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Millets: The Nutri-Cereals

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Abstract

Millets are a diverse genus of small-seeded grasses that are commonly cultivated as cereal crops or grains for human and animal nourishment all over the world. Sorghum and pearl millets, which are significant crops in India and parts of Africa, are the most often farmed millets. They are extremely resilient to drought and other harsh weather. Sorghum, finger millet, pearl millet, foxtail, tiny, kodo, proso, and barnyard millet are among the principal millets that make up millets, which are nutritional cereals (minor millets).Comparison on Nutritional Composition of Rice and Wheat with Millets when compared to wheat and rice, millets have a higher mineral concentration. Now, Government of India has decided to celebrate IYOM, 2023 to make it peoples' movement so that the Indian millets, recipes, value added products are accepted globally.

Introduction

Millets are a diverse genus of small-seeded grasses that are commonly cultivated as cereal crops or grains for human and animal nourishment all over the world. The majority of the species that are commonly referred to, as millets are members of the Paniceae tribe, but some millets are also members of other taxa. With 97% of millet production occurring in developing nations, millets are significant crops in the semiarid tropics of Asia and Africa, particularly in India, Mali, Nigeria, and Niger. This crop is preferred because of its productivity and short growing season in hot, dry climates. Many regions of the world are home to millets. Sorghum and pearl millets, which are significant crops in India and parts of Africa, are the most often farmed millets.

The estimated global area under millets cultivation has decreased by 25.7%, but millets production has increased by 16.26 percent between 1961 and 2018. (Table 1). Europe

experienced the highest decline in area (90.14%) and output (73.76%) among the continents, followed by Asia (59.79%; 8.77%). In contrast, Africa experienced a remarkable growth in area and production of millets (74.90%; 102.49%).

On an area of 12.45 mha, millets are produced, yielding 15.53 mt at a rate of 1247 kg/ha. In terms of area and yield (4.31 mt), sorghum is the fourth-most important food grain crop in India (3.84 mha) Bajra (7.05 mha) is grown on more than 50% of the country's land, and it produces about an equal percentage of the nation's production. India produces the highest amounts of finger (53.3%), kodo (100%), small millet (100%) and pearl millet (44.5%) in a region of 8.87 mha. This is significant. In recent years, finger millet produced the highest yields of all the millets (Table 2).

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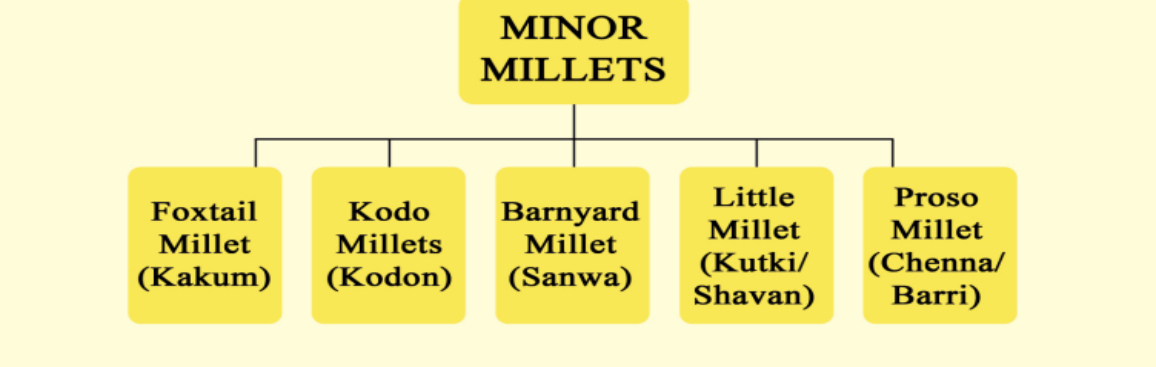

In India, millets are grown in about 21 States. In the states of Odisha, Madhya Pradesh, Jharkhand, Rajasthan, Karnataka, and Uttarakhand, they have long been a staple of tribal cuisine (Sood et al. 2019). However, due to their incredible nutraceutical potential, they have recently gained popularity in urban areas as well. The states with the highest percentage of area under millets cultivation are Rajasthan (29.05%), Maharashtra (20.67%), Karnataka (13.46%), Uttar Pradesh (8.06%), Madhya Pradesh (6.11%), Gujarat (3.94%), and Tamil Nadu (3.74%).In the recent past, Gujarat and Madhya Pradesh have increased the area under millet cultivation. The highest yields of millets have been attained in Indian states like Andhra Pradesh (2626.58 kg/ha), Tamil Nadu (2153.22 kg/ha), Haryana (1906.78 kg/ha), Gujarat (1762.05 kg/ha), and Madhya Pradesh (1729.70 kg/ha). States like Gujarat and Andhra Pradesh have shown high levels of output in comparison to its predecessors.

