



Millet farming systems



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COVER PHOTO

*Milletts are an important part of the agricultural
landscape and dietary culture in the
North East India*

(Photo: Caritas India)

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The editors encourage readers to photocopy and circulate magazine articles.

Dear Readers

Milletts have finally arrived on the global scene. With 2023 being declared as the International Year of Milletts, by the United Nations, the spotlight is on milletts. While half a billion people across the globe consume milletts as a traditional food, it has taken decades, for it to get its due recognition. Thanks to the efforts of Indian government, which proposed the declaration of International Year.

With the announcement of the International Year of Milletts, there has been a lot of programmes and initiatives driven to promote millet production, processing and value addition. The support will go a long way in making communities revive and restore the lost milletts in the production and on the plates. Evidences show that when promotion is done on a mission mode and with the government support, there is lot that could be achieved. Odisha millet mission is one such inspiring example. However, caution need to be exercised to see that the millet crops are not commercialised to such an extent that it ceases to be a poorman's crop, anymore. While focusing on improving productivity, one should not lose the enormous crop diversity that we possess, presently in milletts.

Hope you find this issue interesting. Continue to share your experiences on milletts, as we too would love to celebrate the Year of milletts, by sharing your experiences all round the year. We await your feedback and also request you to continue to support the programme, as before.

The Editors

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge and to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

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AME Foundation promotes sustainable livelihoods through combining indigenous knowledge and innovative technologies for Low-External-Input natural resource management. Towards this objective, AME Foundation works with small and marginal farmers in the Deccan Plateau region by generating farming alternatives, enriching the knowledge base, training, linking development agencies and sharing experience.

AMEF is working closely with interested groups of farmers in clusters of villages, to enable them to generate and adopt alternative farming practices. These locations with enhanced visibility are utilised as learning situations for practitioners and promoters of eco-farming systems, which includes NGOs and NGO networks. www.amefound.org

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Millet farming systems

The paradigmatic shift from agriculture to agribusiness model, based on high input intensive farming eroded local food systems. These systems got stifled further by globalisation influencing 'exotic' food choices and local public distribution systems overwhelmingly limiting to certain cereals like rice and wheat. Gradually, plant and crop diversity so specific to local ecosystems got ignored and gradually disappeared. As an alternative to the mainstream developments, there have been agroecological movements pursued by several civil society organisations like AME Foundation, since late 1980's, have been promoting sustainable alternatives such as Low External Input Sustainable Agriculture, by training farmers and civil society organisations, helping farmers on field application and sharing knowledge in public domain. Organisations like Deccan Development Society for more than three decades have created and popularised alternative millet based food and distribution systems.

In recent times, two phenomena, have caught attention more than ever before - *climate change and health vulnerabilities*. With increased climate aberrations and with renewed and growing interest in healthy and nutritious food choices, revival of millet based food systems is now recognised as a near perfect answer. Millets are well known for being highly resilient to climate aberrations, requiring very low external inputs. They have fortunately remained as most desired food choices in some cultures/geographic areas as well as countries, thus, serving as living examples.

Though an obvious choice, reviving and mainstreaming require strategies that have to be collaborative, inclusive and multipronged. Firstly, the existing habits have to be tackled and overcome. Secondly, it has to be rooted in community ownership at all stages and all levels. Millet food systems where existing have to be reinforced. Those apparently invisible and eroded have to be 'rediscovered'. Farming communities need to be enthused as they are not only cultivators but also

consumers. They infact constitute the rural majority. Millets diverse advantages has to be popularised as well as demonstrated. All aspects of value chain have to be systematically pursued - production, processing, consumption and marketing. Need based training events have to be organised.

Sometimes these experiences could be region specific, as can be seen in North East India (p.29) while some of them driven through a mission mode, like Odisha Millet Mission. Invariably, wherever they are successful, the high commitment of local communities and civil societies closely working with them has been the critical factor. Motivated communities revive their traditional knowledge, bring back forgotten nutritious millet species, practice resource conserving and improved production practices. Their involvement and wisdom in identifying and assessing suitable varieties for their contexts through participatory varietal trials is critical and should be respected. (Susantha Sekhar Chowdhary, et.al., p.11).

Invariably, it is women, as custodians of family food and nutritional diversity and security, who play the lead role especially in reviving millet based nutritious food systems. Thus, it was natural that most of the initiatives have been led by women playing critical roles in terms of conservation, cultivation as well as popularising cuisine besides leading value chains.

Capacity building is a key component of reviving indigenous, mixed and biodiverse farming systems with focus on women. It has to be gradual, through with partial substitution of their preferred crop choices without loss of income. (Ravi Shankar Behera, p.22). This would require promoting alternative production practices like System of Millet intensification and better agronomic practices for improved yields and incomes. (Sivaram and Behera, p.6). However, training women on simple and complex processing of diverse millets and enthusing community youth to take lead is not easy. Future lies in enthusing and building capacities of rural

young men to handle different processes on their own. (Dwijji Guru, p.33).

One of the prerequisites for sustainable cultivation is good quality seed of local and diverse millet varieties. It has to be available in adequate quantities and easily accessible to those interested when required. Addressing the issue of seed scarcity, based on participatory varietal trials, researchers play a substantive role in systematic assessment of those to be multiplied. Communities multiplied these seeds and subsequently, community managed seed banks provide easy access to all those interested in taking up cultivation. (Susantha Sekhar Choudhury, et.al., p.11).

While improved consumption by communities themselves coupled with raised awareness of urban populace about nutritious millet dishes is creating new demand, communities can manage cultivation, consumption, aggregation, processing, value addition and marketing, locally. Three inspiring cases illustrate this. (Dwijji Guru, p.33)

Very often the limiting factor is economies of scale for mainstreaming an alternative movement. Owing to their own legitimate priorities, agencies/institutions in the region pursue different development trajectories. A common vision has to be pursued by all, while respecting and recognising each other's strengths, be it, CSOs, CBOs, FPOs, Research institutions, Government agencies and others active in the area. Such programme must integrate incentives too. It is interesting to know that institutional collaborative efforts can create synergies and good results, as illustrated in Odisha Millet Mission initiatives. (p.6 and p.11). Similarly, farmers efforts at identifying and conserving outstanding local varieties providing a bright future for sustainable millet promotion was recognised at the national level by the facilitative and positive role played by KVK, Tikamgarh, M.P (Prajapati et.al., p.17).



International Year of Millets-2023

The United Nations General Assembly at its 75th session in March 2021 declared 2023 as the International Year of Millets (IYM 2023). UN dedicates 2023 to greater efforts in producing millets given their nutritional properties and resilience in adapting to climate change. Being grown in more than 130 countries at present, millet is considered traditional food for more than half a billion people across Asia and Africa.

Recognising the enormous potential of millets, which also aligns with several UN Sustainable Development Goals (SDGs), the Government of India (Gol) has prioritized millets. A sub-mission on National Food Security Mission – Nutri Cereals was implemented considering the high-nutritive value, potential for economic empowerment of small and marginal farmers and contribution in maintaining the earth's biodiversity; in April 2018, millets were rebranded as "Nutri Cereals", and the year 2018 was declared as the National Year of Millets, aiming at larger promotion and demand generation. The United Nations declared the year 2023 as the International Year of the Millet, following a proposal by India, which wants to position itself as a global hub for millet.

International Year of millets provides a unique opportunity to, raise awareness and direct policy attention to the nutritional and health benefits of millet consumption. Greater millet production can support the livelihoods of smallholder farmers and can provide decent jobs for women and youth. The revenue created can boost economic growth. With the possibility of a health cereal alternative with millets,

the risks associated with production shocks can be mitigated. IYM 2023 hopes to galvanise interest in millets among various stakeholders like farmers, the youth and civil society and push governments and policy makers to priorities the production and trade in these cereals.

During the International Year of Millets - 2023, the Department of Agriculture and Family Welfare (DA&FW) aims to promote cultivation and consumption of Millets at a larger scale and bring it to the entire globe. Towards this endeavour, through a collaborative approach, the Gol urges everyone including the Indian embassies, International Organizations, Academia, Hotels, Media, Indian Diaspora, Start-up communities, Civil Society, and all others in the Millets value-chain to come forward and join hands to revive the forgotten glory of 'Miracle Millets' through the grand celebration of International Year of Millets - 2023.

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INTERNATIONAL YEAR OF
MILLETS
2023

Women-led institutions reviving millet cropping systems in Odisha

Ranchitha Sivaram and Sangeeta Behera

Millet cropping systems turned out to be the potential game changer in improving the overall household economy and addressing nutritional security. By coming together, institutions pursuing a common vision brought about this change. Led by women in FPOs all aspects of value chain were systematically pursued through Odisha Millets Mission.

Mandia (*the local odia name for finger millet or Ragi*) is the buzzword in the nooks and corners of villages and cities in Odisha. From cafes to restaurants, this popular millet grain has recreated its space as meals, snacks, cakes and cookies on the food platter of the urban populace.

To see where it grows, we should travel to reach the unreached tribal pockets of Odisha. The dashing wooden log beats on Mandia crop harvest with a solemn hymn of the *Paraja* song is an attraction to anyone who visits the *Mankditada* village of Koraput district of Odisha in the month of December. This humble homestead crop with its bountiful harvest has reached the commercial mandis of the Koraput and Nabarangpur districts of Odisha.

This was possible owing to the concerted efforts of Adivasi women farmers joining hands with Odisha Millet Mission (OMM) supported by Harsha Trust, an NGO, in taking up large-scale millet farming. By opting for a crop that can thrive in their uplands with lesser inputs,

the FPO institutions are the forerunners in shifting crop choices from input-intensive maize and paddy to millet-based cropping systems and also the consumer choices to healthy diets.

Millet journey in the hills of Odisha

Koraput and Nabarangpur, the districts of tribals and culture, have a total of 2977 villages. More than 50% of the population in these districts belong to Scheduled Tribes (Census, 2011). These tribal communities depend on farming, livestock and Non-Timber Forest Products (NTFP) for their food and livelihoods. The tribal women here are the beholders of the household economy.

It was a time when the tribal farmers of the Borigumma and Kundra blocks of the Koraput district had started looking for better avenues other than farming. In fact, eighty percent of the farmers are small and marginal in Koraput. They own 90% of uplands that are less productive. The marginal farmers resorted to migrating to nearby cities and states to work as wage labourers.

Millets occupy a irreplaceable space in Adivasi Culture. Being the native food and the centre of tribal culture, millets play an integral part in the daily diet of Adivasi farmer households and in their social and cultural events. Owing to their simplicity, being rich in nutrition and affordable, millet-based delicacies such as Mandia Jau, Mudde, and Pittha, Suan upma (little millet), Roasted sorghum, Mandia Tampa (porridge with ragi flour and rice water), Mandia Anda (Ragi Flour with Rice) have always been a part of tribals' food basket.

They were getting frustrated after years of cultivating input-intensive crops like paddy and maize, easily affected by the frequent prevalence of dry spells, pest attacks, insufficient crop inputs, degrading landscape and lowering production. The situation demanded immediate intervention that was sustainable, affordable and amiable to tribal women farmers who toiled in the hilly terrains.

Millets turned out to be the potential game changer in improving the overall household economy and addressing nutritional security. It required coming together of institutions focusing on a common vision.

