

## Importance of Millets and Government Initiatives to Promote Its Cultivation in India

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Millets, also referred to as nutri-cereals or famine crops, are small-grained annual cereal crops that are grown as rain-fed crops in less fertile soil with less chemical fertilizers and pesticide usage. They are tolerant of drought and other extreme weather conditions. Millets have been a traditional mainstay for hundreds of millions of people in Sub-Saharan Africa and Asia (especially India, China, and Nigeria) for over 7000 years and are currently grown all over the world. According to estimates, more than 90 million people in Africa and Asia rely on millets in their diets. Africa produces more than 55% of the world's millet, with Asia producing close to 40% of it and Europe making up about 3% of the total market. Most millets are native to India and were the first crops to be domesticated on the Asian and African continents. The world's largest producer of millets is India (Fig. 1). In 2020, the two millets grown in India, Pearl Millet (Bajra) and Sorghum (Jowar), accounted 19% of global production. Rajasthan, Karnataka, Maharashtra, Uttar Pradesh, Haryana, Gujarat, Madhya Pradesh, Tamil Nadu, Andhra Pradesh, and Uttarakhand are the leading millets-producing states in India. Currently, these ten states collectively account for almost 98% of India's millets production in 2021–22. Rajasthan accounts for 27% of total millet production in India (Fig. 1). Millets are making headlines these days due to their great nutritional content and other advantages. In light of this, the Indian government proposed making 2023 the “International Year of Millets”. It was supported by FAO Governing Bodies and the United Nations General Assembly at its 75th session. The following are the objectives of declaring 2023 the International Year of Millets:

- 1) Elevate awareness of the contribution of millets to food security and nutrition.
- 2) Inspire stakeholders on improving sustainable production and quality of millets.
- 3) Draw focus on enhanced investment in research and development and extension services to achieve the other two aims.

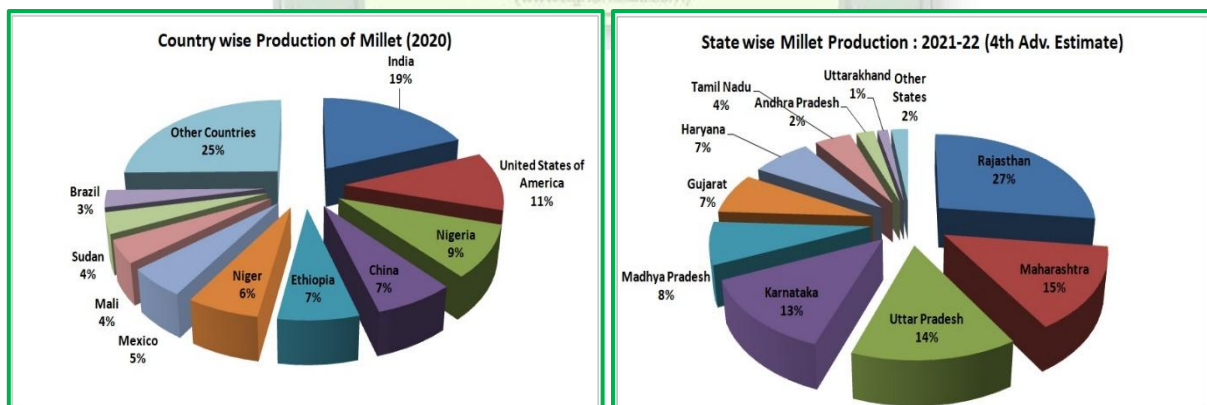


Fig. 1 Country and state wise production of millet (Gov. of India, APEDA, 2022).

