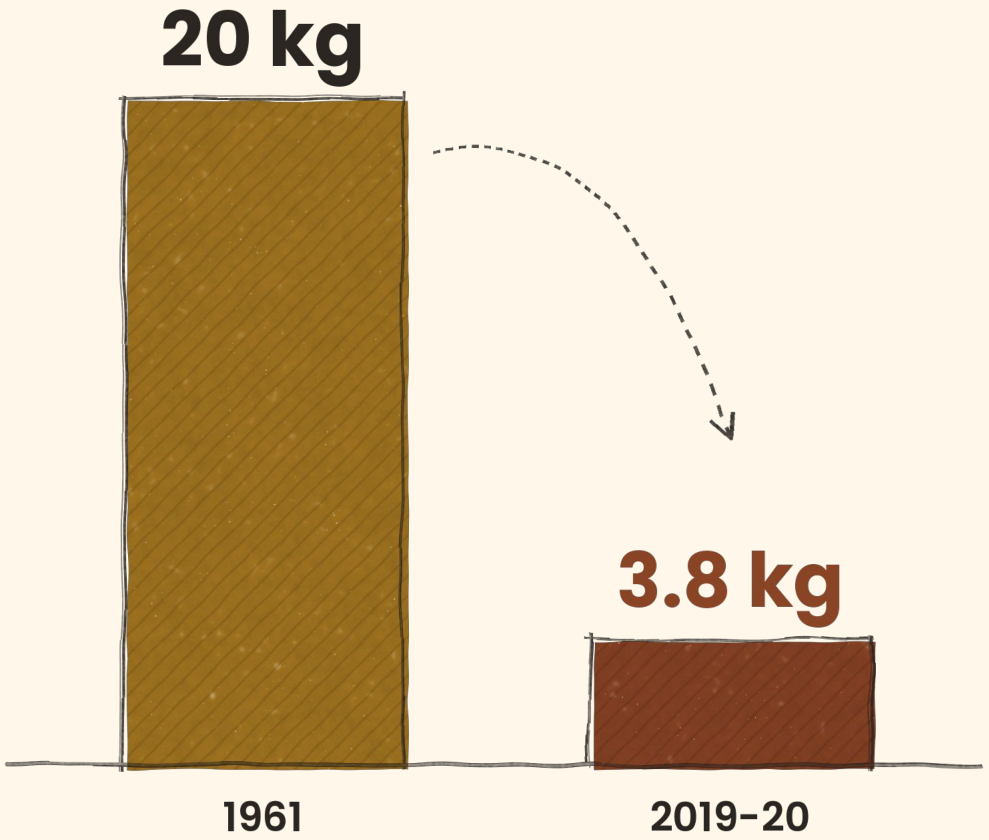


Ranking by area under millet cultivation (largest first)

1. Rajasthan
2. Karnataka
3. Maharashtra
4. Uttar Pradesh
5. Haryana
6. Gujarat
7. Madhya Pradesh
8. Tamil Nadu
9. Andhra Pradesh
10. Uttarakhand

Per capita millet consumption in India has declined significantly in recent decades.

It stood at 20 kg a year in 1961 and fell to 3.8 kg a year in 2019-20.



Per capita millet consumption in India, kg per year

~81%

fall in per capita consumption between 1961 and 2019-20

Types of Millets

Millets fall into two types:
Naked (major) and Husked (minor).



TYPE 1

Naked (major) millets

Sorghum Jowar, Jola	**Pearl millet** Bajra	**Finger millet** Ragi

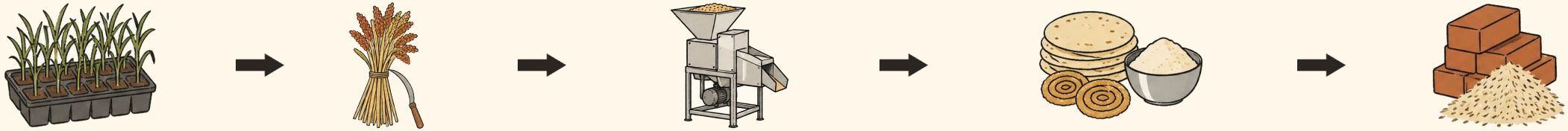


TYPE 2

Husked (minor) millets

Foxtail millet Navane	**Kodo millet** Haarka	**Proso millet** Baragu
Little millet Saame	**Brown top** Korale	**Barnyard** Oodalu

