सत्यमेव जयते
NITI Aayog

Promoting Millets in Diets

Best Practices across States/UTs of India

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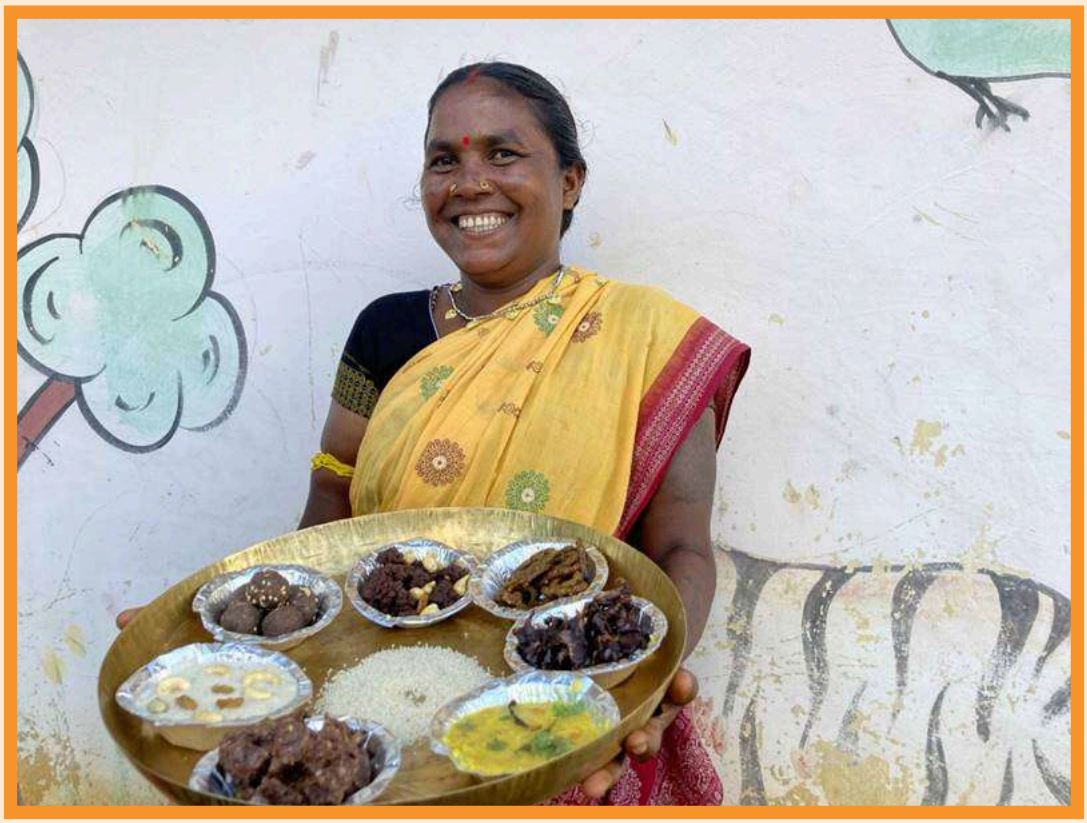

PROMOTING MILLETS IN DIETS: BEST PRACTICES ACROSS STATES/UTs OF INDIA

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FOREWORD

Widely recognized as super food, millets play a crucial role in transforming agri-food systems across the globe. They help create sustainable food value chains, as they are rich in nutrients, carbon neutral and resource efficient. Increasing consumption of these nutri-cereals in India will help improve public health as millets contain many micro and macro-nutrients crucial for the human body.

Millets are, in fact, nutritionally superior to both wheat and rice on account of their higher protein levels and a more balanced amino acid profile. Millets also contain various phytochemicals which exert therapeutic properties owing to their anti-inflammatory and anti-oxidative properties. Further, millets are rich in dietary fibre which helps control blood pressure and sugar levels. As a result, millets-based products can contribute towards reducing obesity and preventing non-communicable diseases.

India is the largest producer and second largest exporter of millets in the world. Most states in India grow one or more millet crop species. Based on India's proposal, the United Nations General Assembly declared 2023 as the International Year of Millets (IYM). Prime Minister Narendra Modi has on multiple occasions shared his vision of making IYM 2023 a 'people's movement' and positioning India as global hub for millets.

Millets are increasingly being introduced in various programs implemented by central and state governments for tackling malnutrition in the population, especially among children. Awareness about the health benefits of millets has also improved in the post-Covid era. The time is ripe for India to boost the domestic production and consumption of millets.

It is in this context that NITI Aayog has prepared this compendium of best practices from States/UTs covering effective policies for promoting millets and including them in the Integrated Child Development Services program as well as research and technology related innovations. The compendium is the result of a collaborative effort between NITI Aayog and various central and state government departments, technical experts and civil society organizations. I hope this compendium will contribute towards knowledge sharing and facilitate the replication of best practices for further mainstreaming millets to improve the nutritional security in the country.

(Suman Bery)

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एक कदम स्वच्छता की ओर

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G20 भारत 2023 INDIA

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Message

Dietary diversity is the key to a healthy and balanced diet. Millets can play an important role in making our daily diets more diverse.

Millets are the ancient crops of the mankind. They provide number of health benefits to the people. They are easy to digest and rich in protein, antioxidants, dietary fibre, iron, magnesium, and calcium. Millets help in maintaining body weight, reduce iron deficiency, and prevent diabetes and cardiovascular diseases. Besides this, these crops are climate-resilient, easy to grow, require less water and help to improve soil health. Thus, millets are not only beneficial for the people, but also for the farmers as well as the environment.

This Best Practice Compendium on Millets has comprehensively included good practices that can be replicated under different themes like promotion of millets through State missions/policies; social safety net programmes like ICDS; and research and development and the use of technology.

During and beyond the International Year of Millets, this Compendium will serve as a guidebook to policymakers, administrators, civil society organizations and development organizations in adopting good practices to promote and mainstream millets in our diets.

(Vinod Paul)

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Message

Millets are the oldest cultivated grains in the world and they are consumed as a staple diet in arid and semi-arid regions around the world. Millets, being rich in nutrients, are considered healthy food for both poor and the rich. Millets serve the dual purpose of food for human beings and fodder for livestock and they provide food/livelihood security to households in disadvantaged and tribal areas. Millets are very hardy crops and they can withstand weather and climate extremes much better than other crops. Millets also require very less water. Because of these properties, they are often called "Miracle Crops" or "Crops of the Future".

India produces all 9 commonly known traditional millets namely Sorghum, Pearl Millet, Finger Millet, Foxtail Millet, Proso Millet, Little Millet, Barnyard Millet, Brown top Millet and Kodo Millet. It is the largest producer of millets in the world. India is among the top 5 exporters of millets in world and its exports have been continuously increasing over the last few years.

Millets were an integral part of the Indian diets before the onset of the Green Revolution but have been almost forgotten due to the strong technology and policy support for rice and wheat. Between 1962 and 2010, India's per capita consumption of millets fell drastically from 32.9 to 4.2 kg, while that of wheat almost doubled from 27 to 52 kg[1]. The decline can be attributed to both demand and supply side challenges. While some of the demand side factors include increasing urbanization and per capita income causing change in consumer taste and preference, mainstreaming of rice and wheat in social safety net programmes and PDS etc. The biggest factor on supply side has been the absence of technological breakthrough in yield of millets whereas green revolution technology brought significant yield gains in rice and wheat and maize. Because of this, relative profitability of millets shrunk considerably and most of the area under millet shifted towards other crops. Weak value chain in production and processing of millets, lack of industrial demand for value-added millet products further discouraged farmers from cultivating millets.

Millets are now slowly coming back to the diets as a healthy super food. The Year 2023 is being celebrated as the International Year of Millets (IYM), which provides us with a unique opportunity to engage all stakeholders to promote the production, productivity and consumption of millets. This Report has identified some of the good practices adopted by different States/UTs in terms of policy and programmes, inclusion in social safety programmes and research and development to improve the production, productivity and value addition in millets. India, being the largest producer of millets and proposer of IYM-2023, is in an exceptional position to exercise leadership and scale up some of the good practices adopted by these States/UTs to revive the forgotten roots of millets in the country.

(Ramesh Chand)

[1] Potaka JK, Anitha S, et al (2021): Assessing Millets and Sorghum Consumption Behavior in Urban India: A Large-Scale Survey https://www.researchgate.net/publication/353894915_Assessing_Millets_and_Sorghum_Consumption_Behavior_in_Urban_India_A_Large-Scale_Survey/link/61171a160c2bfa282a4210c2/download.

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Message

Over the years, Indian agriculture has been able to overcome multiple challenges to become a major driver of economic growth. We have been able to increase crop production, area under crop production and crop productivity, due to which we are not only food secure but also are now a leading producer and exporter of some agricultural commodities. Our exports of agricultural and allied products in FY 22 grew by 19.92% to $ 50.21 billion, which is by far the highest. While we have achieved the goal of food security, dietary diversification within food grains has substantially reduced over the years due to the growing dominance of wheat and rice in our diets. Despite the benefits of growing millets, Indian farmers have made a steady shift in their cereal growing preferences away from millets, and the total area of cropland harvesting millets has almost halved across the country since 1966.

While the proportion of millet based meals on our plates has reduced over the decades, Government of India has made many efforts to increase the production and consumption of millets. NITI Aayog released the National Nutrition Strategy (NNS) for 'Nourishing India' in 2017, which recommended strengthening of millet productivity and production to increase dietary diversity. Government of India officially declared millets as "Nutri-Cereals" and celebrated 2018 as the 'National Year of Millets' to boost the production of millets and encourage agro-industries to produce more value added products of millets. Millets have been included under the POSHAN Abhiyan by the Ministry of Women & Child Development. A sub-mission on Nutri-cereals under National Food Security Mission has been launched as well. Recently, Department of Food and Public Distribution revised its Guidelines for procurement, allocation, distribution and disposal of coarse grains. At the global level, this year has been declared as the International Year of Millets, following India's proposal to Food and Agricultural Organization. Besides these, many State Governments and different organizations are implementing measures to promote production and consumption of millets and including them under different social safety programmes to ensure maximum utilization.

It gives me immense pleasure that NITI Aayog has developed this Best Practice Compendium on Millets which will help in further bringing millets back into our diets. I am hopeful that this Compendium sensitizes all relevant stakeholders to ensure *jan bhagidari* and promote *jan andolan* for millets.

(B.V.R. Subrahmanyam)

PREFACE

Millets are a wide range of small-seed cereals grown and consumed as a staple diet in arid and semi-arid regions. Millets are traditionally grown for their nutritional richness, low water requirement, low inputs requirement and climate resilience. Also known as Nutri-cereals, these are super foods which are storehouse of nutrition. They are rich sources of nutrients like carbohydrate, protein, dietary fibre, good-quality fat and have substantially high amount of minerals like calcium, potassium, magnesium, iron, manganese, zinc and vitamin B complex (Nutritional composition of millets is at annexure 1). Millets are rich in dietary fiber, help in digestion and prevent constipation. Millets are naturally gluten-free and it is good for celiac patients. Millets are rich in antioxidants, which protect our cells from free radicals. Further, the low glycemic index of millets helps manage diabetes. A recent study showed that millets can reduce the risk of developing cardiovascular disease.

India produces nine commonly known traditional millets viz. Sorghum, Pearl Millet, Finger Millet, Foxtail Millet, Proso Millet, Little Millet, Barnyard Millet, Brown top Millet and Kodo Millet. According to FAO Stat 2021, India produces around 173 lakh tonnes of millets, constituting around 80% of Asia's and 20% of global production[1] (India and State-wise area, production and productivity of millets, 2020-21 is at Annexure 2). India is among the top 5 exporters of millets in the world and its exports have been continuously increasing at around 3% CAGR since last 5 years[2]. In addition to nutrition, millets provide food and fodder security to the dry land agricultural communities. They are the most secure crops to small farmers as they are the hardiest, resilient, and climate-adaptable crops in harsh, hot (up to 50 Degree Celsius) and drought environments.

Despite the benefits of growing millets, over the years, Indian farmers have made a slow but steady shift in their cereal growing preferences away from millets. The total area of cropland harvesting the three major millet crops i.e. *jowar*, *bajra* and *ragi* grown in India has almost halved across the country since 1966. Thousands of hectares of land under millet production have shifted to other crops. Table 1 depicts the trend in the area, production and yield of millets since 2010. As seen from the table, production of millets recorded a negative CAGR (-0.94%). Further, area under cultivation also witnessed negative CAGR (-3%). Though there is a decline in area and production, at the overall level, the yield has shown a positive growth with a CAGR of 2.12%.

1 FAOSTAT

2 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1796514

Table 1: Area, Production and Yield of Millet Crops in India from 2010–11 to 2019-20

(Area in '000 Ha, Production in '000 Tonnes and Yield in Kg/Ha)

Year	Finger Millet (Ragi)			Small Millets			Pearl Millet (Bajra)			Sorghum (Jowar)			Total		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
2010-11	1,286.19	2,193.45	1,705.38	774.93	429.97	554.84	9,612.34	10,369.90	1,078.81	7,381.73	7,003.15	948.71	19,055.19	19,996.47	1049.4
2011-12	1,175.78	1,929.24	1,640.81	798.78	451.53	565.28	8,776.70	10,276.00	1,170.83	6,245.08	6,006.47	961.79	16,996.34	18,663.24	1098.07
2012-13	1,131.00	1,574.40	1,392.04	754.09	435.65	577.72	7,297.42	8,741.98	1,197.96	6,214.36	5,281.48	849.88	15,396.87	16,033.51	1041.35
2013-14	1,193.60	1,982.90	1,661.28	682.3	429.91	630.09	7,810.72	9,250.09	1,184.28	5,793.44	5,541.81	956.57	15,480.06	17,204.71	1111.41
2014-15	1,208.10	2,060.90	1,705.90	589.59	385.87	654.47	7,317.95	9,184.22	1,255.03	6,161.39	5,445.30	883.78	15,277.03	17,076.29	1117.78
2015-16	1,138.20	1,821.90	1,600.69	649.8	390.84	601.48	7,128.61	8,066.63	1,131.59	6,077.03	4,238.02	697.38	14,993.64	14,517.39	968.237
2016-17	1,016.10	1,385.10	1,363.15	619.11	441.94	713.84	7,458.50	9,729.84	1,304.53	5,624.42	4,567.90	812.15	14,718.13	16,124.78	1095.57
2017-18	1,194.29	1,985.24	1,662.27	546.27	438.99	803.6	7,480.60	9,208.85	1,231.03	5,024.45	4,803.38	956.00	14,245.61	16,436.46	1153.79
2018-19	890.94	1,238.70	1,390.34	453.75	333	734	7,105.03	8,664.13	1,219.00	4,092.87	3,475.09	849.06	12,542.59	13,710.92	1093.15
2019-20	1,004.46	1,755.06	1,747.27	458.35	370.81	809	7,542.68	10,362.68	1,374.00	4,823.76	4,772.10	989.29	13,829.25	17,260.65	1248.13
2020-21	1159.40	1998.36	1723.62	444.05	346.95	781.32	7652.10	10863.17	1419.63	4377.874	4812.07	1099.18	13,633.42	18,020.55	1321.79
CAGR (%)	-0.94	-0.84	0.10	-4.94	-1.93	3.16	-2.05	0.42	2.53	-4.64	-3.35	1.35	-3.00	-0.94	2.12

***(Source:** Directorate of Economics and Statistics, Ministry of Agriculture)*

The reasons for the decline can be attributed to the promotion of rice and wheat vis-a-vis millet production and lack of suitable initiatives towards millets (All India estimates of area, production and yield of food grains from 2016-17 to 2020-21 is placed in annexure 3). The low margins associated with millet production, vis-à-vis other crops, has created disincentives for millet farmers. The relatively shorter shelf life of the crops creates storage related concerns and gives rise to risks of spoilage. Further, changes in lifestyle and consumer tastes, and unavailability of ready to eat millets have contributed to lower demand.

Considering potential nutritional role of millets in public health, the Government of India delcared millets as *Nutri-Cereals* through the gazette notification dated 10.04.2018 and celebrated the National Year of Millets in 2018. India proposed the International Year of Millets to the United Nations General Assembly (UNGA), with around 70 countries supporting India's constructive proposal and the United Nations General Assembly passed the resolution to observe 2023 as the International Year of Millets.

The timeline of the policy initiatives by Government of India is given in table 2.

Table 2: Timeline of policy initiatives related to millets by Government of India

Year	Policy Interventions
2012	Initiative for Nutritional Security through Intensive Millet Promotion (INSIMP)
2013	National Food Security (NFS) Act covers 'coarse grains'
2017	NITI Aayog of Government of India releases the National Nutrition Strategy (NNS) for 'Nourishing India' and recommends that the Ministry of Agriculture & Farmers' Welfare strengthen cereal productivity and production diversity – including the production of 'coarse' cereals such as millets
2018	Millets officially declared as "Nutri-cereals"
	Millets made part of the National Food Security Mission (NFSM)
	Government of India declared 2018 as the 'National Year of Millets'
	The Indian Government launched the Sub-mission on Nutri-cereals under NFSM with an outlay of INR 300.00 crore for 2018–19
	Government of India sent a proposal to United Nations for declaring 2023 as the 'International Year of Millets', to promote greater production and consumption of millets
2021	UNGA has approved and declared 2023 to be observed as the 'International Year of Millets' (IYM)
2021	Government of India revises its Guidelines for procurement, allocation, distribution and disposal of coarse grains: • 9 months for *jowar* and *bajra*; 10 months for *ragi* and 6 months for Maize. This would increase procurement and consumption of these commodities as the State would have more time to distribute these commodities in TPDS/OWS. • Provision of inter-state transportation of surplus coarse grains through Food Corporation of India (FCI) is incorporated to cater for advance demand placed by consuming State before the start of procurement.

India being the largest producer of millets and proposer of International Year of Millets-2023, there is a great need for India to exercise the leadership in reviving millets through scaling up and replicating the millets value chain in other countries to leverage the emerging demand from global markets.

It is in this regard, an attempt has been made to document the best and innovative practices in millet cultivation, marketing, promotion, research, development, and policy initiated by central ministries, state governments, research institutes, non-governmental organizations, industry, etc. This document will be useful to enhance production, consumption and popularization of millets.

METHODOLOGY

This best practices document on millets comprehensively covers different themes i.e. (a) State Missions and initiatives to promote millets; (b) Inclusion of millets in ICDS; (c) Research and development and use of technology for innovative practices.

The document has been developed based on secondary research and inputs shared by different stakeholders working on millets. A long drawn process has been adopted to prepare

the document. A template was developed and shared with the Ministry of Agriculture, Ministry of Women and Child Development and Department of School Education and Learning, Ministry of Education; Departments of Agriculture, Women and Child Development and Education of States/UTs; national organisations working on millets like Indian Institute of Millets Research (IIMR), Central Food Technological Research Institute (CFTRI), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Indian Institute of Food Processing Technology (IIFPT), Consultative Group for International Agricultural Research (CGIAR) and Central Institute of Post-Harvest Engineering & Technology (CIPHET); and development experts & organizations like Watershed Support for Services and Activities Network (WASSAN);, International Fund for Agriculture Development (IFAD), Andhra Pradesh Drought Mitigation Project (APDMP), Odisha Particularly Vulnerable Tribal Groups Empowerment and Livelihoods Improvement Programme, Tejaswini, Vaagdhara, Dhan, Sahaja Samrudha etc. The inputs have been collated and edited. Thus prepared draft document was shared with all the above stakeholders for further vetting of the content. The final draft has been prepared after incorporating all the inputs and responses.

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The document also benefited from the good initiatives shared by national organizations working on millets like Indian Institute of Millets Research (IIMR), Central Food Technological Research Institute (CFTRI), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Indian Institute of Food Processing Technology (IIFPT), Consultative Group for International Agricultural Research (CGIAR) and Central Institute of Post-Harvest Engineering & Technology (CIPHET); and development experts & organizations like Watershed Support Services and Activities Network (WASSAN), International Fund for Agricultural Development (IFAD), Andhra Pradesh Drought Mitigation Project (APDMP), Odisha Particularly Vulnerable Tribal Groups Empowerment and Livelihoods Improvement Programme, Tejaswini, Vaagdhara, Dhan, Sahaja Samrudha etc.

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ABBREVIATIONS

ADPS	Alternative Public Distribution System
AIP	Program of Agribusiness Innovation Platform
APDMP	Andhra Pradesh Drought Mitigation Project
APEDA	Agricultural and Processed Food Products Export Development Authority
A.P. MARKFED	Andhra Pradesh State Co-operative Marketing Federation Ltd.
ASA	Action for Social Advancement
ATMA	Agricultural Technology Management Agency
CAGR	Compound Annual Growth Rate
CCS-HAU	Chaudhary Charan Singh Haryana Agricultural University
CFTRI	Central Food Technological Research Institute
CGMFP	Chhattisgarh Minor Forest Produce Cooperative Federation
CoE	Centre of Excellence
CSR	Corporate Social Responsibility
DBT	Direct Benefit Transfer
DDS	Deccan Development Society
DMF	District Mineral Fund
DST	Department of Science & Technology
FAQ	Fair and Average Quality
FCI	Food Corporation of India
MFPE	Micro Food Processing Enterprises
FPO	Farmers Producer Organisation
FSSAI	Food Safety and Standards Authority of India
GBPUA&T	Govind Ballabh Pant University of Agriculture and Technology
GoAP	Government of Andhra Pradesh

ICDS	Integrated Child Development Scheme
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IIFPT	Indian Institute of Food Processing Technology
IIMR	Indian Institute of Millets Research
INSIMP	Initiative for Nutritional Security through Intensive Millets Promotion
ITDA	Integrated Tribal Development Agency
IYM	International Year of Millets
KMS	Kharif Marketing Season
LDPE	Low Density Polyethylene
RKVY	Rashtriya Krishi Vikas Yojana
MINI	Millet Network of India
MoU	Memorandum of Understanding
MPACS	Multipurpose Primary Agricultural Cooperative Societies
MPMVEVN	Madhya Pradesh Mahila Vitta Evam Vikas Nigam
MSDA	Mission on Sustainable Dry Land Agriculture
MSP	Minimum Support Price
NADP	National Agriculture Development Programme
NABARD	National Bank for Agriculture and Rural Development
NFB	Nutri-Food Basket
NFHS	National Family Health Survey
NFSM	National Food Security Mission
NIN	National Institute of Nutrition
NPK	NutriPlus Knowledge
NTFP	Non-Timber Forest Products
NYAY	Nyuntam Aay Yojana
OMM	Odisha Millets Mission
PKVY	Paramparagat Krishi Vikas Yojana
PMHPRC	Pearl Millet Hybrid Parents Research Consortium
PoPs	Package of Practices

PVTG	Particularly Vulnerable Tribal Group
SMI	System of Millets Intensification
SNP	Supplementary Nutrition Programme
SRI	System of Ragi Intensification
SVA	Sahabhagi Vikas Abhiyan
UCF	Uttarakhand State Co operative Federation Ltd.
UNGA	United Nations General Assembly
UOCB	Uttarakhand Organic Commodity Board
VPKAS	Vivekanand Parvatiya Krishi Anusandhan Sansthaan
WASSAN	Watershed Support Services and Activities Network

CONTENTS

EXECUTIVE SUMMARY

Millets are small-seed cereals comprising Sorghum (Jowar), Pearl Millet (Bajra), Finger Millet (Ragi/Mandua), Minor Millets i.e. Foxtail Millet (Kangani/Kakun), Proso Millet (Cheena), Kodo Millet (Kodo), Barnyard Millet (Sawa/Sanwa/ Jhangora), Little Millet (Kutki) and two Pseudo Millets (Black-wheat (Kuttu) and Ameranthus (Chaulai). Millets have been traditionally consumed by the rural population especially living in arid and semi-arid regions. Millets are notified as Nutri-cereals by Government of India in 2018 as they are powerhouse of nutrients. Further, millets contain anti-diabetic properties and millet based food have low GI and reduces the postprandial blood glucose level and glycosylated haemoglobin. Therefore, they have great potential to food and nutritional security of the country by addressing various macro and micro deficiencies and reducing under-nutrition. Moreover, millets are climate resilient crops requiring fewer inputs. Millets are, therefore, a treasure-trove that is not only beneficial for food and nutritional security, but also for environment.

