MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

ASSOCHAM
Ideate · Innovate · Impact

Bharat @100
An ASSOCHAM initiative

Azadi Ka Amrit Mahotsav

MILLETS

The Future Super Food for India

June 2022

THE ASSOCIATED CHAMBERS OF COMMERCE AND INDUSTRY OF INDIA

Follow us on:

MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

ASSOCHAM
Ideate · Innovate · Impact

Bharat @100
An ASSOCHAM initiative

Azadi Ka Amrit Mahotsav

Knowledge Paper on

MILLETS

The Future Super Food for India

June 2022

Knowledge Partner

IIMR
भारतीय कदन्न अनुसंधान संस्थान
ICAR-Indian Institute of Millets Research

nutri hub
Innovation | Technology | Business

The Associated Chambers of Commerce and Industry of India
4th Floor, YMCA Cultural Centre and Library Building, 01, Jai Singh Road, New Delhi-110001
Tel: 011-46550500 (Hunting Line) • Fax: 011-23017008, 23017009
Web: www.assocham.org

Follow us on:

Deepak Sood
Secretary General
ASSOCHAM

MESSAGE

In India, millets have been utilized from time immemorial, with symbolic significance, as they are sacred to the farmers. Additionally, millets have been widely accepted owing to their fulfilling qualities. After the emergence of the Green Revolution, the highly productive varieties of rice and wheat were widely promoted, which gradually hindered the expansion of millets production.

Millets are also beneficial in terms of nutritional sufficiency since they contain various vitamins and minerals and are rich in proteins and fibers. The production of millets has been gaining increased importance in nations that are populous, malnourished, and facing significant climatic uncertainties. Millets are highly adaptive to a wide range of climatic conditions and require lesser care. Moreover, they also form the essential raw material for potable alcohol and starch production. Nevertheless, millets haven't attained the popularity they should have compared to the major cereals. Thus, the national and state-level initiatives being undertaken play a critical role in bringing millets back to farms and fields.

The usage of millets in infant food and nutrition products is increasing, and many manufacturers are expanding their business. Growing consumer awareness regarding the health benefits associated with millets consumption will strengthen the industry's growth.

Following India's proposal to the Food and Agriculture Organization, 2023 will be observed as the 'International Year of Millets'. ASSOCHAM is organizing the National Conference on Millets - The Future Super Food for India with the support of the Ministry of Food Processing Industries. On this occasion, ASSOCHAM, in association with the Indian Institute of Millet Research (IIMR) and NutriHub, has prepared this Knowledge Paper on 'Millets: The Super Future Food for India'. We hope this paper provides valuable insights to the industry, stakeholders and policymakers and that the conference will be fruitful and informative for all the participants.

Deepak Sood

Dr CV Ratnavathi
Director (Acting), ICAR-IIMR, Hyderabad

MESSAGE

Millets are a group of cereal food grain crops that are small seeded, adapted to cultivation over a range of tropical and subtropical climates, can be grown with very low inputs. They were the first crops to be domesticated by the mankind in Asia and Africa which later spread across the globe as critical food sources to the evolving civilizations. Major millet crops include Jowar or sorghum, bajra or pearl millet, mandua/ragi or finger millet, and small millets comprising of - kangni or foxtail millet, kutki or little millet, kodo millet, jhangora or barnyard millet, cheena or proso millet, and korale or browntop millet.

Millets are grown in about 12.45 million ha. with an annual production of 15.53 million tonnes and contribute 10% to the country's food grain basket. Millets are nutritious, climate resilient, hardy and dryland crops hence tagged as Nutri-cereals, contribute substantially for food and nutritional security. Recently Millets have gained the attention by the masses due to its non-gluten tendency. Nutrition wise, millets are rich in polyphenols, antioxidants, and fibres that are important for healthy body functioning.

India is the world's leader in the production of millets with a share of around 40% of the world's total production. India produces around 16 million MT of Millets annually. India is the 2nd largest exporter of Millets. Millets exports from India have continuously increased at 12% CAGR in the last 3 years. The millets market is set to grow from its current market value of more than $9 billion to over $12 billion by 2025.

However, despite these substantial benefits, the millets industry has declined, due to several factors that can be attributed to a lack of demand stimulation, and a decreasing or stagnant cultivation of small millets. In the light of growing importance of millets across the globe and the declaration of IYoM 2023 by UNGA, it is imperative of India to take lead in mainstreaming the millets to bring them on the common man's plate. In this regard building a sustainable value chain in millets to usher the millet exports and enhance the demand at domestic and international levels. This knowledge document provides an insight into the millet scenario in India and efforts in mainstreaming millets in the country.

Dr CV Ratnavathi

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Millets are one of the oldest foods known to humans & possibly the first among cereal grains to be cultivated for domestic purposes. Millets are small-seeded grasses that are hardy and grow well in dry zones as rain-fed crops, under marginal conditions of soil fertility and moisture. Millets are also unique due to their short growing season. Important millet crops grown in India are Sorghum (Great millet), Bajra (Pearl millet), Ragi (Finger millet) and small millets viz., Korra (Foxtail millet), Little millet, Kodo millet, Proso millet and Barnyard millet. These were often referred to as coarse cereals but realizing the nutrient richness of the grains they are now gazetted as "Nutricereals" by Government of India. Millets are also rich in minerals like iron, magnesium, calcium, phosphorous and potassium. According to FAO, the world production of millets is 89.17 million metric tonnes from an area of 74 million ha. India is the largest producer of millets in the world. India is the global leader in production of millets with a share of around 15% of the world total production. In India, millets are cultivated majorly in 21 states in an area of 12.53 million hectares, producing 15.53 million tonnes with a yield of 1237 kg/ha. There is a major impetus in Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Telangana, Uttarakhand, Jharkhand, Madhya Pradesh, and Haryana. Other than millets being used for direct consumption it can be used in many other industries such as food processing industries to make value added products, animal feed segment, and distilleries. Restricted cultivation/cultivation under Low productivity of millets, availability of good quality seeds, lesser shelf life of millets, lack of technologies/machineries for primary and secondary processing, absence of market linkages, lack of uniform standards and grades are the major problems related to millets.

Expansion of area under millets, cultivation of high yielding product specific varieties, creation of seed hubs, bridging the gaps in R&D related to shelf life, primary and secondary processing machines, nutritional evaluation, scaling up the successful millet value chain model developed by ICAR-IIMR, incentivizing millet cultivation and mainstreaming millets in public funded programmes such as MDM, ICDS were the major recommendations for improving the status of millets in India.

Dr B Dayakar Rao

CEO Nutrihub & Principal Scientist

ICAR-IIMR

I. INTRODUCTION

Millets are traditional crops with both superior nutritional value and health benefits, of late, millet products are favoured by increased consumers with increasing incidences of lifestyle diseases especially among urban areas. Millets are hardy crops grown in arid and semiarid environments and are resilient to higher temperatures and drought prone environments requires 350 mm of water compared to 1200 mm for rice. They offer food, fodder, fuel, and nutrition security and can be grown in intercropping (or maybe under mixed cropping with pulses and oil seeds. Millets stand for the local food system and culture in Asia and Africa and have a major contribution towards sustainable agriculture and a healthy world. As millets are climate-resilient crops and sustainable income sources for farmers, they provide economic security. Millets are resilient crops with tolerance against extreme climatic stress including drought and flood and can be considered ideal crops of the 21st Century where we face depleting natural resources and an era of climate change. Under deepening climate crisis millets are needed as they are suitable for cultivation in the toughest environments and supplement the unmet demand from rice and wheat that may be result of pronounced effects of climate change. India produces a nine commonly known millets and is the largest producer and second-largest exporter of millets in the world.