## Classification

According to their grain size, millets are divided into major millets, minor millets and small millets. Pseudo millets are so named because they are not members of the Poaceae family, which includes 'real' grains, but they are nutritionally comparable and utilized in similar ways. Ministry of Agriculture and Farmers Welfare has recognized the importance of millets and declared millets comprising of sorghum, pearl millet, finger millet, minor millets i.e., foxtail millet, proso millet, kodo millet, barnyard millet, little millet, brown top millet and two pseudo millets i.e., buck- wheat, amaranth as “Nutri-Cereals” for production, consumption and trade point of view (Table 1.). Other millets, such as fonio and tef, are grown in certain African countries (Venkatesh Bhat et al., 2018).

**Table 1. Millets grown in India and their uses**

Crop	Scientific name	Common name	Origin	Uses
Sorghum	<i>Sorghum bicolor</i>	Jowar	Africa	Potential source of biofuel; used to brew gluten-free beer Used as a wheat substitute for people on a gluten-free diet Commonly used in agriculture as feed for livestock It is one of the really “indispensable crops” required for the survival of humankind
Pearl Millet	<i>Pennisetum glaucum</i>	Bajra	West Africa	Rich in protein, fiber, phosphorous, magnesium and iron
Finger Millet	<i>Eleusine coracana</i>	Ragi/ Mandua	East Africa, India	Rich in calcium and polyphenols Food for toddlers and fermented recipes
Foxtail Millet	<i>Setaria italic</i>	Kanngani /kakun	China	High protein content and sturdy growth Contains copper and iron Food for diabetics and poultry food
Proso Millet	<i>Panicum miliaceum</i>	Cheena	China	High thiamine & energy (kcal) Diet for cardiac patients and green fodder Contains the highest amount of proteins
Kodo Millet	<i>Paspalum scrobiculatum</i>	Kodo	India	Rich in B vitamins especially niacin, pyridoxin and folic acid High lectin and better seed viability Diet for hyperlipidemic patients
Barnyard Millet	<i>Echinochloa frumentacea, E. utilis</i>	Sawa/ Sanwa/ Jhangora	India, Japan	High in crude fiber and iron. Contains Gamma amino butyric acid (GABA) and Beta - glucan, used as antioxidants and in reducing blood lipid levels.

Little Millet	<i>Panicum sumatrense</i>	Kutki/samai	India	High in iron content and dietary fiber Food to boost immunity
Brown top millet	<i>Urochloa ramosa</i>	pedda-sama, korne	India, Southeast Asia	Grows in rocky and shallow soil Forage and green manure
Buck-wheat	<i>Fagopyrum esculentum</i>	Kuttu	Southeast Asia	Contains higher levels of zinc, copper, and manganese Contains rutin which helps to control blood pressure, possess anti-inflammatory and anti-carcinogenic properties Rich in soluble fiber and polyphenols
Amaranth	<i>Amaranthus cruentus</i>	Chaulai	Central America	High in dietary fiber High in iron, magnesium, phosphorus, potassium Contains a lunasin which are thought to have cancer preventive and antihypertensive properties

### Climatic conditions

Millet crops are grown in locations with low rainfall (200-600 mm). These drought-tolerant and adaptive crops are ideal for dryland agricultural environments, and a few are significant in hill and tribal agriculture. Millets have given food and nutritional security to inhabitants in challenged geographical areas for generations. These food crops are distinct in that they use less water to grow, mature earlier, and are grown in low-input circumstances. They are highly adaptable to low rainfall areas, can tolerate fairly lengthy dry spells, and recover quickly following delayed rain, making them suitable reliant crops. Millets are very adaptable to many ecological situations, making them suitable crops for climate change and contingency plantings. These plants are more environmentally friendly due to their high-water usage efficiency and low input demand, but they are also responsive to high input management. Millets are known as nutria-cereals due to their unique nutritional qualities, which include high fiber, quality protein, and mineral content. The majority of millets are kharif season crops (planted in May-June) that mature between September and October. The vast majority of these crops produce well during the rabi season (October-March) and the summer season (January-April).