However, millets which were once an integral part of the Indian diets have been almost forgotten due to various demand and supply challenges. Some of the demand side factors include change in consumer taste and preference due to increasing urbanization and per capita income, lack of traditional knowledge to prepare millets based recipes, lower shelf life of milled grains, mainstreaming of rice and wheat in social safety net programmes etc. The supply side challenges include weak value chain in production and processing of millets, lack of industrial demand for value-added millet products discouraging farmers from cultivating millets, low profitability, low research and development to improve production, yield and value addition of millet products etc.

An analysis of best practices adopted by different states governments and organizations on various aspects related to millets is critical to enable replication and further boosting up their production and consumption. This document is an attempt to collate various best practices in different themes i.e. (a) State Missions and initiatives to promote millets; (b) Inclusion of millets in ICDS; (c) Research and development and use of technology for innovative practices. It can serve as a guiding repository to revive and mainstream millets in our diets.

State Missions and Initiatives to Promote Millets: This section highlights various missions, programmes and initiatives adopted by different States/UTs to boost production and consumption of millets. Odisha Millet Mission launched in 2017 with the aim to revive millets on farms and plates has been the flag bearer in this regard as it simultaneously focuses on production, processing, consumption, marketing and inclusion of millets in government schemes. Other State Mission worth highlighting are Comprehensive Revival Of Millets Cultivation by Tribals and Drought Mitigation Project in Andhra Pradesh, Chhattisgarh Millet Mission, *Bhavantar Bharpayee Yojana*, Haryana, Promotion of *kodo* and little millets in Madhya Pradesh, Promotion of Millets through NFSM-Nutri Cereals Mission in Nagaland, Tamil Nadu

Millets Mission etc. These initiatives have resulted in positive impact, which can be adopted, replicated and scaled up.

Inclusion of Millets in ICDS: Millets have been integrated in the Supplementary Nutrition Programme under ICDS by many States/UTs leading to a boost in production, consumption and distribution. States/UTs like Chandigarh, Chhattisgarh, Madhya Pradesh, Odisha, Tamil Nadu, and Telangana are worth highlighting in this regard. Some of these States/UTs have also adopted innovative practices like engaging SHGs in procuring and preparing millet dishes for children.

Research & Development and Use of Technology for Innovative Practices: Several innovations in research and development and use of technology have been adopted for enhancing millet production and productivity, development of high yielding varieties and value added products of millets. Some of the organizations leading in this field are Indian Council of Agricultural Research (ICAR), Indian Institute of Millets Research (IIMR), Indian Institute of Food Processing Technology (IIFPT), and International Crops Research Institute for the Semi-arid Tropics (ICRISAT) etc. Organizations like Indian Council of Agricultural Research and Indian Institute of Millets Research have been working dedicatedly to develop higher yielding varieties of different millets crops. IIMR has developed Nutrihub-Technology Business Incubator, a first of its kind to cater start-ups needs in millets sector. ICRISAT is utilizing public-private partnerships to steer its R&D initiatives and South-South collaboration for bio-fortification of millets. Apart from conducting research and development, these organizations also focus on capacity building and skill development programs; technology transfer and consultancy services for budding entrepreneurs, existing industrialists, farmers, SHGs, students and research scholars in all aspects of millet production & processing, preservation and value addition.

STATE MISSIONS AND INITIATIVES TO PROMOTE MILLETS

COMPREHENSIVE REVIVAL OF MILLETS CULTIVATION BY TRIBALS IN NORTH COASTAL AREAS AND PARTS OF RAYALASEEMA, ANDHRA PRADESH

1. **Summary of the Initiative:** State Government of Andhra Pradesh launched a program on Comprehensive Revival of Millets Cultivation by tribals in north Coastal Andhra and parts of Rayalaseema in 2016. It is an end-to-end program on Millets Revival in Andhra Pradesh which intends to develop tribal, and rain fed areas into Millet-Hubs that can potentially supply millets, increase demand and find its place in the grain economy.

2. **Situation before Initiative:** The area under millets is estimated to have reduced by 70% over the past two decades due to change in the food habits of the tribal people. Little millet and pearl millet used to be staple crops in earlier days as part of the food and nutrition security of the tribal people.

3. **Nature of Initiative:** The State Government implemented a comprehensive project for revival of millet cultivation by tribal people in North Coastal Andhra and parts of Rayalaseema. This project aims to increase productivity, household consumption, value addition by making ragi biscuits, idli and dosas, marketing support, setting up of processing centers and establishing seed production centers. It is implemented through the Agricultural Technology Management Agency (ATMA), WASSAN as a lead technical agency and NGOs as facilitating agencies. The objective is to promote millet food tradition across all levels and help people drive home the message of long-term benefits of including power-packed millets in the diet. A Millets Promotion Board was established in the State, and a committee was formed for declaring the MSP for Sorghum. A technical committee was also formed for millets production and other aspects of millets.

Trials in small millet intensification in finger millet

Procurement of millets was done through MARKFED and FPOs. A book on Millet Recipes was published in Telugu language. A pilot for inclusion of Millet recipe for pregnant and lactating women was initiated. The Scheme focused on launching awareness campaigns to encourage tribal people to improve food and nutritional security and convert North Coastal Andhra into a millet hub. The main components of the program are as follows:

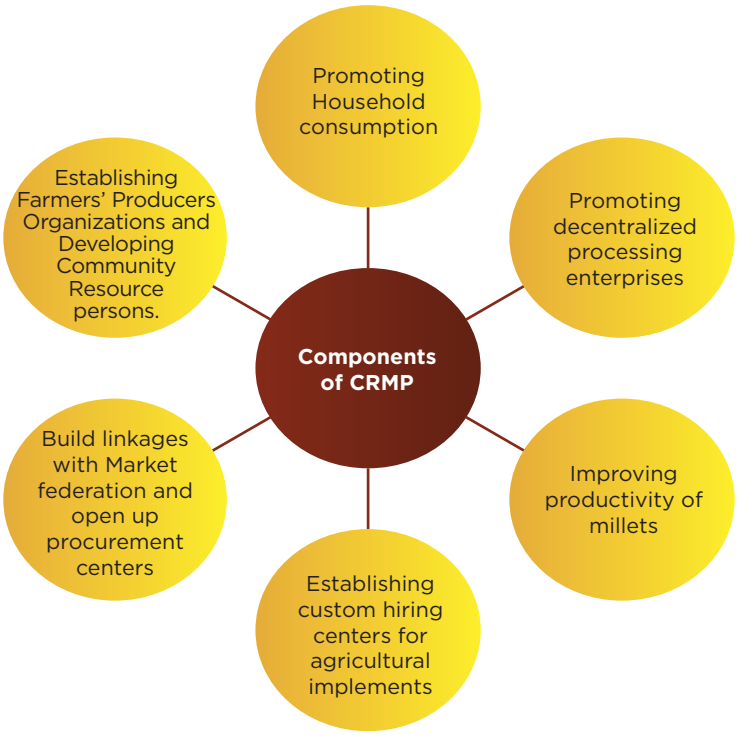


Figure 1: *Components of comprehensive revival of Millet Program*

4. **Impact of Initiative:** Millet's production increased to about 5000 per Mandal i.e. about 2.35 lakh quintals (23500MT) for the State[3]. Household millet consumption increased in about one lakh households. It created ripple and multiplying effects as surplus production was available for Public Distribution System (PDS)/ Integrated Child Development Services (ICDS)/ Mid-Day-Meal (MDM) inclusion. Further, local millet processing enterprises have been scaled up and millet markets/ value chains have been established for better value realization for farmers. Initial trials in small millet intensification on lines of System of Ragi Intensification in finger millet showed positive results (wider spacing, early seedling, mechanical weeding, application of Jeevamrutam etc.). Awareness campaigns like millet festival at National Centre for Management of Agricultural Extension, Hyderabad showed positive impact.

Trials in small millet intensification in finger millet showed positive results (wider spacing, early seedling, mechanical weeding etc.)

In total 7 districts, 44 mandals and 35 NGOs were involved in the program, which helped in promoting the millets cultivation in 28,000 acres of land and promoting a system of millets intensification (SMI) in 4000 acres of land. Many entrepreneurships started working in millet value addition- Kovel Foundation in specific is implementing the millets program in Ananthagiri mandal covering 64 habitations in 10 gram panchayats[4]

3 IIMR

4 IIMR

ANDHRA PRADESH DROUGHT MITIGATION PROJECT (APDMP)

1. **Summary of the Initiative:** Andhra Pradesh Drought Mitigation Project (APDMP), an IFAD and GoAP funded programme, is a concerted and coordinated effort to address the overarching problem of repeated drought, strengthen the drought resilience of 95,000 farm households and to improve the incomes. The project aims at strengthening the adaptive capacity and productivity of agriculture in the worst affected 315 drought prone gram panchayats located in 105 blocks (identified as clusters) of Ananthapuramu, Chittoor, Kadapa, Kurnool (the Rayalaseema region) and Prakasam districts of southern AP.
2. **Situation before the Initiative:** The recurrent spell of drought during past six decades has plagued agriculture and allied sectors in the most rain-fed areas of southern Andhra Pradesh (AP) *i.e.,* Ananthapuramu, Chittoor, Kadapa, Kurnool and Prakasam districts simulating an unpredictable climatic condition causing vulnerable situations leading to migration of 80% of the farmers to cities for low paid jobs.
3. **Nature of the Initiative:** Through 105 Farmer Producer Organizations (FPOs) established in 105 blocks covering 315 Gram Panchayats of southern region of AP, the project has majorly promoted minor millet varieties like foxtail, little, barnyard, kodo, brown top millets etc.

Some of the initiatives undertaken by project are the following:

i. ***Crop Diversification to Millet Cultivation*:** In the baseline survey of the project, the extent of millet cultivation in the project areas was about 19,337 hectare. The farmers were trained about the cost benefit ratio of millets over groundnut and other crops and to explore the marketing opportunities with the Government, local buyers and exporters at a remunerative price. High yield and quality millet seeds are also distributed to interested farmers at subsidized prices under project activities like Navadhanya multi-cropping system and crop diversification and also under various schemes of Agriculture Department, AP.

ii. ***Introduction of improved Package of Practices (PoPs) on Minor Millets***

Table 3: Improved Package of Practices on Minor Millets

Name	Foxtail Millet	Brown top Millet	Sama (Little Millet)
Rainfall (in mm)	500-750 mm	500-750 mm	500-750 mm
Season	Kharif: July- August, Rabi: December – January, Summer: January	June to August	Kharif: June-July
Soil	Light soil, red loams, alluvial and black cotton soils	Grows well in shallow soils.	light soil, red loams, alluvial and black cotton soils

Name	Foxtail Millet	Brown top Millet	Sama (Little Millet)
Variety	Suryanandi, SiA 3085 and local varieties	Local Varieties	Local varieties & OLM 20, OLM 36, OLM 203 and CO_2
Duration	Early duration varieties: 70-75 days and Medium duration varieties: 80-85 days.	70-80 days	100 -105 days
Seed rate	5 kg/ha for line Sowing, 10 kg/ha for broad casting	Line sowing: 5 Kg/ ha Broadcasting: 10-12 Kg/ha	8 kg/ha for line Sowing
Spacing	25 x 10cm	45x15 cm	25 x 10cm
Fertilizer	20N + 30P + 30K kg/ha Top dressing after (30 days crop): 20 N kg/ha	20:20:20 NPK Kg/ha	Basal: 20N + 20P + 20K kg/ ha,
Weed Management	2-3 inter cultivations with one hand weeding	2-3 inter-cultivations and one hand weeding	2-3 inter cultivations with one hand weeding
Important pests	Army worms, Cut worms and Leaf scraping beetles: Spray chloripyriphos 2.5 ml or quinalphos 2 ml/l	Army worm and grass hopper	Shoot fly is the major problem to overcome shoot fly infestation better go for early sowing.
Disease	Blast, Brown spot and Rust	Blast, Brown spot and Rust	Grain smut is major disease very often occur. Seed treatment with Carbendazim @ 2g /kg seed.
Yield	25–30 q/ ha and 1-2 t/ha straw	Grain: 18-20 q per ha	10-15 q/ha

iii. ***On-Farm Demonstrations supporting natural farming practices*:** Millet promotion awareness campaigns are organized in project villages conducting 315 millet on-farm demonstrations in 1 acre/gram panchayat with a financial assistance of Rs.3300 for purchase of improved seed varieties and application of bio-inputs like *Ghana Jeevamrutham*, spraying *kashayams* provisioned from Bio Resource Centers setup by young entrepreneurs under aegis of APDMP, providing protective irrigation and organizing field days. These are monitored by the technical and facilitating agencies, District Project Management Units (DPMUs).

iv. ***Promoting local household consumption of millets:*** The project has promoted processing of millets for the poorest women, using inexpensive micro-millet dehuller. These are developed by WASSAN Foundation, Secunderabad in Chittoor district where the millet cultivation is more to reflect the consumption of millets by the local community. The project has organized training sessions in collaboration with KVK, Yagantipalle for women FPO working on millets. Nutritive, tasty and easily marketable millet recipes like rotis, biscuits, paayasam (kheer), chikkis, laddus, jantikalu etc. using foxtail and brown top millet were developed and sold in the

local markets. At FPO level, storage godowns are being planned to store the agricultural produce with the MGNREGS convergence under 100% assistance and proposals were sent to Department of Panchayat Raj & Rural Development. The project has connected millet producing FPOs with private processing units like M/s. Sattva Millets and Food Products, Renadu a Millet Processing Unit, Nandyal, Kurnool district. The State Agriculture Department, is in discussion with GoAP for inclusion of millets in Public Distribution System (PDS), 2 day/week nutritive millet consumption in mid-day meal and in Anganwaadi centers.

v. ***Exploring sustainable output markets connecting farmers to local markets:*** The project has successfully collaborated with various commodity market players like AP Mark Fed, APEDA, NeML, e-NAM, Reliance Retail, Big Basket, etc. to connect farmers to potential buyers through various digital platforms. The project is in discussion with Samunnati Financial Intermediation and Services Private Limited, Chennai to explore the possibilities in providing credit linkages to potential buyer ready FPOs for aggregation of millet produce from farmers, process them as per the requirements of buyers and sell the output to buyers. This will not only benefit the farmer to receive a remunerative price for their output but also the FPO to gain reasonable profits for marketing.

4. **Impact of initiative:**

Table 4: Increase in millet production area under the project

District	Millet area before Project inception (in ha)	Millet area by Kharif 2020 (in ha)	% increase
Ananthapuramu	6,086	9,188	51.0
Chittoor	5,169	7,395	43.1
Kurnool	4,392	6,072	38.3
Kadapa	1,192	1,668	39.9
Prakasam	2,498	3,527	41.2
Total	**19,337**	**27,850**	**44.0**

- As seen from Table 4, due to the above initiatives, the extent of millet area increased by 44%, from 19,337 hectare to 27,850 hectare, in the project area, and also ensured nutritional security among the rural communities.
- The cost of cultivation minimized and the production has constantly increased.
- The FPOs of APDMP sold 98 MT of Foxtail Millet and 99 MT of Brown top millet to M/s Manyam Grains, Visakhapatnam.
- Two FPOs in Kurnool district made farming agreements with M/s Sattva Millets and Food Products, Anupuram (V) Panyam(M) Kurnool (Dist), with a buyback agreement of Little Millet & Barnyard millet produce from 150 acres.
- FPOs are well versed with the utilization of electronic platforms in exploring markets for their output sale.

- Increased the consumption of millets locally by utilizing the micro millet dehuller.
- The project has planned to establish 35 millet processing units for processing the millets to ready-to-use ingredient by cleaning, removing husk using millet processing units/machines to encourage the farming community to cultivate millets more and to get the remunerative price.

CHHATTISGARH MILLET MISSION

1. **Summary of the Initiative:** Government of Chhattisgarh launched Mission Millet Chhattisgarh in September 2021 to become the Millet Hub of India. Its primary objective is to promote cultivation of Kodo millet, little millets and Finger millet in the State, with a focus on 85 Blocks in 20 Districts with the total budgetary allocation of Rs.170 Crores and input grant of Rs.9000 per hectare was decided[5]. Chhattisgarh Minor Forest Produce Co-operative Federation was appointed as the implementing agency for procurement and processing of millets in the State. Agreement between ICAR-IIMR and 14 district administrations, for promotion of cultivation, procurement storage and processing into value added products, was signed in presence of Hon'ble CM on September 10th, 2021.

Hon'ble Chief Minister Bhupesh Baghel, Chhattisgarh at the launch of "Millets Mission" and signed a MoU with IIMR, Hyderabad.

2. **Situation before Initiative:** The millet cultivation has been on a downward trend due to promotion of wheat and paddy cultivation in State largely due to assured returns to farmers because of MSP, declining demand and lower yield due to poor seed quality, lack of training of farmers in good agricultural practices and modern technology. All these factors have made millet farming un-remunerative for the farmers.

3. **Nature of Initiative:** Mission Millets Chhattisgarh was started under the theme of "Cultivation to Consumption". It is a multi-pronged approach to improve the entire ecosystem of millets from cultivation to consumption, to attain the below mentioned objectives of making millets a profitable farming option for the farmers of the State.

The Mission Millets comprises the following components:

- The duration of Mission Millets is five years, with budget outlay of Rs. 170 crore from 2021-2026.
- A promotion incentive of Rs. 9000 per hectare will be given to farmers under the Nyuntam Aay Yojana (NYAY) to promote cultivation
- Declaration of MSP of Rs 30/kg for Kodo and Little Millets and Rs 33.77/kg for Ragi.
- Creation of Center of Excellence in a 20 hectare area for better seeds, training, modern equipment, capacity building technology demonstrations etc.
- ICAR-IIMR as technical partner for cultivation, procurement, processing and value addition inputs. According to the MoU signed, IIMR will provide support and guidance for increasing the productivity of Kodo, Kutki, and Ragi, technical skills, availability of high quality seeds and establishment of a seed bank in Chhattisgarh.

5 Bastar dists at core of Chhattisgarh's 'Millet Mission' | India News-Times of India. 2021. Available from: https://timesofindia.indiatimes.com/india/bastar-dists-at-core-of-chhattisgarhs-millet-mission/articleshow/86105611.cms

- Establishment of approximately 50 cleaning and grading units, and 10 dehulling units across the State by Chhattisgarh Minor Forest Produce Cooperative Federation (CGMFP) in 2021-22. CGMFP Federation working with 1.2 million tribal population of the State and having more than 18,000 procurement centers for Minor Forest Produce, will be utilized for procurement of millets across the State at MSP.
- Promotion of regional processing units under private investment: An MoU has already been signed for a 10,000 MTPA millet processing unit to be established at Kanker district.
- Increasing consumption of millets by distribution of millets under the PDS program. Provide value added millet products under Mid-Day Meal and ICDS.

4. **Impact of Initiative:** The program is still in its initial stages. It targets to increase the area under millet cultivation from 69,000 hectare to 1,88,400 hectare; increase the yield from 0.45MT/hectare to around 1MT/hectare and to increase per capita consumption of millets in the State.

BHAVANTAR BHARPAYEE YOJANA, HARYANA

1. **Summary of the Initiative:** *Bhavantar Bharpayee Yojana* is a unique Scheme of Haryana Government for horticulture farmers to compensate for the low price of their produce in the market. The Scheme has been extended to Bajra crop from *Kharif* season of 2021 to boost millet growing farmers in the State.

2. **Situation before Initiative:** Farmers were often forced to sell their produce at low price due to surplus production of crops, It resulted in indebtness and eventually becoming a reason for farmer suicides. To avoid such incidents, the State Government of Haryana came up with a new farmer development scheme called the Bhavantar Bharpayee Yojana which aims to safeguard the interest of the farmers.

3. **Nature of Initiative:** Bhavantar Bharpayee Yojana was started with the intention to reduce the risk of farmers by fixed protected prices during low prices of vegetables and fruits in the market and to encourage farmers for diversification in agriculture. Haryana Government announced to include bajra in the *'Bhavantar Bharpayee Yojana'* from *kharif* season 2021, to encourage private players to buy the bajra grains which the Government procures at Rs.2,250 per quintal as per Minimum Support Price (MSP). It considers the difference in price (average market price and MSP) of bajra as '*Bhavantar*' price and after verification of crops, Government will pay farmers the difference in price up to Rs.600 per quintal on average of the yield in case the private players pay lesser. Haryana is the first State in the country to implement such a Scheme. At least 21 horticultural crops have already been included under the Scheme. The Scheme is applicable only to those farmers of Haryana who have registered on the *'Meri Fasal, Mera Byora'* portal for buying bajra. While 86 procurement centers have been set up for purchase of bajra, 38 for moong, 19 for maize, and 7 for groundnut purchase and 199 for purchase of paddy. Additional procurement sites have also been identified as a contingency if there is huge arrival of produce at the procurement centers.