These crops hitherto were largely neglected in terms of research and development and their potential of being climate smart crops and enhanced nutrition was also underexploited. Although they can be grown globally, they are often restricted to marginal and unproductive lands which led to plummeting yields. Further, the policies of the government, directed towards popularizing few crops have led to millets not being mainstreamed. Consequently, farmers growing them obtain lower returns as compared to other crops. However, there are many ways to increase productivity and economic viability of these crops through development of HYVs and hybrids, scaling up the production and processing of these crops when growth in yield of major staples like rice and wheat is below 1%, the potential for yield increases in underutilized crops is substantial.

Millets possess several morpho-physiological, molecular, and biochemical characteristics which confer better tolerance to environmental stresses than major cereals. Primarily, the

short life cycle of millets assists in escaping from stress as they require 12–14 weeks to complete their life cycle (seed to seed) whereas rice and wheat requires a maximum of 20–24 weeks.

Millets represent the local food system and culture in Asia and Africa and have a major contribution towards sustainable agriculture and a healthy world. As millets are climate-resilient crops and sustainable income sources for farmers, they provide economic security. Millets are resilient crops with tolerance against extreme climatic stress including drought and flood and can be considered ideal crops of the 21st Century where we face depleting natural resources and an era of climate change.

MILLETS
"The Future Super Food for India"

II. MILLETS: HISTORICAL PERSPECTIVE

The millet crops originated in Asia and Africa, were domesticated by the local populations and spread to other regions of the world. Further domestication in other regions gave rise to secondary regions of diversity and adaptation and different use options. The origin of each millet is briefly discussed below.

i. Sorghum

Sorghum [Sorghum bicolor] scientifically known as C4 plant, is one of the most energy efficient crops in use of solar energy and water to produce food and biomass. In the grain form, it is used mainly for food, prepared in the form of flat breads and porridges of different kinds. Sorghum originated in north-eastern Africa, with domestication having taken place there around 5,000–8,000 years ago. The secondary centre of origin of sorghum is the Indian Subcontinent, with evidence for early cereal cultivation dating back about 4,500 years. Sorghum stover is a vital source of fodder for livestock. Over half a billion people rely on sorghum as a dietary mainstay and given its diversity of uses, as an important source of income.

ii. Pearl Millet

Pearl Millet (Pennisetum glaucum) is the most widely cultivated cereal in India after rice and wheat. Pearl millet originated in the West Africa. The domestication of **pearl millet** occurred in northern–central Sahelian Africa around 4500 BC. More than 90 million poor people depend on pearl millet for food and income. They generally live in the drier parts of Africa and Asia, places where most other crops just cannot grow, and local farm households literally have nowhere else to turn for food security.

iii. Finger Millet

Finger Millet [Eleusine coracana] is an important primary food especially for the rural populations of Southern India and East & Central Africa. **Finger millet** seems to have originated in the hills of western Tanzania or Ethiopian highlands. It is a domesticated cereal of African origin which spread in prehistory to Asia. In Asia upland races, which are especially widespread in the Himalayas from India to Nepal and southern China, appear to be a secondary adaptation. The

grain is very nutritious and has excellent malting properties. Finger Millet plays an important role in both the dietary needs and incomes of many rural households in Eastern and Southern Africa and South Asia.

iv. Barnyard Millet

Barnyard Millet (Echinochloa colona) It is cultivated on marginal lands where rice and other crops will not grow well. It is grown for both grain and fodder in India especially in the hilly tracts of Uttrakhand, Eastern Asia and parts of Africa, and in the Eastern

USA it has been a valuable forage crop. There is no much information on the origin of barnyard millets. General consensus is that these originated in central Asia; Echinochola crus-galli was domesticated in Japan, China and Korea whereas Echinochloa frumentacea was domesticated in India. Barnyard millet is the fastest growing of all millets, with some varieties capable of producing a crop in just six weeks.

v. Proso Millet

Proso Millet (Panicum milaceum) is a short-season crop cultivated in drier regions of Asia, Africa, Europe, Australia, and North America. The grain after hulling makes a nutritious and palatable cereal for unleavened bread or cooked. **Proso millet** or common millet is the true millet of the history and it is one of the oldest human foods and believed to be the first domesticated cereal grain. Most of the evidence ascribe it to a central or eastern Asiatic origin, since the diversity increases towards Mongolia, China and Eastern Asia. Yellow River valley of China has been suggested to be the origin. Proso millet is well adapted to many soil and climatic conditions. Being a short season crop with a low water requirement, it grows further north than the other millets and adapts well to plateau conditions and high elevations.

vi. Foxtail Millet

Foxtail Millet (Setaria italica) grains are very similar to paddy rice in grain structure. They contain an outer husk, which needs to be removed in order to be used. Foxtail millet was domesticated in China more than 8000 years ago, contributing greatly to the development of Chinese civilization and remaining as a staple cereal in arid and semi-arid regions. Foxtail millet is fairly tolerant of drought; it can escape some droughts because of early maturity. Due to its quick growth, it can be grown as a short-term catch crop. It is adapted to a wide range of elevations, soils and temperatures it cannot tolerate water logging.

vii. Little Millet

Little Millet (Panicum sumatrense) is similar to proso millet in appearance but is generally shorter, has smaller panicles and seeds, and is grown on a limited scale voluntarily or with minimum care on poor lands. The origin of **little millet** crop is not well documented except for the probable Indian origin since it is endemic to India and has a name in all vernacular languages of India. This millet was cultivated or naturalized throughout India and Sri Lanka, and cultivated in neighbouring countries and no diversity and related wild species are found outside India, suggestive of Indian origin. Little millet is a reliable fast-growing crop that is early maturing and resistant to adverse agro-climatic conditions.

viii. Kodo Millet

Kodo Millet (Paspalum scrobicultum) is an annual tufted grass that grows up to 90 cm high. The grain is enclosed in hard, corneous, persistent husks that are difficult to remove. **Kodo millet,** also known as cow grass, rice grass, ditch millet, Native Paspalum, or Indian Crown Grass originates in tropical Africa, and it is estimated to have been domesticated in India 3000 years ago. Paspalum scrobiculatum var. scrobiculatum is grown in India as an important crop, while Paspalum scrobiculatum var. commersonii is the wild variety indigenous to Africa. Often it grows as a weed in rice fields. Many farmers do not mind it, as it can be harvested as an alternative crop if their primary crop fails. Kodo millet has around 11% protein, and the nutritional value of the protein has been found to be slightly better than that of foxtail millet, but comparable to that of other small millets.

ix. Brown top millet

Brown top millet [Urochloa ramosa] a native of India, has relatively limited cultivation to the parts of Karnataka and Andhra Pradesh, though its occurrence as a weed is noted in all states of India. The domestication of **brown top millet** probably occurred in South India, in the Deccan, and it spread during prehistory outward to other parts of India. Evidence suggests that this crop, along with other South Indian crops, developed from indigenous wild populations around the beginning of the third millennium BC. It can be grown even in less fertile sandy loam soils and matures in 60-80 days and is the most inexpensive crop to grow and does not need weeding and has no serious pests and diseases.

III. MILLETS SCENARIO – INDIA AND THE WORLD

India is the largest producer of millets in the world. In India, Millets are grown in about 21 States. There is a major impetus in Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Telangana, Uttarakhand, Jharkhand, Madhya Pradesh, Haryana and Gujarat.