Millet revival triggered by institutional collaboration

Millets are generally grown in rain fed regions as they combat climate change, help mitigate dry spells. Realising its potential as a climate-resilient and nutritive option, Odisha Millet Mission (OMM) was launched in 2017 to revive millets in farms and on plates. By partnering with Harsha Trust, the programme prioritised bringing tribal women farmers to the forefront. Earlier, understanding the contextual realities, Harsha Trust has been working with the tribal women farmers to ensure livelihood security as well as to improve their quality

Box 1

“Earlier, I cultivated Ragi on 1.5 acres of my land only for household consumption. The yield was not more than two quintals. I never realised that Ragi could fetch me better profits. After the involvement of the Odisha Millet Mission (OMM) with the support of Harsha Trust, I received training on advanced millet farming practices and learnt the importance of healthy seed selection. This year on the same patch of land, I could cultivate five quintals of Ragi and earned an additional income of Rs. 16,475, apart from sufficing my home consumption.”

– Banamali Chalan (43), Badapindapadar village, Borigumma block, Koraput

of life. In this regard, the NGO, has been working with women farmers in this region since April 2014, organised them into SHGs. Initially, 31 SHGs with a total membership 350 of farmers were formed. These SHGs were governed by a single governing SHG known as the nodal SHG, which later transformed into to Farmer Producer Company (FPC), as per the Companies Act. Harsha Trust started working with Odisha Millet Mission (OMM) in July 2017.

One of the key thrusts of the Farmer Producer Organisations (FPOs) strategy was towards streamlining millets in a phased manner. Led by farmers themselves, FPO served as an enabling ecosystem for the millet value chain. It led to increased household consumption of the millets, while meeting the raising health consciousness in urban consumers. Acting as a nutritional powerhouse, propelled by good demand, millet's fancy menus found their way into new avenues - high-profile forums, urban events, government meetings, seminars and gatherings.

With increased awareness and skill building on improved production techniques, cost-benefit aspects, encouraged by spiraling demand, the communities got convinced that millets can provide equivalent and higher profits compared to input-intensive crops. Moreover, the crop with its low carbon footprint helped in conserving the region's rich ecology and biodiversity.

Building momentum by Nari Pragati Farmer Producer Company Limited (NPPCL)

Initially, Harsha Trust, NGO, promoted community-based organisations such as Self Help Groups (SHGs) guiding them to take up farm-based livelihood initiatives. In February 2020, the groups were organised into a Farmer Producer Organisation, Nari Pragati Producer



Crop cutting experiment in ragi field in Borigumma Block of Koraput, Odisha

Company Limited (NPPCL). NPPCL was formed with 570 farmers in 2020, later by the year 2022, had membership of 3200 farmers. The service model adopted by NPPCL built the necessary momentum. While millets were a preferred choice for tribal households for consumption, their economic potential was yet to be realised. The women farmers lacked technical and financial support, credit linkages, production, and processing facilities to upscale millet production. The farmers did not sell millets as there were no commercial mandis or regularised marketing systems. These gaps were rightly identified and addressed by NPPCL with the support of OMM to promote millet-based farming systems by achieving economies of scale.



Line transplanting ensures proper crop standing and yields better

Holistic strategies for millet revival

The focus was on integration and strengthening multiple enabling mechanisms. It touched all aspects and services - production, processing, consumption and marketing, led by women farmers, with the support of Harsha Trust.

Several *key strategies* drove the millet value chain to success, as highlighted below.

- *Awareness building and training programs for women farmers in millet production:* Awareness was created by first organising Focussed Group Discussions (FGDs) and vision building exercises with the women SHGs and FPO members, while taking them for exposure visits. Various training programs and capacity-building initiatives on improved production techniques, importance of reviving millet farming systems were organised with focus on specific Package of Practices (PoP). Income enhancement through millet farming systems was demonstrated. Being led by women, the knowledge trickled down to the entire household. A total number of 141 training events were organised to promote millet farming systems as detailed below
- *Ensuring higher-quality seed production and access:* This was taken up and supported by four seed centers at Borigumma, Bondaguda, Anchala,

and Khatragada catering to the need of around 3200 farmers.

- *Improving Package of Practices (POP) and incentivising good farming practices:* The primary package of practices included Natural Pest Management practices, System of Millet Intensification, line sowing and transplanting (See box 2).

Farmers adopting improved technologies (SMI,LS,LT) got an additional incentive from OMM for the initial three years. The farmer got

Sl No.	Training Component Name	No. of Training events	No. of Participants
1	Production Enhancement	27	864
2	Package of Practices	21	672
3	Seed Production	11	352
4	Seed Storage	7	224
5	Value Addition	7	448
6	Nutritional Benefits of Millet	9	576
7	Field Demonstration	38	1216
8	Awareness program on Millet	17	2040
9	Collective Marketing	4	120

upto Rs. 5000/ha for SMI and Rs. 2500/ha for LS/LT, and in next two subsequent years, Rs.3000 and 1500 for SMI and Rs.1500 and Rs.1000 for LS/LT. Currently they have been revised as follows.

- *Developing village-level cadres* as Community Resource Persons to provide technical and extension services at the door-step
- *Setting up Custom Hiring Centres and Primary Processing Units* at the Gram Panchayat level to promote the usage of Threshers, Graders etc. Four CHCs, ten pulverisers and processing units each were established as detailed below.
- *Collective marketing by NPPCL and establishment of MSP* : Farmers were organised by the FPO to do collective efforts, specifically, the produce aggregation, primary processing, transportation, and marketing. The aggregated produce enabled farmers to have better bargaining power and reduced the cost of transportation. The MSP system was established by OMM.
- *Marketing outlets*: Mandis were established in Borigumma, Katharaguda, Kerapa, Nuagaon to minimise the gap between the farmers and markets. Earlier, farmers had no outlet to sell the harvested millets, and they used to sell at the local Haat (market) for low prices. The new Mandis gave farmers a platform to sell their produce at an appropriate price.

Mandia Haat is made exclusively for selling millets at a fixed fair price. It is an initiative by OMM to promote consumption of millet. Small shops

Box 2

System of Millet Intensification (SMI) – SMI is an extension of the System of Rice Intensification (SRI) method that includes improved agronomic practices such as reduced seed rate, seed treatment, transplantation of young and healthy seedlings at appropriate spacing (Grid pattern), improved weeding and nutrient management practices. This method has doubled the production of millet in the villages.

Line Transplanting (LT) – Line Transplanting ensures proper crop standing and utilises maximum space giving improved yield.

Multi-cropping/intercropping – Multi-cropping of ragi and sorghum together is adopted to reduce crop risk and increase incomes.

selling popular food items made with Mandia are open in popular tourist places. In 2021, the Odisha government announced November 10 as Mandia Divas to further popularise millets in both rural and urban spaces.

- *Inclusion in welfare schemes*: Inclusion of millets in Public Distribution Systems (PDS), Mid-Day Meal Schemes and Anganwadi Centres by OMM.

Impressive results

Through the OMM, the millet cropping area in Borigumma and Kundra has risen to 1167 hectares in the last three years. The improved production practices have increased the finger millet and the little millet production by three to four times compared to conventional cultivation. From a meagre production of 1-2 quintals per acre, the farmers could now get 6-7 quintals by adopting the System of Millet Intensification (SMI). The establishment of processing units with ten threshers provided by OMM and the Odisha University of Agriculture & Technology (OUAT) has eased the laborious threshing activities. The inclusion of millets in the Public Distribution System (PDS), Mid-Day Meal Scheme, and introduction of millet-based foods such as Ragi ladoos at Anganwadis of Borigumma and Kundra blocks has boosted household consumption that had a direct positive impact on women and child nutrition.

The FPO addressed the challenge of poor transportation and marketing facilities through a collective marketing approach. The regulated market has increased the selling price of millets from Rs.15/kg to Rs.35/kg. Being empanelled as a procurement agency, NPPCL procured millets from women farmers and enabled marketing in the Borigumma Mandi (an exclusive millet mandi by OMM) that fetched higher prices and timely payment that directly reached the bank accounts of women members. After the establishment of mandi, the millet price has increased from Rs.2800 per quintal to Rs.3578 per quintal in three years. In the last three years, NPPCL has expanded its service outreach through an increased membership of 3511 women farmers covering 93 villages in 24 Gram Panchayats, continuing the momentum of millet revival and expansion.

NPPCL aims to redefine its Business Development Plan (BDP) to streamline millets in a phased manner by planning to establish storage godowns, processing and

Box 3: Case of Jayanti Gouda, a millet farmer

Jayanti Gouda is a tribal woman farmer residing in Mankditala village of Kha-tragada Gram Panchayat of Borigumma block in Koraput. In the initial years, she had not taken up millet farming seriously. After associating with NPPCL as a member, she understood the benefits of adopting System of Millet Intensification and other production practices on one acre of land. While she faced losses due to heavy and erratic rainfall in 2018-19, she could continue growing millets with support from NPPCL. The increased production provided her with more than what she yearned for, and her success inspired many women farmers to take up millet cultivation in her village.

"In the 4.5 acres of land we owned, we used to cultivate paddy in 2.5 acres of low land. The remaining 2 acres of upland mostly remained fallow, where we have occasionally sown millet. After the intervention of NPPCL and technical knowledge support provided by Harsha Trust, we started cultivating Ragi on 1 acre, later got inspired to cultivate the entire 2 acres of the upland from which we could produce around six quintals of Ragi and generate an income of Rs. 20,262/- this year", says Jayanti.



value-addition units to produce millet-based products such as ragi biscuits, multi-grain cookies, ragi malt and snacks to promote rural women entrepreneurship.

Conclusion

The journey of women farmers in the Borigumma and Kundra blocks of Koraput district gives us an overall perspective of how a sustainable institutional approach can revive millets.

It had positive ripple effects of spread too. Shift to millets is also being observed in the Jharigaon block of Nabarangpur district. With the support of Harsha Trust, the Mangalmani FPO of Jharigaon has enabled 1456 women members resulting in increased millet cropping area from 16 ha to 685 ha in two years. The FPOs are contributing to the economic takeoff while ensuring nutritional security of rural tribal households.

The inclusive outlook of reviving millet-based cropping systems by OMM has brought newer confidence among farmers to take up millet on commercial scale. Initiatives such as Mandia stalls, Mandia Haat, and Mandia Divas aid in progressing the millets from villages to cities and provide scope for many women farmers to reach the regional, national and international markets through Farmer Producer Companies.

Millets, the talk of the year from International Forums to village-level meetings, is orchestrating livelihood improvement in hundreds of villages in southern districts

of Odisha. The declaration of the year 2023 as the International Year of Millets (IYoM) resonates with the ripple effect of millets in creating sustainable livelihoods for farming communities.

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Seed production of Arengu, a traditional variety of Ragi

Millets Seed System

An experience from Odisha *Millets Mission*

Susanta Sekhar Choudhury, Biswa Sankar Das, Pulak Ranjan Nayak,
Abhishek Pradhan and Bikash Das

Addressing the issue of seed scarcity, participatory varietal trials were conducted with farmers at the centre. After systematic assessment, identified suitable varieties were multiplied and made accessible through community managed seed banks.