Bajra farming in Haryana

4. **Impact of Initiative:** The Scheme has been designed and developed for the safeguarding the investment of the farmers. Some vegetable crops have been identified for the Scheme and now Bajra farmers also benefit. In *kharif* season 2021, 2.71 lakh farmers were registered on the 'Meri fasal, Mera Byora' portal for bajra. This Scheme is a boon for the millet growing farmers of Haryana, as it helped in socio economic improvement of the poor and marginal farmers of the State. It also triggered the farmers to expand area under millet cultivation. Since the private entities are going to buy the bajra, it will have positive impact on its cultivation and consumption in Haryana. The success of the Scheme will pave way for other millet growing states to replicate the Scheme as well.

INITIATIVE FOR NUTRITIONAL SECURITY THROUGH INTENSIVE MILLETS PROMOTION (INSIMP)

1. **Summary of the Initiative:** Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) was one of the well-planned initiatives by the Ministry of Agriculture and Farmers Welfare with a Rs.300-crore outlay in 2011-12 for promoting millets cultivation, processing, and value addition in the country.

2. **Situation before Initiative:** Despite its benefits, one of the major constraints discouraging the production and consumption of millets was the drudgery associated with its processing. This constraint to extend utilization of millet foods was required to be responded with improved processing machinery to the entrepreneurs/NGOs/KVKs. Hence, INSIMP was implemented to increase area, productivity and production.

3. **Nature of Initiative:** INSIMP was launched in 2011–12 under Rashtriya Krishi Vikas Yojana (RKVY-National Agriculture Development Plan) marks the very beginning of promoting millet cultivation and consumption for nutritional security in India. The programme was aimed at supporting the States by providing financial assistance for critical areas in the millet value chain such as seed production, installing processing units and organizing awareness camps. The Scheme is being implemented in 16 States-Arunachal Pradesh, Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal and Sikkim. In total, it targeted 16 States covering 6.71 lakh hectares in 149 districts.

The components of the Scheme are:

- Production
- Seed Production
- Post-Harvest and Value Addition
- Research Activities
- Awareness Campaign

The Scheme also provided financial assistance to set up three National Centres of Excellence (CoEs) in 2011 *i.e.* Chaudhary Charan Singh Haryana Agricultural University (CCS HAU), Hissar, for pearl millet, ICAR-IIMR (Formerly Directorate of Sorghum Research), Hyderabad for sorghum, University of Agriculture Sciences, Bengaluru, for finger millet and small millets etc. Under this initiative, the districts with large crop area under millets (more than 10,000 ha area under sorghum & pearl millet, or more than 5,000 ha under finger millet or more than 2,000 ha area under small millets) with productivity less than that of the National Average Yield were considered for promotion. To improve the productivity in millets, technology demonstrations in farmers' fields were organized. Financial assistance for input kits and seed minikits were provided to the farmers. In addition, capacity building of farmers through organizing training programme was done. To promote new varieties and hybrids, augment the availability of seeds and make cost affordable to the farmers, an incentive of Rs. 3,000/- per quintal for hybrid and Rs. 1000/- per quintal High Yielding Varieties (HYVs) were provided.

4. **Impact of Initiative:** Since its launch in 2011-12, the initiative has had positive impact on millet cultivation, increasing productivity due to continued supply of quality seeds of HYVs and hybrids, development of new products for consumption, creating awareness about nutritive property and health benefits of millets. It has provided an impetus to farmers through technology demonstrations, provision of inputs, financial assistance, and aid in post-harvest value addition. The scheme helped pave the way for the millet missions which were adopted by several states.

   It covered 772,857 hectares in 16 States and demonstrated improved production and post-harvest techniques along with ways of adding value to the crops. Area has increased under sorghum in AP and Tamil Nadu, finger millet in Jharkhand, Maharashtra and Tamil Nadu and small millets in AP, Karnataka and Maharashtra. Larger yield gains have been recorded under small millets in UP (33%), Karnataka (28%), Tamil Nadu (13%) and Uttarakhand (3%)

   This has helped in supporting the farmers financially, and thus enabled many to cultivate millets. Newly developed HYVs and Hybrids were popularized and many of those varieties were brought under the seed system. The Scheme through processing and value addition techniques has generated consumer demand for millet-based products. The Centres of Excellence (CoEs) established under this project are functioning with very positive outcomes. CoE of ICAR-IIMR plays the leading role for sorghum/millet processing and value addition by showcasing the processing technologies and offer troubleshooting. In addition, IIMR is also working on primary processing and secondary processing machines. 30 processing machines that were meant for processing of rice and wheat were retrofitted and conditions were optimized for suiting millet processing such as flaking, extrusion, biscuits making, parboiling including primary processing, dehulling and milling of sorghum. A few of the machinery such as suji making line, dehulling, flaking and cookie making line have been scaled up. Some of these technologies have been replicated in more than 300 processing clusters spread across the millet growing States in the country.

PROMOTING KODO AND LITTLE MILLETS IN MADHYA PRADESH

1. **Summary of the Initiative:** Madhya Pradesh is promoting millets, especially Kodo and Little millet, under the Centre's Nutri Cereal Scheme. In the tribal districts of Mandla and Dindori, Action for Social Advancement (ASA), a non-profit organisation, has identified around 30-40 villages for millet promotion.

2. **Situation before Initiative:** The Gond tribals in Mandla district of Madhya Pradesh have been cultivating and consuming millets since generations, but many families have stopped or reduced cultivation and consumption due to commercialization of crops like, paddy, cotton, ground nut *etc.* They are now consuming rice because of free distribution through PDS. Non-availability of modernized millet processing machines is also a reason for shifting from millets to rice and other crops. Recently with the intervention of the Government and other NGOs these tribal families started growing millets as they became aware of its water efficiency and nutritional benefits.

3. **Nature of Initiative:** Madhya Pradesh decided to promote Kodo and Little millets, under the Centre's Nutri-Cereal Scheme in the tribal areas of Mandla district where the non-profit Action for Social Advancement (ASA) identified around 30-40 villages for millets promotion. The millet cultivating farmers in this area were facing problems with stone removal in the millets and even after dehulling, stones remain mixed with the grains and they have to be separated manually. With the help of the Government of Madhya Pradesh, twenty dehulling machines have been set up by the Agriculture Department in the district. Further State Government is also working on procuring processing units with a view to popularize millets. They are also trying to get a big machine from the Bhopal-based Central Institute of Agriculture Engineering which helps in processing and separating the stones. ASA is taking technical guidance from the Chennai-based non-profit MS Swaminathan Research Foundation on millet-based recipes.

Farmers participated in field level demonstration of best practices in millets cultivation in Madhya Pradesh

4. **Impact of Initiative:** Kodo and Little millets are recognized as key assets to support farmer adaptation to climate change, which is bringing greater drought pressure to eastern Madhya Pradesh. Production and consumption of little millets have improved in tribal districts of Mandla and Dindori. It has brought a major change in the lives of over 5000 women in areas who are now financially and socially empowered, inspiring many others in the region. About 3700 women of 41 villages in Dindori are now producing

minor millets. The WCD Department has also contributed to help these women form Self-Help Groups under Tejaswini Rural Women Empowerment Programme of Madhya Pradesh Mahila Vitta Evam Vikas Nigam (MPVEVM) to help them technically. Loans have been given to them to purchase processing machines for their crops. The Women and Child Development Department signed an MoU with these women farmers. They are supplying breakfast of Kodu barfi for 5000 children of 226 anganwadis centres.

PROMOTION OF MILLETS THROUGH NFSM-NUTRI CEREALS MISSION, NAGALAND

1. **Summary of the Initiative:** Millet (Foxtail) is one of the important crops grown in Nagaland for not only table purposes, but also medicinal purposes and the husk for animal feed. During the *kharif* season, it can be grown in all districts of Nagaland. To promote and increase area, production and productivity, foxtail has been taken up under NFSM- Nutri-Cereals. The interventions under NFSM- Nutri Cereals include front line demonstration, distribution of seed, seed production, integrated nutrient management, integrated pest management and training.

2. **Situation before the initiative:**

Low awareness of nutritional value	No seed production in village cluster.	No monitoring and evaluation from sowing till harvest by the implementing authorities.	Non usage of high yielding varieties or improved variety seeds
Non adoption of improved packages and practices for millet production	Low or no usage of soil ameliorants like agricultural lime, micronutrients, etc.	Poor agronomic practices and plant health care	

3. **Nature of Initiative:** Implementation of Nutri-cereal Program remains with Agriculture Department, Krishi Vigyan Kendra (KVK), and Agricultural Technology Management Agency (ATMA). Major target group of millets cultivation are women farmers, small and marginal farmers and progressive farmers.

   The main components of the program include the following:

   - Promotion of millets cultivation and conservation of seeds germaplasm through different department interventions
   - Conservation of traditional varieties by preserving farmers' Indigenous Technical Knowledge in millets cultivation
   - Awareness through trainings, frontline demonstrations, observation of Year of Millets, 2018, Millet Day by different stakeholders like Krishi Vigyan Kendra, Agricultural Technology Management Agency, etc.
   - Distribution of seed, seed production, integrated nutrient management, integrated pest management, and trainings in potential areas

4. **Impact of the Initiative:** The awareness on the importance of nutritional value has improved. Due to activities under Mission, positive changes have been observed in the behavior, perception and adoption of good practices of millet cultivation, varietal seed conservation, post harvest storage, home based processing and consumption pattern etc. Secondly, seed production and conservation has started at domestic level to some extent. High yielding varieties and improved varieties are also distributed and adopted by farmers to some extent. Further, adoption of improved packages and practices for millet cultivation is taking place with the inception of the initiative.

Foxtail millets in Nagaland

ODISHA MILLETS MISSION

1. **Summary of the Initiative:** The Government of Odisha launched the special programme for promotion of millets in tribal areas known as Odisha Millet Mission (OMM) in 2017 with aim to *Revive Millets on Farms and Plates* and simultaneously focus on production, processing, consumption, marketing and inclusion of millets in Government Schemes

2. **Situation before the Initiative:** Data from NFHS-4 shows that Odisha ranks in the top 10 of the most affected States of under-five year child malnutrition on all the three indicators of wasting, stunting and underweight. In terms of deprivations and marginalization, the State also has some of the highest proportion of tribals (24%) in the country with higher malnutrition levels with the relationship strongest for underweight children.

   Further, farmers are shifting towards cultivation of high profiting commercial crops like cotton, maize, paddy, vegetables etc., which created a void in millet cultivation. Moreover, change in food habits, drudgery in processing of millets, lack of storage facilities, and lack of support from the Government led to declining in area under cultivation and consumption of millets. These problems triggered the formation of Millet mission.

   Some of the key issues related of the millet production cycle are as follows:

   - Decrease in household consumption of millets
   - Low productivity of millets due to lack of innovation in improved agronomic practices and limited availability of good quality seed of suitable landraces
   - Lack of decentralized processing units that could reduce drudgery
   - Limited millet market linkages

3. **Nature of The Initiative:** Odisha Millet Mission (OMM) was initiated in 2017 to promote Millets (Ragi) as a staple crop of the farming system. Emerging from a consultation between the State government, academia and civil society, it is the first project in the Agriculture and Farmers Empowerment Department with simultaneous focus on production, processing, consumption, marketing, and inclusion of millets in Government Schemes

   The objectives of OMM (Figure 2) are as follows:

   - Promoting household level consumption
   - Improving productivity of millet crops by improved agronomic practices
   - Promoting FPOs for marketing
   - Setting up decentralized processing unit
   - Inclusion of millets in ICDS, MDM and PDS

   Entire project is implemented by FPOs with support of local NGOs under the guidance of line departments at district and block level.

Figure 2: *Objectives of Odisha Millets Mission*

4. **Impact of the Initiative:**

i. ***Reach and Scale of OMM:*** The Mission was started with 30 Blocks (7 Districts) in 2017 but due to positive response and demand from the farmers it was expanded to 55 Blocks (11 Districts) in 2018 to 142 Blocks (19 Districts) currently. Figure 3 shows the reach and scale of OMM.

Figure 3: *Scale of OMM*

Millets are being cultivated in 54495.83 hectares, with *ragi* occupying over 86% of area. More than 11 lakhs farmers have taken up millet cultivation through improved agronomic practices. During Kharif marketing season of 2021-22, OMM has procured 3,23,000 quintals(3,2300MT) of millets from 41,286 farmers. Around 76 Farmer Producer Organizations have been registered under OMM. Odisha has conducted 45 Participatory Varietal Trails and identified 103 unique traditional and 14 unique improved varieties.

Ragi was distributed under PDS to more than 50 lakh beneficiaries in 14 districts. OMM envisages addressing both supply side and demand side aspects of millet use. The initiative is unique as it leverages on a range of stakeholders in the farm and tribal development space, including community-based organizations, grassroot level NGOs and technical advisors. A key component of the programme is also the incentive structure put in place using the direct benefit transfer model where

farmers who follow the recommended practice are provided a conditional cash transfer. To summarize whole mission achievements, the following key achievements should be highlighted:

- Gross value of produce per farmer household increased over three times, from Rs.3957 to 12486 during from 2018-19 to 2020-21.
- Gross value of produce per hectare increased more than 2 times, from Rs. 9447 to 20710, millet production per hectare increased over 2 times from 5.79 quintal/hectare (0.6MT/hectare) to 12.72 quintal/hectare (1.3 MT/hectare). Average area in hectare per farmer household increased from 0.42 hectare to 0.60 hectare per household from 2018-19 to 2020-21.

During a review meeting held in August 2021, the Hon'ble Chief Minister has approved the extension of the 5-year programme period and expansion of the program into new blocks and districts for the next phase of OMM. The scaling up of procurement and inclusion of millet in ICDS, MDM and PDS has also been approved. Odisha was declared "Best Millet Promoting State" under "Poshak Anaj Awards" by ICAR-IIMR and FAO. The State Planning Commission of Chhattisgarh has asked the Government of Chhattisgarh to start a millet mission on the lines of "Odisha Millets Mission". In fact, the Government of India has set up a task force to understand the framework of the Odisha Millets Mission and to revise the National Sub Mission on millets based on the learnings of the OMM. Cambridge University partnered with Odisha Millets Mission to explore possibility of design of OMM as alternative to Green Revolution framework.

ii. ***Introduction of Ragi Laddu in ICDS:*** Ragi laddu has been introduced as a morning snack for pre-school children under ICDS in Keonjhar and Sundargarh. Ragi Laddu now covers 7066 anganwadi centres and 1,50,682 preschool children.

Millet Shakti Cafés – Quick Service Restaurant under Odisha Millets Mission

Wall painting for awareness

Ragi procurement awareness rath

v. ***Millet Shakti Cafe:*** Cafes have been established across Odisha, called Millet Shakti Cafe to serve the millet-based hot cooked items and bakery products. More than 45 events have been organized and millet-based food items have been served to 4.4 lakh people in the last two years.

Ragi distribution through PDS

vi. ***Income Generation:*** As seen from Table 5, assured income from Government supported ragi procurement has helped develop markets with remunerative prices for rainfed produce. This in turn has led to a revival of ragi cultivation across several areas multiplying the increase in income. The FPO, a farmer led body to ensure improvement of production and productivity, provide platform for small and marginal millet farmers to collectively sell processed grains and value added products of millets. The FPOs successfully deal with challenges and constraints that confront farmers by leveraging collective strength and bargaining power to access financial and non-financial inputs, services, and appropriate technologies, reduce transaction costs, tap high-value markets, and enter into partnerships with private entities on more equitable terms

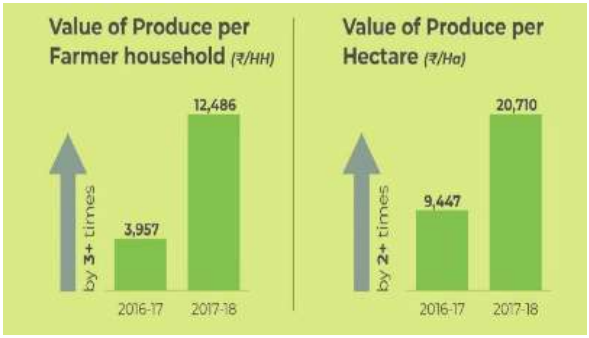


Figure 4: *Improvement in value of produce*

Table 5: Increase in MSP of Millets (Rs)[6] from 2017-18 to 2021-22

Year/Crops	Ragi	Bajra	Jowar (Hybrid)	Jowar (Maldandi)
2017-18	1900	1425	1700	1725
2018-19	2897	1950	2430	2450
2019-20	3150	2000	2550	2570
2020-21	3295	2150	2620	2640
2021-22	3377	2250	2738	2758

6 Minimum Support Prices. Available from: https://farmer.gov.in/mspstatements.aspx

vii. ***Nutritional Security*:** The objective of Odisha Millets Mission is to revive millets on farms and on plates. Ragi procurement has supported the consumption among people. As mentioned above, the procured ragi based entitlements were included in the PDS and ICDS Schemes. These efforts are set to be expanded through inclusion of ragi based preparations in MDM. Hence, the focus has been on the nutritionally vulnerable category of children.

viii. ***Gender and Nutrition Benefits:*** Mechanized and decentralized processing of millets at block level has helped increasing ease of doing agriculture and in reducing women's drudgery in producing millets.

ix. ***Climate Resilience:*** The assured market for finger millet has led to an increase in area under millet production. This has increased farmers' resilience in the face of drought. Deficient rainfall posed a problem for paddy cultivation but has had no impact on non-paddy crops.

PROMOTION OF TAPTAPANI FARMERS PRODUCER ORGANISATION FOR MILLET PROMOTION IN ODISHA

1. **Summary of the Initiative:** A proposal was raised to NABARD to form a formal FPO, the Taptapani Farmer's Producer Company Limited in Chandiput, a gram panchayat in Mohana block of the tribal dominated Gajapati district of Odisha for millets, maize and vegetable promotion.

2. **Situation before the Initiative:** Most of the people in Odisha depend on Non-Timber Forest Products (NTFP) for their livelihoods. People have recently started the cultivation of maize. Due to their low bargaining power and lesser marketing options they did not get fair price of their produce. This led to the launch of the pilot project for the promotion of an FPO in the year 2014-15 which since then has been handed over to Sahabhagi Vikas Abhiyan (SVA).

3. **Nature of the Initiative:** A baseline survey conducted by a local NGO, Social Action For Community Alternative Learning (SACAL) to understand the ground situation showed a grave picture of distress migration of people because of the exploitation by the local traders. Empathizing with the situation, a proposal was raised to NABARD to form a formal FPO, the Taptapani Farmer's Producer Company Limited.

Input distribution camp organised by Taptapani FPO in Chandiput

During the year 2016-17, Government of Odisha decided to take the Mohana Block under the umbrella of Odisha Millets Mission involving a few thousand farmers. Under this programme, the Taptapani FPO was formally recognized by Odisha Millet Mission as a CBO for promotion, marketing and value addition of Millet based products. It has promoted 2500 acres of millet crops through a millets mission program[7]. With this FPO, there has been marked reduction in the cases of migration of labor, with decreased cases of exploitation by local traders, easy and sound access to the marketplace, and good farming inputs (seeds, fertilizers and other farming tools).

7 Taptapani Farmers Producer Company Limited (TFPCL). Annual report 2020-21-Collectivising Dreams for a prosperous tomorrow. Available from: https://www.taptapanifpc.com/_files/ugd/3c839a_9bbb7785d5a840508e632993666b3e43.pdf

Vision	Mission	Goal
To evolve as a center of excellence in service of its members, shareholders, and the farming households in general to promote their income and livelihoods.	To enable its shareholders to have a decent income and to have all the basic necessities for a high-quality living.	To promote farmers producer organization for organizing, orienting, sensitizing the farming community for improved agriculture production, value addition and marketing to achieve sustainable livelihood and socio economic development.

Overview of Taptapani FPO

4. **Impact of the Initiative:** The FPO, as of today, has 699 shareholders with a shared capital of Rs. 6,99,000, maintaining a cash credit limit up to Rs. 5,50,000[8]. It has its outlets at Luhagudi, Mohana Gobidpur and Chandiput for delivering its services. The FPO is actively engaged in supplying finished millet products to the markets of Bhubaneswar. In the year 2019 it facilitated record procurement of 1400 quintals of Ragi in Gajapati district.

   The Taptapani FPO has received the best FPO cash award for the Gajapati district of Government of Odisha through Krushi Odisha Programme. It is also registered with the RMC and has a trading license on millets and maize. Additionally, it is also running a community managed seed centre and custom hiring centre with the requisite farm implements.

Market linkages for millets

Taptapani FPO receiving best FPO cash award

8 Taptapani Farmers Producer Company Limited (TFPCL). Annual report 2020-21-Collectivising Dreams for a prosperous tomorrow. Available from: https://www.taptapanifpc.com/_files/ugd/3c839a_9bbb7785d5a840508e632993666b3e43.pdf

CONVERGENCE BETWEEN ODISHA MILLETS MISSION AND SHG MISSION SHAKTI

1. **Summary of the Initiative:** Convergence of Odisha Millets Mission and SHG Mission Shakti where development of innovative recipes along with training of women SHGs on these have been one of the major interventions to promote millet consumption.
2. **Situation before the Initiative:** Millets have been an integral part of the culture of tribals. Millets have had an irreplaceable position representing love, respect and belongingness in all festivities, celebrations, visiting a relatives' house or marital exchanges. Despite such an ancient cultural association, this signature cereal had lost its popularity and fame among the newer groups of the population.
3. **Summary of the Initiative:**


SHG members preparing millets dishes

There have been numerous developments around new and innovative recipes of millets which are mostly a contemporary take on age-old traditional recipes. The recipe innovation tool has come up with a plethora of opportunities to get the once dominant cereal back into mainstream food culture among rural and urban population.

WASSAN is State level resource NGO for the Odisha Government's "Special programme on promotion of millets in the tribal districts of Odisha" under the Odisha Millets Mission initiated in the year 2017. Presently, it is collaborating with the Government of Odisha in 84 blocks of 15 tribal

Awareness camps on millets

dominated districts of Odisha, mainly comprising hilly terrain having fallow upland[9]. Implemented through FPOs with the help of NGOs that function as block level Facilitating Agencies, the program includes interventions on enhanced agronomic practices, varietal trials, processing units, value addition, establishment of associated enterprises, marketing, and procurement. The development of innovative recipes along with training of WSHGs on these have been one of the major interventions to promote millet consumption.