In India, millets are cultivated in an area of 12.45 million hectares, producing 15.53 million tonnes with a yield of 1247 kg/ha. Sorghum is the fourth most important food grain in India after rice, wheat, and maize in terms of area (3.84 Mn. ha) and production (4.31 Mn. MT). Bajra 7.05 m ha) is contributing more than 50 per cent of the country's area under millets with nearly equal percentage of production. It is interesting to note that, India is the topmost producer of Barnyard (99.9%), Finger (53.3%), Kodo (100%), Little millet (100%) and pearl millet (44.5%), producing about 12.46 million metric tonnes from an area of 8.87 million ha.

Rajasthan has the highest area under millets cultivation (29.05%) followed by Maharashtra (20.67%), Karnataka (13.46%), Uttar Pradesh (8.06%), Madhya Pradesh (6.11%), Gujarat (3.94%) and Tamil Nadu (3.74%). The states of Gujarat and Madhya Pradesh have increased their area under millets over the recent years. However, the highest yields were recorded in Andhra Pradesh (2626.58 kg/ha), Tamil Nadu (2153.22kg/ha), Haryana (1906.78 kg/ha), Gujarat (1762.05 kg/ha) and Madhya Pradesh (1729.70 kg/ha). The states like Gujarat and Andhra Pradesh have shown better productivity levels as compared to their counterparts.

Table 1. Area under cultivation, production, and yield of millets

Crop	Area (m ha)	Production (m tons) *	Yield (kg per ha)
Sorghum(kharif)	1.76	1.58	967
Sorghum (Rabi)	3.07	2.73	1002
Sorghum (total)	4.83	4.31	989
Bajra	7.55	9.22	1374
Ragi	1.01	1.67	1747
Small millets	0.459	0.33	809
Total millets	13.83	15.53	1248
Source: Final Estimates-2021-22, DES, Government of India			

According to FAO, the world production of millets is 89.17 million metric tonnes from an area of 74.00 million hectare during 2020. Sorghum and Pearl millet are the major millet crops grown, constituting above 90% of the world millets production followed by Finger millet, Foxtail millet, Proso millet, Barnyard, Little millet and Kodo millet

Furthermore, Foxtail millet predominates all millets in terms of productivity, yielding about 2166 kg/ha followed by Finger millet (1623 kg/ha), Proso millet (1535 kg/ha), Sorghum (1426 kg/ha), Barnyard millet (1034 kg/ha), Pearl millet (850 kg/ha), Little millet (469 kg/ha) and Kodo millet (419 kg/ha)

Sorghum is the major millet grown globally constituting 65% of total millets. During 2010–2020, the Sorghum area is near stable between 42.16 million hectares to 40.98 million hectares while production between 60.18 million metric tonnes to 58.70 million metric tonnes. During the same decade, the area under other millets showed a declining trend from 36 million hectares during 2010 to33.02 million hectares during 2020, while production decreased from 32.79 million metric tons in 2010 to 30.46 million metric tonnes in 2020.

The trend in millet cultivation shows a better picture with millets making their roads with increased productivity. However, declining area under millets is of great concern which may be addressed through policy support like incentivizing millet cultivation, opening of processing industries in millet clusters etc which offers a dual advantage of creating demand alongside ensuring continuous supply.

IV. MILLETS AND THE NUTRITIONAL BENEFITS

Millet grains are rich sources of nutrients like carbohydrate, protein, dietary fibre, good-quality fat and have substantially higher amounts of minerals like calcium, potassium, magnesium, iron, manganese, zinc, and B complex vitamins, making them a preferable choice over the cereal grains.

- Millets also contain several bioactive phytochemicals including feraxans, lignans, β-glucan, inulin, resistant starch, sterols and phenolic compounds (e.g., ferulic acid, caffeic acid and quercetin). Studies have supported the role of polyphenols in antioxidant, anti-carcinogenic, anti-inflammatory, antiviral and neuroprotective activities which in all have shown to be beneficial against diseases like cancer and cardiovascular disease, diabetes, high blood pressure, high cholesterol, inflammatory diseases, metabolic syndrome and Parkinson's disease (Dayakar et al., 2018).

- The millets are also regarded to have antimicrobial and DNA damage protection activities due to their phytochemical content (Aknabi et al., 2019 and Kaur et al., 2014). A very high proportion of the millet grain comprises dietary fibre and non-starch polysaccharides which help in weight regulation. Due to the slow release of glucose, millets are an excellent choice of food for diabetics (Dayakar Rao et al., 2017).

- Millets are an excellent source of slow digestive starch and fibres which are good for the gut cohabited with trillions of bacteria, namely Lactobacillus acidophilus, rhamnosus GG, Actinobacteria and Bifido species. The non-starch polysaccharides found in millets form a major part of dietary fibre which produce short-chain fatty acids by fermentation of resistant starch and serve as excellent Prebiotics.

- Fermentation of millets using various cultures promotes the growth of Gram-negative bacteria that makes millets an effective probiotic food in the gut

- Millets have lower glycemic properties owing to higher fibre content. Though the glycemic properties of foods vary with the nature of the processing, food matrices, ingredient composition, food form (grain or flour form), etc., most of the millet recipes can be managed to have a low glycemic index

Based on the nutritional composition table compiled (Table 1) from the Indian Food Composition Table (IFCT), 2017 released by ICMR- National Institute of Nutrition (NIN), and Nutritive Value of Indian foods written by Gopalan et al., 2004. The below nutritive values Millets are compared with rice and wheat.

1. Calcium – Finger millet - ragi (364 mg)
2. Fat – Pearl millet (5.43 g)
3. Protein – Proso millet (12.50 g)
4. Dietary fibre – Pearl millet (11.49 g)
5. Magnesium – Proso millet (153 mg)
6. Zinc – Barnyard millet (3 mg)
7. Iron – Pearl millet (6.42 mg), Barnyard millet (5 mg)
8. Folic acid – Kodo millet (39.49 µg), Sorghum (39.42 µg)

MILLETS
"The Future Super Food for India"

V. UTILIZATION OF MILLETS IN INDIA

i. Utilization at farm level

The utilization of pattern of millets was estimated by ICAR-IIMR and the results showed that, in case of close to three fourth of the sorghum production is going towards self-consumption which means it is directly consumed by humans. Sorghum is also utilized as animal feed to the tune of 12 per cent while about 8 percent of it processed into value added products to form the FMCGs. Sorghum as crop for alcohol production also utilizes it to the tune of 5 per cent. Remaining sorghum is diverted towards export in the form of grains and value-added products.

Similarly, in case of bajra (pearl millet) is used for direct human consumption to the tune of 69 per cent whereas, nearly 15 per cent of bajra is used as animal feed and 10 per cent is used in breweries for producing alcohol. Utilization of bajra for processing towards value addition is about 5 per cent. About 1 per cent of bajra is utilized as seed material for seed production and multiplication.

Further, the utilization of ragi is slightly different from sorghum and bajra with nearly 10 per cent of ragi being utilized for creating value added products into FMCG segment. However, with regard to utilization of ragi for direct consumption, it is similar to sorghum with about three fourth of the production being directly consumed by humans. Nearly 13 per cent of ragi is used as animal feed with a limited utilization of 1 per cent towards exports.

ii. Utilization at Industry level

Other than millets being used in food processing industries and for human consumption, it can be used in many other industries also.

Feed Replacement: Maize is one of the cheapest sources of energy used in production of animal feed or compound feed compared to other grains. It provides the most energy at INR 1 compared to other feed grains as it provides highest metabolizable energy. Despite this, the scenario may not remain the same in coming years as the growth of maize production is slower compared to its consumption in animal feed segment. Moreover, the production of compound feed is likely to grow by CAGR of 5.6% which would put more stress on domestic maize demand.