Millets are one of the oldest foods known to humans and possibly the first among cereal grains to be cultivated for domestic purposes. These are small-seeded grasses that are hardy and grow well in dry zones as rain-fed crops, under marginal conditions of soil fertility and moisture. Important millet crops grown in India are Sorghum (Great millet), Bajra (Pearl millet), Ragi (Finger millet) and small millets viz., Korra (Foxtail millet), little millet, Kodo millet, Proso millet and Barnyard millet. These were often referred to as coarse cereals but realizing the nutrient richness of the grains they are now gazetted as “Nutricereals” by Government of India.

Post Green Revolution in India, there has been a decline in the production of millets. In Odisha too, 16.7% area under all millets and 32% area under ragi have declined. The major millet growing districts were motivated towards cash crop like eucalyptus, cashew, mango and other plantation crops in millet growing field due to non-availability of quality seeds, poor yield, less market price, non-subsidized inputs from Government.

Seed is an essential input for crop production. Access to quality seed of superior varieties is key in increasing agricultural productivity and production. Use of quality seeds alone could increase productivity by 15 - 20 % indicating the critical role of seed in agriculture. The

Government of Odisha supports only 2% certified finger millet seeds whereas 73% area is cultivated under finger millets. The private sector is not forthcoming for multiplying the open pollinated varieties (OPVs) as there is no proprietary advantage. The seed requirement shows that the farmers are inevitably sourcing seed from informal sector mostly through own-saved seed or from local markets where grain is sold as seed during sowing time, leading to low productivity. So for millet farmers, production of quality seed from popular and site specific varieties is very essential. This article explains about the alternative millet seed system working in Odisha to support millet growers under Odisha Millets Mission.

Alternative Millet Seed System

In 2017, Odisha's Department of Agriculture and Farmers Empowerment (DA&FE) launched a five-year programme known as Odisha Millets Mission (OMM) in tribal areas to revive millets in farms and on plate.

Considering its phenomenal success, the state government has extended OMM to 142 blocks during 2022, with a target of reaching out to more than 75,000 hectares (Ha) and around 1.5 lakh farmers. In this mission, Watershed Support Services and Activities Network (WASSAN) is the implementing partner working with selected NGOs and Community Managed Organization (CBO) at CD block level for promotion of millets, Nabakrushna Choudhury Centre of Developmental Studies (NCDS) is the research partner working on baseline, mid-term and endline survey. Department of Agriculture and Food Production (DAFP) is the monitoring and evaluation partner. One of the agendas of this mission is to increase millet productivity by providing support to improved access to quality seeds of promising varieties of millet.

More than 70% area is cultivated by finger millets in millet growing districts of Odisha. Broadcasting is the major sowing system followed by single weeding. No

Some of the characteristics of preferred ragi landraces from primary conserver

Name of the varieties	Duration (days)	Yield potential (ql/ha)	Special Characters	Exploration districts
Arengu	130	15-17	Tall, more productive tillers, its gruel is tasty	Gajapati
Bada Mandia	130	12.2-14	Higher yield, thick soup & tasty	Koraput, Rayagada, Malkangiri
Bagad Mandia	125	12.2-14.2	Long finger, less disease & pests, Dark brown grains	Bolangir
Bhoda Mandia	115	7.5-9	Dwarf, more number of productive tillers, popular, light brown grains	Bolangir
Bati Mandia	130	13-15	long duration, higher yield, incurved finger, tasty with thick gruel, no disease & pests, seed colour light brown	Koraput
Budha Mandia	130	9.5-12	Good plant type with high tillers, open panicles, No disease & pest occurrence, popular variety	Kandhamal
Burkha Mandia	125	8.5-10	Bold grain, less shattering, tasty, No disease and pest	Kandhamal
Dushera Mandia	120	10.2-13.5	Less disease & pest, popular variety, medium grain, light brown seed	Koraput, Malkangiri
Dhepka Mandia	120	10.5-12.2	Good tillers with Semi compact panicles and 4-6 no.of fingers, non-shattering, good grain filling	Rayagada
Hatabhanga Mandia	120	20-22	Good plant type with high tillers, Semi Compact type of Panicles, Fingers are more with well grain filling, No disease, pest occurrence	Gajapati
Jamba Mandia	140	15-17	long duration, compact panicle, copper brown seed colour	Koraput
Jhupa Mandia	110	9.5-11	Uniform grain size, deep red colour seed,	Kalahandi
Kala Kerenga Mandia	135	13-16	Popular variety, long duration, dark purple seed colour, more fingers	Koraput
Kantamara Mandia	110	15-17	High tillering, good seed establishment, Dark brown colour seed	Gajapati
Karkati Mandia	120	7.2-10	medium duration, light purple, bold grain, open panicle	Rayagada
Khunta Mandia	110	12.5-15	Dark brown seed colour, resistance to high water stress	Bolangir

plant population is maintained and nutrient and pest management system is absent in the cultivation practices. The prevalent seed rate was 12-15kg/ha. The finger millet was being cultivated not only as a solo crop but also in inter and mix cropping system. From the baseline survey conducted by NCDS from 7 OMM operational districts in 2016-17, finger millet yield was found to be 5.8 (q/ha), which is much below the national average yield.

There are a few finger millet notified varieties which were released by Government of Odisha more than 5-7 years ago. But these varieties are not accessible to farming communities. Therefore, farmers have been cultivating more than 50 traditional varieties which were saved from generations and in impure stage. These traditional varieties are neither recognized nor notified by any Government agencies because they are not taken under breeding process. In an effort to mainstream these traditional varieties, Odisha Millet Mission has been working on the traditional varieties of ragi.

Process of Alternative Seed System

A. Exploration, documentation and *in-situ* conservation

Odisha Millet Mission has explored some of the landraces of rice, millets, pulses and oil seeds which are still being grown in few pockets of the districts. The explored varieties are kept both in field gene bank established in the block attached to Community Management Seed System (CMSS) programme of OMM and also in the State Seed Testing Laboratories (SSTL) in Bhubaneswar in a cryogenic system. In the field gene bank, landraces are grown in farmer's field every year and farmers choose the best varieties, for further multiplication. Farmers are provided access to the landraces from SSTL, in case of loss of landrace owing to natural calamities. Till now, there are 97 different traditional millet varieties being stored in SSTL.



PVT selection process by farmers

B. Characterization of millet landraces

The explored millet landraces from different parts of Odisha are grown in Agro-ecological center. They are characterized as per the prescribed format developed by All India Coordinated Research Project (AICRP) of India. Distinctness, Uniformity and Stability (DUS) are developed by ICAR-IIMR. Around 12 Ragi landraces among 66 yielded higher than Government recommended varieties, promoted by Government of Odisha. The millets which are not available or cultivated in Odisha are also conserved and characterized in the centre. They include Proso millet, Barnyard millet, Browntop millet, Teff which will be provided to farming communities for further multiplication. Farmers and experts from research institutions have visited these landraces plots and have requested for seed materials.

C. Participatory Varietal Trial (PVT)

The Participatory Varietal Trial (PVT) was conducted in farmer's field to find out the best varieties from a pool of landraces for a small agro-ecological region. The process adopted is as follows:

In each block, planning meeting was conducted with farmers, OMM representatives and staffs of wassan to decide upon selection of plot, farmers, source of

Participatory Varietal Trials demonstration (2018 – 21)							
Season	No of Districts	No of blocks	No of farmers	No. of traditional landrace/ accessions	No. of Check (Govt.) varieties	No. of final selected trad. varieties	No. of selected Govt. varieties
Kharif 2018-19	5	12	12	79	14	18	6
Rabi 2018-19	2	4	4	26	3	2	4
Kharif 2019-20	12	39	39	185	41	71	8
Kharif 2020-21	3	12	12	104	15	23	1
Kharif 2021-22	2	12	12	107	12	23	1

Source: PVT reports of Odisha Millets Mission

Seed Production of traditional varieties				
Sl	Particulars	2019-20	2020-21	2021-22
1	Number of Districts	5	12	2
2	Number of Blocks	10	45	8
3	Number of farmers	19	93	17
4	Number of traditional varieties	14	47	17
5	Number of Govt. recommended varieties	1	4	0
6	Area in Ha	10.5	56	8
	Total quality seeds (Qntls)	27.18	122.6	38.3

irrigation, layouting and designing. Few local ragi varieties were collected from the block or districts. Some local varieties were collected by WASSAN from different organizations or districts to support the trial.

The PVT trial was designed in Randomized Block Design (RBD) in three replications with government recommended varieties as check. The minimum plot size per variety per replication is 25sq.m. Distance between replication to replication was kept at 100cm and variety to variety in the replication was 60cm. Twenty one to twenty five days seedlings were uprooted and planted in rows of 20 x 10 cm.

The plots were treated with 5 to 7q good dried FYM as basal dose and ploughed thoroughly. Equal amount of liquid JIBAMRUTA was applied to each plot after 1st weeding (15 days after transplanting) and after 30 days & 45 days of transplantation. Water supply during late vegetative stage, flowering period and milky stage was

ensured. The farmers and grass root workers regularly visited the PVT plots for monitoring and recording.

During physiological maturity stage, a field day was organized for selection of varieties. Male and female farmers (20 – 60 years age) are invited from cluster of villages to the replication plot. Names of varieties are decoded and the purpose of visit is explained to farmers. Farmers are divided into groups of 5-10 members. Each group along with a Community Resource Person (CRP) will enter the trial plot, discuss and tag the varieties as best, very well and poor. The CRP records the reasons for the tags assigned.

The researcher will also collect both visual and measurement characters of the varieties during vegetative stage. First five plants/plot/variety/replication will be selected randomly. Data from selected plants will be collected in a prescribed format. Crop Cutting Experiments-CCE (1 x 1 sq.m) data for each variety from each replication will be collected and fresh and dry



PVT nursery ready for transplanting

grain weight is recorded. Ten finger millets traditional varieties were found to be superior in yield over the check plot.

The data of selected varieties both from farmers and researchers is compiled and compared, to come out with the best two varieties for the block. Seed production of these selected varieties is planned for next year.

D. Seed production and mass selection

The two selected finger millets varieties from PVT is cultivated during the second year on one hectare of farmers field for seed production. Seeds are treated organically and an isolation distance of one meter is maintained between varieties. During maturity stage farmers are invited to select good seed patches from the field. Mother panicles are collected and harvested. After proper sun drying, the seeds are kept safely in the Community Seed banks at 10-12% moisture level.

E. Seed Multiplication

Quality seeds produced in 2nd year of the seed programme are kept in the community seed bank. Under OMM each block has one main seed bank which preserves, maintains and supplies quality seed to farmers. Seeds were multiplied on farmers fields by the Farmers Producer Organizations (FPO) after properly assessing the seed requirement at the block or district level. The FPO

selected experienced farmers for seed multiplication and provided training on quality seed multiplication, rousing, intercultural operations and maintenance. An MoU was signed to fix the seed procurement price and quantity to be procured.

E. Seed Purification

Promising and potential ragi landraces were collected from the PVT for purification and validation. In the year 2018-19, 14 well performed Ragi landraces were collected from PVT. These 14 landraces along with 2 improved varieties were grown in RBD method in Bhubaneswar under control condition in 2 replications. Four Ragi landraces *Mami*, *Kalia*, *Bati* & *Bharati* were selected by experts as superior among all other landraces and checks. In the year 2019-20, these four Ragi landraces were grown in two replications and data collected.