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Table 1. Millets area, production and yield data worldwide (excepts sorghum)

	Area (tons/ ha)							Production (lakh/ tons)							Productivity (kg/ha)						
	1961-1963	**1971-1973**	**1981-1983**	**1991-1993**	**2001-2003**	**2011-2013**	**2016-2018**	**1961-1963**	**1971-1973**	**1981-1983**	**1991-1993**	**2001-2003**	**2011-2013**	**2016-2018**	**1961-1963**	**1971-1973**	**1981-1983**	**1991-1993**	**2001-2003**	**2011-2013**	**2016-2018**
Africa	118.39	133.23	108.75	168.99	197.69	191.28	207.07	69.42	74.51	77.62	109.66	142.48	113.39	140.57	586.00	559.00	714.00	649.00	720.00	597.00	677.00
America	2.66	2.53	2.46	2.26	2.15	1.67	1.68	3.26	2.98	3.07	3.36	2.89	2.45	3.63	1223.00	1176.00	1247.00	1486.00	1269.00	1361.00	2166.00
Asia	271.75	272.35	229.05	174.64	144.70	121.96	109.26	152.93	181.63	178.19	142.07	137.57	142.50	139.52	562.00	666.00	777.00	811.00	938.00	1171.00	1276.00
Europe	40.89	26.87	28.02	22.45	8.18	6.28	4.03	23.78	26.75	21.40	16.28	9.04	8.36	6.24	583.00	982.00	761.00	765.00	1079.00	1301.00	1517.00
Australia & New Zealand	0.29	0.33	0.33	0.30	0.36	0.35	0.35	0.32	0.36	0.32	0.26	0.29	0.36	0.36	1087.00	1067.00	975.00	855.00	814.00	1015.00	1022.00
World	433.98	435.31	368.61	368.65	353.10	321.54	322.38	249.70	286.24	280.59	271.63	292.27	267.0	290.31	557.00	686.00	761.00	736.00	823.00	832.00.	900.00

SOURCE: FAO STAT 2018
(Each value represents average of 3 years)

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Table 2: Area, production and yield trends for various millets from 1951-2022 in India

Crop		1951-1960	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011-2020	2021-2022
Finger Millet	Area (mha)	2.33	2.49	2.51	2.43	1.85	1.48	1.17	1.01
	Production (Mt)	1.70	1.86	2.41	2.57	2.42	2.07	1.79	1.67
	Productivity (kg/ha)	725.40	746.80	956.30	1059.10	1319.50	1395.00	1591.38	1747.00
Sorghum	Area (mha)	17.09	18.30	16.36	15.83	11.76	8.76	6.07	4.83
	Production (Mt)	7.65	9.29	9.75	11.09	9.80	7.27	5.07	4.31
	Productivity (kg/ha)	446.00	506.90	596.60	701.60	831.00	836.90	883.38	989.00
Pearl Millets	Area (mha)	10.66	11.58	11.97	10.94	10.32	9.39	8.05	7.55
	Production (Mt)	3.21	4.00	5.35	5.08	7.33	7.87	9.02	9.22
	Productivity (kg/ha)	300.00	345.00	444.40	460.40	64.60	829.50	1130.10	1374.00
Total Millets	Area (mha)	30.08	32.37	30.84	29.20	23.92	19.63	15.29	13.83
	Production (Mt)	12.56	15.14	17.51	18.73	19.55	17.20	15.88	15.53
	Productivity (kg/ha)	300.00	345.00	444.40	460.40	657.30	829.50	1130.10	1248.00

SOURCE: INDIASTAT 2020; and Final Estimates-2021-22, DES, GoI

(Each value represents average of 10 years)

Millets are ancient grains that have been produced and eaten in the Indian subcontinent for more than 5000 years. Millets are warm-weather, annual, small-