Eventually, this increase in demand and shortness of supply would push its prices and encourage cheaper imports. To arrest this deficit projected in coming future may to some extent filled by using alternative feed grains particularly millets like bajra, sorghum, ragi etc. The availability of conventional cereals or grains like wheat and rice would be limited due to their extensive usage in food segment.

Distilleries: Jowar is used in distilleries for use for liquor production.

During 2010-11, most of the millets were used as food with a small portion going towards animal feed and other segments. The share of millets used as direct food for human consumption over the year has gradually declined to 10.72 MMT by 2019-20. It fell at a CAGR of 2.45% during 2010-11 to 2019-20. This can be attributed to change in food habits amongst the population particularly in rural areas. But over 50 % of Indian Urban millet consumption is in value-based products and the major distribution channel in urban is e-commerce/online stores

The rising health consciousness amongst upwardly urban youth population is likely to re-discover the millets consumption as direct food in coming years. Moreover, many start-ups/ FMCGs are coming up with millets-based food products which is likely to attract more people in coming year. This resurgence in demand in urban and semi-urban areas is likely to boost its growth at a CAGR of 20.01% from 2019-20 till 2029-30.

In case of animal feed, projected rise in population of livestock and poultry in the coming 10 years is likely to put strain on the dominant feed grain i.e. maize. Its growth in production is projected slower compared to its Feed and FSI demand for the mentioned period. This would push feed manufacturers to either import maize which could be costly or use other domestic grains. The conventional grains like wheat and rice would mostly be used as food so it availability for feed is doubtful and this could make millets both major and minor the perfect replacement for maize in this segment.

India has preponed the target of achieving 20% ethanol-blending with petrol by five years i.e. from 2030 to 2025 as it looks to cut dependence on costly oil imports. The govt wants to use excess food grain supplies including millets to achieve this target. Taking this policy change into account, we are projecting usage of millets in distilleries to grow by a CAGR of 7.05% for the duration 2019-20 till 2029-30.

COMBINED MILLETS DEMAND BREAK UP IN MMT

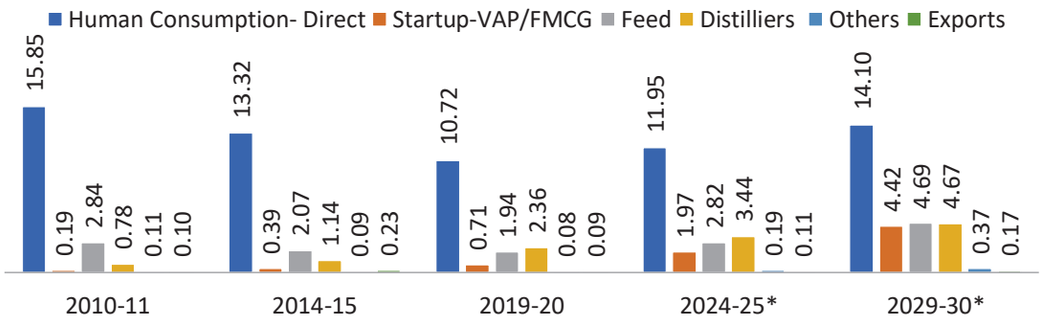

Table 1: Nutritional composition of Millets in comparison with Rice and Wheat

Millets	Carbohydrates(g)	Protein (g)	Fat (g)	Energy (Kcal)	Dietary Fibre (g)	Ca (mg)	P(mg)	Mg(mg)	Zn(mg)	Fe(mg)	Thiamine(mg)	Riboflavin(mg)	Niacin (mg)	Folic Acid (mg)
Sorghum	67.68	9.97	1.73	334	10.2	27.6	274	133	1.9	3.9	0.35	0.14	2.1	39.4
Pearl millet	61.8	10.96	5.43	347	11.49	27.4	289	124	2.76	6.42	0.25	0.2	0.86	36.11
Finger millet	66.82	7.2	1.92	320.73	11.18	364	210	146	2.5	4.6	0.37	0.17	1.3	34.7
Kodo millet	66.19	8.92	2.55	331	6.39	15.27	101	122	1.65	2.34	0.29	0.2	1.49	39.99
Proso millet	70.4	12.5	1.1	341	-	14	206	153	1.4	0.8	0.41	0.28	4.5	-
Foxtail millet	60.1	12.3	4.3	331	-	31	188	81	2.4	2.8	0.59	0.11	3.2	15
Little millet	65.55	10.13	3.89	346	7.72	16.1	130	91.41	1.82	1.26	0.26	0.05	1.29	36.2
Barnyard millet	65.5	6.2	2.2	307	-	20	280	82	3	5	0.33	0.1	4.2	
Wheat	64.7	10.6	1.47	321	11.23	39.36	315	125	2.85	3.97	0.46	0.15	2.68	30.1
Rice	78.24	7.94	0.52	356	2.81	7.49	96	19.3	1.21	0.65	0.05	0.05	1.69	9.32

Source: 1. Indian Food Composition Table 2017 – National Institute of Nutrition,
2. Nutritive value of Indian foods, 2004 - National Institute of Nutrition

VI. MILLETS RESEARCH AND DEVELOPMENT

i. Millet R&D in India: ICAR-IIMR and its contributions

ICAR-IIMR is a premier institute with dedicated research on millets is engaged in basic and strategic research on sorghum, pearl millet and small millets. Institute is mandated with conducting basic and strategic research in millets to enhance area, production, productivity, improve plant protection technologies, training and consultancy on millet production, utilization and dissemination of technologies and capacity building, diversified utilization of millets to enhance profitability of the farmers and other stake holders. IIMR coordinates and facilitates millets research at national level through All India Coordinated Research Projects on Sorghum, Pearl Millet and Small Millets and provides linkages with various national and international agencies.

ii. Millet Value Chain: Bridging the gap between production and consumption

India and Africa are predominantly cultivating millets. Any improvement in productivity of millets in these countries depends on the development and availability of modern technologies and institutional reforms needed to improve input flows to farmers and the marketing of millets thereof. ICAR-IIMR has pioneered the development of successful millet value chain ecosystem with end-to-end solutions for creating demand for millets in the states of Karnataka, Telangana, Andhra Pradesh and supporting the governments of Rajasthan, Madhya Pradesh, Chhattisgarh, and Uttarakhand in replicating the successful millet value chain to boost the millet cultivation and promotion in these states. A systematic network of forward and backward linkages is developed in millets through involvement of multi-stakeholders in millet ecosystem and sharing the expertise in processing and value addition of millets for the benefit of farmers, FPOs and SHGs. ICAR-IIMR is working towards strengthening the millet seed chain and providing technological backstopping for value addition in millets across different states in the country and has pioneered the efforts in devising farm gate processing and value addition alongside enabling seed chain and cost-effective processing of millets.

iii. Processing/Value Addition of Millets

Despite the high nutritional content and climate resilience, millets production has declined drastically over the decades. One of the reasons for this has been the non-availability of suitable processing technologies and machinery for providing convenience in the form of the Ready-to-Cook (RTC) and Ready-to-Eat (RTE) products to consumers, similar to major cereals. The absence of R&D activities towards processing for value addition, enhancing the shelf-life of the products and also diversification of the millets towards substituting rice and wheat were the main reasons for them to remain confined to the traditional consumers till recent years. Lack of gluten in millets limited their usage in bakery products, and characteristics such as odours and hardy texture are also the roadblocks for positioning them as a substitute for rice.

iv. Pre-processing of Millets

The harvesting process followed for millets is mostly carried in a traditional manner wherein a lot of refractions such as immature grains, chaffs, mud particles, stones, admixed gains as well as obnoxious material, dust, etc. will be mixed. For this, de-stoners, graders and aspirator systems suitable for millets are available and millet processors are using them effectively.

v. Primary processing

The primary processing of millets is a vital step to convert the grain into edible form and thereby enhancing their quality and consumer acceptability. Among the millets, sorghum, pearl millet and finger millet are naked grains as almost all the glumes get detached from the grains during harvesting; however, a few traditional varieties do contain glumes randomly that can be detached by mild abrasion in cereal (emery) pearler.