F. Multi-location trials of purified landraces and release

Multi-location trials of the four landraces were conducted in four locations. The purified four varieties along with local checks, national checks and state checks were trialed in farmer's field in RBD method with three replications. Experts from IIMR, OUAT and other eminent breeders visits were organized during crop growth period.

Box 1

Under SoP for landraces seed system, a landraces varietal release committee has the following role:

- To advise the State Government on all matters relating to the mainstreaming of the Landraces in the State.
- To review the implementation of the Govt approved Standard Operating Procedure (SoP) on Landraces in the State and to send periodic reports to the State Government
- To assess and release of landraces of crops for the State considering the different traits of the landraces and community/ farmers preference
- Guide on seed standards monitoring as per approved proposal
- To review the assessment of landraces seed requirements especially of certified, foundation seed and plan for different regions of the state
- Any other functions may be assigned to it by State Government in connection with the implementation of Govt approved SoP on Alternate Seed Systems For Landraces ‘
- To facilitate the landraces for registration as farmers varieties under PPVFRA
- To support and guide for preparation of Geographical Indication (GI) tagging proposal of landraces

A working group on seeds was constituted to guide the OMM team on variety purification and different trial design and documentation. All the agronomic data collected were analyzed on yield attribute traits, field level disease & pest resistance, nutritional profiling, 50% flowering and maturity in days etc., using OPSTAT software.

Four landraces **Identification proposal** for different agro climatic zones has been submitted to DA&FP to discuss with Landraces Varietal Release committee for release. Department of Agriculture and Farmers Empowerment (DA&FP), Odisha has approved Standard Operating Procedure (SoP) for landraces seed system in April 2022. A committee is in place which guides the release of varieties (see Box 1).

Conclusion

The millet seed system operated under Odisha Millets Mission is reducing the millet seed scarcity. The promising varieties of finger millets are now popular among the farmers and they can access from the

community seed banks. FPOs are strengthened on seed multiplication and are selling the seeds. Once the landraces committee approves the proposal, then for the first time the millet landraces seeds will be produced in formal seed chain and supply to the farmers.

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Farmers conserve rare species of kodo millets

R.K. Prajapati, B.S. Kirar and Yogranjan Singh

The tribal farmers of Tikamgarh district in Bundelkhand region earned respect at the national level by cultivating and conserving their traditional small millet varieties. The germplasm of these promising traditional varieties were deposited in the National Gene Bank for utilizing them for crop improvement programmes. Thus, practice of traditional conservation by farmers provided valuable raw materials to the country, from developing many good varieties of small millets in the future.

The importance of small millets increased considerably during Covid-19 pandemic. Millet cultivation was considered as an obligation of small and marginal farmers. It was often believed that they cultivated them to meet economic needs, being unable to spend on chemical inputs like fertilizers, pesticides etc. In reality, they cultivated them based on traditional, social and cultural backgrounds.

The Bundelkhand region has an excellent history of conservation of coarse grains and small millets. Besides having a suitable climate for their cultivation, it is linked to coarse grain preferences of locals on food plate. During different seasons coinciding with ceremonies and festivals, diverse dishes prepared from small millets can be seen even today. Thus, lots of efforts have been made by the tribal farmers in conserving traditional varieties of coarse millets.

The farmers of Tikamgarh districts in Bundelkhand region of Madhya Pradesh have been conserving many varieties of small millets for the past many years. They are recognized by their local names - *Sawan*, *Cheena*,

Sathiya, *Fikaar* etc. The cultivators are deeply familiar with their physiological and reproductive characteristics. The mythological beliefs and traditions prevailing in the society associated with these varieties have also been explicitly maintained in local folk literature. For instance, in well-known temples of the region, such as the famous Ramraja temple of Orchha and the renowned Kundeshwar temple at the district headquarters, small millets form the key ingredient in the offerings to the deities in the form of '*prasaad*'.

Efforts of Krishi Vigyan Kendra

Krishi Vigyan Kendra, Tikamgarh has been anchoring a project on awareness of "Farmers Rights – Plant Varieties and Farmers Rights Protection Act 2001" for the last 8 years. Under the project, efforts were made

Tikamgarh farmers were felicitated for conserving 12 traditional varieties of great value



to conserve the traditional crop species available in the district, preserving the germplasm in the National Gene Bank, and giving rights and recognition to those farmers who were conserving and cultivating them.

Initially, intensive surveys were conducted to find out which crops, varieties especially traditional varieties were being cultivated by the tribal farmers in remote areas. Training programs were organized every year since 2013-14 in which more than 650 farmers got trained on conservation aspects. The rare and endangered species of different crops of the district were publicized through exhibitions to encourage locals to take up their conservation. As a result of intensive and conducting repeatedly conducting awareness programmes, varieties with certain unique characteristics could be identified. Along with other crops like oilseeds, pulses, spices and cereals, during 2013-14, 2014-15 and 2015-16, eleven, seven and thirty seven varieties of kodo millets respectively were collected from the farmers of the KVK adopted villages.

These identified varieties were sent to the National Gene Bank at National Bureau of Plant Genetic Resources (NBPGR), New Delhi. NBPGR conducted multi-locational yield trials of these selected varieties in the fields of its regional centers. Their distinctiveness was ascertained through by conducting DUS (*Distinct, Uniform, Stable*) test. The DUS testing is a way of determining whether a newly recognized variety differs from other existing varieties within the same species and also whether the traits reported are uniform and stable. After three years of multi-locational trials, the genes present in these rare varieties collected from 12 farmers of Tikamgarh district were found to be very prominent and useful. These varieties were not only found to be better in yield potential, but also useful in being resistant to insect-pests. These trials thus proved that wild species are generally resistant to insect diseases. Also, nutritionally, the quantity and quality of proteins found were better than other parallel varieties of the kodo millets in the country. The fiber content of these varieties was found to be in the range of 11-13gm/100 gm that is significantly higher than refined wheat flour or rice (<3 gm/100 gm).

These farmer's impressive efforts were communicated at the national level by the Krishi Vigyan Kendra, highlighting how traditional conservation practices of

farmers could lead to development of good varieties in future. Especially, keeping in view the quality and their usefulness in future in crop improvement programmes, these 12 millet farmers of Tikamgarh were honored by the then Honourable Union Agriculture Minister Shri Radha Mohan Singh on 18 April 2017 in a public function. As an honor and award, each farmer was given a letter of honor and an honorarium of Rupees One Lakh. The Minister in his address, said *"this joint effort of Krishi Vigyan Kendra, Tikamgarh and local farmers is indicating the importance of Indian traditional knowledge along with conservation of valuable plant varieties and should be considered as a national benchmark"*.

Rama bai of Soriyana village, reacted, "I never dreamt that our tradition would get us such a big award at the national level".

Although, in general, millets have been relegated as 'coarse' grains, their rich nutritional characteristics, short growing period and long survival in storage make them the most suitable option in India. These farmers of Bundelkhand have opened the door for developing mechanisms for millet improvement but also influencing millet cultivation by larger number of farmers. Due to higher production, they also got buyers. In this way, the kodo millet, which was grown only for maintenance of tradition, has now become a means of earning.

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Towards a Climate-Smart tomorrow: Solutions for transforming Asia's agriculture sector

In November last year, global leaders, donors, civil society organizations, and the private sector convened for the 27th Conference of the Parties (COP 27) of the United Nations Framework Convention on Climate Change, in Sharm-el-Sheikh, Egypt. As people gathered in the warm coastal town, the writing on the wall was clear: without concerted efforts to change course, global temperatures will continue to rise, bringing with them more extreme weather events and disrupting all aspects of our lives—from ecosystems and biodiversity to food security and livelihoods.

The last few years have witnessed rapid transformations of Indian agriculture, prompted in part by erratic weather patterns and extreme temperatures across the country's diverse climate zones. These innovations have been supported by a series of reforms and a robust policy framework.

Farmers in India are adopting new farming practices, sharing information, and applying technology to address climate change. Several institutions with expertise in climate-smart agriculture, in both the private and public sectors, are working with farmers to develop and implement climate-responsive solutions. For example, a range of organizations, including private sector, agricultural cooperatives, civil society organizations, and

farmer-producer organizations, are working closely with smallholder farmers to test, replicate, and scale climate-resilient agriculture. These organizations have devised context-specific and locally led strategies for natural resource and watershed management and are working to enhance agricultural and forestry practices in local communities.

Smart-agriculture solutions such as land shaping, which creates more sources of water and improves the land surface for a variety of crops, are helping farmers manage ecologically vulnerable agricultural land in areas prone to cyclones and droughts. New, drought-tolerant crops have been developed to address climate vulnerabilities. Several organizations in India are working to diversify farmer household incomes by integrating agriculture with livestock management to help replenish soil fertility and maximize the quality of livestock and crops. Farmers have adopted easily operable machines such as inexpensive “rotavator” rotary tillers and drum seeders to improve soil health and crop productivity.

Source : <https://asiafoundation.org/2023/02/22/towards-a-climate-smart-tomorrow-solutions-for-transforming-asias-agriculture-sector/>

Prof Chandel preparing curriculum on Natural Farming for Agricultural Universities

After successfully implementing Natural Farming in the state, Dr YS Parmar University of Horticulture and Forestry, Nauni Vice-Chancellor Prof Rajeshwar Singh Chandel is preparing a curriculum on Natural Farming for Agricultural Universities.

University Vice-Chancellor Prof Rajeshwar Singh Chandel, in a meeting with Governor Shiv Pratap Shukla at Rajbhawan Shimla on Tuesday, apprised that the University is preparing a national curriculum on natural farming for agricultural universities and schoolchildren through NCERT.

The university has also played a leading role in designing the curriculum on natural farming for the agriculture universities of Gujarat, Prof Chandel informed the Governor.

Prof Chandel informed the Governor that the horticulture university has taken initiative in creating India's first 100 per cent natural farming-based Farmer Producer Company and the university is also handholding the company in processing and value addition of its products along with marketing.

“Successful pilot has helped to increase the income of the farmers by 2.9 times,” Prof Chandel further said and further elaborated on the university’s role in the implementation of the State Government’s Prakritik Krishi Khushaal Kisan Yojana.

Professor Chandel invited the Governor to visit the university and see the different models of natural farming created in the state.

Source: <https://thenewshimachal.com/2023/02/nauni-university-preparing-curriculum-on-natural-farming-for-agricultural-universities/>

CEF Group to invest ₹650 crore in Uttar Pradesh for biofuel production

Energy solutions company, CEF Group will set up multiple waste processing plants in various locations in Uttar Pradesh to address the problem of waste mismanagement and augment bio-fuel production at an investment ₹650 crore.

CEF and the Uttar Pradesh government have signed an MoU for setting up the plants that will generate employment for approximately 240 people, the company said in a statement.

The plant will address the problem of waste mismanagement and augment bio-fuel production.

Maninder Singh Nayyar, CEO of CEF Group, said, “Uttar Pradesh is the largest state in the country which requires adequate waste management solutions, and we are capable of doing it. This agreement will prove beneficial for the entire state in various regards.”

The company said organic waste processing plants with captively grown Napier grass will also be utilized, bringing stable earnings for farmers. The project will be one of the largest ones of its kind in India.

