



Millets and Their Role in Combating Hunger and Climate Change

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Millets are ancient heritage grains that boast nutritious characteristics, tolerance to abiotic stresses, and minimal agricultural input. Hidden hunger, as well as micronutrient deficiency malnutrition, makes women and children particularly susceptible to social and life-threatening diseases. This adds an additional challenge to addressing the unpredictability of food supply, something that remains a pertinent global issue in food security while threatening the well-being of millions around the world. These coarse grains are a high source of carbohydrates, dietary fibers, lipids, proteins, vitamins, critical minerals, trace elements, necessary amino acids, and antioxidants, and hence can be considered a miracle (Kankarwal *et al.*, 2024).

Essential human needs like food, shelter, and clothing are met by plants and their components, with food security being a major global concern. With its origins going back more than 3000 years, agriculture has been essential to the survival of human societies (Mehta *et al.*, 2024). It mainly utilizes food obtained from vegetables, cereals, millet, and legumes. However, powerful populations like India face severe barriers to food development. Some obstacles comprise insufficient land space triggered by population boom, urbanization, and industrialization. A potential solution to this problem is to add Indian millet to the international food market. Millet, an ancient small-seeded cereal, has been cultivated in India for ages, and is gaining recognition for its ability to bolster global food security.

Millets as a Neglected Cereal

Despite their historical importance, millets have largely fallen out of favor in modern agriculture and diets (Shukla *et al.*, 2023). The increasing prominence of other high-yielding cereal crops, such as rice, wheat, and maize, has pushed millets to the periphery of global food systems. This negligence brings about a pertinent concern since it has concealed the numerous benefits and qualities that millets offer both in terms of nutrition and agriculture.

Millets and malnutrition

Malnutrition remains a global health concern. Until now, experts have been trying to find the best way to cope with this problem. Nutritional deficiency is largely found in children aged between 1 and 5 years and in pregnant women, thus leading to greater health complexities later on. As far as India is concerned, major contributors to malnutrition are poverty and low metabolic rate. Apart from being neglected for long periods, millets have the potential to alleviate malnutrition since they are one of the richest sources of macro and micro nutrients. It also helps in tackling several other diseases. The quality of the food is important in improving health conditions and addressing the problem of nutritional security to some extent, due to a lack of awareness regarding the richness of millet grains in terms of dietary fiber, protein content, flavonoids, gluten free the cereal grain was ignored (Goel & Mishra, 2022).

They have significant economic value for a number of African and Asian nations. Considering the technological advancements in the food industry, millets can be marketed as a sustainable crop due to their harsh climate tolerability, short growth period, and cost-effectiveness. The way millet is utilized and processed is changing in every country. Processing is vital since the consumption of unprocessed whole cereal grains is not possible. There is an ever-growing concern for food and nutrition security, and that further intensifies the challenge for commercial players to create new health-focused food products at an affordable cost. Economically Poor population could improve their socio-economic status by value-added millet-based products, which could also help to address the issue of hidden hunger. These millets, when integrated into several low-cost formulations for adults and children, could help alleviate malnutrition and other degenerative diseases (Goel & Mishra, 2022).

Millets Production in India

Millet production in India (Fig. 1) is mostly focused on dry and desert regions with poor and unpredictable rainfall. India produces the most pearl millet in the world, and other millets, with an annual production of around 120 Millets' Role in Addressing Malnutrition and Ensuring Food Security in a Changing Climate 12.46 million metric tonnes on an area of 8.87 million hectares. Rajasthan leads the way in millet production, with 7.29 million tonnes produced from 5.91 million hectares, followed by Karnataka (6.45 million tonnes), Madhya Pradesh (4.82 million tonnes), Maharashtra (4.73 million tonnes), and Uttar Pradesh (4.73 million tonnes), Tamil Nadu (3.33%), and Telangana (3.12%), respectively and a diminishing trend in area and production from 2010 to 2018 is observed (Dayakar Rao et al., 2018). Karnataka is well-known in India for farming minor millets, with finger millet (granted with a Geographical Indication (GI) tag for finger millet by the national government) serving as a staple meal in the state's southern region (Ashok et al., 2020). Telangana ranks seventh in millet production, with 3.12 million tonnes produced over an area of 0.66 million hectares. The statistics, on the other hand, revealed a reduction in the area under millets from 1950 - 1955 to 2015 - 2019 at a Crop Growth Rate (CGR) of 16.21%; similarly, output was declining at a CGR of 13.58%. India has a total planted area of 1.17 million hectares producing 1.79 million tonnes of finger millet, with Maharashtra, Tamil Nadu, Andhra Pradesh, Odisha, Uttarakhand, and Karnataka being the main states producing more than 90% of the country's supply and kodo millet is the second minor millet that is produced on large scale in India after finger millet. India produces 4.77 million tonnes of sorghum annually, placing it sixth in the world (Kankarwal et al., 2024).