On the other hand, the processing of Little, Proso, Kodo, Barnyard, Browntop and Foxtail millets are complicated as they have an inedible husk that needs to be removed, followed by the de-branning to a desirable extent through primary processing. It was noticed that Barnyard, Little, Browntop and Kodo millets need multiple passages whereas Foxtail and Proso could be dehusked in a single stage. Even small-scale millet milling machinery has been developed in Japan and Hong Kong and is gaining popularity in the country. The current machinery is available in small capacities up to 2 tonnes/hour which needs to be scaled up for bulk processing by food manufacturers. Though the higher capacity machines are available from MNC companies like the Buhler group, they are of high cost and unviable for micro, small and medium enterprises.

vi. Secondary Processing and Product Development

It involves the conversion of the primary processed raw material into different Ready-to-Eat (RTE) and Ready-to-Cook (RTC) millet products. Although the dehulled and de-branned millets are largely used for cooking and consumption similar to milled rice, they are pulverized into flour and suji and for use as roti and other foods similar to rice/wheat flour and semolina. Several R&D institutes, especially ICAR-IIMR have been diversifying the value addition technologies such as puffing, baking, popping, flaking, cold and hot extrusion, expanded millets, instant/convenience foods, etc. (Dayakar, 2016). Through these technologies, millet products with enhanced taste, convenience and nutritional quality have become a possibility. Millet-based RTE foods – puffs, flakes, muesli, extruded snacks, cookies, murukus, etc., and RTC foods – vermicelli, pasta, millet semolina (medium, fine & coarse), instant mixes, etc., were developed, including millet-plus-milk-based beverages (Dayakar, 2016 and Krishnan, 2012).

During processing, some nutrient losses will also occur. To overcome this problem, fortified products (cookies, vermicelli, pasta, khichidi mix and bread) are also developed by adding natural nutrient-rich ingredients like garden cress (rich in iron), gingelly seed (rich in zinc), spinach (rich in iron), etc., to enhance the iron and zinc content and thus enhance the iron and zinc proportions in them. Various processing methods such as germination (Grewal and Jood, 2006) or malting (Kannan et al., 2010, Najdi Hejazi et al., 2017, Platel et al., 2010), thermal processing, soaking, and fermentation (Makokha, 2002) minimize the nutritional loss and increase the physiological and chemical accessibility of micronutrients in the body and also decrease the antinutrients like phytates. The efforts towards developing novel foods such as plant-based vegan protein, express foods, analogue rice, nutraceutical and functional foods are taking place by premier institutes and start-ups. Other institutes such as CFTRI, NIFTEM, IIFPT, SAU's and ICRISAT followed suit in strengthening value addition in millets. Thus, these combined R&D efforts are further widened with private players such as Britannia, ITC, etc., for novel technologies and the start-ups who obtained technology licenses from ICAR-IIMR, and other institutes have been marketing them with improved shelf life.

vii. Shelf-life of Millet-based Products

The shelf-life of any raw millet flour is about 1–2 months and it is only 5 to 7 days for pearl millet because they are easily prone to oxidative rancidity due to the free fats and sugars. If the millets are expanded into different value-added products, the technologies like parboiling, irradiation and germination can enhance the shelf-life to 6–12 months. Consistent R&D

programs for enhancing the shelf-life of processed millets and their products with the aid of inactivating lipases, use of natural and permitted antioxidants, and also suitable packaging approaches are being explored at IIMR, CFTRI, etc.

The shelf-life of grain is normally above 6–8 months for FAQ grain, with 10–12% moisture. The shelf-life deterioration of processed products especially flour is a big challenge; however, some start-ups have come up with 6 months' shelf-life of flour. Other RTC/RTE technologies as mentioned above especially extrusion provides a shelf-life of 6–8 months. Irradiation technology and proper packaging structures enhance substantially the shelf-life; however, the former form is not easily saleable among the Indian population. Pearl millet with more than 5% fat with rancidity issues is the biggest challenge today with the largest production mainstreaming in public-funded programs and for export purposes needing integrated shelf-life management of processed products which needs a focused R&D attempt from institutions such as NIFTEM-K, NIFTEM-T, ICAR-IIMR, DFRL and CSIR-CFTRI.

viii. Biofortified varieties

Concerted efforts in collaboration with other national and international initiatives have led to the development of 12 varieties of pearl millet (8), finger millet (3) and small millet (1) (Devendra Kumar, 2020). Recently, the Prime Minister of India has dedicated 3 biofortified varieties of 2 millet crops to the nation on the occasion of the 75th Anniversary of the Food & Agriculture Organization (FAO), and the United Nations. The Finger varieties CFMV 1 and 2 are rich in calcium, iron and zinc, and the Small Millet variety-CCLMV1 is rich in iron and zinc.

Special efforts are being made to popularize these biofortified varieties among the masses. Quality seeds of biofortified varieties are being produced and made available for commercial cultivation. The Extension Division of ICAR has also launched two special programmes viz. Nutri-sensitive Agricultural Resources and Innovations (NARI) and Value Addition and Technology Incubation Centers in Agriculture (VATICA) for up-scaling the biofortified varieties through its Krishi Vigyan Kendras (KVKs). The Commercialisation of Biofortified Crops Programme launched for expanding the reach of nutrient-enriched staples and carried out jointly by GAIN and HarvestPlus has highlighted that about 2 billion people are primarily in low- and middle-income countries, do not get enough essential vitamins and minerals (micronutrients) in their daily diets. This "hidden hunger" increases their vulnerability to serious health problems, particularly in women and children, including stunting, blindness, poor brain development, weakened immunity and anaemia. In India, malnutrition in children under 5 years of age continues to be among the highest in the world. 38% of children under 5 years are too short for their age (stunted) and 21% are too thin for their height (wasted) (2018 Global Nutrition

Report). 58% of Indian children under 5 are estimated to be iron deficient. Further, Global Nutrition Report shows that an average 11% annual GDP losses can occur due to deficiencies and malnutrition for Asian and African countries.

ix. Commercialization of millet products' technology

Commercialization of millet products was absent till a decade ago when ICAR-IIMR realized that no millet-based product was available on market shelves but was just lying in the laboratories. Although the entire millets value chain was broken and unorganized, the demand-side pull was in a very pathetic state such that consumers didn't even know the existence of millet-based products or their possibilities.