“This is a direct replacement for chemical fertilizers in commercial farming. Therefore, enabling more scope for sustainable and natural/organic farming on a larger scale. We will be able to produce both biofuels and organic manure resulting in a sustainable environment,” he added.

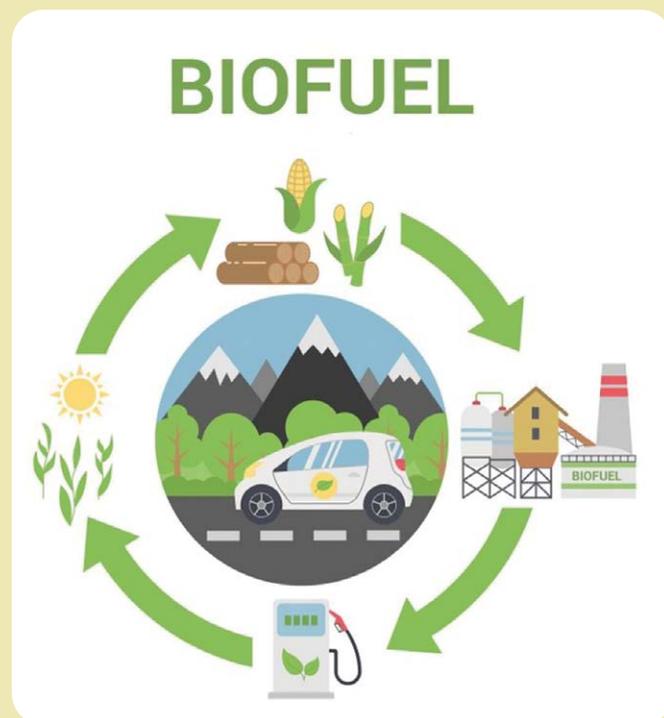
Under the ongoing Invest UP streak, CEF Group has seized the opportunity to invest in the state this year with a proposed project named bio-fuels and allied products, in which CEF group will convert municipal solid waste, agricultural, industrial waste like press mud from sugar

mills and other organic wastes into bio-fuels and allied products.

The projects will come in phases, with construction starting by the end of 2023. Different municipalities of Uttar Pradesh will provide the waste and land.

The overall set-up of the project with offtake arrangements of the bio-CNG and organic manure or city compost will be processed scientifically in the CEF waste processing plant.

Source : <https://www.livemint.com/news/india/cef-group-to-invest-rs-650-crore-in-uttar-pradesh-for-biofuel-production-11676893570471.html>



India brought 4.78 lakh hectare land under natural farming last year

In line with the government's thrust on zero-budget farming, Indian farmers have brought an additional 4.78 lakh hectares area under natural farming covering 17 States last year.

To promote natural farming, the central government has approved the National Mission on Natural Farming as a separate scheme with an expenditure of Rs 1,584 crore, said Union agriculture minister Narendra Singh Tomar while addressing the National Conference on Soil Health Management for Sustainable Farming on Monday.

Under the Namami Gange Programme, the project of natural farming is going on along the banks of the river Ganges, while the Indian Council of Agricultural Research (ICAR) and all Krishi Vigyan Kendras (KVKs), Central and State Agricultural Universities and Colleges are making all-round efforts to promote natural farming, a statement from the agriculture ministry said.

Speaking at the Conference, Tomar said that due to chemical farming, soil fertility is getting eroded and climate change in days to come is going to be a big concern for the country and the world across. The lack of organic carbon in the soil is a serious concern.

"To meet this serious challenge and for better soil health, we have to promote natural farming, which is beneficial

for the environment," the Union minister was quoted in the statement.

Natural Farming System is an ancient technique used by farmers for farming and at that time people also knew how to live in harmony with nature, he added. States like Andhra Pradesh, Gujarat, Himachal Pradesh, Odisha, Madhya Pradesh, Rajasthan, Uttar Pradesh, Tamil Nadu etc. have made many innovations to promote natural farming.

In two phases so far, more than 22 crore soil health cards have been distributed to farmers across the country.

At the conference, Vice Chairman of NITI Aayog, Suman Berry, Member Ramesh Chand, CEO Parameswaran Iyer, Senior Advisor Neelam Patel, Central Agricultural University Vice Chancellor of Jhansi, A.K. Singh and Drik Steffis, along with several scientists, policymakers and other stakeholders were present. Various technical sessions were also addressed by experts at the conference. (ANI)

Source: <https://theprint.in/economy/india-brought-4-78-lakh-hectare-land-under-natural-farming-last-year/1250459/>

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Revival of millets

Ensuring food and nutritional security

Ravi Shankar Behera

Millet based cropping systems suited to local agroecology have stood the test of time and extreme weather conditions. Sustainance of such agricultural systems is also critical to address the issues of malnutrition among the tribal communities.

Millets have been an integral part of everyday diets of indigenous communities in Odisha. Millet crops are climate-resilient, capable of growing in rainfed conditions with low water requirements. They are the source of food security and nutrition for the small and marginal farmers.

Indigenous communities practice shifting cultivation on medium and uplands along the hill slopes, where the crop is cultivated during June to September. Subsistence farming is practiced by a majority of the farmers for household level consumption. Only 10-20% of the farm produce is sold in the local haats (local markets). Traditionally, they have been practicing mixed farming and crop rotation, which are best suited to the local agroecology. These cropping patterns have stood the test of time and extreme weather variabilities. Changes in the daily dietary patterns have been observed since the last two decades with more rural households preferring rice, which is readily available under the Public distribution system (PDS). Besides subsistence agriculture, local communities are dependent on the forest for Non Timber Forest Produce (NTFP). Distress migration is a reality for most poor households in Kandhamal.

The Initiative

In the year 2012, NIRMAN started its work with local indigenous communities promoting mixed, biodiverse and sustainable agriculture practices and ecological farming. As a first step, Participatory Rural Appraisal (PRA) exercise was conducted in all the villages to collect baseline information. Information on various aspects like household income, status of indigenous agriculture practices followed, extent of seed diversity etc. To motivate the communities to revive their indigenous agricultural practices, a village level meeting was organized to discuss issues related to erosion of the indigenous crop diversity, indigenous agriculture practices and sustainable agriculture.

Some of the women in Nayagarh and Kandhamal districts have clearly articulated the various challenges in the cultivation of minor millets in the region. There has been drastic reduction in the area under cultivation of minor millets and also a reduction in yields of the crops. This reduction is to the tune of 25-30% of the cultivated area and almost a third in the reduction of crop yields, over the last two decades. The major reasons attributed include non availability of local indigenous varieties of seeds, restrictions to undertake “*Podu chas*” on the hill

slopes by the forest department, large-scale deforestation and accelerated soil erosion.

Trainings on millet-based mixed farming were conducted during the first year of project intervention. During the second year, village level trainings were done on sustainable agricultural practices, focusing on indigenous mixed and biodiverse farming system and the need to restore seed diversity. The major strategy of our intervention was to promote women-led approaches, to assert their control over food production system and to conserve indigenous agro-biodiversity.

Village meetings were conducted with women. Village Level Institutions (VLIs) were promoted. Around 21 VLIs were formed and the members were trained on the management of millet-based community seed banks. Currently around 27 community-based seed banks have been formed, supporting around 600 farmers in 27 villages. Heirloom seeds of 12 indigenous crops of local choice were supplied to local communities as one-time seed-capital, for conservation. These 12 crop varieties were revived within one cropping season.

Women were encouraged to practice mixed farming in an effort to revive the indigenous mixed farming system. Restoring seed diversity was focused. The major strategy was to promote women-led approaches.

Communities were encouraged to cultivate millets both on uplands and low lands. Major minor millets cultivated in the region got a new fillip under the Millet Mission project. Minor millets are grown for 2-3 months during the Kharif season. Most of the small and marginal farmers who cultivate on the highlands, prefer to grow paddy for reasons of food security. Partial substitution of paddy with alley cropping is considered to be more appropriate measure to achieve the crop diversification. Mixed cropping of different combinations of crops is therefore being popularized.

Nirman also motivated the communities to adopt System of Millet Intensification (SMI) availing the subsidy of cash transfer under the Millets Mission. This has led to the increase of area under cultivation and

yield of ragi in most villages covered under the Millets Mission project.

NIRMAN has supported farmers groups for processing of minor millets like provisioning of millets processing units including solar based in remote tribal hinterlands. The women's groups are involved in aggregation, processing, packaging and marketing of the millets to earn better income.

Custom hiring centres were established for hiring implements, machines for post-harvest operations (clean millet harvests) at cluster level.

Millets are now being procured by the Government under the Odisha Millets Mission. There is a MSP for Ragi. However, MSP has not yet been set up by the Government for other types of millets. The millets are now part of the PDS and MDM schemes in the state, though on a pilot basis. Millets are also sold at the Government outlets in various towns and cities. There are only a few Government marketing agencies like Mission Shakti/OLM and very few private companies like ORMAS and TRIFED. International marketing of millets is just evolving. A few civil society actors have started to link up with international consumers recently using digital marketing channels, especially in countries like Germany.

Results and Impact

Women farmers have been playing a major role in the revival of indigenous crops, management of the community-based seed banks and conservation of the indigenous agro-biodiversity.

Seed festivals are jointly organized in Kandhamal and Nayagarh districts to facilitate farmer to farmer

Table 1: Millets cultivation data of 2021-22, NIRMAN, Odisha

SI No.	Block	No of village covered	No of farmers involved	Total area covered in Ha.	Total surplus ragi procured (through TDCC) in quintals	Total INR received through Procurement	Total incentive transferred to the farmers account (INR)
1	Tumudibandha	212	2255	1081.4	3850.69	12965755.1	1659800
2	Kotagada	75	1096	700.2	3762.74	4798142.9	1602000
3	Dasapalla (1st Yr)	22	496	190.95	0	0	1699659
4	K.Singhpur	57	1675	1075	2500	8442500	1069000
Total		366	5522	3047.55	10113.43	26206398	6030459



Farmers use simple equipment to do weeding in ragi field

interactions, knowledge transfer and exchange of traditional best varieties of millets. There is a growing awareness and interest among farmers to adopt ecological farming systems and practices and practice traditional methods of organic farming.

Presently, the community-based seed banks have been maintaining heirloom seeds of 55 indigenous crops, which include millets, maize, pulses, vegetables and edible tubers. Communities now cultivate 7 varieties of indigenous paddy, 6 varieties of indigenous maize, 3 varieties of finger millet, 3 varieties of little millet, 2 varieties of barnyard millet, 2 varieties of pearl millet, 3 varieties of foxtail millet, 2 varieties of sorghum, 4 varieties of pigeon pea, 2 varieties of cow pea, 3 varieties of rice bean, 4 varieties of country bean, 2 varieties of black gram, horse gram and 17 types of edible tubers, under millets-based mixed farming system.

Conclusion

Women play a major role both in the fight against climate change and in eradicating chronic hunger and malnutrition. The bondage between millets and women in these tribal tracts is indispensable. Revival of millets is a boon to mitigate the prevalent malnutrition amongst the poor.

It is important to design strategies to encourage the cultivation, maintenance and propagation of local varieties of millets in the region with good marketing strategies, so that their cultivation is comparable to the cash crops. These policy options may help to maintain enough landraces for *in situ* evolution in view of imminent climate change.