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grained cereals that are related to the grass family. In comparison to other common cereals, these robust, rain-fed grains require less water and fertility. They are extremely resilient to drought and other harsh weather.Sorghum, finger millet, pearl millet, foxtail, tiny, kodo, proso, and barnyard millet are among the principal millets that make up millets, which are nutritional cereals (minor millets).These are among the oldest foods that humans have ever consumed. One of the several varieties of coarse cereal grasses in the Poaceae family; these are grown for their tiny edible seeds. Although pseudo millets do not belong to the Poaceae botanical family, which is the family to which "real" grains do, they are nutritionally comparable to "genuine" grains and can be used in similar ways. Millets are incredibly nourishing, non-glutinous, and acid-free foods.Millets provide a variety of health-enhancing and nutraceutical benefits, particularly due to their high fibre content. Millets provide micro-nora in our internal ecology with prebiotic food. Millets help us stay hydrated in the colon, which prevents constipation. Millet's niacin can aid in lowering cholesterol. Millets are a good source of dietary fibre and major and minor nutrients. Millets are gluten-free and can be used in place of wheat or other grains that contain gluten by people with celiac disease.

Comparison on Nutritional Composition of Rice and Wheat with Millets

When compared to wheat and rice, millets have a higher mineral concentration. The abundance of sulphur-rich amino acids in finger millet proteins makes them special. Since millets are nutritionally far superior to both rice and wheat, they are the answer to the widespread malnutrition that plagues the Indian population. Millets are a good way to maintain a healthy lifestyle and lower your risk of developing lifestyle diseases including diabetes, hypertension, and cardiovascular disease. Millets, particularly the high fibre content, offer several nutritional, nutraceutical, and health-promoting qualities (Table 3).

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Table 3: Nutritional profile: Comparison of millets and cereals for quality parameters (per 100g of seed)

Crop	Protein (g)	Carbohydrates (g)	Fat (g)	Fiber (g)	Minerals (g)	Calcium (mg)	Phosphorous (mg)
Bajra	11.6	67.5	5.0	1.2	2.3	42	296
Sorghum	10.4	72.6	1.9	1.6	1.6	25	222
Finger millet	7.3	72.0	1.3	3.6	2.7	344	283
Foxtail millet	12.3	60.9	4.3	8.0	3.3	31	290
Proso millet	12.5	70.4	1.1	2.2	1.9	14	206
Barnyard millet	11.6	74.3	5.8	14.7	4.7	14	121
Rice	6.8	78.2	0.5	0.2	0.6	10	160
Wheat	11.8	71.2	1.5	1.2	1.5	41	306
Maize	11.5	66.2	3.6	2.7	1.5	20	348
Barley	11.5	69.6	1.3	3.9	1.2	26	215

SOURCE: National Institute of Nutrition (NIN), Hyderabad

Why Millets are Miracle crops?

1. They benefit the user by assisting in the treatment of vitamin and mineral deficiencies, such as those related to iron, zinc, folic acid, calcium, diabetes, etc.
2. The majority of millets can be cultivated on low fertility soils, and many of them are also grown to reclaim soils, which is good for the environment. They are crops devoid of pests and do not require chemical fertilisers. In reality, millets thrive in the absence of chemical fertilisers when grown on dry land. As a result, the majority of millet farmers produce them in wholly environmentally favourable settings utilising farmyard manure. Most millet fields are naturally biodiverse and in compliance with climate change. They help to guarantee food safety.

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Why one should eat millets?

Millets are free of gluten, very nourishing, and high in nutritional fibre. They are abundant in micronutrients including calcium, iron, phosphorus, and other elements. Due to their low glycemic index (GI), they don't significantly raise blood sugar levels. Idealistically, millets ought to be a staple of our daily diet.

Millets' dietary fibre has the ability to bulk up and absorb water. It lengthens the time that food travels through the gut, which lowers the risk of inflammatory bowel disease and serves as a cleansing agent for the body.

What are the Health benefits of Millets?

- Millets are anti acidic;
- Millets are gluten free;
- Helps to prevent type 2 diabetes;
- Effective in reducing blood pressure;
- Reduces risk of gastrointestinal conditions like gastric ulcers or colon
- Cancer;
- Eliminate problems like constipation, excess gas, bloating and cramping;
- Millet act as a prebiotic feeding microflora in our inner ecosystem.

