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Minor Millet: Distribution, Health Benefit and Strategies for Enhancing the Productivity of Millets

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INTRODUCTION

Millets, also known as Nutri-cereals, are one of the oldest crops cultivated for food and fodder in dry and arid regions of India (Saini *et al*., 2021). Millets are considered to be very important for human nutrition due to their numerous beneficial qualities. They are ranked as the sixth most important grain in the world and sustain one-third of the world population. India is the largest producer of rice, wheat, and other cereals, but the production and productivity of major crops have replaced the production and productivity of other important crops, such as minor millets. There are two types of millets cultivated in India: major and minor. The major millets include sorghum, bajra, and maize, while the minor millets include finger millet, foxtail millet, banyard millet, and kodo millet. Farmers grow major millets in larger quantities than minor millets in India, but minor millets contain more nutritional values. People living in the northeastern part of India, including Manipur, Meghalaya, and Nagaland, use millets as their staple food. Millets are adaptable and can grow successfully in diverse soil and climatic conditions. Minor millets are a good source of protein, fiber, essential fats, and minerals like calcium, zinc, magnesium, phosphorus, and potassium (Tang *et al*., 2017). They do not contain gluten, which is beneficial to diabetic patients, people with cancer, oxidative stress, obesity, celiac disease, and gastrointestinal disorders. Small millet grains are nutritionally rich and contain low levels of phytic acid, making them rich in iron and calcium. Dietary surveys carried out by the National Institute of Nutrition, Hyderabad indicate that these grains are particularly beneficial for human nutrition. Small millets are the smallest of the millet grains, including finger, kodo, foxtail, proso, little, and barnyard millets. They are the staple food for millions of people living in the arid and semiarid tropics of the world, and they are distributed in most of the Asian and African countries and parts of Europe.

The grains of small millets, being nutritionally superior to rice and wheat, provide cheap proteins, minerals, and vitamins to the poorest of the poor where the need for such ingredients is the maximum. However, small millets are vulnerable to different spectrum of field pests and diseases, including blast, viruses, smuts, shoot fly, and borers (Brahmachari *et al*., 2018). Small millets are generally cooked like rice and can also be used in local specific sweets and savories. Small millets can also be used as substitutes for wheat and rice in various food products. For example, bread can be prepared from finger millet for diabetics, and it can also be used in many bakery products. Most small millets could be popped or flaked. In recognition of the nutritional and environmental benefits of millets, the Indian government has announced 2022-23 as the International Year of Millets. This initiative aims to promote the production and consumption of millets in the country and raise awareness of their nutritional value and benefits.

Climate requirement: Millets in India have a growing season spanning from June to November, and are best cultivated in well-drained loamy soil. Germination of millets requires a warm temperature range of 20-35°C, but is vulnerable to frost (Nagarkoti, 2018). These crops are dependent on rain and can be grown with limited rainfall. Major millets require an average rainfall of 450 mm, while minor millets can thrive with 350 mm of rainfall.

Distribution: According to FAO STAT-2021, the global millet production was estimated to be 86.3 million tonnes. India is the largest producer of millets in the world, with a production of 17.96 million tonnes and a global share of 21%, followed by Africa. In Karnataka, a large area of 1.25 million hectares is covered under small millets, producing 1.54 million tonnes with a productivity of 1230 kg/ha, mostly located in the northern part of the state. The popular millets cultivated in Karnataka include finger millet (Ragi), foxtail millet (Navane), Little millets (Savi/Samai/Kutki), Barnyard millet (Oodahe/Banti), Proso millet (Baragu/Cheena/French millets), Brown top millet (Korle), and Kodo millet (Haraka/Varagu).

The leading producers of millets in India include Maharashtra, Rajasthan, and Karnataka. Small millets cover the highest area in Madhya Pradesh (32.4%), followed by Chhattisgarh (19.5%), Uttarakhand (8%), Maharashtra (7.8%), Gujarat (5.3%), and Tamil Nadu (3.9%). The highest productivity of small millets was recorded in Uttrakhand (1174 Kg/ha), followed by Tamil Nadu (1067 Kg/ha) and Gujarat (1056 Kg/ha) (Nin, 2021).

Minor millets

Finger millet: According to research, Finger millet is believed to have been developed in Africa from E. coracana subsp. Africana, possibly in the Ethiopian region. The crop was likely introduced to India over 3,000 years ago and is cultivated as a tropical crop at altitudes ranging from sea-level to 3,000 meters above sea level. It is the most commonly grown small millet in both India and Africa and is capable of high productivity (Mirza & Marla, 2019).

Proso millet: Proso millet, an ancient crop, was likely domesticated in central and eastern Asia and was cultivated during the Neolithic period in Europe. It was widely recognized by the Romans and became known as the "common millet." While primarily grown in temperate regions, it is also cultivated in sub-tropical areas and at high elevations during tropical winters (Joshi *et al*., 2021).

Foxtail millet: Foxtail millet is an ancient crop, which is believed to have been domesticated in eastern Asia and has been known to the Chinese since 2,700 BC. This crop is mainly grown in the sub-tropical and temperate zones. The primary production areas of foxtail millet are in Japan, China, India, and Eastern Europe (Rao, 1989).