Millet cultivation owing to its several benefits, has been proactively promoted by the Millets Mission, local NGOs and farmer organizations in Odisha. However, caution need to be exercised to ensure that a complete commercial approach for the cultivation of millets should not lead to monocultures, resulting in the loss of crop diversity.

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Millet production

A mutual learning experience

Surabhi

Small support can bring in significant changes. This has been our experience as students of RAWE programme. While helping millet farmers with linkages, we were the ones who learnt a lot during the programme.

As a part of our B.Sc. Agriculture curriculum, the students of 7th semester are placed in a village under the Rural Agriculture Work Experience (RAWE) programme. In this programme, students work and learn along with a host farmer, while living in the village for an entire cropping season. During July to November 2022, 22 students were placed in a small village named Barbaspur in Umaria, Madhya Pradesh.

two years he started growing kodo millet on his 2 acres of land, as he felt that the crop doesn't require a lot of inputs like irrigation and fertilizers. His family is one of the only three families in the entire village that grew

Shri Pyarelal produces kodo millet and sells to a millet processing unit

There are around 450 farmers in Barbaspur village and agriculture is the primary source of livelihood. Barbaspur comes under the northern hills zone of Chhattisgarh, with hilly and undulating topography. The major soils are red and yellow, followed by sandy soils. Paddy, maize, pigeon pea are the major kharif crops, while wheat, gram and lentils are grown during rabi season. However, almost half of the farmers in the village leave their lands fallow during the Kharif, owing to uncertainty of rainfall. The farmers with uplands or sloping lands find it difficult to stagnate water for transplanted rice. Farmers therefore, prefer growing crops only during the rabi season.

Shri. Pyarelal, my host farmer has been growing paddy for years. Since the last



kodo millet. Most of the farmers, are not confident of growing kodo millets as they are not sure of the markets available. Pyarelal too has this fear. *“We are not technically sound enough to manage our crop and produce’s sale as well, so we decided to have kodo as crop just to have something to eat from our own field”*, quoted Pyarelal.

Small changes, big gains

As students and keen learners, we envisaged an opportunity and a solution too. We realised that Kodo millet could be a good option and a replacement for paddy in kharif and especially on the undulating lands, which did not require more water or standing water. We decided to connect Pyarelal and other interested farmers with the nearest KVK - KVK Umariya. With the technical guidance from KVK, we ensured that the farmers adopted good crop management practices. For example, Pyarelal had been facing the problem of crop damage caused by trampling of crops by wild animals. Earlier, he used to guard the farm all through the night which was quite tedious. With KVK’s guidance, he fenced the fields with rope dipped in animal repellent Neelgo. The KVK also trained farmers on preparation of Jeevamrit. Farmers were advised to incorporate rhizobium and Phosphorus Solubilising Bacteria cultures in the soil during sowing in next cropping season. These small changes led to a 30% increase in the yield this year as compared to the previous years and this energised his confidence.

We also wanted to ensure that the farmers see more selling options so that they are encouraged to grow millets. We arranged for a meeting of the farmers with executives of ASHA Foundation, an NGO working in the area. The Foundation agreed to provide farmers with quality seeds and offered to link with the procurers in Nashik, if the farmers found the price fit. We also talked to millet grain sellers in Jabalpur who have their stock transported all the way from southern states of the country. They are more than happy to find farmers from nearby districts to procure the grains from, given the quality is maintained. Pyarelal after comparing all options available now, decided to sell his produce to the millets processing unit procurers in the adjacent district as he got a better price from them this year.

Coincidentally, during the same time there was an announcement of setting up of a large millets processing units sanctioned by the government, in the adjacent

district of Dindori. Dindori is just around 100 kms away, who are stocking up tonnes of millets at good rates. As in the end it all comes down to prices fetched by the crop, money will be the greatest precursor. During an interaction Pyarelal said *“we are lucky to have a processing mill being opened nearby, without all the hassles, Kodo seems like a better option than rice”*. Jhalki bai, a lady farmer said *“the prices being offered and the ease of milling is giving me hope for even better returns next season”*. The millets processing unit soon to be opened in Dindori will prove to be a catalyst for expanding area under millets. Farmers will have the option to send their produce for milling and later on sell it to buyers of their choice or even make other value added products.

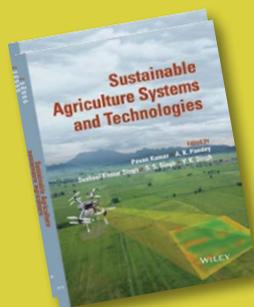
Mutual learning

Farmers learnt that their fallow lands could be used for producing millets, which required less water. They also understood that millets have an excellent keeping quality and hence need not resort to distress selling. They understood the importance of storing the grain and selling at the right time. Also, with regular interaction with the students, farmers learnt that there is a growing demand for millets and the establishment of processing units will give rise to better market opportunities. With enhanced awareness, we are expecting more farmers in the village to take up kodo millets production during kharif 2023. With greater production of millets, we also envisage better health for the households with millet rich diets.

The RAWE programme has been a great learning opportunity to students as well. We learnt how to make crop choices based on the local topography and changing rainfall patterns, turning them to our advantage. Students also learned the change that simple value addition can bring about in the economic condition of farmers.

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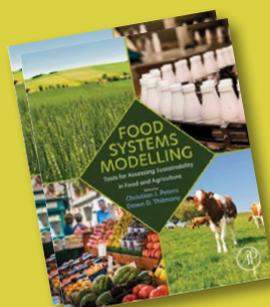


Sustainable Agriculture Systems and Technologies

A. K. Pandey, Pavan Kumar, S. S. Singh, Susheel Kumar Singh, V. K. Singh, 2022, Wiley, 400 p., ISBN:9781119808534

In *Sustainable Agriculture Systems and Technologies*, a team of distinguished researchers delivers an up-to-date and comprehensive exploration of sustainable agriculture and its relationship to the drivers of climate change. Along with robust examinations of food security and the agrarian livelihood, the book covers the impact of climate change and variability on agriculture, water management in agricultural systems, and precision agriculture.

This book represents a significant contribution to the scientific understanding of the application of technologies that address food insecurity and climate change through sustainable productivity, system diversification, irrigation practices, crop modeling, data analytics, and agricultural policy. It also explores the risks and benefits of different agricultural systems under changing climate scenarios.



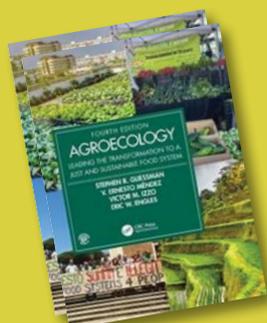
Food Systems Modelling: Tools for Assessing Sustainability in Food and Agriculture

Christian J. Peters, Dawn Thilmany, 2022, Elsevier Science, 388 p., ISBN 9780128221105

Food Systems Modelling emphasizes sustainability, including the impact of agriculture and food production on profits, people and environment, with a particular focus on the ability of humanity to continue producing food in the midst of global environmental change. Sections introduce the purpose of models, the definition of a food system, the importance of disciplinary, interdisciplinary, and transdisciplinary inquiry, cover specific branches of modeling in the sustainability of food systems, and wrestle with the challenge of communicating modeling research and appropriately integrating multiple dimensions of sustainability.

This book will be a welcomed reference for food scientists, agricultural scientists, nutritionists, environmental scientists, ecologists, economists, those working in agribusiness and food supply chain management, community and public health, and urban and regional planning, as well as academicians and graduate students interested in the sustainability of food systems.

Emphasizes sustainability, including the impact of agriculture and food production on profits. Focuses on the ability of humanity to continue producing food in the midst of global environmental change. Deciphers what models can teach us about food system sustainability.



Agroecology - Leading the Transformation to a Just and Sustainable Food System

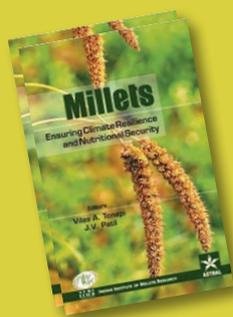
Stephen R. Gliessman, V. Ernesto Méndez, Victor M. Izzo, Eric W. Engles, 2023, CRC Press, 470 p., ISBN 9781032187105

Agroecology is at the forefront of transforming our food systems. This bestselling textbook provides the essential foundation for understanding this transformation in all its components: agricultural, ecological, economic, social, cultural, and political. It presents a case for food system change, explains the principles and practices underlying the ecological approach to food production, and lays out a vision for a food system based on equity and greater compatibility with the planet's life support systems.

A Companion Website at <https://routledgetextbooks.com/textbooks/9781032187105/> incorporates the entire contents of the updated practical manual *Field and Laboratory Investigations in Agroecology*, split into student and lecturer resources. These 24 sample investigations facilitate hands-on learning that involves close observation, creative interpretation, and constant questioning of findings.

Groundbreaking in its first edition and established as the definitive text in its second and third, the fourth edition of *Agroecology* captures recent developments in the field and forcefully applies the idea that agroecology is a science, a movement, and a practice. Written by a team of experts, this book will encourage students and practitioners to consider the critical importance of transitioning to a new paradigm for food and agriculture.

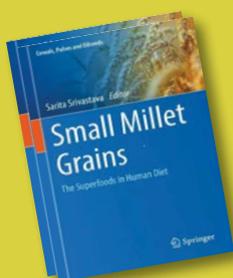
SOURCES



Millets Ensuring Climate Resilience and Nutritional Security

J. V. Patil , 2015, *Daya Publishing House*, 664 p., ISBN 9789351306719

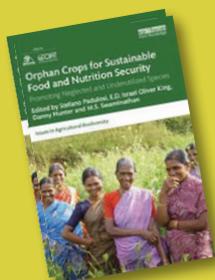
Millets: Ensuring Climate Resilience and Nutritional Security presents the current status of germplasm resource management and genetic improvement of group of climate smart nutri-cereal crops called Millets encompassing Sorghum, Pearl Millet, and Small Millets comprising Finger Millet, Foxtail Millet, Kodo Millet, Proso Millet, Barnyard Millet and Little Millet. The focus is on genetic improvement, agronomy, physiology, biotic and abiotic stresses, pest and disease management, molecular marker-aided approaches for improvement of millets, nutritional and health benefits of millets, utilization pattern, creating demand through value addition, commercialization and marketing of millet products, sustaining viability of informal millet seed systems and Innovative seed delivery models. The emphasis is on improvement of millets elucidating the future road map to enhance scope of millets as "MIRACLE NUTRI-CEREALS" through value chain to ensure food, feed, fodder, biofuel, nutritional and livelihood security, including climate resilience.



Small Millet Grains The Superfoods in Human Diet

Sarita Srivastava, 2022, *Springer Nature Singapore*, 190 p., ISBN 9789811693069

This book discusses the various aspects of the health and nutritional benefits of the wonder grains, small millets. It introduces the readers to the historical use of small millet grains in the diet of humans. It further discusses the consumption and strategies to improve the global production of these nutrient-dense grains. The book outlines how the inclusion of small millet as a staple could prevent nutritional deficiency diseases, hidden hunger, and non-communicable diseases. Different chapters of the book provide information about the nutritional profile of popular small millet grains. It also includes information about the effects of processing on the dietary factors in the grains. It describes the traditional food products as well as unconventional products from small millet. It advises the readers on the best ways to consume this super-food. The book also highlights the role of small millet as a functional food. It highlights how this food can address the challenge of nutritional security.