4. **Impact of the Initiative:** The convergence between Mission Shakti and the OMM has been key in achieving a boost in consumption not just among producers, but in towns and cities as well. Till date, 262 Mission Shakti SHGs have been trained on a range of delectable dishes; chakuli, enduri pitha and bara made up of ragi, suan or kangu; aaluchop, chicken pakoda, onion pakoda, kakera pitha, malt, soup made of ragi; pulao and chicken biryani made of kangu, suan, or proso; suan kheer and the ultimate ragi Laddus and so on. One of the biggest impacts of the initiative has been empowerment of more than 70 lakh women who have been organized into 6 lakh groups in all blocks and urban local bodies of the State so far.

Millets Shakti on Wheels

To bring these recipes to a wider audience several block level enterprises have been initiated in Malkanagiri, Mayurbhanj, Bolangir and Rayagada districts. These include Millet Shakti Tiffin Centers for hot cooked meals, and food trucks called Millets Shakti on Wheels. More urban Millet Shakti Cafés have been planned for the prominent cities of Odisha such as, Bhubaneswar, Cuttack, Sambalpur, Rourkela, Puri, Konark, Berhampur, Keonjhar, Sundargarh and Jeypore. There has been never ending demand for millet preparations at these outlets. With an initial investment support of Rs 30,000, Millet Shakti Tiffin Centers were each generating revenues of around Rs. 20,000 and profit of Rs. 6,000 per month even in their initial phase.

9 Multi-sectoral approach must to enhance millet production. Available from: https://www.mssrf.org/events/multi-sectoral-approach-must-to-enhance-millet-production/

TAMIL NADU MILLETS MISSION

1. **Summary of the Initiative:** Tamil Nadu Millet Mission was started in 2014-15 under National Agriculture Development Programme (NADP) with the intention to bring back the forgotten millets to normal cultivation by incentivizing cultivation & distribution of millets, organizing frontline demonstration, and to conduct training to farmers on farming and value addition of millets.

2. **Situation before Initiative:** Millet growing farmers are generally small land holders and they cultivate the crop for their own consumption. It was necessary to reduce the cost of cultivation by providing necessary technological inputs and market linkages to motivate these farmers to produce market surplus, which would ultimately result in retaining these farmers in cultivation of millets.

3. **Nature of Initiative:** Objectives of Tamil Nadu NADP Millet Mission includes the following components :

   - Organizing frontline demonstration in an area of 11,500 hectares of millet-growing districts.
   - Supply of 11,500 kits comprising liquid biofertilizer, micronutrients, fungicides, pesticides, etc., to the beneficiary farmers at the subsidy of Rs 3000/hectare for major millets and Rs.2000/hectare for minor millets subject to maximum area of 2 ha in millets.
   - Training to farmers on farming and value addition of millets

   A series of workshops on millets and their role in diabetes prevention, overall nutritional value, and income generation were organized for Self-Help Groups. Agricultural department officials were sensitized about the importance of millets. Based on crop suitability and climatic conditions, the schemes were designed by the Planning Commission so that dry districts reaped the maximum benefits. The State also worked with the Tamil Nadu Agricultural University (TNAU) to fine tune the huller and decrease the gap of the rolling wheels. This ensured that the polished grain still had the nutrients. Mini-mills were also commissioned specifically for millets.

4. **Impact of Initiative:** The overall proposed outcome of the Millet Mission was to increase productivity of millets to 4000 Kg/hectare. Millet production and area under millet cultivation has more than doubled in Tamil Nadu in the five years as a result of this policy driven initiative. Soil moisture conservation increased by 10% and soil health status has improved. The Mission enabled dissemination of millets cultivation technology and awareness and adoption of post-harvest technology and processing of millet. The Mission has generated increased consumer demand for millets based food and thus increased income to farmers. It also encouraged the farmers to become entrepreneurs. In addition, this Millet Mission helped in transforming fallow land to cultivable land, conjunctive use of water through drip irrigation, proliferation of newly released varieties/ market preferred varieties of millets, nutrient conservation and soil preservation in low productivity areas, and intensifying crop diversification from high water intensive crop to less water intensive crop. Recognizing its success, the State won the Krishi Karman Award in 2014-15 for the production of coarse cereals.

MISSION ON SUSTAINABLE DRY LAND AGRICULTURE, TAMIL NADU

1. **Summary of the Initiative:** The Agriculture Department of Tamil Nadu launched the Mission on Sustainable Dry Land Agriculture (MSDA) mission in 2016 for Dry Land farming, focusing on improving the production and productivity of millets, pulses, and oilseeds. The Mission covered various aspects such formation of dry land clusters, village clubs, comprehensive land development, value addition, strengthening FPOs, custom hiring centers, animal husbandry, *etc.*

2. **Situation before Initiative:** Government of Tamil Nadu intends to have more than 4% growth in agriculture. Around 70% of the population are involved in agricultural activities as this is one of the major means of their livelihood. The Agricultural Department of Tamil Nadu thus decided to implement various development Schemes and generate innovative technologies to ensure growth in the State's agriculture as well as to improve the economic status of the cultivation sector. MSDA is one of the major initiatives taken by the Government to enhance millet area and cultivation, increase value addition, and thereby mitigate malnutrition in the State.

3. **Nature of Initiative:** The State Government, with a focus to increase the income of farmers in dryland area, announced a special Scheme Mission on Sustainable Dryland Agriculture (MSDA) with a sanctioned, amount of Rs.802.9 Crore, in 25 districts with the main objective of developing 25 Lakh acre of dryland by forming 1000 dry land clusters of 2,500 acre each. Many districts with dry land agriculture land have been identified for converting them into fertile land for growing millets.

   The following activities were implemented under MSDA:

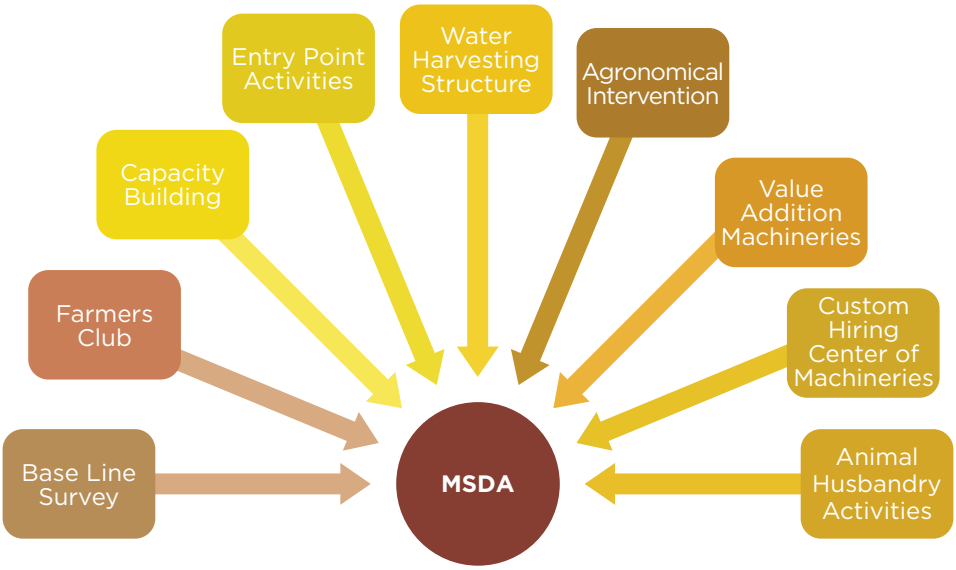


Figure 5: *Activities under MSDA*

4. **Impact of Initiative:** MSDA has had a great impact on transforming millet and other crop cultivation. Total area of millet increased by 25% despite a 24% deficit in the

rainfall. During 2019-20, Rs.100 crores were extended to target 10 lakh acre of dry land to benefit 3.70 lakh dry land farmers by forming another 400 dryland clusters and implementing the welfare activities[10]. Cultivation of millets, pulses, oil seeds and cotton in 15 lakh acre of dry land was encouraged with distribution of seeds and other inputs at 50% cost with extended subsidy to 5.73 Lakh dryland farmers and ploughing subsidy at Rs.500/acre for 15 lakh acres.

Production process under MSDA

174 Value Addition Machinery Units for Millet and other processing units were commissioned with a financial assistance of Rs.10 Lakh /unit or 75 % of the machinery cost whichever is less. 801 Village level Custom Hiring Centers have been established which enabled timely availability of machinery and created employment to rural youth. Through this scheme, soil moisture conservation techniques and improved dryland technologies were disseminated to dryland farmers to reap higher yield in dryland crops like millets, thereby improving socio economic status of the farming community.

Success in millet farming in Salem district

10 Agriculture Department, Government of Tamil Nadu. Policy Note. 2020.

ORGANIC PRODUCTION AND CERTIFICATION OF THE MILLETS, UTTARAKHAND

1. **Summary of the Initiative:** In hilly regions of the State, farmers mostly grow the local crops like finger millet, barnyard millet, amaranthus etc. As per the State Government, organic production and certification of the millets is being done under Centrally Sponsored Scheme such as Rashtriya Krishni Vikas Yojana (RKVY)-Organic programme in 70240 hectares, Paramparagat Krishi Vikas Yojana (PKVY) in 1657 clusters (33140 hectare) and Namami Gange programme in 620 cluster (12400 hectare).

2. **Situation before Initiative:** Millets are grown mainly in the hilly region of Uttarakhand, which is by default organic. These crops are very nutritious and have medicinal values, requiring less water and other inputs. The average selling price was very low as compared to Minimum Support Price i.e. around 40 to 50% of MSP. Due to the lack of collection centers the process of procurement and supply was very difficult and a time taking process. Lack of packaging and processing also resulted in delay of the supply and compromises with the quality as it creates a gap between harvesting, processing and packaging. Farmers were unaware or had very little knowledge about the byproducts and value added products of millets.

3. **Nature of Initiative:** State Agriculture University Govind Ballabh Pant University of Technology and Agriculture (GBPUA&T), Pantnagar and Central Research Institute Vivekanand Parvatiya Krishi Anusandhan Sansthaan (VPKAS) have worked for improvement of traditional varieties and many improved resistant varieties have been developed for Uttarakhand and North- Eastern States. Encouraged by the results, these improved varieties have been introduced under various schemes benefitting the farmers. To facilitate and encourage organic farming, organic inputs like organic manure, bio fertilizers, bio pesticides, etc. are provided to the farmers.

   Some private entrepreneurs (under different Government sponsored Schemes) have started making value added products of Millets i.e. biscuits, cakes, namkeens, and momos. These value added products are being widely appreciated throughout the State as well as out of State. There has been shift of priority of crop cultivation trends towards millets due to better market price offered to the farmers.

   The target group of organic millet production are small and marginal farmers. Under PKVY and Namami Gange programme, groups of 40 to 50 farmers having 20 hectares of land were formed and registered under Participatory Guarantee System (PGS) portal for Organic Certification. Under RKVY programme, group having 50-500-hectare land were formed to register under NPOP Organic Certification (third party). Agriculture Department and Uttarakhand Organic Commodity Board (UOCB) have made efforts through numerous initiatives in the forward linkage activities e.g. buyer seller meets, website advertising promotion activities and, attracting wholesalers interested in the supply chain for millets.

4. **Impact of Initiative:** There is a lot of potential of organic millet production (especially finger millet) as it is being practiced traditionally. Organic certification and capacity

building of farmers for organic practices under RKVY, PKVY and Namami Gange Scheme have brought major changes in the scenario. Linkages of farmers with organic buyers, Mandis and Co-operatives for marketing of their produce have provided them better prices. Efforts are being made to provide the farmers premium prices for their organic products and make them trained in the value addition of their produce. Presently a total of about 1.16 lakh hectares area is covered under organic production and certification of millets. After the Government intervention under RKVY-Organic, PKVY and Namami Gange Programme, cluster based organic farming resulted in getting bulk production of these millets and the farmers were able to sell their produce as organic in comparatively 20-30% premium prices. There is an increase of 25-30 % annually on marketing of millets. To facilitate the marketing of organic products, 430 organic outlets are being developed at main tourist places as *char dham yatra* route, railway station, airport, main religious places and market.

Field inspection of Amaranth crop under organic certification

Field inspection of Amaranth crop under organic certification programme

PROCUREMENT AND PROCESSING FOR VALUE ADDITION OF MILLETS, UTTARAKHAND

1. **Summary of the Initiative:** Under the State Millet Mission and as per the directive from the State Department of Agriculture, Uttarakhand State Co-operative Federation Ltd. (UCF)has taken a target of procuring Finger Millet (Mandua) and MT Barnyard Millet (Jhingora) in addition to setting-up and installing a Multi Grain Processing facility for primary and secondary processing of traditional small millet varieties.

2. **Situation before Initiative:** The State of Uttarakhand is mainly a hilly State, 86% of the total area of the State is mountainous. Traditional crops such as *Ramdana, Mandua, Jhingora etc.,* rich in nutrients and flavor, have been cultivated in remote villages of the State and have often failed to reach their mainstream markets. Due to the lack of any major state intervention, such crops have largely been ignored and entire farm to fork value chain remained undeveloped. Today, these crops have become very important as organic foods and super foods in food processing sector. Despite being produced in a large area of more than 1 lakh hectares, these crops have remained beyond the reach of the general consumer. Some of the main reasons responsible for these conditions are given in Figure 6.

Figure 6: *Reasons for low reach of millets to consumers*

It has been envisioned that the State Co-operative department through its various interventions shall make efforts to promote such crops both at national and international level and thereby enabling doubling of farmers' income.

3. **Nature of initiative:** The project entails setting up of Collection Centres in each of the identified millet growing clusters in the State which shall serve as the transaction points for farmers and also provide minimal infrastructure for aggregation, assaying, weighing and bagging of the agricultural produce. Cooperative Department through their Multipurpose Primary Agricultural Cooperative Societies (MPACS) aids in procurement of such crops through their farmer members. Thereafter, the produce is transported to the multigrain processing unit for further storage, processing and onward market linkages, thereby giving double benefit to the farmers.

   i. ***Supply chain development:*** To promote sustainable agriculture enterprise, the project envisions setting up a robust supply chain that provides infrastructure support, market linkages, logistics support, and ensures elimination of systematic barriers and that farmers get fair price for their produce. In case of millets there shall be buy back assurance by the way of an informal agreement where the farmers will voluntarily sell the produce to the Co-operative federation (UCF). The federation will also develop an extension team that will facilitate following quality inputs to the farmers through their Primary Input Cooperative Societies.

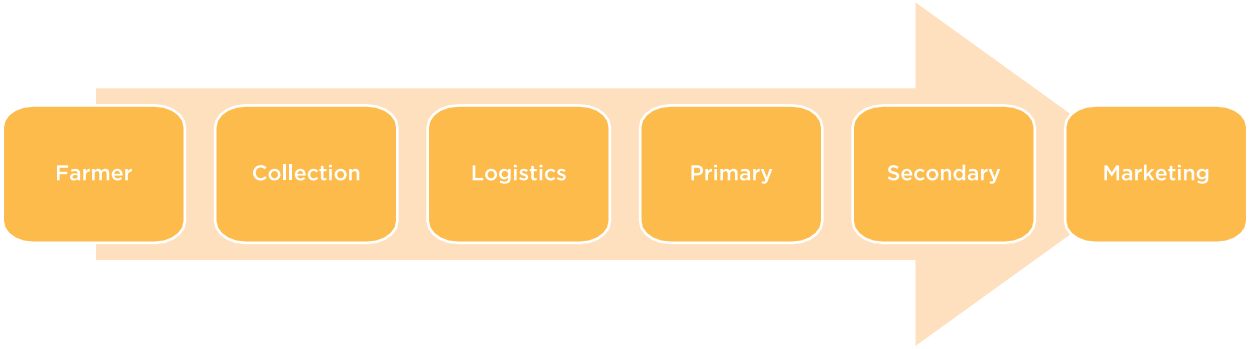


Figure 7: *Millet supply chain*

   ii. ***Purchase assurance from farmers:*** An assured buyback Scheme is proposed under the planned intervention to avoid distress due to price fluctuations. A mechanism under the administration of various MPACS would be setup whereby the potential production in each farm land can be estimated while providing input supply and extension services to each farmer. Crops thus procured shall be transported and stored at the UCF's Project site located at Haldwani (Halduchaud) District, Nainital. A multigrain processing unit is also proposed to be set-up at the site for Primary and Secondary Processing of such crops.

Figure 8 shows the procurement plan process:

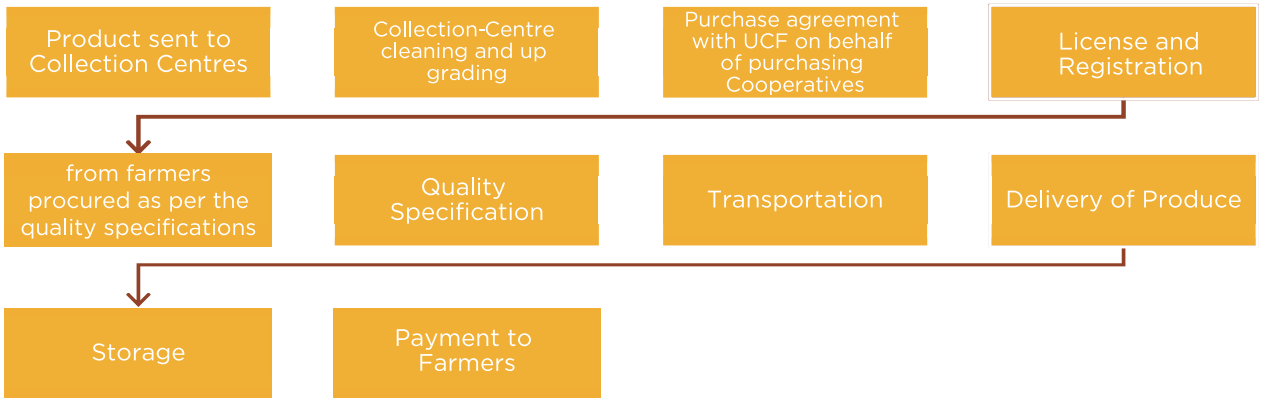


Figure 8: *Process of procurement*

iii. ***Selection of collection centres:*** Procurement plan initiated in four districts namely- Almora, Pithoragarh, Chamoli & Uttarkashi

4. **Impact of the Initiative:** Under the pilot project during 2021 UCF was able to procure a total of 131.2 MT of Finger Millets and Barnyard Millets (Table 6).

Table 6: Procurement, selling and average selling price under the project

UCF Millet Project 2020-21			
Product	**Procured Qty (qtl)**	**Sold(qtl)**	**Avg Price(Rs)**
Mandua/ Finger Millet	851.89	90.07	3,400.00
Jhingora/ Banyard Millet	460.16	195.12	4,169.18

Finger millet production in Cluster Village- Raon, Block- Hawalbagh District, Almora

INCLUSION OF MILLETS IN ICDS

INCLUSION OF MILLETS IN TAKE HOME RATION IN CHANDIGARH

1. **Summary of the initiative:** Millets (Bajra and Jowar) are an excellent source of iron, protein and carbohydrates, are rich in fiber and also constitute part of the daily intake for phosphorus and magnesium. Keeping this in mind, to improve the health of Anganwadi children, pregnant women, lactating mothers, and adolescent girls, the Women and Child Development Department has taken an initiative to promote millet (bajra and jowar) consumption by introducing them in the Take Home Ration to the beneficiaries of all 450 Anganwadi Centers under the Integrated Child Development Scheme.The Anganwadi workers are made aware of the benefits of this superfood so that they can spread the message to the beneficiaries.
2. **Situation before the initiative:** As seen from the Table 7, anemia among the population of Chandigarh is higher than the national average. Thus, it was necessary to take necessary actions to address the issue of malnutrition.

Table 7: Nutritional Status of Chandigarh against National Average

Key Indicator	Chandigarh (NFHS 4)	National Average (NFHS 4)
Stunting	28.7%	38.4%
Wasting	10.9%	20.1%
Pregnant, Anaemic Women (15-49yrs)	75.9%	50.3%
Non-pregnant, Anaemic Women (15-49yrs)	75.9%	53.1%

3. **Summary of the Initiative:** Keeping in mind the nutritive values of millets and to promote their use in daily diet, the Department of WCD, Government of Chandigarh has taken an initiative to distribute Millets i.e. Jowar and Bajra (as per the season) in the Take Home Ration from 16.12.2020. The objective is to improve nutrition value of Take Home Ration received by the beneficiaries and provide them with a healthy and balanced diet. This was done by a dedicated supply chain through various NGOs who deliver the THR at various Anganwadis in Chandigarh.

   Bajra millet was distributed from 16th December 2020 to 15th June 2021, and now Jowar millet is being distributed from 16th June 2021 onwards. Orientation Trainings about "Importance of Millets in daily life" are given to all Anganwadi Workers and Helpers for further dissemination to the beneficiaries. To spread awareness about the importance of Millets, demonstrations/lectures/talks, etc., are being conducted by experts as a part of the POSHAN Maah and POSHAN Pakhwada.
4. **Impact of the Initiative:** Millets are economical grains that are high in nutritional value and fiber content. They are also rich sources of various vitamins and minerals, and have proven health benefits upon consumption. These grains can be the potential

solution to resolve the various health issues and chronic diseases faced by the citizens of Chandigarh, U.T.

Beneficiaries receiving millets in ICDS

Campaigns and activities have ensured that the awareness among the beneficiaries about the nutritional benefits of millets and increased consumption of millets. Overall, it has ensured a suitable inclusion of millets in the daily diets of the beneficiaries.

Beneficiaries receiving millets in ICDS

INTRODUCTION OF FINGER MILLETS (RAGI) IN SUPPLEMENTARY NUTRITION PROGRAMME IN CHHATTISGARH

1. **Summary of the Initiative:** In year 2018, State Government of Chhattisgarh, under Mukhyamantri Suposhan Yojna, introduced Finger millets (ragi) in Supplementary Nutrition Program (SNP). Under Take Home Ration, ready-to-eat food packet comprising ragi, wheat, soyabean, bengal gram, sugar, groundnut and fortified soya bean oil is distributed to 6months to 6 years children, pregnant and lactating women, severely malnourished children and 11 to 14 years adolescent girls.

2. **Situation before the Initiative:** As per NFHS-4 (2015-16) data, about 37.7% children below 5years are malnourished and about 47% women in the age group of 15 to 49 years are anemic in Chhattisgarh.