### Benefits of millet consumption over other cereal food crops

1. Millets are highly nutritious, non-glutinous and non-acid forming foods. Millet diets are well established as a rich source of phytoconstituents, vitamins, minerals, and fibrous materials (non-starch polysaccharides) that are required for appropriate growth, type 2 diabetes control, and overall nutritional well-being.
2. It contains a protein content of 7-12%, a fat content of 2-5%, a carbohydrate composition of 65-75%, and a dietary fiber of 15-20%. The essential amino acid composition of millet protein is superior to that of other grains such as maize. Millets act as a probiotic feeding for micro - flora in our inner-system. Millets hydrate our colon to keep us from being constipated. Millets contain fewer cross-linked prolamins, which may be another factor contributing to millet protein digestibility. Niacin in millet can help lower cholesterol.

Millets contain major and minor nutrients in good amount along with dietary fiber. As millets are gluten free and it can be a substitute for wheat or gluten containing grains for celiac patients (Amadou et al., 2013).

- Millets are high energy yielding nutritious meals that aid in the treatment of malnutrition. They're eaten as flour, rolled into balls, parboiled, and served with milk. Traditional food processing processes such as decortication, milling, germination, fermentation, malting, and roasting of millets are suggested by the FAO in order to prevent antinutritional traits and promote edible qualities. The content of proximate composition of several millets is shown in Table 1. Millets have the potential to be processed and consumed as traditional local dishes such as popping meals, porridges, chapati, dosa, pastas, bread, and cookies (FAO, 2009).

#### Nutrient composition of millets compared to fine cereals (per 100 g)

Food grain	Carbo hydrates (g)	Protein (g)	Fat (g)	Energy (KCal)	Crude fiber (g)	Mineral matter (g)	Ca (mg)	P (mg)	Fe (mg)	Thiamin (mg)	Niacin (mg)	Ribo flavin	Folic Acid (mg/100g)
Finger millet	72.0	7.3	1.3	328	3.6	2.7	344	283	3.9	0.59	3.2	0.11	15.0
Kodo millet	66.9	8.3	1.4	309	9.0	2.6	27	188	0.5	0.41	4.5	0.28	-
Proso millet	70.4	12.5	1.1	341	2.2	1.9	14	206	0.8	0.42	1.1	0.19	18.3
Foxtail millet	60.9	12.3	4.3	331	8.0	3.3	31	290	2.8	0.3	3.2	0.09	9.0
Little millet	67.0	7.7	4.7	341	7.6	1.5	17	220	9.3	0.33	4.2	0.1	-
Banyard millet	68.5	6.2	2.2	307	9.8	4.4	20	280	5.0	0.15	2.0	0.09	23.1
Sorghum	72.6	10.4	1.9	349	1.6	1.6	25	222	4.1	0.38	4.3	0.15	20.0
Bajra	67.5	11.6	5.0	361	1.2	2.3	42	296	8.0	0.38	2.8	0.21	45.5
Wheat (whole)	71.2	11.8	1.5	346	1.2	1.5	41	306	5.3	0.41	4.3	0.04	8.0
Rice (raw, milled)	78.2	6.8	0.5	345	0.2	0.6	10	160	0.7	0.05	0.05	1.7	9.32

(Source: Nutritive value of Indian foods, NIN, 2007)

- Similar to cereal proteins, the millet proteins are poor sources of lysine, but they complement well with lysine - rich vegetables (leguminous) and animal proteins which form nutritionally balanced composites of high biological value. Millets are more nutritious compared to fine cereals. Small millets are good source of phosphorous and iron.
- The consumption of millets is associated with a number of health benefits, owing mostly to the bioactive phytochemicals found in these grains, such as lignans, flavonoids, phenolics, beta-glucan, sterols, inulin, pigments, dietary fiber, and phytate. These nutraceuticals have been linked to the treatment of asthma, migraines, blood pressure, diabetes, cardiovascular disease, and immune system function. Millet based meals are regarded as potential prebiotics and probiotics with significant health advantages. Millets high in phenolics are important for health, ageing, and metabolic syndrome. Millets contain phytate, which has anticancer and cholesterol-lowering properties. Millets with a high fiber content are essential for preventing gallstone formation. Millets are most generally considered of as a good source of proteins, which play an important role in malnutrition prevention.