The Millet Value Chain



STAGE 1

On-Farm

- Nursery preparation and seed treatment
- Transplanting
- De-weeding
- Intercultural operations (spraying bio-inputs)

STAGE 2

Harvesting and Pre-processing

- Harvesting (reapers, combine harvesters)
- Threshing (small and medium-scale threshers)
- Winnowing
- Drying

STAGE 3

Post-Harvest/ Primary Processing

- Pre-cleaning
- De-stoning
- Hulling (only for minor millets)
- Polishing
- Grading
- Colour sorting

STAGE 4

Value Addition/ Secondary Processing

- Roasting
- Milling and pulverising
- Atta kneading
- Roti, papad and chakli making

STAGE 5

By-product Utilisation

- Waste millet husk into fired clay bricks
- Husk ash used in concrete as a supplementary cementitious material

Pressures on Millet Farming

Today, farmers cultivating millets are facing both climatic and farm-related problems.



Heat

Rising heat alters how millets are cultivated and reduces yields.



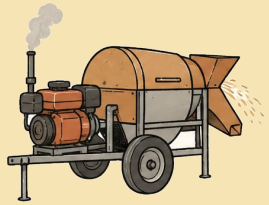
Rainfall

Changes in rainfall cause water stress at critical growth stages, crop loss and damage.



Labour and Land

Labour is expensive and scarce, and landholdings are mostly small and fragmented.



Equipment

The equipment available is not versatile, is difficult to own, and uses fossil fuels.

The problem continues at the processing stage too, especially for small-scale processors. From contaminated grains to weak business support, these affect how well the grain is processed and how well it is sold.



Poor input quality control

Grain are delivered with mudballs and dust. Entrepreneurs with small-scale processing units have to invest in expensive pre-cleaning equipment.

Labour-intensive work

Uneven grain sizes slow down processing and reduce efficiency.

Limited access to technology

Processing units lack millet specific machinery and face unreliable power, which hinders production efficiency and quality.

Limited storage provision

Inadequate storage makes marketing hard and forces immediate processing, with no room for strategic inventory management.

Limited business support

Local marketing is difficult with little business development support, guidance on government schemes and available financing.

What Shapes the Millet Value Chain

Six factors decide which technologies fit a region and how widely they are used.



Seasons

Set when and how much millet is grown, and how often equipment is used.



Land

Sets which equipment suits the plot and terrain, and how easily farmers can reach it.



Practices

Set which technologies and features are needed, from intercropping to open grazing and shared ownership.



Varieties

Set which machines and settings work, as each variety responds differently.



Water

Sets whether farming is rainfed or irrigated, and the technology options that follow.



Climate

Sets how robust technology has to be, given erratic rain and disasters such as droughts, floods.

Most millet farmers in Karnataka are smallholders cultivating on arid, rainfed land with limited access to technology.

Seasons	Two seasons a year, Kharif and Rabi.
Land	Most farmers are small to marginal, on 2 to 5 acres. Some farm leased land, which makes them ineligible for MSP (Minimum Support Price). Soils range from black cotton to red loamy alluvial. Most equipment, from tillers and weeders to harvesters and threshers, is rented.
Water	Only critical irrigation is provided, from farm ponds with diesel pumps, and there are no reliable electricity sources for timely irrigation. Check dams and farm ponds capture rainwater where irrigation is limited.



80 lakh

smallholder farmers in Karnataka

Traditional intercropping, multiple varieties and erratic rainfall require technology that is versatile and robust.