3. **Nature of the Initiative:** Chhattisgarh introduced *Mukhyamantri Suposhan Yojna*, a Chief Minister's initiative Scheme for reducing malnutrition which has been a major challenge in the State. Under Mukhyamantri Suposhan Yojna, all beneficiaries are getting hot cooked meals, kodo-kutki khichdi, ragi halwa and nutrition supplements like ragi laddu, egg, fruit, dalia, laddu etc. Reimbursement for the expenditure incurred in the implementation of this Yojna is done by the District Mineral Fund (DMF), CSR and other local funds available at the district level. Some Districts have started their own initiatives under the Scheme to introduce millets in their ICDS. Some of the initiatives undertaken by the districts are highlighted below:

Millet laddu distribution to children beneficiaries as a jan andolan activity under POSHAN Abhiyaan

   i. **Kanker:** Kanker has started *Kanker Kilkari* project under this Yojna. From February 2021 ragi halwa and kodo kutki khichadi are provided to children in the age group of 6 months to 5 years, pregnant and lactating women. The budget for this is made available by the DMF fund of the district. These millets (kodo, kutki and ragi) are supplied by the Agriculture Department.

   ii. **Kondagaon:** Started kodo millets and little millets (kutki) khichadi under the Yojna in May 2021. It is provided to 2 to 6 years malnourished children. The budget for this is made available by the Tribal department and are being supplied by Women's SHGs.






Children receiving various millet dishes in anganwadi centres

iii. **Raigarh:** Introduced Ragi in 5 blocks of the district on 15th September 2021. Ragi laddu is given to 6 months to 3 years malnourished children, 3 to 6 years children and pregnant women. The budget for this is made available by CSR funds. Ragi laddu mix is supplied by women SHGs.

4. **Impact of the Initiative:** The major impact of this Yojna are as follows:

Children receiving various millet dishes in anganwadi centres

- Awareness creation related to millets, introduction of millets based recipes and motivate community to conserve and preserve the traditional millets recipes. Awareness enhancement regarding cultivation and use of millets in daily diet, which will ultimately lead to reduction of malnutrition and anemia.
- Establishing effective coordination and better convergence among the various departments concerned for millets promotion and better nutrition status.

INCLUSION OF KODO-KUTKI MILLETS THROUGH TEJASWINI RURAL WOMEN EMPOWERMENT PROGRAMME IN ICDS, MADHYA PRADESH

1. **Summary of the Initiative:** In order to enrich the diet of children and mothers, Madhya Pradesh has taken initiatives to promote millets based recipes in Anganwadi Services and POSHAN Abhiyaan. Two Districts of Dindori and Mandla are serving millets based recipes in Dindori and Mandla to 3-6 year children.

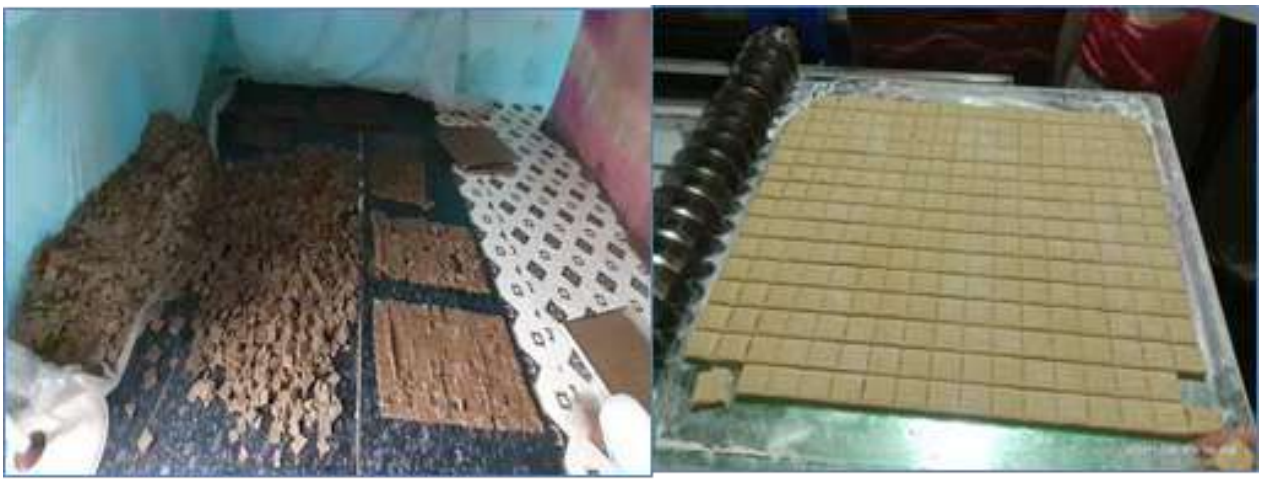
2. **Situation before the Initiative:** Kodo (Dutch Millet) and Kutki (little millet) are climate resilient hardy millets adapted to drylands as they can survive drought, need less than 90 days from sowing to harvest, and grow on poor soils. They have traditionally been growing in the semi-arid regions of Madhya Pradesh, by local tribal communities, notably, Baigas and Gonds but over years their productivity and value declined and were thus abandoned. In 2013, the Federation and Women SHG members in Mehandwani Block of Dindori district worked with Tejaswini programme staff to revive the cultivation of Kodo and Kutki as a climate resilient and nutri dense crop.

Women farmers growing kodo and kutki millets under Tejaswini Rural Women Empowerment Programme

3. **Summary of the Initiative:**

   - Two districts are Dindori and Mandla are serving millets based recipes (Kodo Namkeen and Cookies) in the breakfast to the children aged 3-6 years in 3714 Anganwadi Centres every Wednesday and Thursday since 2017.
   - Tejasvani women SHGs (a State initiative) are engaged in preparing the millet based THR (Kodo Khichdi and Makka Khichdi) to provide children aged 6 months to 3 years, pregnant women and lactating women in selected 2 projects (Karanjiya and Mehandwani) of Dindori District through newly established plant as a pilot.
   - Federation of SHGs constituted under the programme was made responsible for technical, financial and marketing support to the farmers, while the identified farmers ensured that at least 0.5 acres of their lands would be used for millet production. Each farmer contributed 20 kg of their produce to the federation post-harvest.
   - An agreement was made with the Department of WCD, Government of MP initially in Dindori district for providing nutritious kodo bars for breakfast in Aanganwadi Centres. Initially one federation began the production of kodo bars, and it has now scaled up to all 9 federations constituted under the International Fund for Agricultural Development (IFAD) assisted Tejaswini programme. Now these kodo bars are supplied to all 1913 Aanganwadi Centres for 38,043 children.

- Using the convergence of traditional culture, "Kodo-Kutki" is being promoted and production in nearly 4500 acres of land.
- To revive the traditional diet rich in essential nutrients a compendium encompassing millets based 71 recipes, has been developed by the Department and circulated to the districts and the key stakeholders.
- IEC/BCC activities are also carried out at the AWC level to increase the demand for consumption of millets at the household level.



Preparation of Kodo bars

4. **Impact of the Initiative:**

- As a result of the initiative, total production has increased from 9117 quintal (911.7MT) in 2019-20 whereas, to 16284 quintals (1628.4MT) in 2020-21 leading to food security and cash incomes for farmers.
- The profits of farmers and federation have systematically grown over the years. Net income per farmer increased fromRs.1800 in 2013 to Rs.16277 in 2020-21.
- Starting with 1497 farmers the production has grown to cover 16,289 farmers in all 9 federations of Dindori district. Seeing the advantage not only more farmers took up these millets but they also expanded the area under cultivation per farmer from 0.5 acres to 1 acre or more.
- Improved agriculture practices have helped to reduce the drudgery for Baiga women involved in millet production. This initiative showed that profitability for women can go hand in hand with better nutrition for children and revival of climate resilient crop.
- Involvement of Federation as buying agent has helped in increase in rates of Kodo and Kutki in the local market from Rs.14 to 16 in 2016-17 to Rs. 22 and 34 in 2020-21. respectively. Federation itself has evolved as a major buyer of Kodo and kutki to meet the demand of Kodo bars/cookies/sev in anganwadi centres.
- The children in Anganwadi getting access to healthy nutrition.

RAGI LADDU IN ICDS, SUNDARGARH AND KEONJHAR, ODISHA

1. **Summary of the Initiative:** The Odisha Government's project, **"Special program for promotion of millets in tribal areas"** aims to revive millets in farms and on plates considering the climate resilience of the crops and its high nutritional value. *Ragi* or finger millets has better calcium, iron, and protein than polished rice, is grown enormously in the tribal districts of Odisha. With a little innovation and some value addition, it has turned out to be a benchmark in nutrition promotion by ICDS among pre-school children.

Preparation of ragi laddu

2. **Situation before the Initiative:** Data from NFHS-4 shows that Odisha ranks in the top 10 of the most affected States of under-five year child malnutrition on all the three indicators of wasting, stunting and underweight. In terms of deprivations and marginalization, the state also has some of the highest proportion of tribals in the country

   Odisha has a tribal population of roughly 22.5% with high malnutrition outcomes.

ICDS beneficiary eating ragi laddu

3. **Nature of the Initiative:** To test the nutritional sufficiency of millets, Odisha Millet Mission's High-Power Committee decided to take up the consumption of "Ragi Laddus" on a pilot basis in 335 Anganwadis in the Sadar block of Keonjhar district of Odisha starting from July 2020. From September 2020 onwards, the pilot was replicated all over Keonjhar district as well as in the neighboring Sundargarh district. The District Mineral Fund (DMF) of the respective districts have been funding this initiative. DMF Keonjhar has reported investing nearly Rs. 1.5 crores per annum for this initiative. Ragi Laddu is given as a morning snack additionally to existing menu in Sundargarh and Keonjhar. CFTRI is working with the Odisha Government on recipes and other requests related to shelf life, nutritional profiling etc.

Ragi laddu

The objective of inclusion of millets in ICDS were:

- To increase food diversity
- Promote local consumption
- Provide additional nutrition

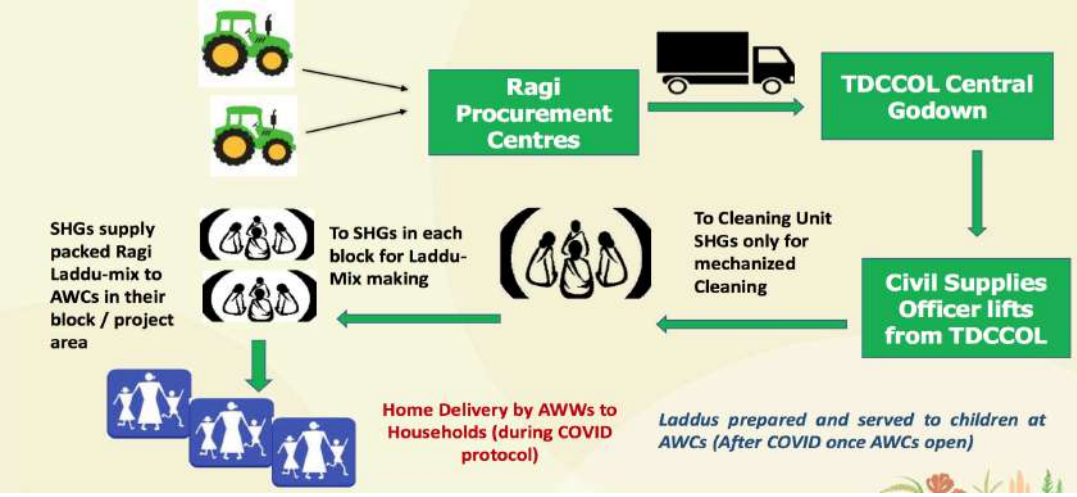


Figure 9: *Flow-Chart for Ragi Laddu Mix Supply to AWCs*

Table 8: Recipe of Ragi Laddu

Ingredients	Quantity (in gms)
Roasted Ragi flour	11.00
Roasted Sesame	1.00
Powdered Sugar	5.00
Powdered Ground nuts	1.00
Powdered Cardamom for flavour	0.04
Oil	2.00
Total	20.04
Cost of per Laddu	1.90 Rs

A Shelf life study of ragi laddu mix was done whose observations were that the laddu mix exhibited a shelf life of 168 days, after 154 days showed slightly stored flavor, at ambient conditions.

The COVID-19 lockdown and the closing of anganwadis did not deter this initiative. Instead of distributing packaged ragi laddus, the programme creatively home delivered a ragi laddu mix to efficiently distribute the sanctioned amount.

Preparation of ragi laddu by SHG women

Initially provisioned for 2 laddus per week per child, the initiative's strong acceptance by both the children and their parents combined with achieving the desired outcome in its pilot phase has led to an increase in the provisioning to 4 laddus per week per child. As of now, 21 Women Self-Help Groups (WSHGs) and 39 WSHGs in Keonjhar and Sundargarh districts respectively are engaged in preparing the Ragi Laddu Mix.

4. **Impact of Initiative:** Odisha has become the first State to introduce "Ragi Laddus" as a morning snack in ICDS. 3,257 and 3,809 Anganwadi centres in Keonjhar and Sundargarh districts respectively have been catering to nearly 1.5 lakh pre-school children through this initiative since September 2020 with the help of DMF. Total reach of the initiative is presented in Table 9.

Table 9: Reach of the Initiative

	Sundargarh	Keonjhar	Total
No of Children Covered	60,000	80,000	1.4 lakhs
No of AWCs covered	3809	3257	7066
No of SHGs engaged in supply of Laddu Mix	39	21	60

One of the reasons for the success of this initiative was that it was participatory. Recipes were finalized in consultation with mother committees, teachers, cooks and children for acceptance. A Community Acceptance Feedback Survey in Hemgir Block Sundargarh during Phase-1 was undertaken by Nabakrushna Choudhury Centre for Development Studies. The results of the survey are given below:

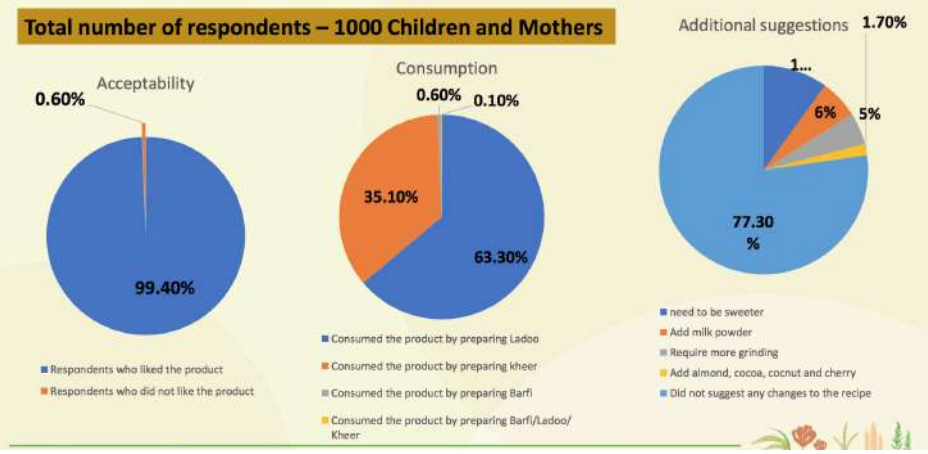


Figure 10: *Results of the Community Acceptance Survey Feedback*

Campaigns were undertaken to generate awareness in the community. Posters were designed for children in Sundargarh and Keonjhar to create awareness and interest amongst children regarding ragi consumption. Instruction Manual is provided to households on "How to use Ragi Laddu Mix"

Beneficiary receiving Ragi Laddu mix

Awareness posters Instruction manuals

Acknowledging the success of the program, the State has decided for an expansion of Ragi Laddu as a snack in ICDS in all Districts. Odisha is also considering to conduct a Pilot of Ragi Based THR as well as pilot of Little Millet Khichri as hot cooked meal in ICDS.

Beneficiaries receiving ragi based THR.

LOCAL TRADITIONAL RECIPES AS HOT COOKED MEALS AND MILLET IN COMPLEMENTARY WEANING FOOD IN ICDS, TAMIL NADU

1. **Summary of the Initiative:** The State of Tamil Nadu introduced the revolutionary nutritious meal programme to encourage children to take up education and at the same time compensate the lack of resources caused by poverty. Ragi millet is one of the main composition of its weaning food which is provided to 6 months–2 year children, pregnant women & lactating mothers .

2. **Situation before the Initiative:** Initially, standard monotonous food was given in the Supplementary Nutrition Programme of Tamil Nadu. In order to realize the goal of "Malnutrition Free Tamil Nadu" and ensure building on the principle of "Leaving no one behind" as envisaged in Sustainable Development Goals, Tamil Nadu introduced the revolutionary nutritious meal program. In order to avoid monotony, also considering the special digestive capacity of small children below the age of 6 years, after due consultation with nutrition experts, Variety Meal Program was introduced in one block of each district on 20.03.2013 on a pilot basis, and based on the positive feedback, the Scheme was extended to all Anganwadi centres in the State with effect from 15.08.2014.).

3. **Nature of the Initiative:** Complementary weaning food is given to the targeted beneficiaries as Take Home Ration under ICDS Program. Complementary Food is provided 300 days in a year, to all eligible beneficiaries. Ragi millet is one of the main compositions of its Complementary Weaning Food (Table 10). Ragi in the form of roasted powder as well as malted ragi found in the weaning food. The composition of the Complementary weaning food are as follows:

Table 10: Composition of the Complementary Weaning Food

S.No.	Raw Materials	Percentage
1	Wheat Flour	45.50
2	Malted Ragi Flour	5.00
3	Full Fat soya bean flour	10.50
4	Jaggery	27.00
5	Roasted Ragi Flour	6.00
6	Fortified Palm Oil	5.00
7	Vitamin and Mineral Premix	1.00

'Sathumavu' or Complementary Weaning Food is procured from twenty five weaning food manufacturing Women Industrial Cooperative Societies and two private manufacturers in the ratio of 65:35. At present, there are 1,450 members enrolled in the 25 Co-operative Societies. Most of the women members are widows, deserted or destitute women. These societies are managed by an elected board of members and a government official in

the cadre of Industrial Cooperative Officer who is appointed as an Executive Officer to the society.

4. **Impact of the Initiative:** Nutritious Complementary Weaning Food is currently provided to around 32,75,607 beneficiaries in Tamil Nadu to help reduce malnutrition in the State.

Sathu Mavu Pakoda

Sathu Maavu Idli

Sathu Maavu Puttu

Sathu Maavu Dosai

Sathu Maavu Cutlets

Sathu Maavu Payasam

INTRODUCTION OF MILLETS IN ICDS, TELANGANA

1. **Summary of the Initiative:** Government of Telangana initiated a strategy to 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 covers children age between 3 and 6 years, their mothers and community members and is implemented by District Administration, Vikarabad (2017-19) and Adilabad (2019-20) and with technical partner WASSAN (Watershed Support Services and Activities Network).

2. **Situation before the Initiative:** Telangana has a dryland area and millets were traditionally grown and consumed. However, over the year's area, production & consumption of millets has declined. Considering the nutritional and environmental benefits of Millets and with an objective to bring it back into the farms and plates, District Collector of Vikarabad in 2017 decided to engage mothers and children on the need to increase millet consumption through ICDS, as generational change must begin early with children.

3. **Nature of the Initiative:** 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. Serving as a platform to spread awareness about benefits of millets, children and mothers were served dishes cooked with millets at these festivals and the feedback was collected from members of the community, mothers, people representatives, Anganwadi workers, helpers and kids. After an overwhelming positive response received from all stakeholders, it was broadly agreed that millets should be served at Anganwadi meals for kids at least every alternate day of the week. Foxtail millet khichidi & Jowar upma prepared with vegetables were finalized through participatory approach and it was decided to impart training to Anganwadi workers. It was tried for 3 months and based on the experience, necessary changes were made to the program. Pilot program was taken up in 45 Anganwadi Centers in 3 Mandals of the Vikarabad District with about 1000 children where millet based meals were served 3 times a week. Current coverage in the details of millets in ICDS in Vikarabad and Adilabad are mentioned below:

Food festivals organized to finalize the Millets Menu at Vikarabad District

- District: Vikarabad
- Mandals: Doultabad, Doma, Bomraspet (3)
- AWCs: 45 (15 AWCs per mandal)
- Target Group; 3-6 Years Children
- Millets meal per week: 3 meals per week (Jowar Upma & Foxtail Kichidi)

- District: Adilabad
- Mandals: Indravelli, Narnoor, Gadiguda(3)
- AWCs: 45 (15 AWCs per mandal)
- Target Group; 3-6 Years Children
- Millets meal per week: 3 meals per week (Jowar Upma & Foxtail Kichidi)

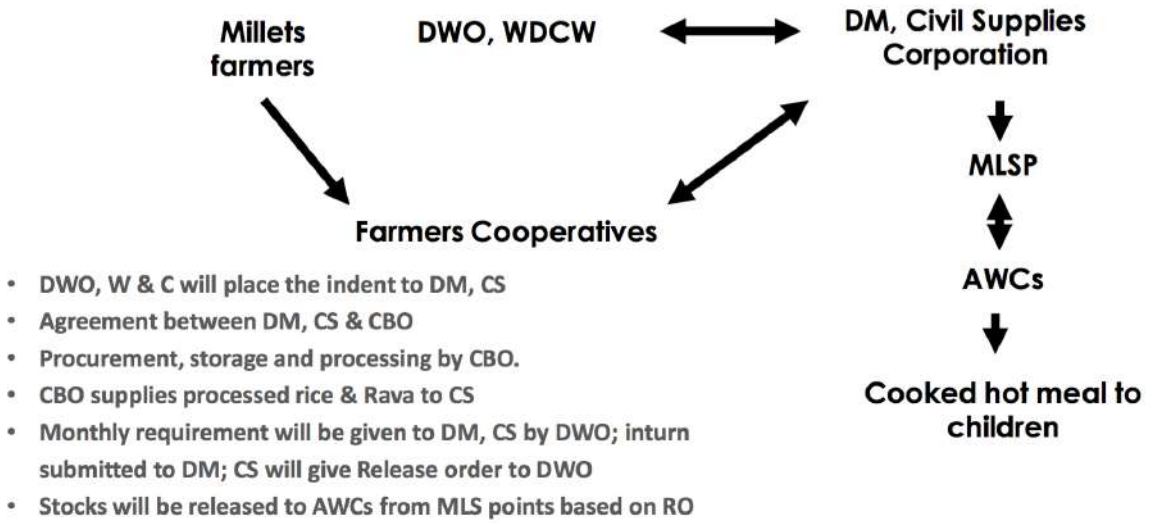


Figure 11: *Schematic Flow of Supply chain of Foxtail Millet Rice and Jowar Rava Supply to AWC*

4. **Impact of the Initiative:** Introduction of Millets in SNP has helped in establishing the market ecosystem, engagement with food cultures as well as large-scale engagement with women on millet food, their nutrition value and recipes. It has successfully enabled to get children used to millet based food much earlier and thereby has invested on re-generation of millet before food cultures.