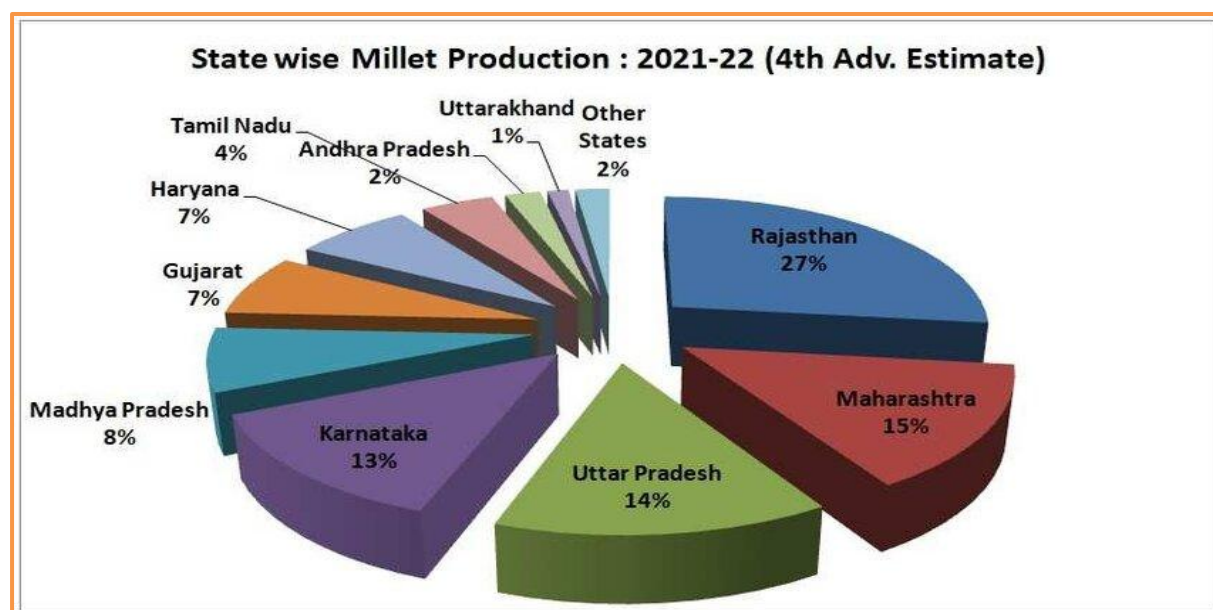


Figure 1: Millet Production statewise; (Source: AEPDA Data 2021-22)

Millets as a Nutrient-Rich Cereal

Millets are nutritional powerhouses, brimming with essential nutrients that contribute to overall well-being. They are a rich source of dietary fiber, providing excellent digestive health support. Additionally, millets are packed with vitamins, including B-complex vitamins such as niacin, riboflavin, and folate, which are vital for energy production and neurological health (Godswill et al., 2020). Millets, along with other grains, include imperative minerals such as iron, magnesium, and phosphorus that greatly contribute to human health. Furthermore, millets do not contain gluten, which makes them appropriate for people suffering from gluten intolerance or celiac disease.

Grain (Millet/ Cereal)	Carbohydrates(g)	Protein (g)	Fat (g)	Energy (Kcal)	Dietary Fibre (g)	Ca (mg)	Mg (mg)	Zn (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Folic acid (mg)
Sorghum	67.7	10.0	1.7	334.1	10.2	27.6	133.0	2.0	4.0	0.4	0.1	2.1	39.4
Pearl Millet	61.8	11.0	5.4	348.0	11.5	27.4	124.0	2.8	6.4	0.3	0.2	0.9	36.1
Finger millet	66.8	7.2	1.9	320.7	11.2	364.0	146.0	2.5	4.6	0.4	0.2	1.3	34.7
Kodo millet	66.2	8.9	2.6	331.7	6.4	15.3	122.0	1.7	2.3	0.3	0.2	1.5	39.5
Proso millet	70.4	12.5	1.1	341.1	-	14.0	153.0	1.4	0.8	0.4	0.3	4.5	-
Foxtail millet	60.1	12.3	4.3	331.0	-	31.0	81.0	2.4	2.8	0.6	0.1	3.2	15.0
Little millet	65.6	10.1	3.9	346.3	7.7	16.1	91.4	1.8	1.3	0.3	0.1	1.3	36.2
Barnyard millet	65.6	6.2	2.2	307.1	-	20.0	82.0	3.0	5.0	0.3	0.1	4.2	-
Wheat	64.7	10.6	1.5	321.9	11.2	39.4	125.0	2.9	4.0	0.5	0.2	2.7	30.1
Rice	78.2	7.9	0.5	356.4	2.8	7.5	19.3	1.2	0.7	0.1	0.1	1.7	9.3

Figure 2. Nutrients in different millets and cereals (Source:IIMR & Food composition tables, NIN -2017)

Millets in the Context of Sustainable Agriculture

Sustainable agriculture is at the forefront of global efforts to ensure food security, protect the environment, and promote economic development. In this context, millets, a group of small-seeded grains, have gained increasing recognition for their potential role in sustainable agriculture. Millets offer a unique set of characteristics that align with sustainability goals, such as reduced water usage, lower chemical inputs, and the promotion of biodiversity and ecosystem services (Vidhya et al., 2023). Moreover, millet farming has the potential to have economic and social impacts on smallholder farmers as well as rural populations.

Conclusion

The successful advocacy from India for the International Year of Millets in 2023 was a key milestone in the revival of ancient grains, and its earlier G20 presidency led the country to spearhead the international promotion of millets. Millets are multifunctional, transforming into flatbreads, idlis, dosas, porridges, popped grains, kichadi, and even beverages like beer. The agro-industrial sector can also utilize these products in the formulation of bioethanol and green coatings. With a unique combination of low-input necessities, ability to withstand biotic and abiotic stress, and an extensive range of health benefits, millets have the potential to alleviate complex problems regarding food, nutrition, and agricultural security. They require renewed focus as 'miracle grains' to enable a healthy, sustainable, and food-secure future.

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