Little millet: Little millet is cultivated in India up to altitudes of 2,100 m, albeit to a limited extent. This millet is also found in the wild in northern India and Southeast Asia. It is capable of producing some grain and useful fodder even under very poor conditions. Certain varieties of little millet mature in just two-and-a-half months (Rao, 1989).

Barnyard millet: *Echinochloa crusgalli*, commonly known as Japanese barnyard millet, was domesticated in Japan approximately 4,000 years ago. It is primarily a crop of the temperate zone. On the other hand, Barnyard millet, was domesticated in India, where it remains a significant cereal crop in some regions. It has also been found in the Central African Republic, Tanzania, and Malawi (Upadhyaya *et al*., 2016).

Kodo millet: Kodo millet is primarily cultivated as a cereal crop in India, whereas its wild variety is considered a prevalent tropical weed. Its cultivation dates back at least 3,000 years, and there is no clear racial differentiation among the crop's various types, including wild, weed, and cultivated (Mall & Tripathi, 2016). However, the crop is said to be poisonous after rain, possibly due to a fungal infection. Nevertheless, properly winnowed and cleaned healthy grains do not pose any known health problems.

Growth rate of area, production and productivity of minor millets in India

Sr. No.	Year	Area (In 000 Hectare)	Production (In 000 Tones)	Productivity (In Kg/Hectare)
1.	2010-11	800	442	553
2.	2011-12	798	452	565
3.	2012-13	754	436	578
4.	2013-14	682	430	630
5.	2014-15	590	386	654
6.	2015-16	650	391	602
7.	2016-17	619	442	714
8.	2017-18	546	439	804
9.	2018-19	454	333	734
10.	2019-20	458	370	809

Millet scenario in India. (Gowri *et al*., 2020).

FACTORS LIMITING PRODUCTIVITY

Production of small millets is subject to wide fluctuations, and the area is declining, except in the case of finger millet. The major constraints limiting small millets production are:

1. These crops are often grown in uneven marginal lands, poor in fertility, shallow and gravelly, with low moisture retention capacity.
2. These crops are grown under rainfed conditions in low rainfall arid regions.
3. Improved crop management practices are not adopted by the farmers due to socio-economic constraints.
4. Research on crop improvement and agro-techniques was neglected till recently.
5. There is no organized programme for production and supply of seeds of improved varieties.
6. There is no ready market for the disposal of surplus produce at a remunerative price.
7. There is lack of extension and development support.

NEED FOR INCREASING PRODUCTION

The cultivation of small millets in marginal and sub-marginal dry lands leads to an imbalance in the food economy of poor and tribal farmers due to several constraints. Fluctuations in production of small millets create instability in the total coarse cereal production, which not only affects the livelihoods of people and animals but also poses hardships.

Strategy

To enhance the production of small millets during the Seventh Five Year Plan, the focus will be on maintaining a consistent and higher level of productivity. To achieve this goal, production plans have been formulated for each crop, outlining the necessary inputs such as seeds, fertilizers, pesticides, and credit. The strategy will involve the following broad outlines.

1. Expansion of area under improved varieties through their popularization.
2. Production and supply of seeds of improved varieties in sufficient quantities to the farmers.
3. Conservation of soil moisture and its utilization by the adoption of dry farming techniques.
4. Adoption of integrated watershed concept to enhance production and productivity.
5. Adoption of recommended package of practices with special reference to non-monetary inputs like optimum plant population, timely weed, pest and disease control through cultural management.
6. Popularization of low-cost technology through full extension support.
7. Remunerative price and marketing facilities. .
8. Intensification of location specific research for development of varieties and low cost technologies for stabilizing production at higher levels.

Health benefit of Nurti-cereals

1. High dietary fiber provides hunger satisfaction and helps reduce obesity.
2. Reduced the risk of diabetes and cardio vascular disease.
3. Beneficial in treating and prevention of gallstones and stomuch ulcers and constipation.
4. Rich in anti-oxidants and hence reduced oxidation stress.
5. Reduce the risk of cancer and hypertension.

CONCLUSION

Minor millets represent an important source of food and nutrition, particularly in regions with challenging climatic conditions. However, their productivity is often limited by factors such as low yields, pests and diseases, and lack of infrastructure and markets. To increase their adoption and impact, efforts are needed to develop high-yielding varieties, improve agronomic practices, strengthen seed systems,

and promote value-added products. Moreover, promoting the health benefits of minor millets, which are rich in protein, fiber, minerals, and vitamins, can contribute to addressing malnutrition and related health issues, especially in vulnerable groups such as children and women. The production and consumption of nutri-cereals made from minor millets can provide important dietary diversification, contribute to food security, and enhance resilience to climate change. Therefore, investing in the research, development, and promotion of minor millets as a climate-resilient crop is crucial to addressing the challenges of food security and malnutrition in many parts of the world. By harnessing their potential, we can create a sustainable food system that benefits both people and the planet.

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