Children consuming millet khichdi at anganwadi centres-Vikarabad District

Introduction of millets in ICDS has created a bulk demand by assuring procurement at scale and thereby stabilizing the market for millets. It has helped developing an ecosystem for millets by comprehensively focusing on production, trade, processing and so on. It has also helped in setting up of rural small industries for women SHGs/ entrepreneurs. Overall, it has placed a public system for millets.

GIRI POSHANA OR NUTRI-FOOD BASKET (NFB): NUTRITIONAL INTERVENTIONS TO IMPROVE DIETARY DIVERSIFICATION IN THE TRIBAL HOUSEHOLDS OF TELANGANA

1. **Summary of the initiative:** *Giri Poshana* (scale up of Nutri-Food basket project) is an innovative approach to improve nutrition among tribal population in the Integrated Tribal Development Agency (ITDA) areas of **Utnoor, Bhadrachalam and Eturnagaram**, Telangana. Under this initiative, food products that supplement existing diets are provided to improve the dietary diversity and nutritional outcomes (stunting, wasting, underweight & anemia)

2. **Situation before initiative:** Prevalence of malnutrition is reportedly high in tribal communities consuming undiversified diet. The health status of Asifabad district (ITDA Utnoor), Bhadradri Kothagudem district (ITDA Bhadrachalam) and Jayashankar Bhupalpally district (ITDA Eturnagaram) from NFHS-5 is presented in the Table 11.

Table 11: Nutritional status of Asifabad, Bhadradri Kothagudem and Jayashankar Bhupalpally districts

Indicators (%)	Komaram Bheem Asifabad district (%)	Bhadradri Kothagudem district (%)	Jayashankar Bhupalpally district (%)
Children under 5 years who are underweight	41.1	25.3	36.7
Children under 5 years who are stunted	38.1	28.4	32.5
Children under 5 years who are wasted	35.7	21.8	31.8
Children (6-59 months) who are anemic	70.7	69.3	67.9
Women (15-49 years) who are anemic	67.3	68.7	65.9

3. **Nature of initiative:** Government of Telangana through the Commissioner of Health and Family Welfare, National Health Mission, Department of Women and Child Welfare; Tribal Welfare Department (donor), Integrated Child Development Services, Integrated Tribal Development Agency, start-up companies (incubated at ICRISAT) for manufacturing of food products, started this initiative, with the technical guidance and support by ICRISAT. It targets a total of 13,098 beneficiaries comprising children, adolescent girls, pregnant women and lactating mothers. Four food formulations using locally available ingredients (sorghum, millets and pulses) have been developed and designed, suiting the taste preference of the beneficiaries, to deliver adequate amounts of energy, protein,

Food basket of sorghum and millet

fat and micronutrients when consumed. Following are the six food products that were customized based on taste and preferences of the tribal population:

i. Jowar meal (sorghum, Bengal gram, groundnut, spices and condiments)

ii. Multigrain meal (sorghum, green gram, foxtail millet, spices and condiments)

iii. Multigrain sweet meal (sorghum, wheat, jaggery, sugar, raisins, almonds and cardamom)

iv. Nutri-cookies (sorghum, finger millet, barley, soya, vegetable fat, sugar, custard powder, cinnamon and raising agent)

v. Energy bar (groundnut, jaggery, sesame, sugar and liquid glucose)

vi. Jowar bytes (sorghum, maize, rice, soya, oil, seasoning mix)

These foods were processed to enhance digestibility of carbohydrate/proteins and ensure enhanced bioavailability of micronutrients. These were provided as a combination of two products per day (breakfast and evening snack) and six days per week for one year. The products provided a good percentage of the Recommended Dietary Allowance of key nutrients like iron, calcium, energy, fat and protein. Nutritional awareness campaigns/ training programs were conducted as part of the project to sensitize anganwadi workers on nutrition, health and hygiene. During the COVID-19-imposed lockdown, all the Ready to Cook (RTC) food products were replaced by Ready to Eat (RTE) food products so that the beneficiaries could easily consume them at home without the need for much cooking. The impact of the intervention has been assessed through baseline, midline and endline studies which involved collection of household data, anthropometry data (height, weight, mid-upper arm circumference (MUAC), hemoglobin using non-invasive device etc.).

4. **Impact of the Initiative:**

- There has been a significant increase in the consumption of millets in the target population groups in their daily diet in addition to supplementary nutrition.
- Nutritional awareness among beneficiaries and anganwadi workers
- The program could achieve a renewal in millet cultivation to the extent of 4401 acres in the target districts.
- One SHG group in Kumaram Bheem Asifabad district has started processing and packaging millets under their own brand.
- Establishment of eight food processing units in ITDA areas managed by tribal women-led Joint Liability Groups (JLGs)
- Capacity building of 80 tribal women to be 'Nutrition Entrepreneurs'. Employment opportunities to local women and youth.
- Baseline and endline surveys suggested that there was an overall improvement in the nutritional status of the target beneficiaries. Among the 3-6 year olds, the *Giri Poshana* initiative recorded 16% decrease in wasting, 39% reduction in stunting, 37% in underweight and 41% decrease in anemia. Shift in severely/moderately anemic population to mildly anemic/normal population has been observed in pregnant and lactating women.

With the success of Phase 1 and Phase 2 interventions in improving dietary diversity and nutritional outcomes, the Department of Tribal Welfare, Government of Telangana, and ICRISAT have now planned to scale up the intervention to cover additional populations, to provide nutritional support to 16,000 PVTG members in the ITDA areas of Utnoor, Bhadrachalam and Mannanur. The food products are being designed with local crops – sorghum, millets and to improve the dietary diversity and thus overall nutritional status. The food products will be manufactured in the local food processing units led by women's Joint Liability Groups (JLGs).

DECENTRALIZED INCLUSION OF MILLET BASED RECIPES AS HOT COOKED MEALS THROUGH ICDS SCHEME IN ASPIRATIONAL DISTRICTS OF TELANGANA (KB ASIFABAD, B KOTAGUDEM, JS BHUPALAPALLY/ MULUGU DISTRICTS) WITH THE SUPPORT OF NITI AAYOG

1. **Summary of the Initiative:** NITI Aayog funded a very comprehensive program for decentralized inclusion of millets where millets based hot cooked meals were provided in the ICDS of Aspirational Districts. Implementation started from September 2020 onwards. This program was unique because as FCI was unable to supply millets from the Food and Civil Supplies Department, thus the District devised a more decentralized model.

2. **Situation before the Initiative:** Sorghum (Jowar) used to be the staple diet of people of Telangana. During the past few decades, the consumption of Jowar has declined. One of the key concerns that emerged during the discussion with NITI Aayog was that millets are sourced from the FCI. If millets can be procured directly from farmers and processed locally, it would not only benefit the farmers financially but also diversify the production systems of Telangana. As this had never been done before, there was a need to establish the proof of concept to allay the concerns related to quality management, storage and processing related issues. Thus, the WD&CW Department proposed to NITI Aayog to pilot a decentralized production, processing and procurement initiative in 3 Aspirational districts of Telangana, in collaboration with WASSAN, and Working Group on Millets of the Revitalising Rainfed Agriculture Network Network.

3. **Summary of the Initiative:** In the decentralized model, locally produced millets were procured and processed through the local SHGs/FPOs and supplied to the Anganwadis to serve children and pregnant mothers. Farmers were linked with FPOs and procurement was done by SHGs.

   The process included the following components:

   - Millet recipes were developed locally in a participatory manner through engagement of Mothers' committees, elders, children, teachers & cook.
   - Capacity Building of AWCs on millets recipes preparation & nutritional values.
   - Encouraging local farmers to grow millets for household consumption and surplus can be sold to market / Government procurement, if any.
   - Creating and strengthening the processing facilities and building the skills and capacities of entrepreneurs'
   - Linking the produce of farmers / FPOs to processing facilities or Government procurement
   - Survey form (Google form) was circulated to district teams and organised online training to them to upload the information farmers who wanted to enroll their names for cultivation. In total 2,372 Households enrolled their names for 8 different type

millets production in 3,818 acres in 5 mandals of Jayashankar Bhupalpally district; 1748 farmer's households enrolled their names for 7 different type millets production in 1314 acres in production mandals in Bhadradri Kothagudem and 2,385 households enrolled their names for 8 different type millets production in 1630 acres infour Mandals in Asifabad district for Kharif, 2021.

- Processing was also decentralized and the district tried to buy small machines like de hullers etc worth Rs. 4500.

Mini De-hulling machine

- WASSAN was responsible to find different sources of the millet seed. A quantity of 3939 kgs of 10 types of millet were ordered for the distribution in Jayashankar Bhupalpally district. Details of the seed distribution in Jayashankar Bhupalpally and Bhadradri Kothagudem is given in Table 12.

Table 12: Details of the seed distribution

District Name	No. of Mandals	Villages	No. of Acres	No. of Households
KB Asifabad	3	54	970	2443
Jayashankar Bhupalpally	5	58	1454	1365
Bhadradri Kothagudem	2	57	1852	2139

Beneficiaries were provided with hot cooked millet meals twice per week. The total 3545 anganwadi centres were covered under the project with a total of 94,368 beneficiaries.

Glimpses of seed distribution

Glimpses of seed distribution

Training organized to Anganwadi functionaries

Glimpses of jan andolan activities for distribution of various millets dishes to beneficiaries

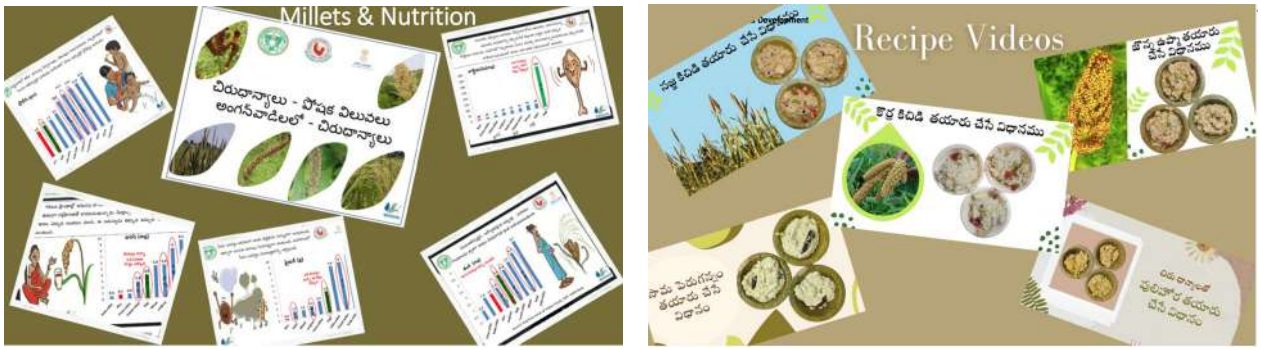
4. **Impact of the Initiative:** The continuous awareness programs on benefits of cultivation and consumption of millets to the farmers has resulted in bringing millets back in around 1000 acres of project area after 15-20 years. Some of the reasons why the project was unique, given below:

   - Focus on decentralization, location specific, local production and placed major role for FPOs. As it was decentralized it needs less storage requirements
   - Focused on rural industrialization & jobs

   Overall impact created in the project area is:

   - Increasing interest in cultivation of millets with more farmers are demanding for supply of Millet seeds in Rabi season so that they can grow millets for their self-consumption and supply to local millet processing organizations.

Millets Recipe posters



Awareness videos on millets importance and millets recipes

- Food festivals and continuous persuasion and monitoring due by AWWs and SHGs led to awareness on the nutritive value and importance of millets in the communities. 80% of beneficiaries and their households are consuming Millets in at least one meal outside the Supplementary ICDS meal in Asifabad.
- Demand for Millets has increased and villagers are willing to pay. Kirana shop dealers are selling on an average 5-6 kg/day of millets to local villagers.
- Millets have started as an economic activity. An SHG group in Asifabad, has started processing and packaging Millets under their brand to cater to increasing demand for millets in Asifabad.

RESEARCH & DEVELOPMENT AND USE OF TECHNOLOGY FOR INNOVATIVE PRACTICES

CASE STUDY ON SORGHUM IN RICE FALLOWS BY ICAR-IIMR

1. **Summary of the Initiative:** ICAR-IIMR has developed a standardized package of practice for sorghum cultivation in rice fallow under zero tillage by repeated field trials, creating awareness among the farmers, conducting field day and large-scale demonstration.

2. **Situation before Initiative:** Rice fallows basically imply to those lowland kharif sown rice areas which remain uncropped during rabi (winter) due to various reasons such as lack of irrigation, cultivation of long-duration varieties of rice, early withdrawal of monsoon rains, water logging, lack of appropriate varieties of winter crops for late planting, and socio-economic problems. The coastal region of Andhra Pradesh, Karnataka and Tamil Nadu form an important rice fallow ecology in peninsular area. In order to meet domestic demands of food, feed and fodder, there is huge scope to promote sorghum in such unconventional areas. Therefore, improved sorghum varieties or hybrids can be a best candidate for rice fallow cultivation. The study was undertaken at Guntur district in Coastal Andhra Pradesh in rice fallow under zero tillage condition. The rice fallows offer good scope for area expansion of this crop and crop intensification. Their productive utilization can overcome many social and economic problems like, unemployment, labour migration and low income.

3. **Nature of Initiative:** Field experiments were conducted at eight villages namely, Ananthavaram, Kondur, Kuchalapadu, Nallapadu, Sripuram, Nandivellugu, Sagupalem and Athrota in Guntur district in Andhra Pradesh, during three winter seasons of 2008-09, 2009-10 and 2010-11. After the harvest of late-kharif transplanted rice, the sorghum cultivars were sown in December under zero-tillage to utilize the residual soil moisture. The sowing done manually and weed control was done effectively. Total thirteen sorghum cultivars[11] were evaluated in rice-fallows under zero-tillage in farmer's fields. Further total 21 field day programmes including farmers' rally on sorghum cultivation in rice fallows were organized and several farmers' day were organized by the ICAR-Indian Institute of Millets Research (IIMR).

4. **Impact of Initiative:** Results of the experiment trials conducted during three years (2008-11) show that, CSH 16 gave higher grain yield (7.95 MT/hectare) compares to all 17 public and private sorghum hybrids evaluated and also higher than local check 'Mahalaxmi 296' (6.54MT/hectare). It was realized that the kharif hybrids with medium height up to 2 m and high grain yield potential were suitable for this area and much preferred by the farmers. Keeping in view of increasing popularity of sorghum cultivation in rice fallows in Guntur district in Andhra Pradesh, field demonstrations of promising sorghum hybrid CSH 16 were organized on large scale to popularize the cultivar. Results of 126 frontline demonstrations (FLDs) organized during 2011-12 revealed that CSH 16 (8.62 MT/hectare) yielded significantly better than the locally popular hybrid Mahalaxmi 296 (6.06MT/hectare). Sorghum hybrids with a shorter stature were found to be more suitable under intensive cultivation practices by farmers in rice fallows, whereas taller cultivars were

11 *viz.,* 'CSH 16', 'C 43', 'Laxmi', 'M35-1', 'CSV 216R', 'MGSH 55', 'MRS 4094', 'SPH 1148', 'SPH 1149', 'CSV 22R', 'MJ 4334', 'Sudama 333', 'CSH 15R'

prone to lodging. Demonstration undertaken under zero tillage condition, sorghum hybrid CSH 16 yields (7.73 MT/hectare) significantly higher than the popular hybrid Mahalaxmi 296 (6.64 MT/hectare) and generated 77% higher net returns (Rs.55,361/- per hectare) than normal cultivation practices. Further, a package of practices was standardized for sorghum cultivation under rice fallows and seeds of CSH16 and CSH 14 hybrids were channelized through local agro centers for wide dissemination. These results pave the path to introduce summer sorghum in rice fallows in Tamil Nadu State.

Sorghum in rice fallows, field view of CSH 16 in rice fallows in Guntur district—Andhra Pradesh

NUTRIHUB-TECHNOLOGY BUSINESS INCUBATOR (TBI) HOSTED BY ICAR-IIMR

1. **Summary of the Initiative:** 'Nutrihub' is the Department of Science & Technology (DST), Government of India supported Technology Business Incubator hosted by the Indian Institute of Millet Research, ICAR – IIMR, Hyderabad. It is a unique and first of its kind initiative to cater start-ups in the Nutri-Cereals sector in the country. Encouraging the budding entrepreneurs to promote the growth of Nutri Cereals (Millets), the Climate Resilient Future Crops.

2. **Situation before Initiative:** Recent studies show that growth in agriculture remains 2–3 times more effective at reducing poverty than growth in other sectors and that India's million small and medium farm holding farmers play a key role in delivering this growth. It is therefore logical to look at ways to stimulate entrepreneurship in the critical sector like millet processing and value addition as most of the millet growers are small and marginal farmers. Incubators play an important role in developing the technology and value chains that let small agricultural businesses thrive.

3. **Nature of Initiative:** Nutrihub is a focal point where ideas, entrepreneurs, agriprenuers, start-ups, experts, the academic and the funding agencies shall gravitate towards creation of a new knowledge-based economy. ICAR-IIMR through its TBI is contributing to the success of the National Innovation system, by providing the right ecosystem for nurturing innovation, technical skills and entrepreneurial talents of thousands of millet stakeholders. The incubator is well connected with transport and communication system horizontal dissemination of millet promotion and commercialization across the country. The broad objective of Nutrihub is to promote knowledge and innovation driven millet based enterprises and to address the much needed requirements of business incubation to convert the agriculture technologies into attractive commercial propositions. It provides a congenial situation for potential entrepreneurs and graduating startups and to transfer knowledge and innovations into creation of successful entrepreneurs in millet processing, value addition and commercialization. It also creates an environment that will foster the entrepreneurial spirit among women and youth through consultancy, research, training, promotion and incubation in high-tech technologies or ideas thereby promoting innovation and knowledge-based entrepreneurship in processing and value addition of millets leading to the self-employment, creation of wealth and social values.

4. **Impact of Initiative:** Nutrihub -TBI has provided grant in aid to 40 startups in the past 2 years up to Rs. 3.4 crores through Rashtriya Krishi Vikas Yojana. It carries out an incubation program to help millet-based startups grow in a streamlined fashion by providing them the required technology and business support system. The incubatees are provided with mentoring support, R & D infrastructure, alongside networking and access to seed funds. Till date more than 185 startups have been incubated, more than 260 have products supported, about more than 60 products are available for commercialization, and more than 170 number of technologies have been transferred to entrepreneurs and industries. Thus, a pipeline of entrepreneurs has been built to establish last mile connectivity with the ultimate consumer in creating demand across the country.

INNOVATIVE APPROACH TO MAINSTREAM SWEET SORGHUM AS A SOURCE OF ETHANOL PRODUCTION BY ICRISAT AND IIMR

1. **Summary of the Initiative:** An innovative project to mainstream sweet sorghum as a source of ethanol production by ICRISAT and ICAR-IIMR, and the results paving the way to create an alternative eco-friendly fuel source from 2014.

2. **Situation before Initiative:** Government of India has launched a road map for blending ethanol with petrol 20% by the year 2025 from current blending of 8.5% to cut pollution and reduce import dependence of petrol. In this connection ethanol extracted from sugarcane as well as damaged food grains such as wheat and broken rice and agriculture waste is less polluting and its use also provides farmers with an alternate source of income. Thus, besides helping the environment, the focus on ethanol is also leaving a positive impact on the lives of farmers. There is not enough ethanol available in the country to meet the blending targets and this necessitates large-scale production of fuel-grade ethanol. Sweet sorghum is one of the most suitable crops for ethanol production and the National Policy of Biofuels, has identified sweet sorghum as an alternative feedstock for ethanol production in India.

3. **Nature of Initiative:** ICRISAT, along with ICAR-IIMR, has been piloting on the development of a sweet sorghum ethanol value chain over the past several years. As a result, sweet sorghum is now an established biofuel feedstock in India. With an aim to bring sweet sorghum back into mainstream biofuel production, and commercialization of sweet sorghum as a complimentary feedstock for ethanol production, seven sugar mills of Maharashtra, Tamil Nadu and Gujarat, have been associated with the initiative which was funded by the Government of India. Big Mill Test has been successfully conducted at Shri Ganesh Sugar Factory, Vataria, Gujarat, without changing any of the mill settings. The sweet juice was fermented, and the ethanol produced was supplied to oil market companies for blending with petrol. Innovative ways of composting using sweet sorghum bagasse was developed as part of the project. Owner of sugar mills, seed producers as well as sweet sorghum farmers have shown interest and were trained in achieving higher yields and in conducting multi location trials.

4. **Impact of Initiative:** Extracting ethanol from sweet sorghum is a promising target for biofuel production. It is a C4 crop with low input requirements and accumulates high levels of sugars in its stalks. Ethanol procurement has risen from 38 crore litres to 320 crore litres from 2014 to 2020 and further, oil companies spent Rs. 21,000 crore on ethanol procurement. In this project sweet sorghum hybrids such as ICSSH 28, CSH 22 SSS, Phule Vasundhara have been identified as suitable for ethanol production in various seasons. This further helps breeders in developing new varieties or hybrids with high recovery of ethanol. The best practice for achieving higher ethanol yields is being perfected at the Indian Institute of Millets Research (IIMR), Hyderabad. Further, developing new varieties and hybrids, validating the results in other sorghum cultivating States, evaluation of fermentation efficiency of sweet sorghum juice from various genotypes, and computation of fertilizer value of stillage from juice is underway. This initiative shows sweet sorghum could be a potential candidate to achieve 20% blending of ethanol with petrol.

INDIAN INSTITUTE OF FOOD PROCESSING TECHNOLOGY (IIFPT) MILLET MISSION

1. **Summary of the Initiative:** IIFPT is conducting research and development, capacity building skill development programs, technology transfer and consultancy services for budding entrepreneurs, existing industrialists, farmers, SHGs, students and research scholars in all aspects of millet processing, preservation and value addition.

2. **Situation before Initiative:** Millets play an important role in food security and economy of many countries in Africa and Asia. They are gaining prominence in Europe and North America due to their gluten-free and hypoglycemic properties. Low priority for research in millet is observed leading to lack of improved methods for production and technology or lack of improved cultivars or high yielding varieties or cultivars. Appropriate technologies are not available for the post- harvest processing of millets. The drudgery in post-harvest operations such as harvesting, threshing and dehulling by non-availability of appropriate technologies is a major constraint for millet processing in bulk or increase in consumption.