ICAR-IIMR has launched the first-ever millet brand in the country to prove consumer acceptability for the millets so as to attract aspiring entrepreneurs. The brand name Eatrite with the tagline of Eat Millets–Stay Healthy was an instant success. It is still continuing in the market with 32 value-added products and has been the inspiration for the birth of 400+ millet brands in the country today.

x. Awareness Creation and Promotion

There is a vox populi that Millets are poor man's foods. Despite the diverse and highly bioavailable nutrients, millets are seen as the poor man's staple as they are cultivated and consumed domestically by the rural poor for decades. Over the decades of efforts and unprecedented situations like the Covid-19 pandemic, there is a shift in perceptions and millets are increasingly sought as healthy and nutritious alternatives to fine cereals. As the hidden hunger led lifestyle diseases are surging irrespective of rural or urban areas, millets are now more pronounced in the diets of many segments of the population. The strategic promotion will lead to setting the proper awareness in people and place the millets as better choice foods in terms of nutrition and health. The challenge is that only a few R&D Institutes, NGOs and state governments are involved in awareness creation.

xi. Training and Capacity Building

Training and capacity building needs to take place at different levels across the value chain such as farming, farm-gate processing, value addition, commercialization, etc. Currently, the several institutes engaged in millets cultivation are engaged in training the farmers, women groups, etc., on various farming activities. There are very limited efforts going into training the public on various product technologies and recipes with millets. ICAR-IIMR being nodal institutes have been organizing some training programs such as value

addition, cooking with millets, entrepreneurship opportunities, etc. Odisha, Karnataka, Madhya Pradesh, etc., have been engaged in training women, tribals, etc., on value addition, and then including them in public distribution. Recently, MoFPI has launched the ODOP program under the PMFME scheme where training and incubation for various commodities are being planned. Total 17 districts from 11 states were selected for millet-based products, where training on some millet products like vermicelli, pasta, flours, etc., are being implemented. The major challenge is that several capacity-building efforts by various stakeholders such as state governments, NGOs, institutes are taking place with their limited expertise on products, as there is no central framework for collating the innovative technologies and training on them.

MILLETS
"The Future Super Food for India"

VII. CHALLENGES IN MILLET SECTOR

Millet sector has been facing numerous challenges pertaining to production, processing, value addition, marketing and consumption which have hindered the process of advocating millets as the staple foods through the world. The following are some of the key challenges identified in the processing and value addition of millets.

Challenges in Millet Production:

1. Low productivity of millets

Compared to wheat, rice and maize, millets have lower productivity in the country. This is attributed to their cultivation in marginal lands in rainfed farming and non-adoption of improved cultivars. The yield gap in millets is largely a reflection of farmers' cultivation technologies that offer ample room for improvement. The country's average yield gap for rabi sorghum, kharif sorghum, bajra, ragi and small millets over 2009-2014 were 58%, 151%, 62%, 183% and 156%, respectively

2. Resistance to pests and diseases

Though millets have minimal pests and diseases, some pests and diseases often cause significant losses in sorghum (shoot fly, stem borer, grain mold), pearl millet (downy mildew and blast) and finger millet (blast). No productive cultivars with highly significant resistance to these pests and diseases are available and management options are mostly limited to agronomic and chemical methods

3. Area expansion in non-traditional areas

Bringing the additional lands under millets cultivation is another important factor in increasing the production, especially the fallow and wastelands and the non-traditional areas are more sustainable without competing with the high remunerative crop

4. End-product specific cultivars

Geometrical and nutritional evaluation of several cultivars available in all the major millet growing areas and mapping them to the suitable end-use is essential for better end-product quality and scaling up the value addition by the giant processors

5. Seed hubs & breeder seed production

There is a huge need for identifying various product-specific cultivars and establishing the seed hubs for breeding and producing such seeds so as to establish demand-driven production. The development of seed hubs that can deliver quality seed at high production levels is an important intervention

Challenges in Millet Processing:

1. The efficiency of current machinery is low with the recovery of 70–80%? of grain and the remaining being the un-hulled and broken grains.
2. One type of dehuller unit is not suitable for all the millets, as their morphological features differ mainly in size, shape and husk content and nature.
3. Separation of husk and its collection is burdensome, which causes spillage all over the working station and sometimes mixes with the final hulled output.
4. De-hulling efficiency of Millets is very much affected by Impeller speed. A provision to control the working speed of machines is to be incorporate
5. Due to lack of gluten, gelatinization of starch through hydrothermal treatment, extrusion, etc., is being employed for the diversification of value addition but making some products like bread, buns, etc., with 100% millets is still a challenge.
6. Lack of comprehensive data on the effect of various processing technologies on nutritional characteristics and a framework of best processing technologies for enhancing the availability of nutrients and decreasing the anti-nutritional contents.
7. The measure of physiologically active bio compounds in altered foods compared to raw millets polyphenols and antioxidant capacity; Resistant starch, exploring medical benefits of anti-inflammatory properties of millets - Prebiotic and Probiotics of Millets

Challenges in Policy Advocacy:

1. Changing consumer tastes and preferences: Over the decades, consumer preferences have shifted to tastier and convenient foods either by demonstration effect of western culture or “indigenous misconception that millets are poor man’s foods.
2. Availability of other fine cereals at incentivized prices: Fine cereals such as Rice and Wheat have been made available at incentivized prices through PDS, MDM, WCD and other public-funded feeding/nutritional programs

3. Inadequate support to research efforts for improving the millets cultivation: While aligning more resources for the improvement of fine cereals, millets were not given adequate importance in research and development on improved varieties, productivity, diversification of processing technologies and marketing

4. Lower profitability and lack of commercialization leading to millets being less remunerative crops due to lower yields coupled with declining prices due to vulnerable quality to environmental factors (e.g., as in the case of Kharif Sorghum).

5. Lack of processing machinery and diversification of processing technologies dedicated to millets (especially given the complexity of processing of small millets)

6. Lack of MSP for Small Millets has slowed their area expansion and consequently the production and supply are hampered.

7. Slow pace of outreach to promote millets through various institutions and governments have led to lack of awareness about the importance of millets.

Regulatory Challenges:

1. Millet based products are not covered under standard foods and thus it will go through an approval process so that FSSAI should consider these innovative products and come out with standard.

2. Quality standards and their certification is still a major drawback for export Millet based product claim should be part of the approved claim list of FSSAI so companies who are interested can use it in public relations.

3. Lack of knowledge about export policies and understanding about the markets in different countries. `

To overcome these challenges, there is a need for concerted efforts towards mainstreaming millets by diversifying production technologies, building forward and backward linkages, nurturing the start-up eco-system and bringing millets to the food plates of all. In this regard successive governments have taken series of steps to promote the millets in India and abroad.

VIII. ROLE OF GOVERNMENT IN MILLET PROMOTION

The Government of India has realized the importance of millets in building Nutritional Security in the country and made series of efforts such as gazetting millets as Nutri-Cereals, the declaration of the National Year of Millets in 2018. Declaration of international year of millets by UNGA with India along with the support of more than 70 nations is an important step in popularizing millets across the world. with India in the lead. The IYoM 2023 is offing the mandate to scale up the interventions for increasing the millets area and production, and diversifying the processing machinery and technologies, and thus to cater to various segments in domestic and export markets. In the country, the ICAR-Indian Institute of Millets Research led consortium has assumed the challenge of reviving millets production and has piloted several value chain interventions. Currently, there are 400+ start-ups, and only a few big giant processors such as ITC, Britannia, Kellogg's, Marico, MTR Foods, 24 Mantra, etc. involved in the value addition. The following are some of the initiatives taken by the government of India and the state governments to promote millets across the country.