6. Millets and their dietary products consist of biologically active compounds with antioxidant potential. Because they are important components, they can be used as functional foods. Millet grain minerals, vitamins, and flavonoids aid to protect cell membranes and other body components by neutralizing free radicals. Millet grain antioxidants have been shown to have anticancer action. Consumption of millet grains may improve bone quality significantly due to the presence of vitamin content and bioactive chemicals that protect bone calcium concentration and promote antioxidant status.
7. Millets are distinct among cereals due to their high levels of calcium, dietary fiber, polyphenols, and protein. Millets have a larger lipid content than maize, rice, and sorghum and contain more important amino acids, notably sulphur-containing amino acids (methionine and cysteine). In general, grain proteins, including millets, have low lysine and tryptophan content, which varies by cultivar (Amadou et al., 2013).

### **Benefits to farming community**

1. Drought-tolerant: Millets are well-adapted to dry and arid environments and require less water than other cereal crops such as rice and wheat. Millets may grow in locations with limited rainfall and low soil fertility, making them a valuable crop for growers in marginal and rain-fed areas.
2. Millet cultivation is a low-cost, low-input agricultural method that may improve biodiversity and the environment. Compared to other crops, millet crops require less pesticide and fertilizer application, and they may be grown utilizing conventional and organic agricultural practices.
3. Farmers can make profits from millets, especially in areas where other crops are difficult to grow. As urban regions have a growing demand for millets, farmers can earn greater profits by selling millet-based snacks, cereals, and bakery goods.
4. Millets are the backbone for dry land agriculture. They are hardy, resilient crops with a low carbon and water footprint, can endure high temperatures, and grow on poor soils with little or no external inputs. So, they are called as the ‘miracle grains’ or ‘crops of the future’. They are the most secure crops for small farmers in times of climate change because they are the hardiest, most resilient, and climate adaptable crops in severe, hot (up to 50 degrees Celsius), and drought environments.

### **Major Initiatives by the Government to Promote Millets**

- In April 2018, the government declared millets to be Nutri-cereals due to their nutritional benefits.
- The government is educating farmers about nutria-cereals (millets) such ragi, sorghum, bajra, and small millets through demonstrations and training as part of the National Food Security Mission (NFSM) - Nutri-cereals Sub Mission.
- The government is helping to popularize Nutri-cereals by funding R&D. Start-ups and entrepreneurs are also offered assistance in developing recipes and value-added items that increase millet consumption. From 2018 to February 2022, eight bio-fortified varieties/hybrids of Bajra have been released for cultivation.
- To promote the shipment of Nutri-cereals, the Ministry of Commerce and Industry has prepared a comprehensive strategy to promote Indian millets exports across the globe starting in December 2022 through its apex agricultural export promotion body, the Agricultural and Processed Food Products Export Development Authority (APEDA).
- On December 20, 2021, NITI Aayog signed a Statement of Intent (SoI) with the United Nations World Food Program (WFP). The cooperation focuses on mainstreaming millets and assisting India in taking the world lead in knowledge exchange by taking advantage of the International Year of Millets in 2023.

- The Union Budget 2022-23 indicated that assistance would be provided for post-harvest value addition, increasing domestic consumption, and branding millet products on both a national and global level.
- Prime Minister of India called on the corporate world to come forward in branding and marketing Indian millets in a webinar held on February 24, 2022, dealing with the positive impact of Union Budget 2022-23 on the agriculture sector.
- During the launch ceremony of the Food and Agriculture Organization of the United Nations (FAO)'s International Year of Nutri-cereals in Rome (Italy), our Prime Minister emphasized the importance of making millets a food choice for the future. He also discussed how climate change affects food supply. The Prime Minister stated, "Millets are good for the consumer, the cultivator, and the climate" (Anonymous, 2022).

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