3. **Nature of Initiative:** IIFPT has developed few innovative millet-based products and few technologies for the benefit of consumers and millet farmers as well.

Millets based Products:

- **Functional millet biscuit:** Innovative technique to incorporate omrega-3 fatty acids in biscuit. Incorporated 100% ragi flour, completely replaced the wheat. In these biscuits almonds were added to enrich the protein content which makes biscuits healthier, with all minerals, fiber and omega-3 fatty acids.

Millet Biscuit

- **Non-dairy Millet Ice-cream**: Farm fresh nutrient rich, which is naturally loaded with millet as the main ingredient without additive. The milk extracted from millet is similar to dairy milk in its gross nutritional composition in addition to zinc, iron and dietary fiber. The millet milk is also cheaper than the cow's milk, all the while matching its nutrition.

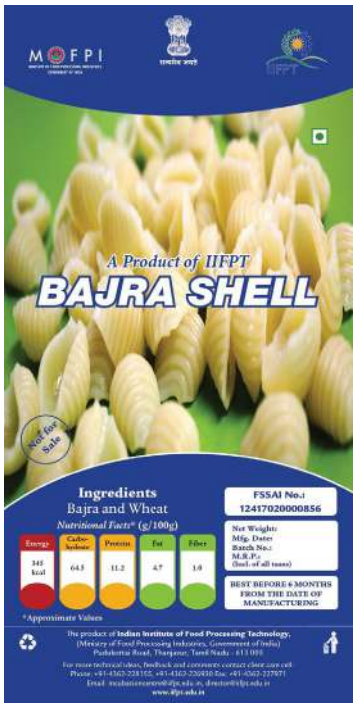
Millet ice cream

- **Instant idli / dosa mix:** Study was taken up to develop idli and dosa dry mix formulations substituting rice for small millets. Generally, composite millet flour mixes are being used. As millets vary in their nutritional profile individual, individual millet idli/dosa mix were formulated like– Finger millet (Ragi) Idli/ Dosa Mix, Foxtail millet (Thinai) Idli/ Dosa Mix, Little millet (Samai) Idli/ Dosa Mix, Barnyard millet (Kuthiraivali) Idli/ Dosa Mix and Kodo millet (varagu) Idli/ Dosa Mix.

Millet idli

- **Millet Pasta:** Millet pasta was developed with the different varieties of millets like pearl millet, finger millet, proso millet, kodo millet, foxtail millet, little millet, barnyard millet. All the developed pasta varieties are rich sources

of dietary fibers, phytochemicals, and micro-nutrients and are more nutritious than wheat and rice.



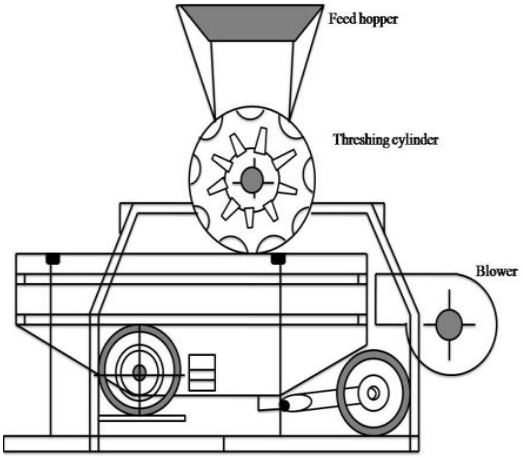
Millet pasta

- **Edible Film** has been developed by IIFPT from composite millet with multi nutrients. It is a thin layer of material that can be eaten by the consumer as part of the whole food product. The edible film has wider application as a food wrapper for instant tea bag, soup bag, pie pastry and ravioli. It can be used as a convenient food and snack bite and processed by steaming and baking and also be used as functional ingredients for the preparation of stalk, broth and soup.

Edible Film composite millet with multi nutrients

Technology:

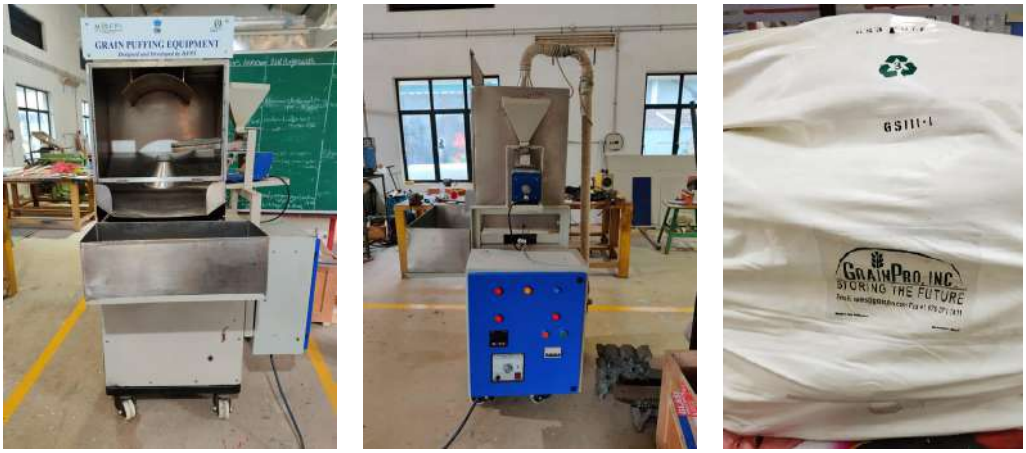
- **Solar Energy Assisted on-farm Thesher cum winnower:** Millet grains harvested during the rainy season are left to dry in the field for up to two weeks. Direct sun drying requires a large open space area, and is dependent on the availability of sunshine, susceptible to contamination with foreign materials such as dusts, litters and are exposed to birds, insects and rodents. Information on the drying of millet is meager. Mechanical drying is expensive, and therefore, must only be



Solar Energy Assisted on-farm Thesher cum winnower

recommended where returns are economical. Solar energy assisted on farm thesher cum winnower can be used.

- **Millet Puffing Machine** which can be used to puff Millets like Finger millet (Ragi), Foxtail Millet (Thinai) and Sorghum has been developed which has capacity of approximately 3 kg of raw grains per hour. The main components of the machine are Vibrating Feed hopper, heating chamber and air blower and collection unit. A notable advantage of this machine is increased efficiency in air heating and electrical power required by the blower to heat the air is decreased. Also, another important advantage of the machine is that it uses air instead of sand as the heating medium and as a result, impurities generated by the sand are neglected. This produces good quality and hygienic puffed millets for consumption.



Millet puffing machine

- **Hermetic storage of millets:** Hermetic safe storage of finger millet and sorghum has been developed. The remarkable advantage of this system over conventional storage practice is promising eco-friendly storage and increased shelf life without compromising the quality; thus helps to give wholesome quality foods for the human consumption

4. **Impact of Initiative:** More than 120 skill development trainings were conducted and 900 trainees were benefitted through these for the last 5 years. A total of 20 successful entrepreneurs in millet value addition have been produced by IIFPT Food Processing Business Incubation Center. The training modules for the ODOP on millet pasta, millet malt and ready-to-eat snack products were prepared under the new centrally sponsored PM-Formalization of Micro Food Processing Enterprises (FME) Scheme. A total of 2,76,369 beneficiaries have visited IIFPT website from June, 2020. IIFPT has submitted draft Interim report on strategy for millets at 2023 under MoFPI-PLI Scheme on May, 2021. The developed functional food products, gadgets and storage solutions were exhibited in International Trade Fair on Organics and Millets at Bengaluru in 2018 and World Food Day event at Delhi, "Olirum Uzhavu"- a Two Day Progressive Agriculture Conference and Exhibition during June, 2019 at Salem, Tamil Nadu.

   The products in the pipeline are as follows: millet curd; millet milk powder; millet starch; millet edible film; millet nutri bar and millet savories. The developed technologies were transferred and commercialized industries like Boinpallys Agro Food Products Pvt. Ltd, Hyderabad, Lantern Foods, Coimbatore, Halo Cap Millet Hub, Trichy, IdVisu, Kerala etc

NUTRIPLUS KNOWLEDGE PROGRAM OF AGRIBUSINESS INNOVATION PLATFORM

1. **Summary of the initiative:** The NutriPlus Knowledge (NPK) Program of Agribusiness Innovation Platform (AIP), ICRISAT, promotes growth in the agri-food sector, through value addition and post-harvest management through innovative processing and product development techniques, thereby enabling the achievement of ICRISAT's vision of a prosperous, food-secure and resilient dryland tropics.

2. **Situation Before Initiative:** Dryland cereals like chickpea, common bean, cowpea, faba bean, groundnut, lentil, pigeon pea, soybean, barley, pearl millet, small millet and sorghum are nutritious, gluten-free, diabetic-friendly and a rich source of antioxidants. However, commercialization of these cereals is low due to lack- of the knowledge and R&D on use of dryland cereals in processing and product formulation; understanding of nutritional and functional properties; validation on content and claims of products using dryland cereals; and support to SMEs and market linkages for the farmers.Thus, primary processing and value addition to these dryland crops is the most appropriate intervention to improve livelihood of smallholder farmers, improve nutritional security in the drylands and generate employment in the drylands. Hence there is a need for an ecosystem to create market demand for dryland cereals.

3. **Nature of Initiative**

- **Development of new millet-based recipes:** The NPK program of AIP has undertaken product development activities based on understanding of nutritional and functional traits of the crops. Following are the categories of millet-based food products technologies developed at NPK laboratory:

  i. **Millet based Ready-to-Cook breakfast mixes:** Jowar meal, multigrain meal, multigrain sweet meal, millet porridge mix etc.

  ii. **Breakfast cereal:** Smart breakfast with millet flakes

  iii. **Ready-to-eat products:** millet energy bar, extruded snacks such as jowar bytes and finger millet crispies

  iv. **Cookies:** Sorghum cookies, finger millet cookies, multigrain cookies

  v. **Energy-Dense foods**

Women members preparing millet dishes

- Value-added products and technologies based on ICRISAT's mandate crops (sorghum, pearl millet, finger millet, pigeonpea, chickpea and groundnut) which have been successfully transferred to entrepreneurs and commercialized through innovative business models by the Agri-Business Incubator (ABI) and Innovations

and Partnership (INP) programs of AIP.

- Development of sorghum- and millet-based 'high-moisture meat analogs' using twin-screw extruder
- Training and capacity building in the areas of millet-based food product development, food processing, value addition, food safety management systems, nutrition, quality and hygiene, establishment of food-testing laboratories
- Client services for development of millet-based business enterprise
- Product development laboratory with capacity for formulation development and shelf-life studies
- Analytical laboratory with expertise in grain nutritional profiling, shelf- life studies and rancidity, microbiological analysis, nutritional profiling of final food products, in vitro starch digestibility studies, validation of health claims etc.
- Consultancy services for the agri-food industry

4. **Impact of Initiative:**

- Millet-based products developed and validated on content and claims of products. Developed and commercialized 20 millet-based product technologies.
- The food products developed by NPK have been introduced in various Government Schemes and helped improve the nutritional status and dietary diversity, and reduce malnutrition.
- Products successfully commercialized through support to SMEs.
- An ecosystem to generate market demand for dryland cereals established and implemented.
- Primary and secondary processing units established in the rural areas for manufacturing of millet-based food products.
- Low-rancidity pearl millet lines for development of shelf-stable pearl millet products identified.
- Nutritional and functional properties of sorghum and millets evaluated.

DEVELOPMENT AND DISSEMINATION OF DIVERSE BREEDING LINES TO ENHANCE CULTIVAR DIVERSITY OF PEARL MILLET THROUGH PUBLIC-PRIVATE PARTNERSHIP

1. **Summary of the Initiative:** ICRISAT, a public institution, has developed improved varieties and diverse hybrid parents of its mandate crops. It initiated the formation of Pearl Millet Hybrid Parents Research Consortium (PMHPRC) during 2000 with the involvement of both public and private sector institutions to share the improved germplasm.

2. **Situation before Initiative:** Till 1980s, pearl millet genetic improvement was dominated by public sector research. During this period, private companies also began to develop high-yielding pearl millet hybrids across India. Till 1999, private companies developed about 70 hybrids of pearl millet, of which 60 hybrids were developed by using the parental lines supplied by ICRISAT through informal collaboration. These hybrids have contributed significantly to enhancing genetic diversity, productivity and yield stability, and thereby impacted the lives of poor dryland farmers in the country. Having recognized the importance of both public sector institutions and private seed companies, the partnership between ICRISAT, public sector institutions and the private seed sector was strengthened with the formation of a Pearl Millet Hybrid Parents' Research Consortium (PMHPRC) in 2000 with the basic objective of increasing farmers' accessibility to better hybrids through effective public-private partnerships


Activities under ICRISAT's Pearl Millet Hybrid Parents

3. **Nature of initiative:** ICRISAT's Hybrid Parents Research Consortium partners with public sector institutions and private sector seed companies in India and abroad, to deliver improved hybrids and varieties to poor farmers. As a group, the consortium members represent a platform with large human resource with expertise in diverse areas such as parental lines breeding, hybrid development, hybrid testing (both on-farm and farmer-participatory), seed production and hybrid seed marketing through which ICRISAT-bred materials find a very fast delivery vehicle to reach farmers, which leads to rapid adoption of diverse range of hybrids on farm.

Some of the activities undertaken are following:

- Evaluating breeding materials for various traits and adaptation at targeted sites
- Screening and developing flowering period heat-tolerant and drought-tolerant breeding materials.
- Identifying high green biomass breeding lines, germplasm and cultivars.
- Evaluating promising pipeline hybrids across agro-ecological zones.
- Providing services to screen private sector lines and hybrids.
- Providing specialized training in breeding, entomology, pathology and molecular marker technology.
- Supporting nucleus seed supply.
- Facilitating networking of partners.
-

4. Impact of initiative

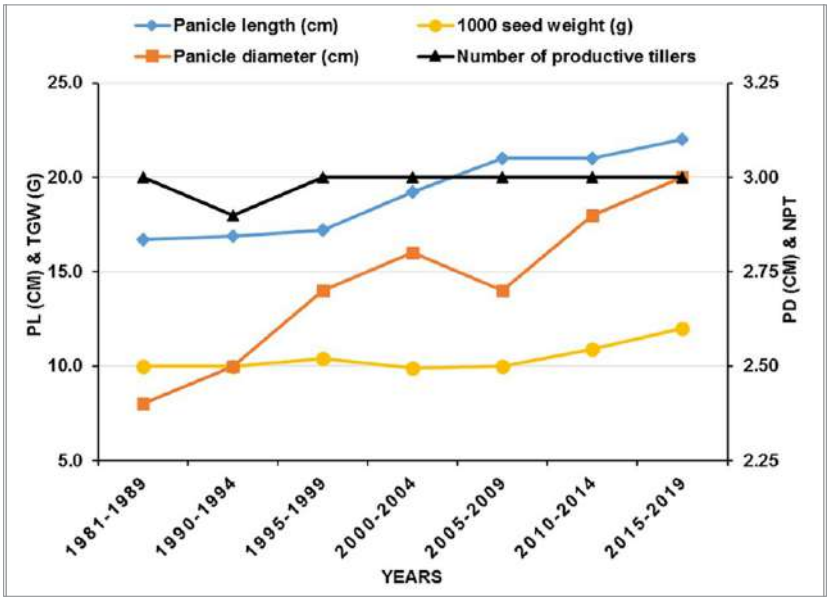


Figure 12: *Comparison of different traits in seed parents (A/B lines) developed between 1981 and 2019 at ICRISAT, Patancheru (PL, panicle length; TGW, thousand grain weight; PD, panicle diameter; NPT, number of productive tillers per plant*

The initiative has contributed to the following on genetic improvement of pearl millet in India:

- 60-70% of the 70-80 pearl millet hybrids grown in India at any point of time are directly or indirectly based on ICRISAT-bred hybrid parental lines. This has made remarkable contributions to biodiversity (largest number of hybrids on-farm in pearl millet as compared to any coarse grain cereal), enhanced resistance to downy mildew and yield stability, and increased productivity.
- The 3-year mean grain yield of India rose from about 539 kg/hectare (0.539MT/ hectare((1986-90) to 1,186 kg/hectare (1.186 MT/hectare) (2010-15) registering a 73% improvement, which is highest among all food crops.

- Breeding for yield-dependent component traits enhanced genetic gain for grain yield. Panicle length has increased from 16.7 to 22.0 cm, panicle diameter from 2.4 to 3.0 cm, and 1,000-grain weight from 10 to 12 g in seed parents developed during the last four decades in ICRISAT-bred A/B pairs (Fig. 12).
- The longevity of the hybrids developed using PMHPRC-bred genetic materials was 8–20 years in the market, compared with 3–7 years for the hybrids of non-PMHPRC-bred lines.

BIO-FORTIFYING PEARL MILLET AND SORGHUM FOR ENHANCED GRAIN IRON AND ZINC CONTENTS AND BUILDING A SUSTAINABLE MILLET VALUE CHAIN IN INDIA THAT IS REPLICABLE IN AFRICA UNDER SOUTH-SOUTH COLLABORATION

1. **Summary of the initiative:** Biofortified sorghum and millets varieties have been developed and value chains built. Grown by more than 100,000 farmers, biofortified crops are in the food chain along with other millets, benefitting consumers.
2. **Situation before initiative:** Micronutrient malnutrition is one of the greatest global challenges of our times. India has the highest burden of diet-induced micronutrient malnutrition. According to CNNS 2016-18[12], around 40% of the population are suffering from at least one micronutrient deficiency. Diversification of food products is not always feasible and there is the issue of accessibility, affordability and awareness among people. Biofortification (enhancing grain nutrient concentration through plant breeding or agronomic means) is a cost-effective and sustainable option to combat micronutrient malnutrition without compromising on crop yields and consumer taste. Consumption of biofortified millets crops can significantly contribute towards addressing the micronutrient malnutrition in India. However, these approaches need continuous investments and support systems to deliver supplies to needy populations and hence, are not sustainable in the long run.
3. **Nature of initiative:** ICRISAT was first to develop and commercialize a biofortified cultivar, pearl millet variety Dhanashakti in 2012, and sorghum variety Parbhani Shakti in 2018. Since then, a number of varieties and hybrids have been commercialized in India. ICRISAT has mainstreamed biofortification in crop breeding research so that nutrition is carried along with the yield and market-preferred traits.

Dhanashakti, the first public-bred biofortified pearl millet cultivar released in India.

12 Ministry of Health and Family Welfare (MoHFW). Government of India. UNICEF. Population Council. Comprehensive National Nutrition Survey (CNNS) National Report. New Delhi; 2019.

With the help of the All India Coordinated Pearl Millet Improvement Program, minimum standards for grain nutrient content were set up for cultivar release in pearl millet. ICRISAT, along with partners, established evidence of health benefits with increased nutrient content in millets. Further, it has developed context-specific seed systems for increased adoption and rapid varietal replacement to benefit farmers. With the help of the Indian Institute of Millets Research (ICAR-IIMR) and other partners, ICRISAT is working on value chain development of millets from farm to plate in India and working with partners to replicate it in Africa.

4. **Impact of Initiative:** With the concerted effort of ICRISAT, ICAR-IIMR and number of other partners, there is greater awareness about nutri cereals in India. India has the strongest crop breeding program in sorghum and millets and its breeding products are globally used. Till date, more than 150 cultivars have been released in sorghum and millets by the Indian national program and it will be more than 300 adding the number of hybrids commercialized by seed industry. The adoption rates of improved cultivars of sorghum and millets is very high (e.g. adoption of improved cultivars in kharif sorghum is >80%).

Millet farmers with ICRISAT scientists

The biofortified cultivars (with increased iron and zinc) are grown by more than 100,000 farmers in Maharashtra, Gujarat and other States and these products are part of the food chain now. Findings from feeding studies conducted among 1,500 children in Karnataka suggest that millet-based Mid-Day Meals can increase relative growth by 50%[13]. This clearly establishes that nutricereals and biofortified food products provide immediate health benefits to the consumers.

13 Anitha S, Kane-Potaka J, Tsusaka TW, Tripathi D, Upadhyay S, Kavishwar A, Jalagam A, Sharma N, Nedumaran S. Acceptance and Impact of Millet-Based Mid-Day Meal on the Nutritional Status of Adolescent School Going Children in a Peri Urban Region of Karnataka State in India. Nutrients. 2019; 11(9):2077. https://doi.org/10.3390/nu11092077

GENERATING SCIENCE BASED EVIDENCE ON NUTRITIONAL AND HEALTH BENEFITS OF MILLETS

1. **Summary of the Initiative:** Collation of science-based evidence on the importance of millets for accurate information on millets.

2. **Situation Before Initiative:** There was a lot of scattered, fragmented, sometimes non-scientific and confusing information available on nutritional and health benefits of millets. While there were several studies conducted in this area, there was none conducted to collate all the information. For the first time, in this initiative all relevant information was collated and meta-analysis conducted.

3. **Nature of Initiative:** Five systematic reviews and meta-analyses were conducted by a team of seven organizations from four countries. The implementing partners were ICRISAT, India; University of Reading (UOR), UK; National Institute of Nutrition (NIN), India; Kobe University, Japan; Avinashilingam University, India; Government of India and IFPRI, Malawi. ICRISAT led the team to generate the evidence on millets' nutrition and health benefits which includes:
   - Millets' potential in managing and reducing the risk of type 2 diabetes.
   - Millets' potential in managing lipid profile and obesity, thereby reducing the risk of developing cardiovascular disorder.
   - Calcium retention from finger millet and its potential in reducing calcium deficiency.
   - Millets' potential in reducing iron deficiency anemia and improving growth among children
   - 65 global studies were eligible for meta-analysis to support the hypothesis that millets help to manage type 2 diabetes. 19 studies were used for meta-analysis to show the millets' potential in managing lipid profile. 22 studies were used to conduct meta-analysis to show the potential of millets in increasing hemoglobin level.

4. **Impact of Initiative**
   - A systematic review and meta-analysis was published and media releases were done in various countries. The studies showed that millets can reduce the blood glucose level by 12% and 15% in fasting and post-prandial testing respectively14. Millets can reduce bad cholesterol up to 10% and improve good cholesterol up to 6%15. Millets can improve hemoglobin level by 13.2% compared to regular rice-based meals (2.7%16).
   - Gaps in millet research identified for development activities and a new proposal is being developed.