Reasons for Negligence

- Due to several inherent issues including rapid seed breaking and uneven maturation, many minor millets are not suitable to modern agro ecosystems and mechanisation. In addition to these fundamental characteristics, grain size is a crucial yield factor since little millets' extremely tiny seeds make mechanised planting and harvesting difficult, and eventually prevent their commercialization. Minor millets' seeds must be dehulled before being consumed by humans. Traditional dehulling techniques used in developing nations require a lot of labour and take a long period.
- For the millet production system to function well, climatic parameters including rainfall distribution and pattern, agronomic management, soil type, and soil fertility, as well as the socioeconomic situation of agricultural communities, are all crucial (Sood et al. 2019). The most significant biotic restrictions related to millets include the prevalence of illnesses, insect-pests, parasitic nematodes, birds,

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parasitic plants, and weeds. The main environmental and soil conditions that limit the growth of millet include moisture stress, nutritional stress, salinity, alkalinity, acidity, and heat stress.

- In addition, the lack of focused crop improvement initiatives, the unavailability of improved seeds, the widespread cultivation of less productive and heterogeneous local cultivars, the shift toward high-value cash crops, the absence of government policies, and low farm profitability may all be contributing factors to the decline.

Recent news:

- Government of India had proposed to United Nations for declaring 2023 as International Year of Millets (IYOM). The proposal of India was supported by 72 countries and United Nation's General Assembly (UNGA) declared 2023 as International Year of Millets on 5 th March, 2021.
- Now, Government of India has decided to celebrate IYOM, 2023 to make it peoples' movement so that the Indian millets, recipes, value added products are accepted globally.
- According to the Indian Council of Agricultural Research, millets are drought-tolerant and resistant to climate change. Cultivation of millets requires less water than rice and wheat, which makes them suitable for small growers.

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Split Up of 154 Varieties Released (2014-21)

- Sorghum-43
- Pearl Millet -52
- Little Millet-11
- Proso Millet-4
- Kodo Millet-4
- Finger Millet-28
- Foxtail Millet-8
- Barnyard Millet-4

However, there are only a few millets kinds that have been created. These cultivars have surprisingly demonstrated higher yield than the State average yield of the relevant crops achieved thus far, which might be utilised to increase the profitability of these nutrient-dense crops.The Indian Prime Minister recently gave three biofortified types of two millet crops to the nation in honour of the 75th anniversaries of the Food & Agriculture Organization (FAO) and the United Nations. The finger types, CFMV 1 and 2, are rich in calcium, iron, and zinc, whereas the small millet variation, CCLMV1, is rich in iron and zinc.

Future outlook

To increase agricultural revenue and nutritional security in rainfed systems, millets' value and climate resilience may be the solution. Therefore, it is imperative that we adapt to climate change by replacing specific niches of water-intensive cereal and vegetable crops with millets that can withstand drought. These crops' fibrous roots help to conserve soil, control water runoff, adapt to muddy terrain, and rebuild natural ecosystems. Millets, which are marketed as gluten-free nutri-cereal smart foods, have recently seen an increase in demand. The health and wellness sector is driving this demand, and the food business is expanding quickly.

As a result, increasing millet production will benefit the typical hill farmer and contribute to the achievement of the goals of raising incomes, developing crop diversification, and preserving agro biodiversity.

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Whether we can sustainably, equitably, and healthily feed the estimated 9 billion people on the planet by 2050 is a major concern. Even if a person consumes enough calories, it is still possible that he may not be getting enough of the essential micronutrients, which could result in micronutrient undernourishment (Hidden hunger). Therefore, the focus of research should be on creating cultivars with increased nutraceutical value and higher stress tolerance. One of the simplest options is to find and enhance native crops that are highly adapted to the local environment, have high nutritional content, and can endure biotic and/or abiotic challenges.

References:-

Doggett H. 1989. Small millets – a selective overview. In: Seetharam A et al (eds) Small millets in global agriculture. Oxford & IBH Publishing Co., Delhi, India, pp 59–70

FAOSTAT. 2018. Production-yield quantities of millets in world + (total) 1962–2018. http://www. fao.org/faostat/en/#data/QC/visualize. Accessed 25 May 2020

Finger millet genetics and breeding in India, All India Coordinated Small millets Improvement Project, ICAR, Bangalore.

Hegde BR and Gowda BKL. 1989. Cropping systems and production technology for small millets in India. In: Seetharam A et al (eds) Small millets in global agriculture. Oxford & IBH Publishing Co, Delhi, India, pp 209–235

INDIASTAT. 2020. Statistical information about India. https://www.indiastat.com/agriculture data/2/stats.aspx. Accessed 6 Apr 2020

Sood S, Joshi DC, Chandra AK and Kumar A. 2019. Phenomics and genomics of finger millet: current status and future prospects. *Planta* 250:731–751