Practices	Akkadi Saalu, a traditional intercropping system on rainfed dryland, encourages biodiversity and secures the yield. Seed is kept through a community-owned seed conservation system.
Varieties	Several are grown. Important ones include the GPU series in ragi, the CSH series in sorghum, and GHB and Pusa varieties in bajra.
Climate	Erratic rain at tillering and grain filling reduces yield. Dry spells or unseasonal rain disrupt threshing, winnowing, drying and storage, and bring pests and disease.

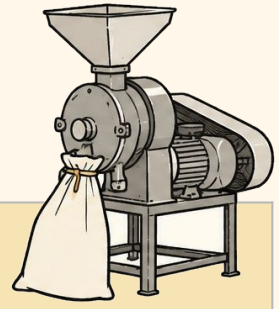


Stage 1



Key Activity	Current Method	Energy source	DRE Opportunity	Notes
Land preparation	Tractor, bullock	Diesel, animal	Small tillage equipment	Needs to suit small, fragmented landholdings
Sowing	Tractor with sowing attachment, bullock	Diesel, animal	Seed drill	
Weeding	Bullock, manual, spraying of weedicides	Manual, animal, battery	Multipurpose weeder	Needs to suit dryland soils (loamy, alluvial, black cotton) and both plain and hilly terrain
Input application	Broadcasting fertiliser, spraying pesticides	Manual, battery	Sprayer, bio-input preparation	Knapsack or centralised sprayers, with nozzles for different crops
Irrigation	Electric pumps and pipes (open wells, tube wells, canals)	Electric power	Portable irrigation, surface or submersible pumps	

Stage 2 to 4



Key Activity	Current Method	Energy source	DRE Opportunity	Notes
Harvesting	Manual	Manual	Reaper	Reapers suit small farms
Threshing	Thresher, manual	Electric power, manual	Small-scale thresher or combine harvester	Small threshers are portable. Combine harvesters harvest and thresh in one pass.
Primary processing	Hulling machine	Electric power	Primary processing unit	Cleaning, de-stoning, hulling and grading. Only husked (minor) millets need hulling.
Flour making	Pulveriser	Electric power	Secondary processing unit	Flour and value-added products
Value-added products	Mostly manual	Electric power, manual	Secondary processing unit	Cookies, laddoos, namkeens, millet flakes and papad

DRE Integration Across the Millet Value Chain

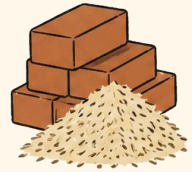
Decentralised Renewable Energy (DRE) can power key activities at each stage of the value chain.











STAGE 1

On-Farm

Solar powered land preparation, sowing and weeding equipment.

DRE enabled micro-irrigation.

STAGE 2

Harvesting and Pre-processing

Solar powered reapers for small farms and portable threshers for separating grains

STAGE 3

Post-Harvest/ Primary Processing

Solar powered millet grain cleaning, de-stoning, hulling and grading.

STAGE 4

Value Addition/ Secondary Processing

Solar powered flour milling and additional food processing technologies for different food items.

STAGE 5

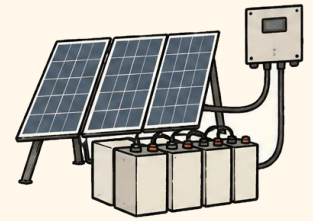
By-product Utilisation

Chaff cutters for millet stalks.

End-User Typologies - Millet Processing

End-User Typology	 **Small** up to 15 kg an hour	 **Medium** up to 100 kg an hour	 **Large** up to 150 kg an hour
Customer Segment	A locality of 50 to 80 households	SHGs, PGs or individuals with entrepreneurial skill	SHGs, PGs or individuals with entrepreneurial skill
Business model	**Service** Milling cleaned millets into flour	**Service + trader** Milling service and bulk processing	**Trader** Bulk processing
Income from	Processing charges of INR 2 to 6 per kg	Processing charges, plus sales of processed millets	Processed millet sales: INR 30 to 150/kg (major), INR 100 to 250/kg (minor)
Market	Community consumption and local retail	Local customers, plus trading, retail or wholesale	Trading, retail or wholesale
Monthly input reserve	None, customers bring their grain	About 3.5 to 4 tons	About 10 to 11 tons, plus storage
Minimum area	About 300 sq. ft.	About 600 sq. ft.	About 1,000 sq. ft.