Orphan Crops for Sustainable Food and Nutrition Security Promoting Neglected and Underutilized Species

Stefano Padulosi, E.D. Israel Oliver King, Danny Hunter, M.S. Swaminathan, *Routledge*, 470 p., ISBN 9780367902827

Orphan Crops for Sustainable Food and Nutrition Security discusses the issues, challenges, needs and opportunities related to the promotion of orphan crops, known also as neglected and underutilized species (NUS).

The book is structured into six parts, covering the following themes: introduction to NUS, approaches, methods and tools for the use enhancement of NUS, integrated conservation and use of minor millets, nutritional and food security roles of minor millets, stakeholders and global champions, and, building an enabling environment. Presenting a number of case studies at the regional and country levels, the chapters cover different but highly interlinked aspects along the value chains, from acquisition and characterization of genetic diversity, cultivation and harvesting to value addition, marketing, consumption and policy for mainstreaming. Cross-cutting issues like gender, capacity building and empowerment of vulnerable groups are also addressed by authors. Representatives from communities, research for development agencies and the private sector also share their reflections on the needs for the use enhancement of NUS from their own perspectives.

This book will be of great interest to students and scholars of food security, sustainable agriculture, nutrition and health and development, as well as practitioners and policymakers involved in building more resilient food and production systems.

Revival of millets in North East India

Prabal Sen, Patrick Hansda, Pradipta Kishore and Chand Haridas VR

The smallholder farmers in NER have revived millets in their cropping systems as well as in their diets. A little support in terms of technical guidance and value addition, and building linkages for marketing has been instrumental in bringing back millets in the food and agriculture systems of Northeast India.

Millets are an important part of the agricultural landscape and dietary culture in Northeast India



Smallholder farmers practising subsistence agriculture dominate the primarily rain-fed agricultural systems in the North East region in India. The region is known for traditional farming practices such as shifting cultivation, which entails clearing and burning small portions of forest land for cultivation. The region is notable for its production of crops such as rice, maize, millets, pulses, tea, spices, and fruits. The region, which is also characterized by a high level of biodiversity, is also home to many indigenous crop varieties and livestock breeds. The region faces a high risk from natural disasters such as floods, landslides, and earthquakes which adversely impact agriculture. Land degradation, soil erosion, low productivity, poor market linkages, and climate change are additional challenges that the farmers in the region face.

Millets are an important part of the agricultural landscape and dietary culture in Northeast India. Finger millet, foxtail millet, buckwheat, pearl millet and Jobs Tears are some of the millet varieties found in North-eastern states. The states of Assam (18.82 kg/hsh/m) and Bihar (18.69 kg/hsh/m) records highest consumption of small millets. These small-seeded grasses have been cultivated and consumed by indigenous communities in the region for centuries, due to their ability to grow well in challenging and hilly terrain, and their resilience to extreme weather conditions. Traditional fermented foods and beverages occupy a special place in the Himalayas across the North-Eastern states of India due to their nutritive value, taste, health aspects, social, ritual, and cultural importance. Finger millet is the predominant millet crop in the eastern Himalayan region. Foxtail millet and finger millets are also found in most states.

Millets form an integral part of subsistence agriculture in the North East Region (NER) predominated by small farmers. It is primarily used for food and beverages, though their use as fodder and bird feed is also significant. The pattern of millet consumption varies across states in the Northeast and has remained similar or reduced over time. Efforts are underway to promote the cultivation of millets in Northeast India.

Caritas India has been working in the region to revive indigenous wisdom and traditional food system for greater food sovereignty. Since 2013, Caritas India is implementing the Facilitating Agricultural Regeneration Measures (FARM) North East (NE) program in the states

of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura. FARM NE is the largest cluster programme of Caritas India reaching out to the smallholders of the region and promoting food security through climate-adaptive traditional agricultural systems, and traditional food systems. The program is designed to be community-led, with smallholder farmers playing a key role in driving positive change.

Caritas India has been actively working in NER and has engaged with various ethnic groups across the seven states for the promotion of sustainable agriculture including millets. To enhance the growth and utilization of millets in India, Caritas India has been emphasising on enhancing food and nutrition security for susceptible populations. Through the promotion of millet cultivation and consumption, Caritas India has been striving to revive the traditional food system, which is nutritious, sustainable, and robust.

Millets have been a part of traditional agriculture in NER, but their use as a staple food has been limited, as the majority of the population are primarily rice eaters. During the 2016-17 growing season, finger millets were promoted for the first time in Ri Bhoi district of Meghalaya. To encourage wider adoption, Caritas India emphasized on the use of millets and raised awareness on the health advantages of millet and advocated for their increased consumption.

The PLD Approach

The program is based on the core principle of People-Led Development approach that prioritizes the participation of local communities and individuals in the planning and implementation of development initiatives. It seeks to empower people to take an active role in their own development and recognizes them as the best source of knowledge about their needs and circumstances. The approach aims to shift power and decision-making to the community and build partnerships between communities, civil society organizations, and government entities.

FARM programme was initiated to revive traditional and cultural food practices for sovereignty through people's participation and collective decision-making. Farmers were collectivised and brought together in community and farmers groups to discuss their common issues pertaining to their lives, livelihood, income, and food security. Community mobilizations was carried out



Women understand the potential of millets to earn extra income through processing and marketing

by the FARM in programme villages and people were made aware of the benefits of millets to human health, the economy, and the environment. This has created awareness and ownership of their collective decisions.

The programme adopted a dual approach in building capacities of the farmers on millet cultivation. FARM worked on upscaling traditional agricultural practices and a perfect mix of traditional and scientific approaches were adopted to facilitate trainings from the Department of Agriculture and Krishi Vigyan Kendras (KVKs) on one side and organising hands-on training through Lead farmers based on their wisdom and practices inherited from their ancestors. Overall, it was a blending of science with tradition. Local resource persons were identified out of these trained farmers to enable them to help and train their communities in millet cultivation.

The programme prioritised fulfilling the nutrition and food requirements of the family, first. Additional produce was normally sold in the local market. To help communities gain returns to scale, communities were sensitized to pool their produce and sell. Several small shops were created in the programme areas where people could sell their produce.

Additionally, the farmers were provided with support in the form of grinding and packaging machines to aid in processing.

Results

Successful millet cultivation practices were adopted by farmers. Seed exchanges helped in wider adoption and upscaling. Community mobilization also helped in creating market linkages for millets by involving local buyers. Access to processing machinery helped farmers to add value to their produce which ensured better marketing options. Value-added products such as cakes and powder made from millet have become popular.

FARM program has successfully promoted millets in 15 districts across five states in the NER in less than 2 years' time. Approximately 1,500 more smallholder farmers in Assam, Arunachal Pradesh, Manipur, Meghalaya, and Nagaland are now growing various types of millets on 3-5 acres of land per household.

Awareness and sensitization sessions have been popularising millets among the farming community. Traditional seed banks started storing millet seeds as well. The success in the field has created a multiplier effect in adoption. Millet seed exchange events organised under the FARM programme at local and state level, accelerated its adoption rates in geographically identical areas.

Inspiring case

Mr. Lang Pyrtuh, a 68-year-old farmer from Samanong village in West Jaintia Hills District of Meghalaya State, is a strong proponent of millet cultivation. Lang laments the decline in millet cultivation over the past 27 years, which has been replaced by rice as a staple grain. The introduction of cash crops like sesame and broom, which offer higher profits than millet, has contributed to this decline according to Lang. Additionally, the supply of the Public Distribution System (PDS), which includes only rice, wheat, and sugar, has resulted in a change in food habits, with people becoming more reliant on external food products.

In response to this challenging situation, Jaintia Hills Development Society (JHDS), with support from Caritas India under FARM NE, took up initiative to address the decline in millet farming. Meetings were organized with farmers to discuss the importance of millet cultivation and its relevance. Krishi Vigyan Kendra, West Jaintia Hills District is providing support to train entrepreneurs in agri-processing from millets.

The intervention has already shown positive results, with 10 families joining the effort to cultivate millet in 2019. It is expected that more families will join in the future, promoting farmer-to-farmer and community-to-community exchanges to bring neighbouring villages and the entire district under millet cultivation.

Caritas India's support to its partner organization JHDS, has resulted in an increase in the number of families cultivating millets in Samanong village to 51. The village grows two varieties of finger millets, commonly known as Kre Lieh (white millet) and Kre long (black millet). The community is convinced of the long-term sustainability of millet cultivation and its potential to earn extra income through processing, packaging, and marketing.

FARM programme has been instrumental in reviving millet cultivation in the community and promoting the idea of food sovereignty, which is crucial for the region's future. Similar cases have been reported in other parts of Meghalaya, Assam, and Manipur and Nagaland.

Conclusion

The FARM program's people-led approach to reviving millets in the NER is showing promising outcomes. By supporting farmers and promoting sustainable agriculture, this initiative not only increased the popularity of millets as a nutritious food source but also enhanced the livelihoods of smallholder farmers and preserved traditional farming methods. The People-Led Development approach has enabled communities to make informed decisions about their food security, considering what works best for them. This initiative has also resulted in maintaining biodiversity while promoting healthy ecosystems. The revival of millets has brought back the cultural food practices within ethnic communities, demonstrating the power of people-led interventions in driving positive change in the society.

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Decentralized small millet processing

Dwiji Guru

Collaborative efforts made by nutrition conscious communities has helped to revitalise, cultivate, process and promote consumption of millets in three geographics in India.

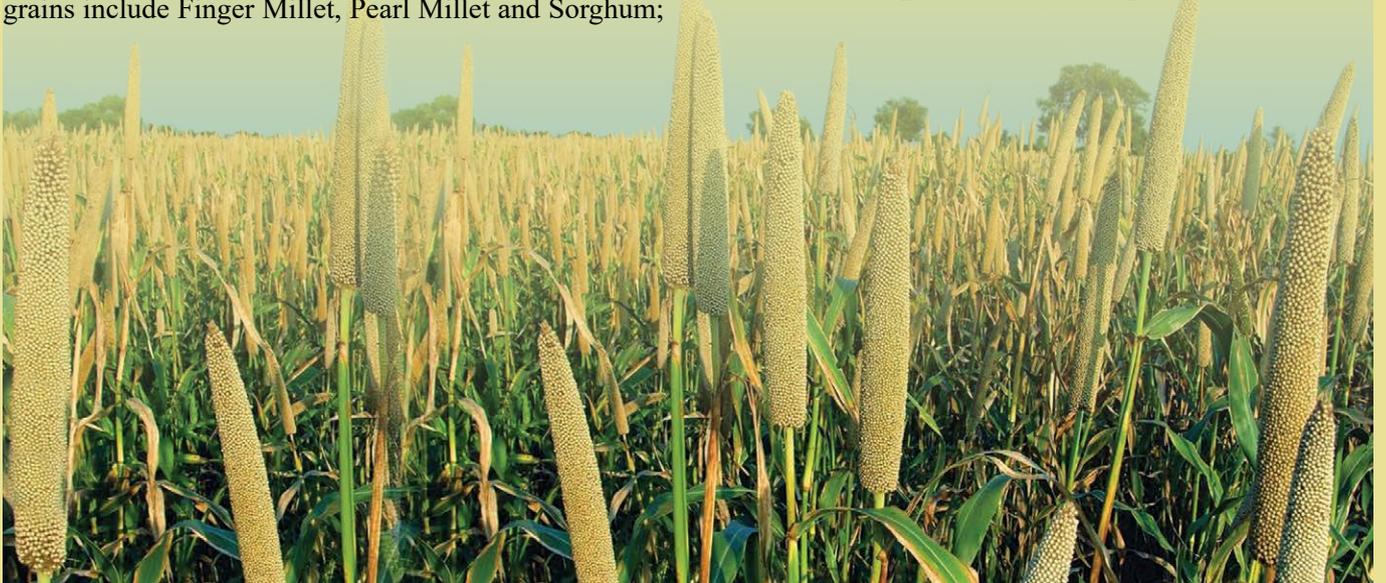
Millets are small grains that grow in rain fed farms across the world. They are a loosely defined bunch of crops that were cultivated and consumed in fairly large quantities in different parts of the world. With the increasing globalization of farming and food, a significant drop has been seen in both cultivation and consumption over the past few decades in almost all countries.