Important initiatives and schemes undertaken to promote production processing and value addition of millets in India:

1) **Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP)** was launched in 2012 as a part of the Rashtriya Krishi Vikas Yojana (RKVY), wherein Rs.300 crores was allocated to advancing equipment and technology related to millet harvest and increasing productivity of inefficient areas. The scheme aimed to demonstrate the improved production and post-harvest technologies in an integrated manner with visible impact to catalyse increased production of millets in the country. Besides increasing production of millets, the Scheme through processing and value addition techniques was expected to generate consumer demand for millet-based food products.

   a. Technology demonstrations in compact blocks were organized in selected districts for four categories of millets – Sorghum, Pearl millet, Finger millet and small millets.

   b. To promote new varieties/hybrids and to augment the availability of seed and to make the cost affordable to the farmers, it was proposed to provide an incentive of Rs. 3,000/- per quintal for hybrid and Rs. 1000/per quintal HYVs, of which 75% incentive

would be passed on to the farmers and 25% to the seed producing agencies towards their handling and processing charges.

c. Three commodity-wise national demonstrations cum training centers were planned to be set up at the ICAR-Indian Institute of Millets Research (Erstwhile Directorate of Sorghum Research (DSR),Hyderabad for sorghum; University of Agriculture Sciences, UAS, Bengaluru for finger millet and small millets and CCS Hisar Agriculture University, Hisar for pearl millet towards (i) Refinement of technology, retrofitting and their demonstration, (ii) Providing entrepreneurship development and training., and (iii) Facilitate market linkages between processors and producers.

d. Demonstration-cum-training unit was planned to be set up in selected 100 KVKs to serve as demonstration cum training centers for furtherance of post-harvest technologies. To utilize the full capacity of these processing unit, KVKs may levy nominal charges. A single complete post-harvest processing cluster/unit at a total cost upto Rs 4.00 lakh will comprise of both primary processing (3-in-one destoner cum grader cum cleaner + Pearling machine) costing upto Rs. 2.0 lakhs and secondary processing machines ((Rava/Flaking machine – Jowar; Popping roaster- Ragi; Parboiling unit- Pearl millet) costing upto Rs 2.0 lakhs.

e. It was proposed to establish processing clusters of sorghum in the areas where such pilot project has been implemented by IIMR (Erstwhile DSR) in collaboration with the State Department of Agriculture. These units will link production with processing, value addition and marketing in rural and urban niche health markets under the aegis of DSR on PPP mode.

2) Production Linked Incentive Scheme for Food Processing Industry (PLISFPI)

a. The objective of the scheme is to support the creation of global food manufacturing champions; promote Indian brands of food products; increase employment opportunities for off-farm jobs, ensure remunerative prices of farm produce and higher income to farmers

b. Incentivizing manufacturing of four major food product segments viz. Ready to Cook/ Ready to Eat (RTC/ RTE) including millet-based foods, Processed Fruits & Vegetables, Marine Products & Mozzarella Cheese

c. Support for branding and marketing abroad to incentivize the emergence of strong Indian brands

3) The Pradhan Mantri Formalization of Micro food processing Enterprises (PMFME)

Scheme, launched under the Atmanirbhar Bharat Abhiyan is currently being implemented in 35 States and Union Territories (UTs).

a. The scheme is launched to enhance the competitiveness of existing individual micro-enterprises in the unorganized segment of the food processing industry and promote formalization of the sector and to support Farmer Producer Organizations (FPOs), Self Help Groups (SHGs) and Producers Cooperatives along their entire value chain

b. It aims at providing Increased access to common services like common processing facility, laboratories, storage, packaging, marketing, and incubation services.

c. Integration with organized supply chain by strengthening branding & marketing and to support the transition of existing 2,00,000 enterprises into formal framework.

d. **The Scheme adopts One District One Product (ODOP)** approach to reap the benefit of scale in terms of procurement of inputs, availing common services and marketing of products. There may be more than one cluster of ODOP product in one district. There may be cluster of ODOP product consisting of more than one adjacent district in a State. The States would identify the food product for a district, keeping in perspective the focus of the scheme on perishables.

- Millets as part of ODOP Scheme

a. Davanagere (Karnataka)

b. Mahbubnagar (Telangana)

4) Odisha Millet Mission (OMM): OMM aims to revive millets on farms and plates with simultaneous focus on Production, Processing, Consumption, Marketing, and Inclusion of Millets in Government schemes.

The program is to address the issues of food and nutrition security through the promotion of native millets. The major objectives of the Odisha Millets Mission (OMM) are increase household consumption, setting up decentralized processing units at block level, increasing productivity of millets crops through improved agronomic practices, conservation and promotion of local landraces, better marketing of millets through farmer producer organizations and inclusion of millets in ICDS, MDM and PDS

5) Karnataka Organic Farming Policy was formulated to in enable the next level development in organic farming and millet promotion, minor millet growing farmers are incentivized with Rs. 10,000 per hectare.

a. Financial assistance is provided for processing machinery setup for Nutri-Cereals processing, up to Rs 10 lakhs (50% subsidy) for setting up of millet processing machinery.

b. It benefits farmers with much needed market linkages alongside providing value-chain linkages between producers and consumers alongside promoting sustainable organic millet production systems.

6) **Comprehensive Revival of Millets cultivation' by tribals in north Coastal Andhra and parts of Rayalaseema** is an end-to-end program on Millets Revival in Andhra Pradesh, the program intends to develop tribal, and rain fed areas into MILLET-HUBS that can potentially supply millets to meet increasing demand and find its place in the grain economy

a. This project aims to increase productivity, household consumption, value addition by making ragi biscuits, idli and dosa, marketing support, setting up of processing centers and establishing seed production centers

b. A pilot inclusion of Millet recipe for Pregnant and Lactating Women. A campaign has been launched to encourage tribal people to improve food and nutritional security and convert North Coastal Andhra into a millet hub.

c. Promotion of Millet based food items in Andhra Pradesh: Keeping in view of the importance of iron, protein and energy rich nutrition to pregnant women, lactating mothers and children below 6 years, certain changes were suggested to maintain uniformity and greater coverage of beneficiaries with recommended nutrition standards, focusing mainly addition of millet food items in Supplementary Nutrition Programme (SNP) like YSR Sampoorna Poshana Yojana (YSR Sampoorna Yojana Plus for Tribal Sub Plans).

7) **Millet Village Scheme** was launched by Government of Kerala to promote the cultivation of cereals such as millet, ragi, bajra and maize by setting up a millet village at Attappady. The project aimed at protecting seeds of traditional varieties of millets and ensures food security and livelihood for tribals.

8) **Introduction of millets in PDS, mid-day meal:** The GoI has enhanced the Minimum support price (MSP) for millets to promote millet cultivation substantially and they were introduced in public distribution system (PDS) and mid-day meals in primary, secondary schools and welfare hostels.

9) **Introduction of Nutritious Millets into Anganwadi Centers in Telangana** was done revive consumption of Millets and enhance the nutritional content of the Hot Cooked Meals served to children under ICDS, thus contributing to reduction in stunting, wasting, anemia and underweight target group. This initiative considered children age between 3 and 6 years, their mothers and community members.

   a. A series of 3 Millet food festivals were organized to finalize the menu and build consensus around their inclusion in ICDS. Further, through the online National Institute of Nutrition (NIN) platform "count what you eat", energy and nutritive values of the recipe were calculated to meet the standards.

   b. These festivals were also used as a medium to spread awareness about benefits of Millets and encourage communities to make them a part of their diet. At these festivals, Children and mothers were served dishes cooked with millets and the feedback was collected from members of the community, mothers, people representatives, anganwadi workers, helpers, and kids.

10) **The Nutrihub-Technology Business Incubator (TBI)** has been established in 2017 at ICAR- IIMR, Hyderabad to strengthen and handhold millet- based startup ecosystem with financial support from DST and RKVY-RAFTAAR which is now supporting more than 200 millet based startups with technology support, mentoring, capacity building, financial support, marketing facilitation and infrastructure support for manufacturing their value added products through different processing lines.

11) **Department of Agriculture and Farmers' Welfare** has supported in establishing of three Centres of Excellence (CoE) on millets at IIMR, Hyderabad; CCSHAU, Hisar; and UAS, Bengaluru. These CoE have come out with many value added technologies. IIMR alone came out with 70 plus value added technologies with SOPs (including technology dockets) for 30 products which were commercialized under their own brand eatrite, and an equal number of processing machineries were retrofitted and standardized.