14 Anitha S, Kane-Potaka J, Tsusaka TW, Botha R, Rajendran A, Givens DI, et al. A Systematic Review and Meta-Analysis of the Potential of Millets for Managing and Reducing the Risk of Developing Diabetes Mellitus. Front Nutr. 2021 Jul 28;8.

15 Anitha S, Botha R, Kane-Potaka J, Givens DI, Rajendran A, Tsusaka TW, et al. Can Millet Consumption Help Manage Hyperlipidemia and Obesity?: A Systematic Review and Meta-Analysis. Front Nutr. 2021 Aug 17;8.

16 Anitha S, Kane-Potaka J, Botha R, Givens DI, Sulaiman NLB, Upadhyay S, et al. Millets Can Have a Major Impact on Improving Iron Status, Hemoglobin Level, and in Reducing Iron Deficiency Anemia–A Systematic Review and Meta-Analysis. Front Nutr. 2021 Oct 14;8.

COMMUNITY GENE FUND/COMMUNITY SEED BANK

1. **Summary of the Initiative:** Initiated in 1996, the Community Gene Fund Programme aims to reduce external dependency and re-establish women's control over seeds, the most critical link in the food chain. Local seed varieties which are being increasingly invisibilized are conserved at community level at Seed Banks where women can borrow and deposit. Traditional seed preservation practices are also followed to retain and enrich the seed quality.

2. **Situation before Initiative:** After the Green Revolution and Public Distribution System, agriculture was mainstreamed and only a few crops were prioritized, resulting in a steady decline of agro-biodiversity. The control of seeds was then passed to the market and State. A consequence of this transfer has been the loss women's autonomy in agriculture. Seed keeping is a traditional practice of women which is passed down from generations of women. The loss of control over seeds thus removed autonomy from the hands of women. Rich traditional knowledge on seed varieties and seed keeping techniques also faced threat of erasure.

3. **Nature of Initiative:** Deccan Development Society initiated the Community Gene Bank Programme to assist *sanghams* in recovering local traditional crop varieties referred to as landraces. The Community Gene Fund programme centres indigenous knowledge and supports identification, preservation and storage of traditional seed varieties of the region, along with ensuring seed autonomy of women farmers. The central role of women in seed keeping is honored and they retain the control of seeds. Farmers in the region help to keep the seeds in circulation to maintain the capacity of 2000 acres which the seed bank now holds. In the seed banks, farmers do not bargain with money, but only with seeds. Those who need seeds borrow one kilo and after the harvest season return the same or more. This tradition is called 'nagu' and creates a flow of seeds.

Woman participating in community seed bank

4. **Impact of Initiative:** The program is still running successfully. Initially, the program created a community level seed bank in every operating village. Currently, the women farmers of 1500 households who have participated in this programme have become seed sufficient to hold individual seed banks. There is an operating Central Seed Bank at Machnoor Village which stores upto 85 varieties of seeds and lends seeds to villages or organizations whom desire to return to millets cultivation or to revive a crop. It also

provides seeds to community seed banks, when they lack a variety of seeds. Women farmers who contribute and hold the control of seed banks among themselves are the key implementing partners of the programme. Local artisans are also involved since seeds are mostly stored in weaved baskets.

Woman participating in community seed bank

Within the first two years of implementation of the programme, around 500 women recovered 50 traditional landraces and set up seed banks in 30 villages. Since the beginning of the intervention to revive the seed keeping tradition, atleast 1500 households in around 75 villages now are keeping their own seeds. Crop varieties have also more than doubled. Crop biodiversity has witnessed a visible increase as women who used to grow 4-5 varieties, now grow 15-20 varieties of crops in their farms.

Several of its key members have won several prestigious awards for their efforts. In 2015, Ms. Anjamma, a veteran Deccan Development Society farmer and expert seed keeper was awarded the 'Plant Genome Saviour Award' by the Protection of Plant Varieties & Farmers Rights Authority, India (PPVFRA) for her efforts in preservation and conservation of local varieties of seeds and extinct varieties of plants.

SHELF STABLE SORGHUM FLOUR

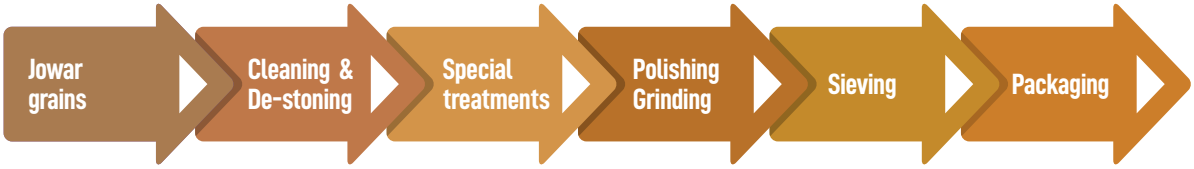
1. **Summary of the Initiative:** Sorghum (jowar) grain is ground to whole grain flour and consumed in the form of roti. The major setback of storing Sorghum milled products like flour is the development of rancidity within 5-15 days of storage due to lipolytic action. The developed technology enhances the shelf-life of the flour upto 10 months, without affecting the product quality. The flour can be packed in low density polyethylene(LDPE) bags.

2. **Situation before Initiative:** Flour from sorghum and other millets has a very low shelf-life of 5-15 days. At present these grains are ground as and when required. The fat rich germ is deeply embedded within the grain and polishing similar to rice does not detach the germ. The activity of the enzyme hydrolyses the fat into free fatty acid leading to oxidation. This imparts a bitter taste and off-flavour to the flour.

3. **Nature of Initiative:** The process involves processing of the grains to enhance the storage capability of the milled products like flour and semolina. This also enhances the export potential of millet and its products. The process developed at Central Food Technological Research Institute (CFTRI) involves a standardized process where in a shelf stable jowar flour is obtained, which has a storage period of 6-8 months. The rotis prepared from the processed flour are soft and lighter in colour, the dough also has better rolling properties. With the increased shelf life and quality characteristics, the product can be manufactured and marketed as a regular commodity like maida, ragi flour etc.

   The installed capacity is 100kg raw material per day. Capacity of the unit is 16000 Kg (raw material /16 hrs per day- 2 shifts) and it can work upto 300 days per annum. The process can be easily adapted by millers engaged in grain processing. The technology for the production of shelf-stable flour is commercialized and has been transferred to 6 entrepreneurs.

   Process:



4. **Impact of Initiative:** The technology enables diversification of the millet products, incorporates convenience in addition to enhanced shelf-life. The shelf-stable millet flour/ semolina can be a base for other intermediary Ready-to-Cook traditional recipes.

MECHANIZED PROCESSING HELPS REVIVE CONFIDENCE IN MILLET ECOSYSTEMS IN ODISHA

1. **Summary of the Initiative:** A solar-powered millet dehusking unit by NIRMAN in the Dupi village of Kandhamal district (Odisha) helps reduce considerably the drudgery associated with traditional milling of millets by tribal women, thus enabling them invest their labor & time for some other jobs. This has also revived the confidence in traditional millet cultivation.

2. **Situation before Initiative:** Traditional milling of millets is not an easy affair for the women, particularly where the processing is intended to produce not the flour but the millet 'rice'**.** Processing of millets is very strenuous. Removing of husk is very difficult as we have to thresh, winnow and hand-pound with the long wooden pestle to remove the husk. Most of the burden falls on women. It takes more than 2 hours to pound one kilogram of millet in the traditional hand-pounding process

3. **Nature of Initiative:** The activity primarily involves processing & value addition of millets. The target groups are mainly the tribal women who belong mostly to the Kutia Kandha community, a Particularly Vulnerable Tribal Group(PVTG). NIRMAN established an electricity-driven processing unit at Dupi in 2016 with support from the Millet Network of India(MINI); but owing to technical issues related to the inconsistency in power supply in this hinterland region, the unit had to face problem in operating the machines smoothly. This is why NIRMAN got it connected with solar power in 2018, thanks to the support received from UNDP. The unit is currently in operation.

   The unit has three machines: grader, destoner, and huller. Of the three women's SHGs of Dupi, the Mahila SHG is the lead agency taking full responsibility of managing the unit whereas the Rendabali SHG provides some support to it. It is a women-operated unit.

The solar-powered millet processing unit at Dupi

The Millets Processing Machine of Dupi village

4. **Impact of Initiative:** The facility has reduced drudgery of the women that they can now devote more time to the *dongar*(hill cultivation) fields of the family where millets and pulses are grown. In the unit it takes only one hour to process 50 kilograms of millets now in the processing unit. This has resulted in enhanced interest in millet production in the locality with an outcome of higher targets of millet products to be marketed annually.

Women working in mechanised processing units

The facility is accessible to about 50 villages of three Gram Panchayats of the region. The major advantage of the Dupi unit is production of millet rice from Foxtail millet(Kangu), Little millet(Kuiri), and even Pearl millet(Bajra). Earlier, the local people used to sell the whole grain of kangu or kuiri which fetched a low price, but now they can easily produce and sell the kangu rice or kuiri rice at substantially higher prices (like, the quantity that would have been sold at Rs. 35 to 40, is now fetching Rs.70-80 or so). To facilitate marketing of their organic millets NIRMAN has also promoted the Piparadi Jaibik Krushak Sangha(FPO) at Dupi which is linked with KFPCL that helps connecting to the larger market base.

IMPROVED METHOD OF MILLING SMALL MILLETS

1. **Summary of the Initiative:** Small millets like foxtail, little, kodo etc are decorticated to produce Bhagar. Multi-pass dehulling system was replaced by introducing Impact dehuller.
2. **Situation before Initiative:** Decortication of small millets like foxtail, little, kodo etc. were being carried out by using abrasive type dehullers in 6 to 8 passes for a dehulling percent varying between 70-85%. Broken percent was also high (10-15%). Installed power was about 30 kW. Studies carried out by Council Of Scientific & Industrial Research-Central Food Technological Research Institute (CSIR-CFTRI) indicated that abrasive dehulling is a poor practice and this was replaced by an impact dehulling system. A unit comprising an impact dehuller and a husk aspirator was designed and output of the unit after separation of unhulled millet was polished to get the bhagar.
3. **Nature of Initiative:** The work was carried out as a collaborative project with M/s Squire Bhagar Mill of Nasik with partial support from AICRP (All India Coordinated Research Project) – Small millets. The project is concluded.
4. **Impact of Initiative:** Presently, almost the entire industry has moved away from abrasive dehulling system to the improved system. Overall yield increased by 2 to 3% with reduction in broken percentage. Installed power requirement for dehulling was reduced to 5 kW per tonne.

ANNEXURE

ANNEXURE 1

NUTRITIONAL COMPOSITION OF MILLETS, 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	25	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	32	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

ANNEXURE 2

STATE-WISE AREA, PRODUCTION AND PRODUCTIVITY OF MILLETS IN INDIA (2020-21)

State/UT	Jowar (Sorghum)			Bajra			Ragi			Small Millets			Total Millets		
	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hectare)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hect.)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hect.)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hect.)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hectare)
Andhra Pradesh	120.00	411.39	3428.25	31.00	70.71	2281.00	33.00	39.50	1197.00	22.00	19.01	864.00	206.00	540.61	2624.32
Arunachal Pradesh	–	–	–	–	–	–	–	–	–	26.82	27.62	1030.00	26.82	27.62	1030.00
Assam	–	–	–	–	–	–	–	–	–	4.97	3.26	656.00	4.97	3.26	656.00
Bihar	1.23	1.31	1067.00	4.22	4.78	1134.00	2.77	2.58	934.00	2.17	1.64	753.00	10.38	10.31	993.06
Chhattisgarh	2.06	2.73	1326.00	0.04	0.02	515.00	5.48	1.65	302.00	84.62	21.83	258.00	92.20	26.24	284.59
Gujarat	41.07	57.43	1398.36	460.26	1008.89	2192.00	10.47	12.62	1205.00	8.46	13.04	1541.00	520.26	1091.97	2098.90
Haryana	31.28	16.42	525.00	569.20	1350.14	2372.00	–	–	–	–	–	–	600.48	1366.56	2275.79
Himachal Pradesh	0.02	0.01	435.00	0.52	0.29	557.00	0.58	0.49	842.00	2.41	2.34	972.00	3.53	3.13	885.64
Jammu & Kashmir	0.00	0.00	–	13.14	6.47	492.00	–	0.00	–	8.11	2.14	264.00	21.25	8.61	404.99
Jharkhand	1.87	1.23	659.00	0.13	0.08	643.00	18.77	16.40	874.00	–	–	–	20.77	17.72	853.19
Karnataka	750.00	903.53	1204.70	222.00	275.50	1241.00	785.00	1369.83	1745.00	26.00	20.23	778.00	1783.00	2569.08	1440.88
Kerala	0.23	0.20	882.91	–	–	–	0.23	0.33	1435.00	0.05	0.04	745.00	0.51	0.57	1117.91
Madhya Pradesh	112.00	217.00	1937.50	327.00	737.71	2256.00	–	0.00	–	78.00	69.42	890.00	517.00	1024.13	1980.91
Maharashtra	2078.90	1746.61	840.16	687.50	656.56	955.00	81.60	93.92	1151.00	37.00	16.72	452.00	2885.00	2513.82	871.34
Meghayala	–	–	–	–	–	–	–	–	–	2.89	2.72	941.00	2.89	2.72	941.00
Nagaland	0.28	0.27	964.00	0.71	0.72	1014.00	0.35	0.34	971.00	8.83	9.98	1130.00	10.17	11.31	1111.86

State/UT	Jowar (Sorghum)			Bajra			Ragi			Small Millets			Total Millets		
	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hectare)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hect.)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hect.)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hect.)	Area ('000 Hect.)	Production ('000 Tonnes)	Yield (Kg./ Hectare)
Odisha	5.50	3.47	631.00	1.27	0.79	622.00	41.31	32.88	796.00	35.25	18.01	511.00	83.33	55.16	661.90
Punjab	-	-	-	0.40	0.26	640.00	-	-	-	-	-	-	0.40	0.26	640.00
Rajasthan	559.69	589.91	1054.00	4348.40	4561.47	1049.00	-	-	-	6.50	4.29	660.00	4914.58	5155.67	1049.05
Sikkim	-	-	-	-	-	-	-	-	-	2.05	2.13	1038.00	2.05	2.13	1038.00
Tamil Nadu	405.42	427.22	1053.77	67.41	158.89	2357.00	82.92	288.64	3481.00	24.47	30.51	1247.00	580.22	905.26	1560.20
Telangana	91.00	155.69	1710.87	10.00	9.30	930.00	1.00	1.34	1343.00	-	-	-	102.00	166.33	1630.71
Tripura	0.19	0.16	852.00	-	-	-	-	-	-	1.62	1.30	801.00	1.81	1.46	806.34
Uttarakhand	-	-	-	-	-	-	89.00	129.85	1459.00	49.00	71.00	1449.00	138.00	200.85	1455.45
Uttar Pradesh	174.00	274.57	1578.00	907.00	2014.45	2221.00	-	-	-	12.00	9.18	765.00	1093.00	2298.20	2102.65
West Bengal	0.19	0.10	538.00	0.07	0.03	425.00	6.03	6.47	1073.00	-	-	-	6.29	6.60	1049.95
D & N Haveli	-	-	-	0.50	0.75	1509.00	0.85	1.40	1652.00	-	-	-	1.34	2.14	1599.11
Delhi	2.95	2.81	953.00	1.33	5.34	4030.00	-	-	-	-	-	-	4.28	8.15	1906.69
Puducherry	-	-	-	0.01	0.03	2600.00	0.05	0.11	2422.00	0.06	0.15	2375.00	0.12	0.29	2411.68
All India	4377.87	4812.07	1099.18	7652.10	10863.17	1419.63	1159.40	1998.36	1723.62	443.29	346.56	781.32	13632.66	18020.17	1321.84

Source: Directorate of Economics & Statistics, DA&FW

ANNEXURE-3

ALL INDIA ESTIMATES OF AREA, PRODUCTION AND YIELD OF FOOD GRAINS (2016-17 TO 2020-21)

Crop	Season	Area ('000 Hectares)					Production ('000 Tonnes)					Yield (Kg./Hectare)				
		2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Rice	Kharif	39845.77	39349.27	39964.35	39012.96	40357.97	96302.79	97135.16	102039.99	102276.51	105208.14	2417	2469	2553	2622	2607
	Rabi	4147.58	4424.80	4192.09	4649.34	5410.71	13395.64	15622.44	14437.83	16593.81	19160.18	3230	3531	3444	3569	3541
	Total	43993.35	43774.07	44156.45	43662.30	45768.69	109698.43	112757.61	116477.82	118870.32		2494	2576	2638	2722	2717
Wheat	Rabi	30785.18	29650.59	29318.79	31357.02	31125.16	98510.23	99869.52	103596.23	107860.51	109586.50	3200	3368	3533	3440	3521
Jowar	Kharif	2059.38	2059.87	1754.69	1755.17	1642.26	1964.36	2273.81	1735.04	1696.97	1986.34	954	1104	989	967	1210
	Rabi	3565.04	2964.58	2338.59	3068.59	2735.62	2603.54	2529.58	1740.36	3075.13	2825.73	730	853	744	1002	1033
	Total	5624.42	5024.45	4093.29	4823.76	4377.87	4567.90	4803.38	3475.41	4772.11	4812.07	812	956	849	989	1099
Bajra	Kharif	7458.50	7480.60	7105.03	7542.68	7652.10	9729.86	9208.85	8664.13	10362.60	10863.17	1305	1231	1219	1374	1420
Maize	Kharif	7841.69	7433.69	7330.57	7552.92	7755.44	18919.20	20118.42	19413.60	19429.33	21555.08	2413	2706	2648	2572	2779
	Rabi	1791.51	1946.38	1696.56	2016.16	2136.53	6980.66	8634.50	8301.50	9336.64	10091.83	3897	4436	4893	4631	4723
	Total	9633.20	9380.07	9027.13	9569.08	9891.96	25899.87	28752.92	27715.10	28765.97	31646.91	2689	3065	3070	3006	3199
Ragi	Kharif	1016.11	1194.29	890.94	1004.46	1159.40	1385.11	1985.24	1238.70	1755.06	1998.36	1363	1662	1390	1747	1724
Small Millets	Kharif	619.11	546.27	453.75	458.35	444.05	441.94	438.99	333.00	370.81	346.95	714	804	734	809	781
Barley	Rabi	656.25	660.80	575.60	589.57	592.47	1747.45	1780.81	1633.07	1721.83	1656.34	2663	2695	2837	2920	2796
Coarse Cereals	Kharif	18994.80	18714.72	17534.99	18313.58	18653.23	32440.48	34025.30	31384.47	33614.76	36749.90	1708	1818	1790	1836	1970
	Rabi	6012.80	5571.76	4610.75	5674.32	5464.61	11331.66	12944.89	11674.93	14133.61	14573.90	1885	2323	2532	2491	2667
	Total	25007.60	24286.48	22145.73	23987.90	24117.85	43772.14	46970.19	43059.41	47748.37	51323.80	1750	1934	1944	1991	2128

Crop	Season	Area ('000 Hectares)					Production ('000 Tonnes)					Yield (Kg./Hectare)				
		2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Cereals	Kharif	58840.57	58063.98	57499.34	57326.54	59011.21	128743.27	131160.46	133424.46	135891.27	141958.04	2188	2259	2320	2370	2406
	Rabi	40945.56	39647.14	38121.63	41680.67	42000.48	123237.53	128436.86	129708.99	138587.94	143320.58	3010	3239	3403	3325	3412
	Total	99786.13	97711.13	95620.97	99007.21	101011.69	251980.80	259597.32	263133.46	274479.21	285278.62	2525	2657	2752	2772	2824
Tur (Arhar)	Kharif	5337.89	4438.31	4549.54	4532.47	4724.45	4873.24	4289.82	3315.44	3891.73	4315.90	913	967	729	859	914
Gram	Rabi	9626.16	10560.43	9547.03	9698.75	9995.92	9377.56	11379.19	9937.99	11078.50	11911.18	974	1078	1041	1142	1192
Urad	Kharif	3478.26	4350.49	4725.92	3701.68	3212.96	2176.42	2751.24	2362.57	1329.64	1506.59	626	632	500	359	469
	Rabi	999.90	928.60	876.56	831.66	929.55	655.47	741.18	697.44	751.64	722.99	656	798	796	904	778
	Total	4478.16	5279.09	5602.48	4533.34	4142.50	2831.89	3492.42	3060.00	2081.28	2229.58	632	662	546	459	538
Moong	Kharif	3369.59	3259.08	3832.01	3521.39	3822.40	1643.18	1433.23	1784.20	1826.23	1996.40	488	440	466	519	522
	Rabi	957.21	983.20	922.95	1059.16	1307.78	522.18	589.96	671.17	682.64	1088.95	546	600	727	645	833
	Total	4326.80	4242.29	4754.96	4580.54	5130.17	2165.36	2023.18	2455.37	2508.87	3085.35	500	477	516	548	601
Lentil (Masur)	Rabi	1461.14	1549.21	1362.72	1302.69	1468.31	1223.85	1621.81	1227.82	1103.03	1493.85	838	1047	901	847	1017
Other Kharif Pulses	Kharif	2177.57	1885.43	1722.20	1779.92	1670.55	891.68	831.47	629.15	873.28	799.34	409	441	365	491	478
Other Rabi Pulses	Rabi	2038.94	1858.41	1617.04	1559.60	1651.42	1767.55	1778.32	1450.08	1488.56	1627.92	867	957	897	954	986
Pulses	Kharif	14363.30	13933.30	14829.67	13535.46	13430.34	9584.52	9305.76	8091.35	7920.88	8618.22	667	668	546	585	642
	Rabi	15083.35	15879.85	14326.29	14451.85	15352.98	13546.61	16110.46	13984.50	15104.37	16844.90	898	1015	976	1045	1097
	Total	29446.65	29813.16	29155.97	27987.31	28783.32	23131.13	25416.22	22075.86	23025.25	25463.12	786	853	757	823	885
Foodgrains	Kharif	73203.87	71997.29	72329.01	70862.00	72441.55	138327.79	140466.23	141515.82	143812.15	150576.26	1890	1951	1957	2029	2079
	Rabi	56028.91	55527.00	52447.92	56132.53	57353.46	136784.14	144547.31	143693.50	153692.30	160165.47	2441	2603	2740	2738	2793
	Total	129232.78	127524.29	124776.93	126994.53	129795.01	275111.93	285013.54	285209.32	297504.46	310741.74	2129	2235	2286	2343	2394

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