In India, millet cultivation is becoming popular as more people are looking forward to them in their nutritious diets. Though the sown area has increased slightly, focus on their cultivation, processing and consumption is being discussed by policy makers and the public too owing to their ease of cultivation and richness in nutrition.

There are two types of millets in terms of their physical morphology – ‘naked grains’ and ‘husked grains’. Naked grains include Finger Millet, Pearl Millet and Sorghum;

Husked grains include foxtail, Little, Kodo, Proso, Barnyard and Browntop millet. During the processing operations, conscious efforts need to be made to retain the nutritional components with least damage.

Naked grain processing: The naked grains do not have a husk and processing consists of cleaning, grading and grounding them into their flour form. The primary challenge is reducing the rancidity rates to increase nutrition retention and shelf life. This requires minimising the heat generation during the flour milling process. Another solution that communities have evolved over time is to process only limited quantities so that the flour will be consumed before the rancidity becomes too prominent. While finger millet and some traditional varieties of pearl millet and sorghum have very low susceptibility to storage pests, the newer varieties developed in the recent past are seen to be



more prone to pest damage. Diligent size and density grading are simple techniques to clean damaged grains and prepare the material for grinding into flour, grits or any other consumable form.

Husked grains processing: The husked grains need to be cleaned, graded and dehusked. Dehusking is also referred to as hulling. After dehusking, further cleaning and grading is required so that the broken and the unhulled grains are separated out. The husked grain morphology, and therefore, its processing is a little more complex. The outer most layer is a hard shell called the husk. Just within the husk layer is a thin layer of bran that flakes easily. Within the bran layer is the endosperm – often referred to as the rice kernel. In one concentrated point in the grain, within the husk, embedded in the endosperm but breaking through the bran layer is the grain germ. The husk is rich in cellulosic fibres and cannot be digested by humans. So dehusking, or hulling, to remove the husk is an essential step in processing husked grains. The bran layer is rich in minerals, fibres and essential fatty acids. A good process would retain as much of the bran as possible. As the bran layer is rich in fat, it is also important to minimize the damage to the bran layer in order to reduce the rancidity rates. The germ is rich in proteins and we need to ensure that it is retained and not lost during the processing. The endosperm is the most dense component and can break or shatter when the grain moisture or the relative humidity in the air is high during processing. So it is important to dry the grains to below 12% moisture content and as far as possible, process the grains on warm or cool dry days.

Community led processing initiatives - Cases of Processing units in three geographies

This article highlights process highlights of on-going efforts in 3 villages in India. Requisite training events to local communities were conducted to guide cultivation as well as (re)introducing millet based dishes, most critically processing them locally, as illustrated in the following geographies. In each of these places, the backgrounds are different. Local organizations have been working with the local communities for different periods of time. They are focussing on increasing farm production and in house consumption of millets, especially those grains that were prevalent in the food cultures of their respective communities in the past.

1. Teertha village, Kundhgol taluk, Dharwad district, Karnataka Teertha village has undulating landscape with rich black soil. It is part of a historically major production centre of Little millet. The initiative is a collaborative effort result of Indian Council for Agricultural Research, through the Indian Institute for Millet Research, KVK Hulkoti, Gadag District, Sahaja Samrudha, an NGO working on conservation and food equity and SELCO Foundation. Sahaja Samrudha, active with communities since 2018, started working with IIMR, secured ICAR support in setting up processing unit with KH Patil KVK in Hulkoti, Gadag as the nodal agency. The process flow for the small millet processing, machine specifications, training and capacity building were provided by The Millet Foundation. SELCO Foundation provided solar power so that consumer side processing machines can run independent of grid power availability. Sahaja Samrudha coordinated the various collaborative efforts. Every season, dozens of truck loads of Little millet grains get shipped out of the region to processing centres in far away places. There is lot of drudgery involved in manual processing of Little millets. Though cultivated continuously, there is a break in consumption in these communities. This issue was addressed by setting up a local processing unit. The processing unit is run by the Bibi Fathima Swasahaya Sangha (BFSS), a Self Help Group, in partnership with an Devadhanya Krishi Utpadakara Sangha, an FPC set up in 2022. The BFSS consists of 14 women from Teertha village who have come together under the leadership of Smt. Bibi Jan Halemani. The FPO, registered a few months ago, links the processed produce to the local markets. Thus, setting up a community oriented small millet processing unit was necessitated in this area. Since it was set up, the Bibi Fathima Swasahaya Sangha millet processing unit has processed about 5 tons of Browntop, Foxtail, Little and Proso millet. About 80% of their production has been sold in markets and events, given their access through the various organizations and their location. Efforts to increase local consumption is one of the focus areas of the initiative in the upcoming months. The challenges include guiding women to get familiar with processing principles and gaining confidence to operate processing machines and convincing the younger members in the communities about the nutritional value of the bran.

2. Attapady of Palakkad district in Kerala: This was set up in late 2021 and is managed by members of

the local community with support from Thanal, an NGO based in Thrissur and Thirvanantapuram. Attapady is a small town nestled in the eastern edge of the Western Ghats in Palakkad district of Kerala. Thanal started working on millets with the community in Attapady in 2019. The Adivasi communities in these parts have been cultivating and consuming millets for many years now. The villages around Attapady have a weather pattern that results in uncertain rainfall and it seems quite natural that millets have been a part of people's diets. The Little millet varieties grown in these hills are much smaller than the varieties grown in the plains. Increased drudgery in cleaning, grading and dehusking the Little millets had resulted in a drop in consumption and increased vulnerability to changes in the rainfall and weather patterns. Pigeon pea is also grown locally and there are not too many flour milling options nearby.

The Community Centred Small Millet Processing Unit was set up with support from the Pesticide Action Network, India through a CSR grant from UST a multinational IT company. The process flow for the small millet processing, machine specifications, training and capacity building have been provided by The Millet Foundation. Also, a dal milling machine and a flour mill have also been installed in the unit. However, owing to various reasons, the unit was under utilized, in spite of several expressions of interest from organizations. In late 2022, a second round of training was conducted to prepare a team of local women to operate the machines and the staff from the local Thanal office to supervise the operations of the unit. Local community are keen that the unit is fully operational as they have fond memories of their food cultures involving Little Millet. The continued cultivation supported by processing unit presents an opportunity for communities and local organizations to facilitate return of millets into people's diets.

3. Pipri village, Mishrikh Block, Sitapur district, Uttar Pradesh : The unit established here is called सेहत का बाखाना Sehat ka baardaana (SkB) – which roughly means *the toolbox for health*. This is the youngest among the six such units that have been set up so far.

SkB is run by a coalition of Sangtin Kisan Mazdoor Sangathan (a farmer labour collective), Healthy Awadh Foundation (a not for profit company set up u/s 8 of the company's act) and Sangtin, an NGO based out of Sitapur. Even though SkB is the most recent processing

unit, Sangtin in fact has been working with communities on promoting millets in farmers' fields and in their diets since 2014. The local communities in Sitapur district have strong memories of cultivating and consuming millets. While it is Kodo millet in a few remote villages in the district, it is Foxtail millets, in some others. However, majority of the families have not seen millets in their diets or on their fields ranging from a few seasons to a few decades.

Sangtin Kisan Mazdoor Sangathan (SKMS), a 6000 members strong local farmer labour collective spread over 12 blocks of Sitapur and Hardoi districts of central UP, initiated a new movement in the year 2015. Their persistent work led to discovering those families that continue to cultivate millets using seeds that have been passed on to them by their respective families suitable for local soils and agro climatic conditions. Though new seeds from other parts of the country were introduced through the initiative, only a few farmers cultivated them successfully. Within 2 years, it was clearly evident that local seeds had greater acceptability. Kodo Millet, Foxtail Millet and Barnyard Millet are regularly cultivated in rainfed farms of about 500 farmers. Concerned with high levels of malnutrition in the community, the farmer labour collective focussed on farming with a perspective of food and nutritional security. It had two faces – one, on farm initiatives, two, promoting consumption of millets in the villages.

Taakati Khana Shivar, Energy Food cook outs, were conducted in different villages over a 3 year period time to reintroduce and emphasise the need to include use of millets, pulses, and oil seeds in their menus and diets. The nutritional benefits of mixed cropping produce, as well as that of eggs and meat, was highlighted. Cost benefit analysis of food practices was done.

As people started cultivating and consuming millets, one of the Sangathan members talked to a paddy rice miller and convinced him to hull some millets. The small scale miller used a paddy polisher to dehusk the millets. Using hand sieves with different sieve sizes brought from Anantapur District, Andhra Pradesh, and local winnowing pans, the members of the Sangathan started to clean and grade the grains before hulling and cleaned the post hulling output as well. As can be expected the quality of the hulled millet rice was compromised, but it helped the community improve their access to nutrition



Processing unit at Sitapur district in Uttar Pradesh

with a capital expenditure that was a fraction of what setting up a processing unit would have otherwise cost. In 2020, a good 6 years after the initiative was started, the decision to set up a small scale mechanized processing facility was approved by the Sangathan – thanks to philanthropic funding secured by Sangtin, technical assistance from The Millet Foundation and the ground support from SKMS. Since being operational from six months, about 2.5 tons of the procured grains has been cleaned at the SkB. About two thirds of the 0.5 ton of millet rice has been sold within the local community, and the remaining third has been marketed to individuals and organizations in Lucknow and other parts of UP.

Thus, in these three different geographies initiatives are underway to revive millet production and consumption. These include, developing skills by training local men and women on processing millets in a way to retain nutritional components as much as possible, and reintroducing millet based foods back into their diets. Most of these involved farmers are either small and marginal or those keen on practising changed farming and food system. Covid 19 Pandemic did hamper planned timelines for training and setting up of processing units, but, communities rode through

the difficult times keen on improving their nutritional levels. There are other challenges being faced too – for instance, finding suitable talent in the local communities to run the machines, issues such as GST on machines for small scale decentralized processing and on the products from such units. The primary focus of the mainstream has been on market centric approach, however to usher sustainable food systems, what needs to be strengthened is people centric decentralised community owned processes.

Over the next few years, many such processing units as illustrated need to be encouraged. They would serve as torch bearers of a decentralized economy, strengthened innovative ecosystem and local solutions to improved access to nutrition.

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