12) **Establishment of Centre of Excellence** on millets with around 100 millet processing plants announced in the recent budget by the state of Rajasthan.

13) **Budgetary allocation** for post-Harvest value addition, consumption and branding of millet products, funds to finance start-ups for agriculture and rural enterprises, supporting FPOs through these enterprises, and boosting domestic millet production to promote millet exports in the wake of IYoM 2023.

14) **Government has proposed to form the industry led** 'Millet Promotion Council' to facilitate the scale up of millet promotion across the world and to liaison with government and the industry to leverage the opportunities during IYoM 2023 and beyond.

i. Millets' trade and global scenario toward International Year of Millets - 2023: India is the world leader in the production of millets with a share of around 15% of the world total production. India produces around 15 million MT of Millets annually. India is the second-largest exporter of millets. It has seen a continuous increase at 12% CAGR in the last 3 years. The millets' market is projected to grow from its current value of more than $9 billion to over $12 billion by 2025, based on current trends and projections. The top 10 millet importing countries which are Japan, Indonesia, Germany, Belgium, The Netherlands, Italy, UK, Poland, China and Rep. of Korea together are drawing 64% of total world millet imports. India's top 10 destination countries which are Nepal, Saudi Arabia, Pakistan, UAE, Tunisia, Sri Lanka, Libya, Namibia, and Morocco together are 80% of India's exports. ICAR-IIMR and APEDA have been organizing sensitization events to educate millet startups on value addition, emerging trends and potential export markets. Thus, a framework is in place to work on the refinement of the value chain for export markets, with the involvement of several other stakeholders such as ICRISAT, NIN, IIFPT, DFRL, CFTRI, Private companies, FPOs, etc.

ii. Future Possibilities for Indian Millets in Global Markets: While exploring the possibilities for millets export, the approach should be a two-way framework factoring the emerging trends and potential export countries. Policy interventions such as inclusion of millets in RODTEP (Remission of Duties/Taxes on Export Products) scheme will aid in fueling the exports of millets.

iii. Existing Markets: India exported millets of 26.97 USD million in 2019-20 against USD 28.5 million, including the top three destination countries -Nepal (USD 6.09 million), UAE (USD 6.09 million), Saudi Arabia (USD 3.84 million). The other top seven countries are Libya, Tunisis, Moracco, UK, Yemen, Omen and Algeria. Realigning focus to increasing the demand in these importing countries through awareness creation and promotion is important to build the solid demand pillar for Indian millets. For targeting this market, an advanced solution like Champion millets to be implemented, as per which a couple of millets will be selected and then positioned and branded with a clear proposition like milk for calcium, egg for protein, quinoa for fiber and protein, etc. Also, millets can be branded as local millet foods or "desi" foods in international markets.

IX. CONCLUSION AND WAY FORWARD

Consumption of millets as direct food has significantly declined in India due to policies centered around Green Revolution–led food security from the 1960s onwards. During the journey towards food security, nutritional security was not the primary focus, which has resulted in the current state of malnutrition and the rise of Non-Communicable Diseases (NCDs).The transformative role of millets in tackling lifestyle diseases, the benefits of mainstreaming millets in public-funded programs and the growing realization of huge potential for export markets, especially, in midst of the Covid-19 pandemic are projecting them as immune boosters owing to their rich nutritional profile. It is presumed that the world is looking towards India's traditional foods, and it turned to be the mandate of the Government of India to scale up the interventions for increasing the millets area and production, diversifying the processing machinery and technologies, expanding the private food processing ecosystem and thus to cater to the various segments in domestic and export markets.

****

ABOUT ASSOCHAM

The Knowledge Architect of Corporate India

Evolution of Value Creator

ASSOCHAM initiated its endeavour of value creation for Indian industry in 1920. Having in its fold more than 400 Chambers and Trade Associations, and serving more than 4,50,000 members from all over India. It has witnessed upswings as well as upheavals of Indian Economy, and contributed significantly by playing a catalytic role in shaping up the Trade, Commerce and Industrial environment of the country.

Today, ASSOCHAM has emerged as the fountainhead of Knowledge for Indian industry, which is all set to redefine the dynamics of growth and development in the technology driven cyber age of 'Knowledge Based Economy'.

ASSOCHAM is seen as a forceful, proactive, forward-looking institution equipping itself to meet the aspirations of corporate India in the new world of business. ASSOCHAM is working towards creating a conducive environment of India business to compete globally.

ASSOCHAM derives its strength from its Promoter Chambers and other Industry/ Regional Chambers/Associations spread all over the country.

Vision

Empower Indian enterprise by inculcating knowledge that will be the catalyst of growth in the barrierless technology driven global market and help them upscale, align and emerge as formidable player in respective business segments.

Mission

As a representative organ of Corporate India, ASSOCHAM articulates the genuine, legitimate needs and interests of its members. Its mission is to impact the policy and legislative environment so as to foster balanced economic, industrial and social development. We believe education, IT, BT, Health, Corporate Social responsibility and environment to be the critical success factors.

Members – Our Strength

ASSOCHAM represents the interests of more than 4,50,000 direct and indirect members across the country. Through its heterogeneous membership, ASSOCHAM combines the entrepreneurial spirit and business acumen of owners with management skills and expertise of professionals to set itself apart as a Chamber with a difference.

Currently, ASSOCHAM has more than 100 National Councils covering the entire gamut of economic activities in India. It has been especially acknowledged as a significant voice of Indian industry in the field of Aerospace and Defence, Auto and Auto Ancillaries, Arbitration & Legal Affairs, Corporate Social Responsibility, Environment & Safety, HR & Labour Affairs, Corporate Governance, Information Technology, Luxury and Lifestyle, Biotechnology, Telecom, Banking & Finance, Company Law, Corporate Finance, Economic and International Affairs, Tourism, MSMEs, Textiles, Civil Aviation, Infrastructure, Energy & Power, Education, Legal Reforms, Real Estate and Rural Development, Start-ups & Skill Development to Mention a few.

Insight into 'New Business Models'

ASSOCHAM has been a significant contributory factor in the emergence of new-age Indian Corporates, characterized by a new mindset and global ambition for dominating the international business. The Chamber has addressed itself to the key areas like India as Investment Destination, Achieving International Competitiveness, Promoting International Trade, Corporate Strategies for Enhancing Stakeholders Value, Government Policies in sustaining India's Development, Infrastructure Development for enhancing India's Competitiveness, Building Indian MNCs, Role of Financial Sector the Catalyst for India's Transformation.

ASSOCHAM derives its strengths from the following Promoter Chambers: Bombay Chamber of Commerce & Industry, Mumbai; Cochin Chambers of Commerce & Industry, Cochin: Indian Merchant's Chamber, Mumbai; The Madras Chamber of Commerce and Industry, Chennai; PHD Chamber of Commerce and Industry, New Delhi.

Together, we can make a significant difference to the burden that our nation carries and bring in a bright, new tomorrow for our nation.

Deepak Sood
Secretary General, ASSOCHAM
E: sg@assocham.com

The Associated Chambers of Commerce and Industry of India
4th Floor, YMCA Cultural Centre and Library Building, 01, Jai Singh Road, New Delhi-110001
Tel: 011-46550500 (Hunting Line) • Fax: 011-23017008, 23017009
Web: www.assocham.org

NOTES

The Associated Chambers of Commerce and Industry of India
4th Floor, YMCA Cultural Centre and Library Building, 01, Jai Singh Road, New Delhi-110001
Tel: 011-46550500 (Hunting Line) • Fax: 011-23017008, 23017009
Web: www.assocham.org