Machines and Solar - Millet Processing



	Small (up to 15 kg an hour)	Medium (up to 100 kg an hour)	Large (up to 150 kg an hour)
MACHINE			
Machines	Pulveriser only	Huller, integrated destoner-cum-grader and pulveriser	Grader, de-stoner, huller and polisher
Ratings	• Pulveriser 2 to 3 HP	• Huller 1 to 3 HP • Destoner 2 HP with a 0.5 HP grader, or a 2 HP integrated destoner-cum-grader • Pulveriser 2 to 3 HP	• Grader 1 HP • Destoner 2 HP • Huller 1 to 3 HP • Polisher 3 HP
Power supply	Single phase	Single or three phase	Single or three phase
SOLAR			
Solar panel	2,000 Wp	3,350 Wp	4,020 Wp
Battery	120 Ah, 12 V × 8	180 Ah, 12 V × 8	180 Ah, 12 V × 10
PCU	6 kW, 7.5 kVA, 96 V	6 kW, 7.5 kVA, 96 V	8 kW, 10 kVA, 120 V

HP: horsepower | Wp: watt-peak | Ah: ampere-hour | V: volt | PCU: power conditioning unit | kW: kilowatt | kVA: kilovolt-ampere.

Business Model - Millet Processing

	Small (up to 15 kg an hour)	Medium (up to 100 kg an hour)	Large (up to 150 kg an hour)
Business model	**Service**	**Service + Trader**	**Trader**
Machine (approx.)	INR 35,000	INR 3,75,000	INR 5,50,000
Solar (approx.)	INR 4,00,000	INR 7,00,000	INR 8,00,000
Other installation costs, including GST	INR 20,000	INR 20,000	INR 20,000
Total	**INR 4,55,000**	**INR 10,95,000**	**INR 13,70,000**

Working pattern
15 to 20 working days a month, in 8 to 10 hour shifts, depending on production.

Year-round use
Adding spice and flour processing, dal milling and millet value-added products keeps the unit running even after harvest.

Quality
Entrepreneurs need to be able to show the quality of their processed millets.

Stakeholders: Community and State

Community level State level

Promoting organisations	Priyadarshini Self-Employment Training and Rural Sector Sarvodaya Integrated Rural Development Society Nisarga Social Work Centre State Rural Livelihood Mission DMR Raitha Siri
Government departments	Department of Agriculture Department of Rural Development District Agriculture Department
Training and testing	KVK FPOs Local NGOs District Agriculture Training Centre (DATC) SKDRPD State Agriculture Universities
Product development and manufacturing	Satwik Organics Food processing companies Matru Foods
Operators	Millet Farmer Producer Organisations State Agricultural Departments Food entrepreneurs

Stakeholders: National and Global

National level Global level

Promoting organisations	IIMR, Directorate of Millets Development, NABARD, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Food and Agriculture Organization of the United Nations (FAO)
Government departments	Ministry of Industries and Commerce
Training and testing	Indian Council of Agricultural Research (ICAR), AgBiTech, Central Food Technological Research Institute (CFTRI), FAO, International Food Policy Research Institute (IFPRI)
Product development and manufacturing	PMFME, CSIR-IIHR, AICR, Narayanee Enterprise, Bill and Melinda Gates Foundation, World Food Programme
Operators	Ashoka Foundation

Integration of DRE technology can lead to higher farmer incomes and decentralised services.



Where to intervene

Key activities and nodal points across the value chain from on-farm work to primary and secondary processing.



Which unit fits whom

Small, medium and large processing units, matched to communities, groups and entrepreneurs.



How to run it

Developing business models, set-up costs to keep a unit working through the year.

Organisations working with rural communities, FPOs or institutional partners in Karnataka, and those building climate-resilient agri-value chains, are invited to collaborate.

Reach out to explore ideas or pilot together.



SELCO Foundation